



**COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET**
Frankfort, Kentucky 40622
www.transportation.ky.gov/

Matthew G. Bevin
Governor

Greg Thomas
Secretary

May 24, 2016

CALL NO. 300
CONTRACT ID NO. 161234
ADDENDUM # 2

Subject: Carroll County, FD04 SPP 021 0042 009-014
Letting May 27, 2016

- (1) Revised - Plan Sheet - U69
- (2) Revised - Technical Specifications for Gas Line Relocation -
Pages 40-96 of 313
- (3) Revised - Technical Specifications for Sewer Line Relocation -
Pages 163-223 of 313

Proposal revisions are available at <http://transportation.ky.gov/Construction-Procurement/>.

Plan revisions are available at <http://www.lynnimaging.com/kytransportation/>.

If you have any questions, please contact us at 502-564-3500.

Sincerely,

A handwritten signature in cursive script that reads "Rachel Mills".

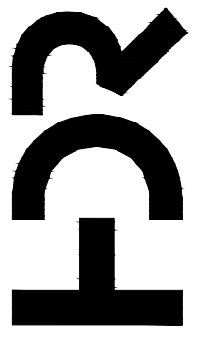
Rachel Mills, P.E.
Director
Division of Construction Procurement

RM:ks
Enclosures

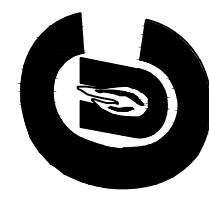


An Equal Opportunity Employer M/F/D

ONE RIVERFRONT PLAZA
LOUISVILLE, KENTUCKY 40202
PHONE: 502.909.3234
FAX: 502.909.3235



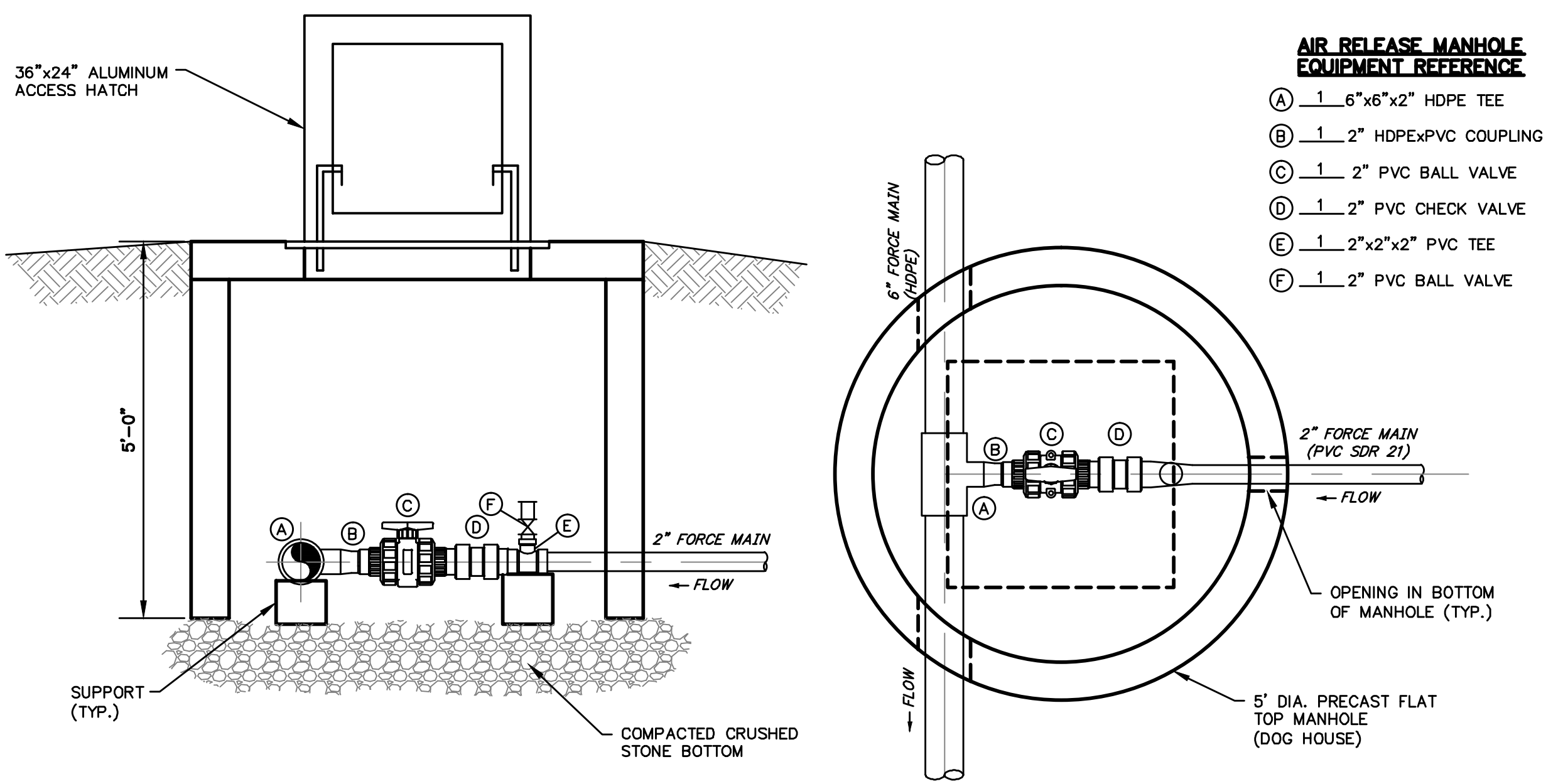
Carrollton Utilities



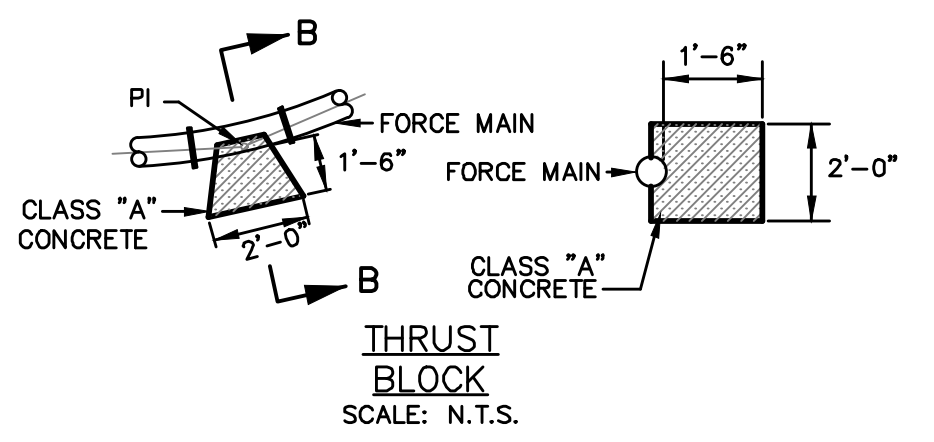
US 42 SEWER LINE
RELOCATION
CELETEX PUMP STATION
STANDARD DETAILS

SCALE: AS SHOWN
DATE: FEBRUARY 2016
JOB NO.: 65868
DESIGNED: KJB
DRAWN: WMG
CHECKED: KJB
Q/C: NJB

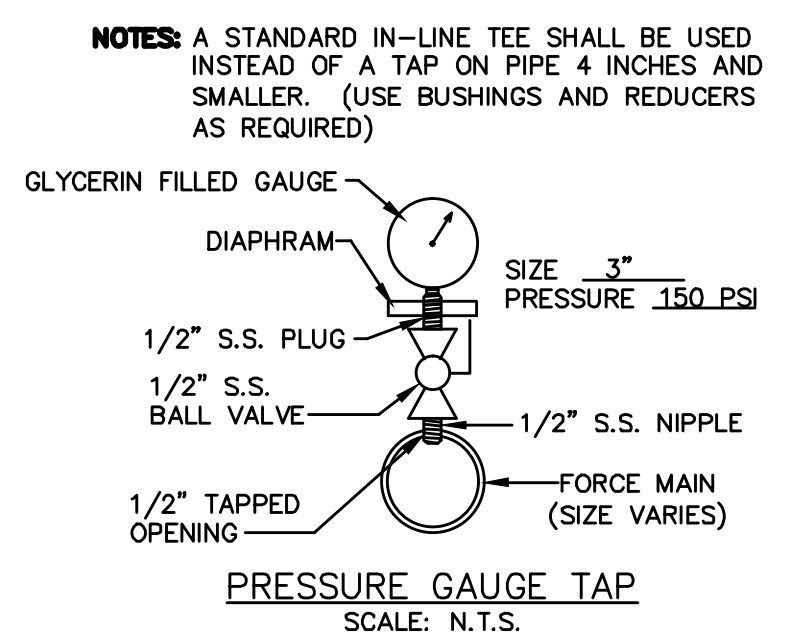
DRAWING:
S-24
OF 29



FORCE MAIN TIE-IN MANHOLE (STA. 145+50)
PLAN AND SECTION
SCALE: N.T.S.



THRUST BLOCK
SCALE: N.T.S.



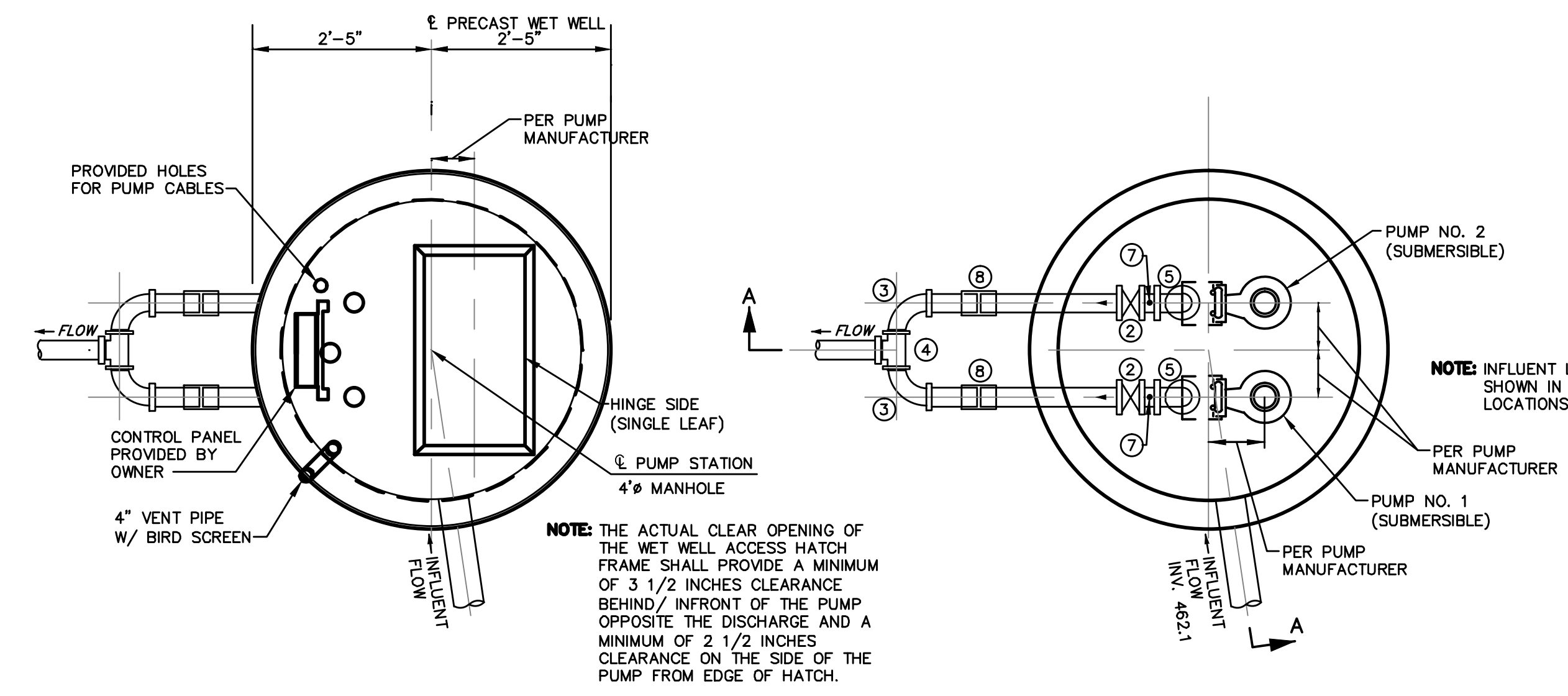
NOTES: A STANDARD IN-LINE TEE SHALL BE USED INSTEAD OF A TAP ON PIPE 4 INCHES AND SMALLER. (USE BUSHINGS AND REDUCERS AS REQUIRED)

PUMP STATION DESIGN DATA

AVG. DAILY SEWAGE FLOW = 4,000 G.P.D.
PEAK HOURLY FLOW: 4 X 4,000 GPD = 16,000 G.P.D.
PEAK FLOW RATE: 16,000 G.P.D./1,440 = 11.1 G.P.M.
MIN. DESIGN PUMP RATE: (3 FT/S SCOUR VELOCITY IN 2" FM) = 29.4 G.P.M.
STATIC HEAD (456.8 - 451.5) = 5.3 FEET
FORCE MAIN SIZE: 2"; MATERIAL PVC (SDR 21)
DYNAMIC HEADLOSS @ 29.4 G.P.M.:
- WITH GHENT PS ON - 85 FEET
- WITH GHENT PS OFF - 30 FEET

PUMP STATION EQUIPMENT DATA

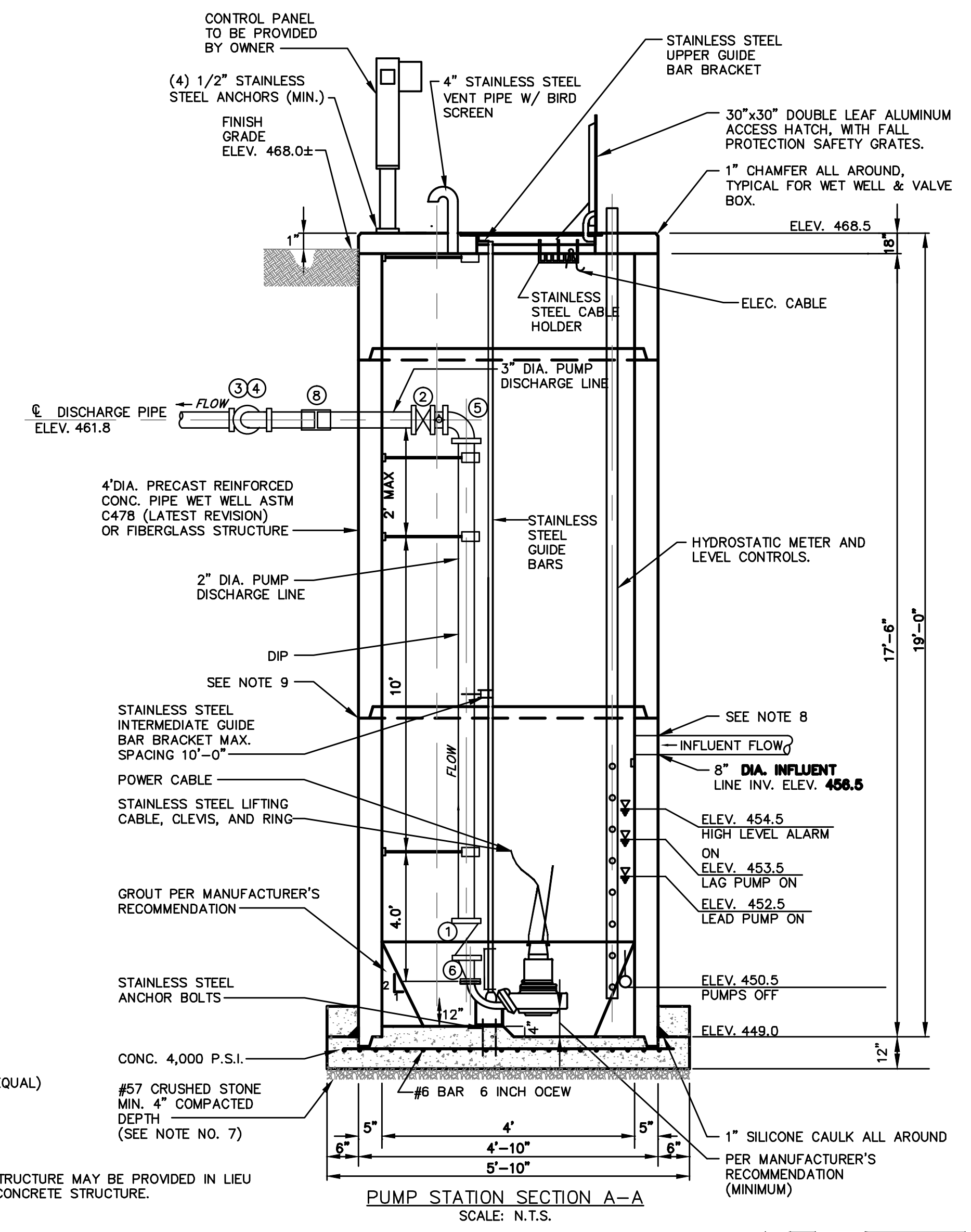
- TWO (2) 5 HP (MIN.) PUMPS
- CAPACITY (OPERATING POINTS):
- 44 GPM @ 100' TDH
- 84 GPM @ 70' TDH
- PUMP TYPE & MANUFACTURER: MEYERS WGX50H 5 1/2" IMPELLAR (OR EQUAL)
- DISCHARGE SIZE: 1 1/4"
- SOLIDS PASSING SIZE: GRINDER



PUMP STATION PLAN TOP SLAB
SCALE: N.T.S.

NOTES: 1. INSTALL PEDESTALS OR APPROPRIATE SUPPORT FOR ALL PIPING AND VALVE STRUCTURES.
2. PROVIDE ADEQUATE CLEARANCE ON EACH SIDE OF CHECK VALVE SO THAT THEY CAN BE FULLY SERVICED IN PLACE

PUMP STATION PLAN WITHOUT TOP SLAB
SCALE: N.T.S.



PUMP STATION SECTION A-A
SCALE: N.T.S.

NOTE: FIBERGLASS STRUCTURE MAY BE PROVIDED IN LIEU OF PRECAST CONCRETE STRUCTURE.

GENERAL NOTES

- ALL CONCRETE SHALL HAVE MINIMUM COMPRESSIVE STRENGTH OF $F_c = 4,000$ PSI (28 DAY STRENGTH) EXCEPT AS NOTED.
- REINFORCING STEEL SHALL CONFORM TO A.S.T.M. 615-80, GRADE 60.
- MINIMUM CLEAR COVER SHALL BE 2" UNLESS OTHERWISE NOTED.
- DIMENSIONS FROM FACE OF CONCRETE TO REINFORCING BARS ARE CLEAR DISTANCES.
- DIMENSIONS FOR BAR SPACING ARE CENTER TO CENTER.
- ALL LAPS SHALL BE 30 BAR DIAMETERS UNLESS OTHERWISE NOTED.
- FOR #57 CRUSHED STONE BEDDING MATERIAL SEE KENTUCKY DEPARTMENT OF TRANSPORTATION'S STANDARD SPECIFICATIONS, LATEST EDITION.
- THROUGH WALL CONNECTIONS SHALL BE MADE WITH PRESS-SEAL OR KOR-N-SEAL GASKETS WITH STAINLESS STEEL STRAPS TO PERMIT LIMITED DIFFERENTIAL SETTLEMENT.
- ALL WET WELL JOINTS SHALL BE WATERTIGHT, O-RING/FORSHEDA AND MASTIC BUTYL WRAP SEALS.
- ALL BOLTS SHALL BE STAINLESS STEEL TYPE 304L WITH STAINLESS STEEL HARDWARE.
- HYDROSTATIC METER PIPE SHALL BE SCH 40 S.S. W/18" HOLES 12" ON OTHER SIDE.
- ALL PIPING, VALVES AND FITTINGS INSIDE WET WELL SHALL BE STAINLESS STEEL.

EQUIPMENT REFERENCE

- 2" CHECK VALVE
- 2" BALL VALVE
- 2" 90° ELBOW
- TEE 2"x2"
- 2" 90° ELBOW
- REDUCER 2" x 1 1/4"
- SEE PRESSURE GAUGE TAP DETAIL
- 2" COATED MECHANICAL COUPLING (DRESSER, STYLE 138) (OR EQUAL)

FILE NAME: C:\P\WORKING\PTTY\006740\ PUMP STATION DETAILS.DWG

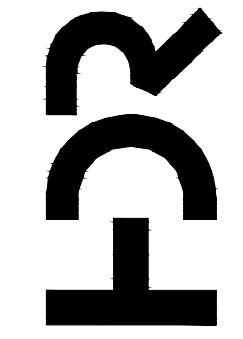
USER: SHSHELTO
DATE PLOTTED: -

E-SHEET NAME: -

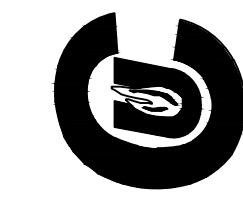
AutoCAD Civil 3D, 2014

GRAPHIC SCALE = 1" ON ORIGINAL

ONE RIVERFRONT PLAZA
LOUISVILLE, KENTUCKY 40202
PHONE: 502.909.3234
FAX: 502.909.3235



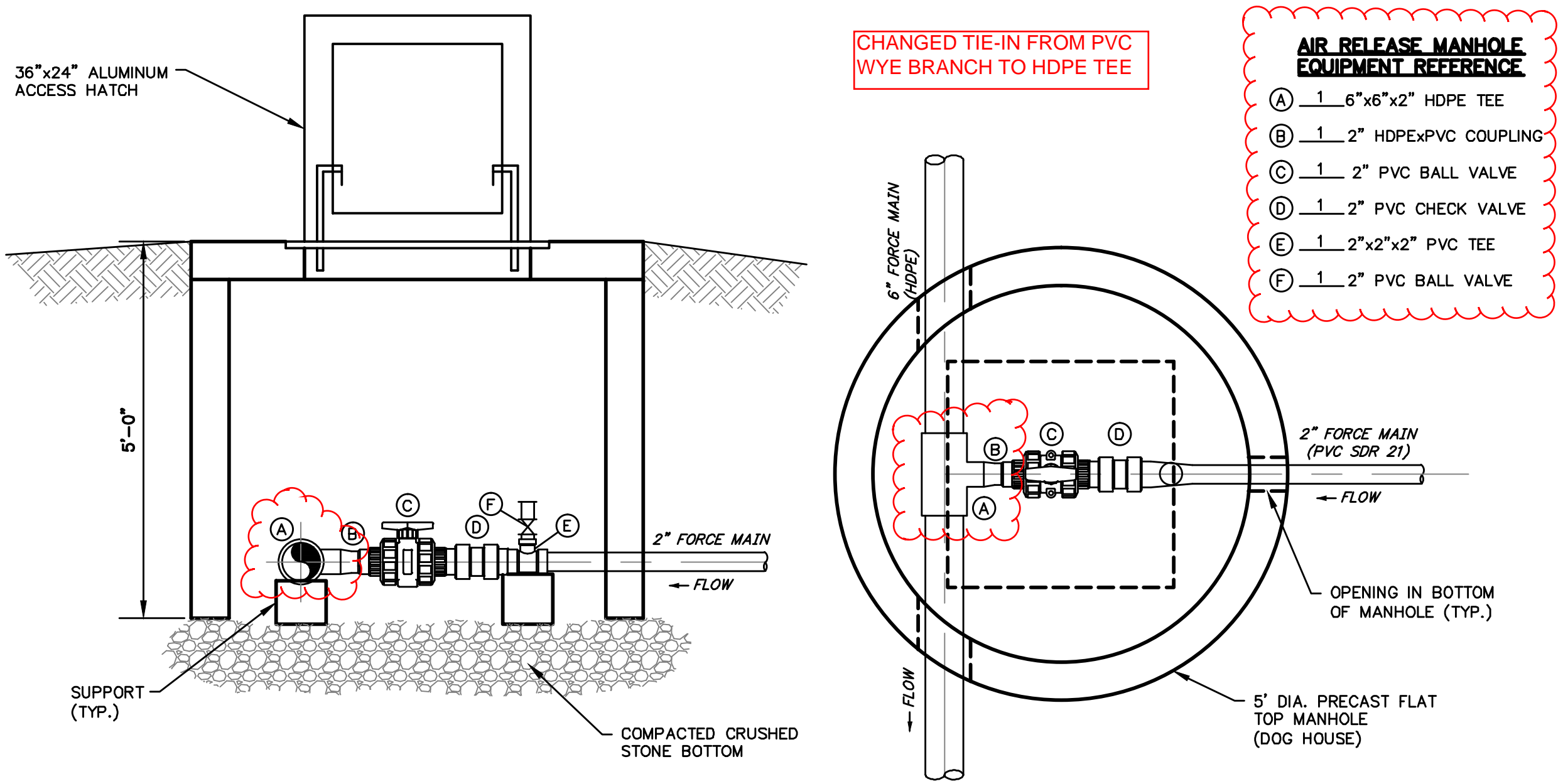
Carrollton Utilities



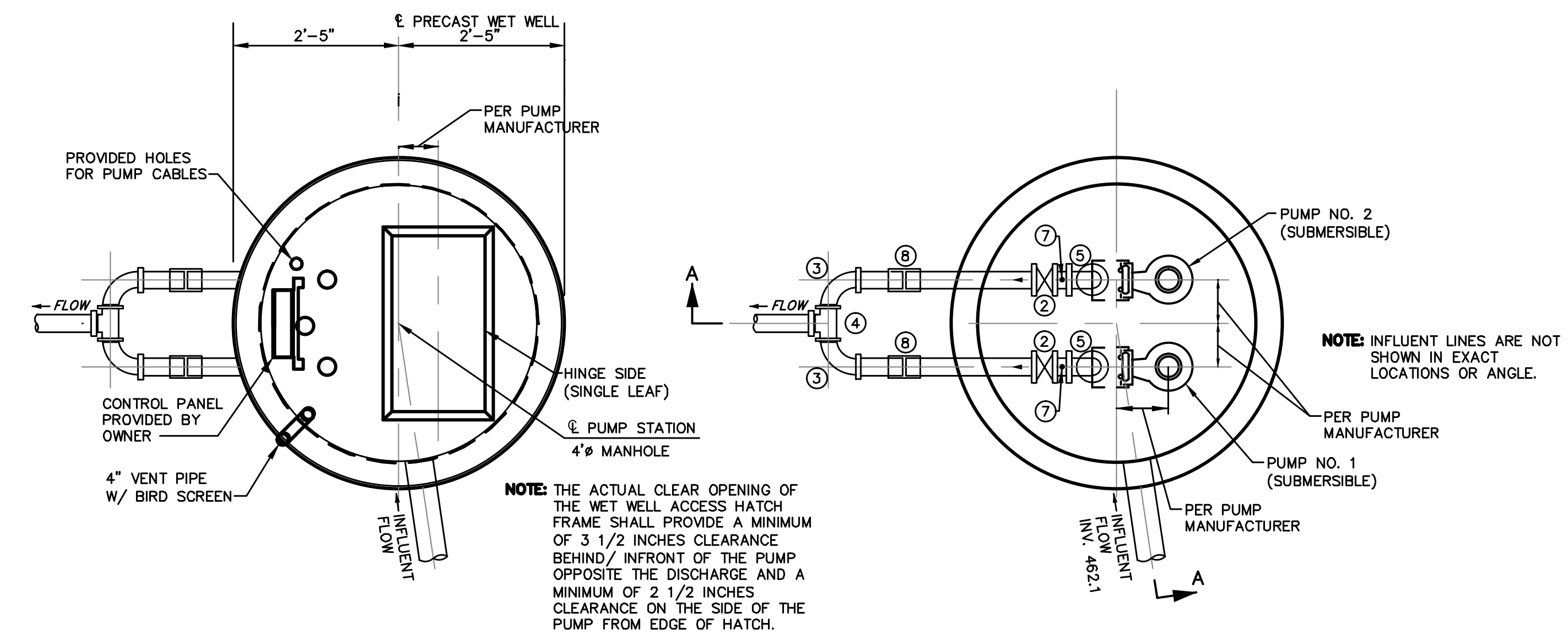
US 42 SEWER LINE
RELOCATION
CELETEX PUMP STATION
STANDARD DETAILS

SCALE: AS SHOWN
DATE: FEBRUARY 2016
JOB NO.: 65868
DESIGNED: KJB
DRAWN: WMG
CHECKED: KJB
Q/C: NJB

DRAWING:
S-24
OF 29

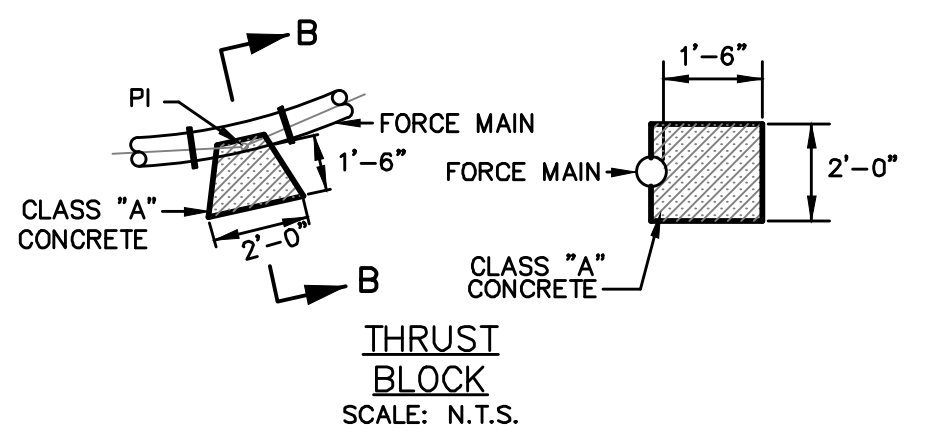


FORCE MAIN TIE-IN MANHOLE (STA. 145+50)
PLAN AND SECTION
SCALE: N.T.S.

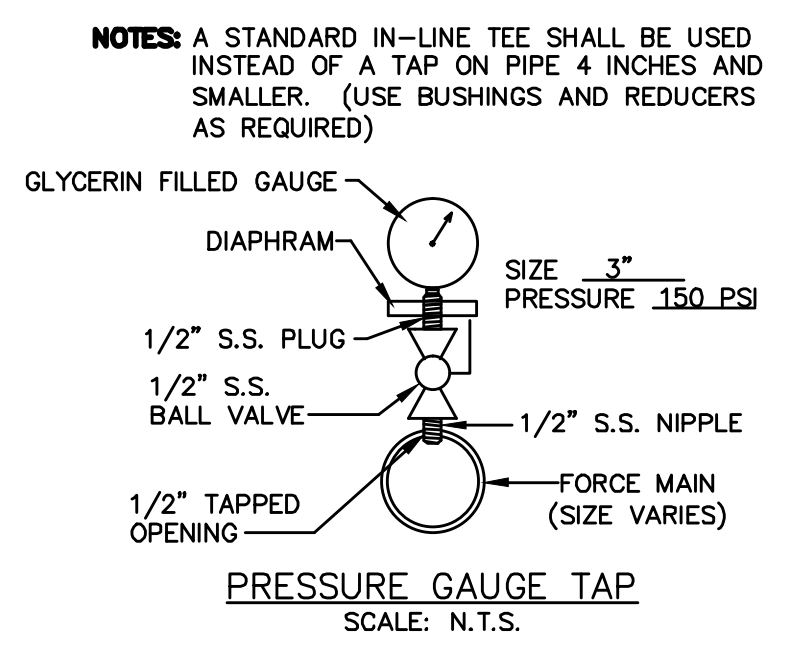


PUMP STATION PLAN
WITHOUT TOP SLAB
SCALE: N.T.S.

PUMP STATION SECTION A-A
SCALE: N.T.S.



THRUST BLOCK
SCALE: N.T.S.



PRESSURE GAUGE TAP
SCALE: N.T.S.

PUMP STATION DESIGN DATA

AVG. DAILY SEWAGE FLOW:	= 4,000 G.P.D.
PEAK HOURLY FLOW: 4 X 4,000 GPD	= 16,000 G.P.D.
PEAK FLOW RATE: 16,000 G.P.D./1,440	= 11.1 G.P.M.
MIN. DESIGN PUMP RATE: (3 FT/S SCOUR VELOCITY IN 2" FM)	= 29.4 G.P.M.
STATIC HEAD (456.8 - 451.5)	= 5.3 FEET
FORCE MAIN SIZE: 2" MATERIAL PVC (SDR 21)	
DYNAMIC HEADLOSS @ 29.4 G.P.M.:	
- WITH GHENT PS ON - 85 FEET	
- WITH GHENT PS OFF - 30 FEET	

PUMP STATION EQUIPMENT DATA

- TWO (2) 5 HP (MIN.) PUMPS
- CAPACITY (OPERATING POINTS):
 - 44 GPM @ 100' TDH
 - 84 GPM @ 70' TDH
- PUMP TYPE & MANUFACTURER: MEYERS WGX50H 5 1/2" IMPELLAR (OR EQUAL)
- DISCHARGE SIZE: 1 1/4"
- SOLIDS PASSING SIZE: GRINDER

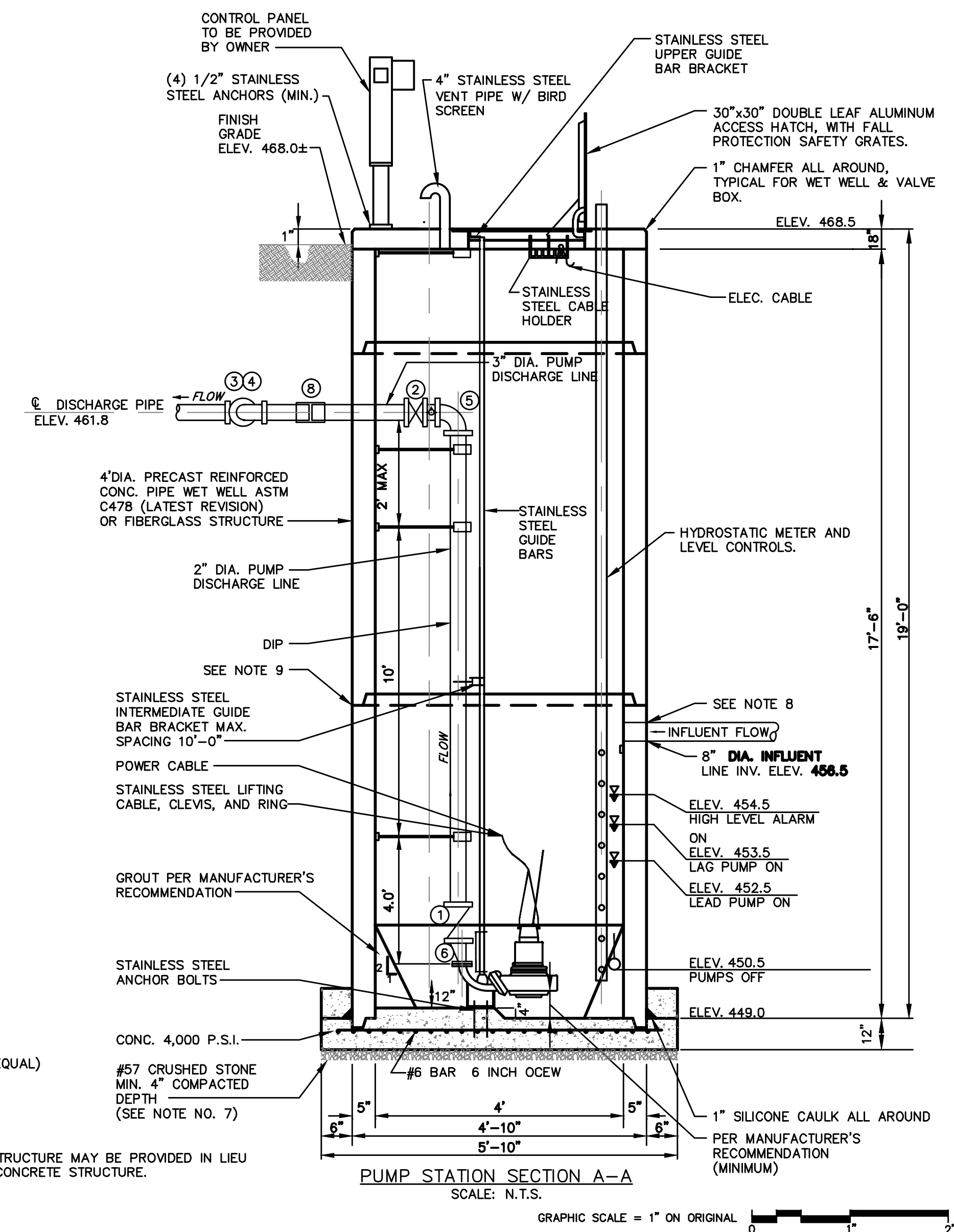
GENERAL NOTES

- ALL CONCRETE SHALL HAVE MINIMUM COMPRESSIVE STRENGTH OF $F_c = 4,000$ PSI (28 DAY STRENGTH) EXCEPT AS NOTED.
- REINFORCING STEEL SHALL CONFORM TO A.S.T.M. 615-80, GRADE 60.
- MINIMUM CLEAR COVER SHALL BE 2" UNLESS OTHERWISE NOTED.
- DIMENSIONS FROM FACE OF CONCRETE TO REINFORCING BARS ARE CLEAR DISTANCES.
- DIMENSIONS FOR BAR SPACING ARE CENTER TO CENTER.
- ALL LAPS SHALL BE 30 BAR DIAMETERS UNLESS OTHERWISE NOTED.
- FOR #57 CRUSHED STONE BEDDING MATERIAL SEE KENTUCKY DEPARTMENT OF TRANSPORTATION'S STANDARD SPECIFICATIONS, LATEST EDITION.
- THROUGH WALL CONNECTIONS SHALL BE MADE WITH PRESS-SEAL OR KOR-N-SEAL GASKETS WITH STAINLESS STEEL STRAPS TO PERMIT LIMITED DIFFERENTIAL SETTLEMENT.
- ALL WET WELL JOINTS SHALL BE WATERTIGHT, O-RING/FORSHEDA AND MASTIC BUTYL WRAP SEALS.
- ALL BOLTS SHALL BE STAINLESS STEEL TYPE 304L WITH STAINLESS STEEL HARDWARE.
- HYDROSTATIC METER PIPE SHALL BE SCH 40 S.S. W/18" HOLES 12" ON OTHER SIDE.
- ALL PIPING, VALVES AND FITTINGS INSIDE WET WELL SHALL BE STAINLESS STEEL.

EQUIPMENT REFERENCE

- 2" CHECK VALVE
- 2" BALL VALVE
- 2" 90° ELBOW
- TEE 2"x2"
- 2" 90° ELBOW
- REDUCER 2" x 1 1/4"
- SEE PRESSURE GAUGE TAP DETAIL
- 2" COATED MECHANICAL COUPLING (DRESSER, STYLE 138) (OR EQUAL)

NOTE
FIBERGLASS STRUCTURE MAY BE PROVIDED IN LIEU OF PRECAST CONCRETE STRUCTURE.



PUMP STATION SECTION A-A
SCALE: N.T.S.

GRAPHIC SCALE = 1" ON ORIGINAL

FILE NAME: C:\P\WORKING\PTTY\D\006740\PUMP STATION DETAILS.DWG

USER: SHSHELTO
DATE PLOTTED: -

E-SHEET NAME: -

AutoCAD Civil 3D, 2014

TECHNICAL SPECIFICATIONS
for
US 42 GAS LINE RELOCATION
Carrollton Utilities

February 2016

Prepared by:
HDR Engineering, Inc.
One Riverfront Plaza
401 West Main Street, Suite 500
Louisville, Kentucky 40202
(502) 909-3234

**TECHNICAL SPECIFICATIONS
US 42 GAS LINE RELOCATION
CARROLLTON UTILITIES**

TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
DIVISION 1 - GENERAL REQUIREMENTS		
01010	SUMMARY OF WORK	1 - 1
01015	WORK SEQUENCE	1 - 1
01300	SUBMITTALS	1 - 3
DIVISION 2 - SITE WORK		
02150	SHORING AND BRACING	1 - 1
02221	ROCK REMOVAL	1 - 4
02225	EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES	1 - 4
02646	HORIZONTAL DIRECTIONAL DRILLING	1 - 6
DIVISION 3 - CONCRETE		
03300	CAST-IN-PLACE CONCRETE	1 - 11
DIVISIONS 4 - THROUGH 8 - NOT USED		
DIVISION 9 - PROTECTIVE COATING		
09905	PAINTING AND PROTECTIVE COATINGS	1 - 9
DIVISIONS 10 - THROUGH 14 - NOT USED		
DIVISION 15 - MECHANICAL		
15061	GAS PIPE AND FITTINGS	1 - 4
15090	PIPE SUPPORT SYSTEMS	1 - 4
15100	VALVES: BASIC REQUIREMENTS	1 - 5
15104	BALL VALVES AND METERS	1 - 3
DIVISION 16 - NOT USED		

END OF TABLE OF CONTENTS

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Relocation of approximately 10,511 lineal feet of steel gas transmission main and related work in Carroll County, Kentucky.
- B. The Contractor shall provide all materials, labor and equipment necessary for completion of the Project. The Contract Documents are intended to provide the basis for proper completion of the work suitable for the intended use of the Owner. Anything not expressly set forth but which is reasonably implied or necessary for proper performance of the Project shall be included.
- C. Continuous Operations: The existing system must be maintained in continuous operation in such a manner that it meets all local, state, and federal requirements. The Contractor is responsible not to deactivate, demolish, or interfere with any system component required for the continuous operation until a new or temporary permanent-like system has been installed and is operational. The Contractor is responsible for payment of all fines resulting from any action or inaction on his part or the part of his subcontractors during performance of the Work that causes the facility/facilities to operate in an illegal manner or fail to operate in a legal manner.
- D. The construction of the following major Work items are included in the Contract:
 - 1. 10,511 lineal feet of 10-inch steel (0.250" wall) API5L, Gr X42 pipe
 - 2. 300 lineal feet of HDD of 10-inch steel (0.250" wall) API5L, Gr X42 pipe across McCools Creek
 - 3. Two (2) 6-inch steel gas relocation (lowering) segments
 - 4. 124 lineal feet of 6-inch steel (0.188" wall) API5L, Gr X42 pipe
 - 5. Three (3) 6-inch gas tie-ins
 - 6. One (1) 4-inch gas tie-in
 - 7. Two (10) above grade 10-inch isolation valve assemblies
 - 8. Two (2) 6-inch buried steel gas valves
 - 9. Two (2) 4-inch buried steel gas valves
 - 10. Four (4) pressure regulator relocations
 - 11. Five (5) steel gas service relocations
 - 12. Cathodic protection system and test stations

1.2 PERMITS

- A. The Contractor shall obtain any permits related to or required by, the Work in this Contract.

1.3 CODES

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

1.4 EXISTING CONDITIONS AND DIMENSIONS

- A. The Work in this Contract will primarily be performed in or around existing facilities of which a portion must remain functional. The Contractor must maintain the required items and/or systems functional without additional effort by the Owner's personnel and at no extra costs to the Owner.
- B. The Contractor is responsible for verifying all existing conditions, elevations, dimensions, etc., and providing his finished work to facilitate existing conditions.

END OF SECTION

SECTION 01015 WORK SEQUENCE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall conform to all miscellaneous requirements as contained in the Contract.
- B. The Contractor shall perform all Work included in the Contract Documents [Drawings].
- C. The Contractor shall perform the entire Work incidental to the items shown in the Contract Documents [Drawings] even though it may not be specifically enumerated.
- D. The Contractor will have to perform the work in a sequence acceptable to the Owner, and in some instances the Work will have to be performed in a sequence directed by the Owner.
- E. Further, the Contractor shall have to perform all the Work included in this project in a sequence that does not cause undue hardships on day-to-day operating personnel.

1.2 RELATED REQUIREMENTS

- A. Section 01010 - Summary of Work.
- B. Section 01040 - Coordination.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 SCHEDULING THE SEQUENCE OF CONSTRUCTION OPERATIONS

- A. Carrollton Utilities (CU) provides high pressure gas transmission services to major industry along the US 42 corridor. There will be no interruption of service for the gas relocation work. Service must be maintained at all times.
- B. The Contractor shall submit to the Engineer and CU, for review and approval, a complete schedule (progress chart) of his proposed sequence of construction operations and tie-ins prior to commencement of the work. A suggested tie-in sequence and tie-in procedures is provided on Drawings G-21 and G-22. Ultimately, the Contractor will be responsible for developing a tie-in sequence and procedures, which will require approval by the Engineer and CU.
- C. The Engineer will neither consider nor approve a construction schedule that fails to utilize the entire time allocated by the Contract for the construction of the Project.
- D. The Contractor shall schedule the various construction activities to complete the Project throughout the entire Contract time period. This schedule requirement shall not prevent the Contractor from completing the Project in a shorter time frame than illustrated in the schedule. The construction schedule along with a cost breakdown schedule shall be reviewed and approved by the Owner prior to the submission of the first partial payment request in accordance with the General Conditions.
- E. A copy of the construction schedule shall be submitted to the Owner with each pay request, appropriately marked to indicate the actual progress of the work compared to the planned schedule. This revised schedule must be approved by the Owner prior to payment.

END OF SECTION

SECTION 01300 SUBMITTALS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Shop drawings, descriptive literature, project data and samples (when samples are specifically requested) for all manufactured or fabricated items shall be submitted by the Contractor to the Engineer for examination and review in the form and in the manner required by the Engineer. All submittals shall be furnished in at least three (3) copies to be retained by the Engineer and shall be checked and reviewed by the Contractor before submission to the Engineer. The review of the submittal by the Engineer shall not be construed as a complete check, but will indicate only that the general method of construction and detailing is satisfactory. Review of such submittal will not relieve the Contractor of the responsibility for any errors which may exist as the Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work.

1.2 DEFINITIONS

- A. The term "submittals" shall mean shop drawings, manufacturer's drawings, catalog sheets, brochures, descriptive literature, diagrams, schedules, calculations, material lists, performance charts, test reports, office and field samples, and items of similar nature which are normally submitted for the Engineer's review for conformance with the design concept and compliance with the Contract Documents.

1.3 CONTRACTOR'S ULTIMATE RESPONSIBILITY

- A. Review by the Engineer of shop drawings or submittals of material and equipment shall not relieve the Contractor from the responsibilities of furnishing same of proper dimension, size, quantity, materials and all performance characteristics to efficiently perform the requirements and intent of the Contract Documents. Review shall not relieve the Contractor from responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. Review of shop drawings shall not be construed as releasing the Contractor from the responsibility of complying with the Specifications.

1.4 GENERAL REQUIREMENTS FOR SUBMITTALS

- A. Shop drawings shall be prepared by a qualified detailer. Details shall be identified by reference to sheet and detail numbers shown on Contract Documents. Where applicable, show fabrication, layout, setting and erection details. Shop drawings are defined as original drawings prepared by the Contractor, subcontractors, suppliers, or distributors performing work under this Contract. Shop drawings illustrate some portion of the work and show fabrication, layout, setting or erection details of equipment, materials and components. The Contractor shall, except as otherwise noted, have prepared the number of reviewed copies required for his distribution plus three (3) which will be retained by the Engineer and Owner. Shop drawings shall be folded to an approximate size of 8-1/2 inch x 11 inch and in such manner that the title block will be located in the lower righthand corner of the exposed surface.
- B. Project data shall include manufacturer's standard schematic drawings modified to delete information which is not applicable to the Project, and shall be supplemented to provide additional information applicable to the Project. Each copy of descriptive literature shall be clearly marked to identify pertinent information as it applies to the Project.

- C. Where samples are required, they shall be adequate to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged. Provide sufficient size and quantity to clearly illustrate functional characteristics of product and material, with integrally related parts and attachment devices, along with a full range of color samples.
- D. All submittals shall be referenced to the applicable item, section and division of the Specifications, and to the applicable Drawing(s) or Drawing schedule(s) and shall be accompanied by transmittal forms in the format provided by the Engineer.
- E. The Contractor shall review and check submittals, and indicate his review by initials and date.
- F. If the submittals deviate from the Contract Drawings and/or Specifications, the Contractor shall advise the Engineer, in letter of transmittal of the deviation and the reasons therefor. All changes shall be clearly marked on the submittal with a bold mark other than red. Any additional costs for modifications shall be borne by the Contractor.
- G. In the event the Engineer does not specifically reject the use of material or equipment at variance to that which is shown on the Drawings or specified, the Contractor shall, at no additional expense to the Owner, and using methods reviewed by the Engineer, make any changes to structures, piping, controls, electrical work, mechanical work, etc., that may be necessary to accommodate this equipment or material. Should equipment other than that on which design drawings are based be accepted by the Engineer, shop drawings shall be submitted detailing all modification work and equipment changes made necessary by the substituted item.
- H. Additional information on particular items, such as special drawings, schedules, calculations, performance curves, and material details, shall be provided when specifically requested in the technical Specifications.
- I. Submittals for all electrically operated items (including instrumentation and controls) shall include complete wiring diagrams showing lead, runs, number of wires, wire size, color coding, all terminations and connections, and coordination with related equipment.
- J. Equipment shop drawings shall indicate all factory or shop paint coatings applied by suppliers, manufacturers and fabricators; the Contractor shall be responsible for insuring the compatibility of such coatings with the field-applied paint products and systems.
- K. Fastener specifications of manufacturer shall be indicated on equipment shop drawings.
- L. Where manufacturer's brand names are given in the Specifications for building and construction materials and products, such as grout, bonding compounds, curing compounds, masonry cleaners, waterproofing solutions and similar products, the Contractor shall submit names and descriptive literature of such materials and products he proposes to use in this Contract.
- M. No material shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed by the Engineer and returned to the Contractor.
- N. All bulletins, brochures, instructions, parts lists, and warranties packaged with and accompanying materials and products delivered to and installed in the Project shall be saved and transmitted to the Owner through the Engineer.

1.5 CONTRACTOR RESPONSIBILITIES

- A. Verify field measurements, field construction criteria, catalog numbers and similar data.
- B. Coordinate each submittal with requirements of Work and Contract Documents.
- C. Notify Engineer, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.
- D. Begin no work, and have no material or products fabricated or shipped which required submittals until return of submittals with Engineer's stamp and initials or signature indicating review.

1.6 SUBMITTAL SCHEDULE

- A. At a minimum the following submittals shall be submitted for review and approval:
1. Work Sequence
 2. Tie-In Sequence, Procedures and Details for Gas Main and Industrial Services Tie-Ins,
 3. Steel Pipe and Fittings
 4. Horizontal Directional Drill Plan
 5. Gas Line Markers
 6. Above Grade Isolation Valve Assembly
 7. Buried Steel Gas Valves
 8. Cathodic Protection System and Test Stations
 9. Pressure Regulator Assembly

END OF SECTION

SECTION 02150 SHORING AND BRACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Shore and brace sidewalls in excavations with steel sheet piles with wale systems or soldier piles with timber lagging and tie back system as required to protect existing buildings, utilities, roadways, and improvements.
- B. Maintain shoring and bracing during construction activities, and remove shoring and bracing if practical when construction and filling is complete.
- C. Geotechnical investigation borings, if applicable, were drilled for this project where indicated on the drawings in the report. The geotechnical report was not prepared for purposes of bid development and the accuracy of the report is limited. The Contractor should confer with a geotechnical engineer and/or conduct additional study in the area to obtain the specific type of geotechnical information required for construction and for preparation of bids.

1.2 SUBMITTALS

- A. Provide copies of information on methods of the shoring and bracing system proposed for the work, design basis, calculations where applicable, and copies of shop drawings for inclusion in the project and job-site record files.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Shoring and bracing system design shall be prepared and sealed by a registered professional engineer or structural engineer. The system design shall provide the sequence and method of installation and removal. Shoring and bracing system design shall be in accordance with Occupational Safety and Health Administration (OSHA) requirements 29 CFR Section 1926.652.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet Piles: Heavy-gauge steel sheet.
- B. Soldier Piles: Steel H-beams.
- C. Timber Lagging: Heavy timber. Pressure treated with wood preservative for use below water table for extended time period.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in proper relation with adjacent construction. Coordinate with work of other sections.
- B. Locate shoring and bracing to avoid permanent construction. Anchor and brace to prevent collapse.

END OF SECTION

SECTION 02221 ROCK REMOVAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall excavate rock, if encountered, as required to perform the required work, and shall dispose of the excavated material, and shall furnish acceptable material for backfill in place of the excavated rock.
- B. In general, rock in pipe trenches shall be excavated so as to be not less than 6 inches from the pipe after it has been laid.

1.2 REFERENCES

- A. NFPA 495 - Code for the Manufacture, Transportation, Storage and use of Explosive Materials.
- B. Commonwealth of Kentucky Department of Mines and Minerals, Laws and Regulations Governing Explosives and Blasting.

1.3 REGULATORY REQUIREMENTS

- A. Conform to Kentucky Department of Mines and Minerals code for explosive disintegration of rock.
- B. Obtain permits from local authorities having jurisdiction before explosives are brought to site or drilling is started.
- C. KRS 351.330
- D. 805 KAR Chapter 4

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Rock definition: Solid mineral material that cannot be removed with a power shovel.
- B. Explosives: Type recommended by explosives firm and required by authorities having jurisdiction.
- C. Delay devices: Type recommended by explosives firm and conforming to state regulations.
- D. Blasting mat materials: Type recommended by explosives firm and conforming to state regulations.

PART 3 - EXECUTION

3.1 EXPLOSIVES

- A. The Contractor shall keep explosives on the site only in such quantity as may be needed for the Work under way and only during such time as they are being used. He shall notify the Engineer, in advance, of his intention to store and use explosives. Explosives shall be stored in a secure manner and separate from all tools. Caps or detonators shall be safely stored at a point over 100 feet distance from the explosives. When the need for explosives has ended, all such materials remaining on the Work shall be promptly removed from the premises.
- B. The Contractor shall observe all state, federal and municipal laws, ordinances and regulations relating to the transportation, storage, handling and use of explosives. In the event that any of the above-mentioned laws, ordinances or regulations require a licensed blaster to perform or supervise the Work of blasting, said licensed blaster shall, at all times have his license on the Work and shall permit examination thereof by the Engineer or other officials having jurisdiction.

3.2 BLASTING PRECAUTIONS

- A. No explosives shall be used within 20 feet of:
 - 1. Building and/or structures existing, constructed or under construction.
 - 2. Underground and/or overhead utilities whether existing or partially constructed.
- B. Permission for any deviation from the restriction set forth above shall be secured from the Engineer, in writing; however, permission for any such deviations shall not relieve the Contractor from any responsibility in the event of damage to buildings, structures or utilities.
- C. All operations involving explosives shall be conducted with all possible care to avoid injury to persons and property. Blasting shall be done only with such quantities and strengths of explosives and in such a manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not to be excavated in an unshattered condition. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, and to prevent injury to existing pipes or other structures and property above or below ground. Rock shall be well covered with logs or mats, or both, where required. Sufficient warning shall be given to all persons in the vicinity of the Work before a charge is exploded.
- D. The Contractor shall be solely responsible for his blasting operations. The Contractor shall not hold the Owner and/or the Engineer liable for any damages resulting from his blasting operations on this project.

3.3 PREBLAST STRUCTURE SURVEY

- A. Perform a preblast survey to determine and document with pictures the condition of adjacent structures, utilities, wells, buried cables, and other features within a minimum of 400 ft. of the blast area unless otherwise required by applicable regulatory authorities. Determine safe distances to structures or other facilities according to NFPA 495, Appendix B. Where facilities are closer than these distances, and natural barriers are not present, or when the amount of explosive cannot be reduced economically, blasting mats shall be used. Provide mats to protect environmentally sensitive areas, trees within 20 feet from the blasting area, streams, and rock formations from throw rock.
- B. Purpose of survey is to document existing condition of structures prior to blasting, and is intended to be used as evidence in ascertaining whether and to what extent damage may have occurred as result of blasting.
- C. Conduct survey prior to start blasting.
- D. Record information for each structure surveyed:
 - 1. Age and type of construction.
 - 2. Location and character of cracks.
 - 3. Evidence of settlement and leakage.
 - 4. Other pertinent information.
- E. Record preblast survey information on forms prepared specifically for preblast surveys.
- F. Supplement written records with photographs or videotape recordings.
- G. Submit copies of written records and photographs or videotapes to respective property owner, as well as, OWNER and ENGINEER, prior to start of blasting.

3.4 BLAST DESIGN

- A. Design each blast to avoid damage to existing facilities, adjacent property, and completed Work. Consider effects of blast-induced vibrations and air blast, and fly rock potential in design of each blast.
- B. Whenever peak particle velocity exceeds vibration limits, change design of subsequent blasts, as necessary to reduce peak particle velocity to within limits established by BIC.
- C. Whenever air blast exceeds limits, change design of subsequent blasts or provide controls necessary to reduce air blast to within specified limits.

3.5 VIBRATION LIMITS

- A. General: Establish appropriate maximum limit for vibration for each structure or facility that is adjacent to or near blast sites. Base maximum limits on expected sensitivity of each structure or facility to vibration, and federal, state, or local regulatory requirements, but not to exceed 1.25 in/sec.

3.6 AIR-BLAST LIMITS

- A. Establish appropriate maximum limit for air blast for each structure or facility that is adjacent to or near blast sites. Base maximum limits on expected sensitivity of each structure or facility to air blast, and federal, state, or local regulatory requirements, but not to exceed 0.015 psi peak overpressure (133 decibels).

3.7 FLY ROCK CONTAINMENT

- A. Where fly rock may damage existing facilities, adjacent property, or completed Work, cover area to be blasted with blasting mats or provide other means that will contain and prevent scattering of blast debris.

3.8 VIBRATION AND AIR-BLAST MONITORING

- A. Monitor and record blast-induced vibrations and air blast using suitable sensors and recording equipment for each blast.
- B. Contractor shall provide two (2) seismographs during blasting operations capable of the following:
 - 1. Designed for monitoring blast-induced vibrations and air blast. Capable of recording particle velocity in three mutually perpendicular directions in range from 0 to 6 inches per second.
 - 2. Flat vibration frequency response between 4- and 200-Hz.
 - 3. Capable of recording air-blast overpressure up to 140 decibels.
 - 4. Flat air-blast frequency response between 2- and 500-Hz.
- C. Monitor on, or at, structures or other facilities that are closest to point of blasting. Monitoring more distant facilities that are expected to be sensitive to blast-induced vibrations and air blast.
- D. BIC shall supervise establishment of monitoring programs and initial operation of equipment; review interpretation of records and recommend revisions of blast designs.
- E. Include following information in blasting plan.
 - 1. Vibration and air-blast limits as recommended by BIC.
 - 2. Name of qualified BIC who will be responsible for monitoring program and interpretation of records.
 - 3. Types and models of equipment proposed for monitoring.
 - 4. Numbers and locations of proposed monitoring stations.
 - 5. Procedures to be used for coordinating recording of each blast.
 - 6. Steps to be taken if blasting vibrations or air blast exceed limits.

3.9 EXPLOSIVES

- A. The CONTRACTOR shall keep explosives on the site only in such quantity as may be needed for the Work under way and only during such time as they are being used. Notify the OWNER, in advance, of provisions to store and use explosives.

3.10 BLASTING PRECAUTIONS

- A. Permission for any deviation from the blasting plan and other specified restrictions shall be secured from the OWNER and applicable authorities, in writing; however, permission for any such deviations shall not relieve the CONTRACTOR from any responsibility in the event of damage to buildings, structures or utilities.
- B. All operations involving explosives shall be conducted with all possible care to avoid injury to persons and property. Blasting shall be done only with such quantities and strengths of explosives and in such a manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not to be excavated in an unshattered condition. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, and to prevent injury to existing pipes or other structures and property above or below ground. Rock shall be well covered with logs or mats, or both, where required. Sufficient warning shall be given to all persons in the vicinity of the Work before a charge is exploded.

- C. The CONTRACTOR shall be solely responsible for his blasting operations. The CONTRACTOR shall not hold the OWNER and/or the ENGINEER liable for any damages resulting from his blasting operations on this project.

3.11 BLASTING RECORDS

- A. For each blast, document the following:
 - 1. Location of blast in relation to Project stationing or state plane coordinate system and elevation.
 - 2. Date and times of loading and detonation of blast.
 - 3. Name of person in responsible charge of loading and firing.
 - 4. Details of blast design, as previously specified.
 - 5. Vibration records including location and distance of seismograph geophones to blast and to nearest structure, and measured peak particle velocity. Report peak particle velocity in units of inches per second.
 - 6. Air-blast records. Report peak air blast values in units of pounds per square inch overpressure above atmospheric or in decibels at linear response.
 - 7. Comments by BIC regarding damage to existing facilities, adjacent property, or completed Work, misfires, fly rock occurrences, unusual results, or unusual effects as required.

3.12 SUSPENSION OF BLASTING

- A. In event damage to existing facilities, adjacent property, or completed Work occurs due to blasting, immediately suspend blasting and report damage to ENGINEER and OWNER. CONTRACTOR shall be responsible for all costs of repairs or replacement due to damage from blasting.
- B. Before resuming blasting operations, adjust design of subsequent blasts, or take other appropriate measures to control effects of blasting, and submit complete description of proposed changes for reducing potential for future damage.
- C. Do not resume blasting until authorized by OWNER and applicable regulatory authorities.

3.13 ROCK REMOVAL B MECHANICAL METHOD

- A. Excavate and remove rock by the mechanical method. Drill holes and utilize mechanical impact to fracture rock.
- B. In utility trenches, excavate 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- C. Stockpile excavated materials and reuse select materials for site landscaping. Remove and dispose of excess materials offsite at approved location.
- D. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 02220.

3.14 PAYMENT

- A. Rock excavation shall be bid as unclassified and will **not** be paid for separately.

END OF SECTION

SECTION 02225

EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall make excavations in such widths and depths as will give suitable room for below grade vaults, laying pipe to the lines, grades and elevations, furnish, place and compact all backfill materials specified herein or denoted on the Drawings. The materials, equipment, labor, etc., required herein are to be considered as part of the requirements and costs for installing the various pipes, structures and other items they are incidental to.

1.2 RELATED WORK

- A. Section 02221- Rock Removal
- B. Section 15090 – Gas Pipe and Fittings

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Crushed stone material shall conform with the requirements of the applicable sections of the Kentucky Bureau of Highways Standard Specifications and shall consist of clean, hard, and durable particles or fragments, free from dirt, vegetation or objectionable materials.
- B. Two classes of crushed stone material are used in this Section. The type of material in each class is as follows:
 - 1. Class I - No. 9 Aggregate.
 - 2. Class II - Dense Graded Aggregate (DGA).

PART 3 - EXECUTION

3.1 EXCAVATION OF TRENCHES

- A. Unless otherwise directed by the Engineer, trenches are to be excavated in open cuts.
 - 1. Where pipe is to be laid in gravel bedding or concrete cradle, the trench may be excavated by machinery to, or just below, the designated subgrade, provided that the material remaining at the bottom of the trench is no more than slightly disturbed.
 - 2. Where pipe is to be laid directly on the trench bottom, the lower part of trenches in earth shall not be excavated to subgrade by machinery. However, just before the pipe is to be placed, the last of the material to be excavated shall be removed by means of hand tools to form a flat or shaped bottom, true to grade, so that the pipe will have a uniform and continuous bearing and support on firm and undisturbed material between joints except for limited areas where the use of pipe slings may have disturbed the bottom.
- B. Trenches shall be sufficient width to provide working space on each side of the pipe and to permit proper backfilling around the pipe.
 - 1. The Contractor shall remove only as much of any existing pavement as is necessary for the prosecution of the Work. The pavement shall be cut with pneumatic tools, without extra compensation to the Contractor, to prevent damage to the remaining road surface. Where pavement is removed in large pieces, it shall be disposed of before proceeding with the excavation.
- C. All excavated materials shall be placed a safe distance back from the edge of the trench.

- D. Unless specifically directed otherwise by the Engineer, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew, and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew. Watchmen or barricades, lanterns and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions, shall be provided by and at the expense of the Contractor.
- E. When so required, or when directed by the Engineer, only one-half of street crossings and road crossings shall be excavated before placing temporary bridges over the side excavated, for the convenience of the traveling public. All backfilled ditches shall be maintained in such manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged at the direction of the Engineer.
- F. Trench excavation shall include the removal of earth, rock, or other materials encountered in the excavating to the depth and extent shown or indicated on the Drawings.

3.2 GAS PIPE BEDDING

- A. Piping for gas mains shall be supported as follows:
 - 1. The trench bottom for gas main piping shall be stable, continuous, relatively smooth and free of frozen material, clodded dirt, foreign material and rock or granular material larger than 1/2 inch in diameter. The foundation for gas main piping shall be prepared so that the entire load of the backfill on top of the pipe will be carried uniformly on the barrel of the pipe. Any uneven areas in the trench bottom shall be shaved-off or filled-in with Class I granular bedding. When the trench is made through rock, the bottom shall be lowered to provide 6 inches of clearance around the pipe. Class I granular bedding shall be used to bring the trench bottom to grade.
- B. After each pipe has been brought to grade, aligned, and placed in final position, earth material for gas main piping in areas not subject to vehicular traffic and Class I material for gas mains in paved areas, shall be deposited and densified under the pipe haunches and on each side of the pipe up to the spring line of the pipe to prevent lateral displacement and hold the pipe in proper position during subsequent pipe jointing, bedding, and backfilling operations.
- C. In wet, yielding and mucky locations where pipe is in danger of sinking below grade or floating out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.
- D. Where an unstable (i.e., gas, mud, etc.) trench bottom is encountered, stabilization of the trench bottom is required. This is to be accomplished by undercutting the trench depth and replacing to grade with a foundation of crushed stone aggregate.
- E. The depth of the foundation is dependent upon the severity of the trench bottom. The size of stone aggregate used in the foundation will be determined by the condition of the unstable material. Once the trench bottom has been stabilized, the required Class I bedding material can be placed.
- F. It should be noted that no pipe shall be laid on solid or blasted rock.
- G. Pipe bedding as required in Paragraphs A, B, C, and D of this Section is **not** considered a separate pay item.

3.3 GAS PIPE BACKFILLING

- A. Initial Backfill:
 - 1. This backfill is defined as that material which is placed over the pipe from the spring line to a point 6 inches above the top of the pipe. For gas main piping in areas not subject to vehicular traffic, initial backfill material shall be earth material free of rocks, acceptable to the Engineer or with Class I material when a condition exists mentioned in Paragraph A, 3. below. For gas main piping in paved areas, initial backfill shall be Class I material.

2. Material used, whether earth or Class I, in the initial backfilling is **not** a separate pay item. Payment for the material is included in the unit price per linear foot of gas main.
 3. In areas where large quantities of rock are excavated and the available excavated earth in the immediate vicinity is insufficient for placing the required amount of backfill over the top of the pipe as set forth in Paragraph A.1, the Contractor shall either haul in earth or order Class I material for backfilling over the pipe. Neither the hauling and placement of earth nor the ordering and placement of Class I material to fulfill the backfill requirements set forth herein is considered a separate pay item.
- B. Final Backfill:
1. There are two cases where the method of final backfilling varies. The various cases and their trench situations are as follows:
 - a. Case I - Areas not subject to vehicular traffic.
 - b. Case II - Paved areas including streets, drives, parking areas, and walks.
 2. In all cases, walking or working on the completed pipelines, except as may be necessary in backfilling, will not be permitted until the trench has been backfilled to a point 6 inches above the top of the pipe. The method of final backfilling for each of the above cases is as follows:
 - a. Case I - The trench shall be backfilled from a point 6 inches above the top of the pipe to a point 8 inches below the surface of the ground with earth material free from large rock (greater than 6 inches in the longest dimension), acceptable to the Engineer. The remainder of the trench shall be backfilled with earth material reasonably free of any rocks.
 - b. Case II - The trench shall be backfilled from a point 6 inches above the top of the pipe to a point 12 inches below the existing pavement surface with Class I (No. 9 crushed stone aggregate) material. The backfill shall be mechanically tamped in approximately 6-inch layers to obtain the maximum possible compaction. The remaining backfill shall be as follows:
 - c. For gravel surfaces - Class II (dense graded aggregate) material mechanically tamped to maximum possible compaction. The trench may be left with a slight mound if permitted by the Engineer.
 - d. For bituminous and concrete surfaces - Bituminous and concrete pavement sections as detailed on the Drawings and as specified for Bituminous Pavement Replacement and Concrete Pavement Replacement.
 3. Earth and Class I material used in final backfill is not a separate pay item. Payment shall be included in the price of gas main.
 4. Class II material used in final backfill shall be included in the unit price of the pipe.
- C. A sufficient amount of Class II material shall be stockpiled to insure immediate replacement by the Contractor of any settled areas. No extra payment will be made for the filling in of settled or washed areas by the Contractor.
- D. Excavated materials from trenches, in excess of quantity required for trench backfill, shall be disposed of by the Contractor. It shall be the responsibility of the Contractor to obtain location or permits for its disposal, unless specific waste areas have been designated on the Drawings or noted in these Specifications. The cost of disposal of excess excavated materials, as set forth herein, no additional compensation being allowed for hauling or overhaul.

3.4 COMPACTION

- A. Place backfill in 6- to 8-inch lifts and compact thoroughly.
- B. Granular Material
 1. Field compaction shall consist of vibratory plate
 2. Obtain 85% relative density (ASTM-4253 and D-4254)
- C. Earth Material
 1. Field compaction shall consist of self propelled sheepsfoot or pad foot
 2. Obtain 90% standard density (ASTM D-698)

3.5 PLACEMENT OF IDENTIFICATION TAPE

- A. Detectable underground marking tape shall be placed over all utility lines. Care shall be taken to insure that the buried marking tape is not broken when installed and shall be Lineguard brand encased aluminum foil, Type III. The identification tape is manufactured by Lineguard, Inc., P.O. Box 426, Wheaton, IL 60187.
- B. The identification tape shall bear the printed identification of the utility line below it, such as "Caution - Buried Below". Tape shall be reverse printed; surface printing will not be acceptable. The tape shall be visible in all types and colors of soil and provide maximum color contrast to the soil. The tape shall meet the APWA color code, and shall be 2 inches in width. Colors are: yellow - gas, green - gas, red - electric, blue - gas, orange - telephone, brown - force main.
- C. The tape shall be the last equipment installed in the trench so as to be first out. The tape shall be buried 4 to 6 inches below top of grade. After trench backfilling, the tape shall be placed in the backfill and allowed to settle into place with the backfill. The tape may be plowed in after final settlement, installed with a tool during the trench backfilling process, unrolled before final restoration or installed in any other way acceptable to the Owner or Engineer.

END OF SECTION

SECTION 02446 HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Labor, materials, machinery, and construction equipment required to construct entry and exit pits and associated shoring and sheeting (actual size and depth to be determined by the Contractor) and perform in a good workmanlike manner all horizontally-controlled directional drilling for the installation of approximately 300 lineal feet of steel gas main under McCool's Creek as indicated on the Drawings.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 15061 – Gas Pipe and Fittings

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. F1962, Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.
- B. Qualifications:
 - 1. Directional drilling and pipe installation shall be done only by an experienced Contractor specializing in directional drilling and whose key personnel have at least 5 years experience in this work. Furthermore, the Contractor shall have the following minimum experience:
 - a. Successfully completed a minimum of five (5) HDD installations in the last 5 years that were 10-inch diameter and up to 1,000 feet.
 - b. At least three (3) of the projects shall have utilized gas steel pipe for river crossing.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Certification from the pipe and fitting manufacturer that all of the materials used to manufacture the pipe and fittings meet the requirements of this specification and the referenced standards.
 - b. Products information, material specifications, material composition, and handling procedures.
 - c. Material safety data sheets and special precautions required.
 - d. Method of mixing and application.
 - 3. The Contractor shall prepare and submit a detailed schedule for the work. The schedule shall include all major tasks including, but not limited to, the following:
 - a. Manufacture of steel pipe and fittings.
 - b. Pipe delivery to the project site.
 - c. Drill rig mobilization and setup.
 - d. Pipe stringout and assembly.
 - e. Beginning and completing the pilot hole drilling.
 - f. Beginning and completing the pre-reaming.
 - g. Beginning and completing the pipe pull-back.
 - h. Hydrostatic pressure testing.
 - i. Disposal of drilling fluids.
 - j. Cleanup, site restoration and demobilization.

4. At least 15 days prior to mobilizing drilling equipment, the Contractor shall submit a detailed plan to the Engineer for review. The plan shall include the following:
 - a. Pilot hole drilling procedure, reaming operation, pullback procedure, ballasting, internal gauging, hydrostatic testing, and dewatering procedures.
 - b. Equipment, solids control plant, and pipe string layout plan.
 - c. Calculations showing anticipated maximum pipe stresses during pull-back, required and maximum drilling fluid pressures, and safety factors for potential inadvertent return of drilling fluid due to soil hydrofracture.
 - 1) The calculations shall be sealed by a Professional Engineer.
 - d. Emergency response plan for inadvertent return of drilling fluid.
5. It is anticipated that the pipeline will be installed in one continuous length; therefore no pipe joining during pull-back is anticipated. If proposed by the Contractor, such pipe joining must be submitted with full details of methods and performance for approval by the Engineer at least ten (10) days in advanced of proposed operations. Contractor bears sole risk and responsibility for proving the acceptability of such pipe joining and associated work.
6. Following completion of the pilot hole drilling, the Contractor shall submit a detailed plan and profile of the bore plotted at a scale no smaller than 1 IN equals 20 FT horizontally and 1 IN equals 10 FT vertically. (The Contractor may make changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points, provided these changes are first submitted in writing and agreed to by the Owner and Engineer.)

1.4 COMPLETION OF DIRECTIONAL DRILLING

- A. If a directional drilled pipeline is not successfully installed or the Contractor abandons the effort, he will forfeit all payments for that HDD crossing under this Contract.
- B. Completion and successful testing of the approved pipeline will entitle the Contractor to full payment for the Contract unit price for the HDD crossing, less retainage for site restoration, which sum shall be determined by the Owner, but in no case greater than ten (10) percent of the Contract lump sum price.
- C. In the event of his failure to install the directional drilled pipeline, the Contractor shall retain possession of the steel pipe and remove it from the site. The bore hole beneath land shall be completely filled with grout or sand to prevent future settlement. If the steel pipe cannot be withdrawn, it shall be cut off at least 3 feet below the ground and capped with a blind flange. The annular space shall be grouted at the Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall provide all materials, equipment, and labor for completing the subaqueous crossings and for adequate protection of the Work.

2.2 MATERIALS

- A. Refer to Specification Section 15061 for steel pipe.
- B. Drilling Materials:
 1. The drilling materials used by the Contractor to aid in the horizontal drilling operations shall be of the Contractor's choosing. Products shall comply with environmental regulations applicable to this project.
- C. Drilling Fluids:
 1. Drilling fluids used in the drilling operation shall be a mixture of bentonite and water or such other fluids of the Contractor's choosing.
 2. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor's drilling plan presented to the Owner.

3. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.

PART 3 - EXECUTION

3.1 COORDINATION OF WORK

- A. The Contractor shall coordinate his work with the agencies, corporations, and individuals owning or having jurisdiction of land in the project vicinity including, but not necessarily limited to:
 1. Corps of Engineers
 2. KYTC
- B. The Contractor shall be required to construct test pits to locate existing underground utilities and/or structures in advance of construction. Test pits shall be excavated and backfilled by the Contractor so as not to create a hazardous area. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Owner.
- C. The Contractor shall have the option of securing additional construction easements in different locations if desired to accommodate his construction method. In this case, the Contractor shall notify the Engineer of his intention to secure additional easements. The cost of negotiating and obtaining these easements shall be borne by the Contractor.
- D. Drilling water required for drilling may be purchased from Carroll County Water District or Carrollton Utilities. Contractor is responsible for purchasing, transporting and storing any water required. River or pond water shall not be used for any purpose in the construction. Securing permission to use water from any other source is the responsibility of the Contractor.
 1. The Contractor shall coordinate with CU to identify available source points for water. Any source point is subject to the approval of CU.
 2. The Contractor shall furnish and install any required backflow preventers, valves and adapters.
 3. The quantity of water that the Contractor may use for construction purposes may be limited by flow rate (gallons per minute), time of day, and/or the needs of the water utility, including firefighting.
 4. All water for drilling shall be paid for by the Contractor at the water utility's prevailing rates.

3.2 CONSTRUCTION LAYOUT

- A. The Contractor shall employ Kentucky licensed land surveyors to locate the positions of the entry and exit points, established elevation and horizontal datum for the borehead control, and layout for the pipe assembly area.

3.3 INSTALLATION

- A. General:
 1. The Contractor shall install the pipeline under the river and its adjacent banks by the horizontally drilled, directionally controlled method of construction. The horizontally drilled, directionally controlled method shall consist of the drilling of a small diameter pilot hole in a vertical arc from one side of the river to the other followed by an enlarged diameter hole for the steel pipeline insertion. The exact method and techniques for completing the directionally drilled crossing shall be determined by the Contractor, subject to the requirements of these Specifications.
 2. The Contractor shall comply with the applicable portions of ASTM F1962.

- B. Pipe Stringout:

1. The Contractor shall elevate the pipe stringout if required, to provide access to private property.
 2. The Contractor shall comply with any and all additional restrictions of affected property owners.
 3. Utilities may be present in the stringout area, and adequate precautions must be taken by the Contractor to prevent damage to the utilities, as required by each utility owner.
- C. Instrumentation:
1. The Contractor will provide and maintain instrumentation which will accurately locate the pilot hole at all times. The Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible.
 2. The Contractor will provide and maintain instrumentation which will accurately measure drilling fluid flow discharge rate and pressure.
 3. The Contractor shall provide continuous access to these instruments and their readings to the Owner and Engineer at all times.
- D. Tolerances:
1. Steel pipe installed by the horizontally drilled directionally controlled method must be located in plan as shown on the Drawings, and must be within the elevation limits shown on the Drawings. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 50 feet. This "as-built" plan and profile shall be updated continuously as the pilot bore is advanced. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot bore shall be withheld from the Owner or Engineer. At the completion of the pilot hole, the Contractor shall provide the Engineer with the coordinates of the pilot hole. The entry point location of the pilot hole shall initially penetrate the ground surface at the location shown on the Plan and Profile Drawings. The Contractor will stake this location in the field.
 2. The Contractor shall make every effort to have the exit point located where shown on the Plans. In no case shall the actual exit point be located farther than 10 feet (along the length of the pipe) from the intended exit point or more than 5 feet on either side perpendicular to the pipe at the exit point location shown. The entire pipe must be within the permanent easement and/or permitted location.
 3. The alignment of the pilot boring must be such that the pipe can be strung out in a straight line. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require a new pilot boring be made, at no additional cost the Owner. The Contractor will stake this location in the field.
 4. The Contractor shall at all times handle the high density polyethylene pipe in a manner that does not overstress the pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The maximum allowable tensile load imposed on the steel pipe shall be within the limits of the pipe grade and wall section strengths. The Contractor shall be responsible for determining pulling loads required for his method of installation. Such loads shall be minimized as required to prevent failure of the pipeline during installation. Protect interior and exterior surfaces at all times.
- E. Entry and Exit Pits:
1. Approximate locations of entry and exit pits are shown on the Drawings, subject to the restrictions of the landowners and applicable provisions below:
 - a. Erosion protection and sediment control BMPs shall be installed in accordance local regulations. The Contractor shall implement BMPs to accommodate his sequence and method of construction.
 - b. Trenching shall be in accordance with Specification Sections 02225.

3.4 REAM AND PULL BACK

- A. Prereaming: Prereaming operation shall be conducted at the discretion of the horizontal drilling Contractor. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to prereaming operations.
- B. Pulling Loads: The Contractor shall be responsible for determining pulling loads required for this method of installation. Such loads shall be minimized as required to prevent failure of the pipeline during installation.
- C. Torsional Stress: A swivel shall be used to connect the pipeline pull section to the reaming assembly to minimize torsional stress imposed on the section.
- D. Buckling Stress: Contractor shall fill the pipe with clean water, as installation proceeds, as required to prevent buckling and reduce buoyancy.
- E. Pull Section Support: The pull section shall be supported as it proceeds during pull back so that it moves freely and the pipe exterior is not damaged.
- F. Pull Section Length: If space allows, the pull section shall be installed in one continuous length with no tie-in joints. If space is not available, tie-in joints shall be minimized and fully inspected prior to installation.

3.5 OVERPULLING

- A. After the high density polyethylene pipeline has been pulled into the reamed pilot hole, the pipe shall be pulled so that at least 3% of the HDD pipeline length is exposed on the end of the bore. The pulling force shall be relieved, and the pipe allowed to “relax” while the pipe is still connected to the pulling head. The Contractor shall allow a time period equal to the total pullback time for the pipe to recover from its elastic strain and visco-elastic stretch, but in no case shall this time be less than 24 hours.

3.6 HANDLING OF DRILLING MUD AND CUTTINGS

- A. The HDD operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to nearby waterways. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.
- B. The general work areas on the entry and exit sides of the crossings shall be enclosed by a berm to contain unplanned spills or discharge.
- C. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desilter/desander, centrifuges, material handlers, and haulers, all in a quantity sufficient to perform the cleaning/separating operations without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by Contractor to the extent necessary for legal disposal in off-site landfills. Water from the dewatering process shall be treated by Contractor to meet permit requirements and disposed of locally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.
- D. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.
- E. Disposal of drilling fluids and cuttings shall be the responsibility of the Contractor and shall be conducted in compliance with all relevant environmental regulations, right-of-way and work space agreements and permit requirements. Bentonite slurry used during the horizontal drilling process shall not be disposed of on-site, but shall be hauled away in watertight trucks to a legal disposal facility. All costs related to disposal shall be borne by the Contractor.

- F. Inadvertent drilling fluid returns at locations other than the entry and exit points shall be minimized. Contractor shall immediately clean-up any inadvertent returns.

3.7 TESTING

- A. Testing:
 - 1. See Section 15061.
- B. Pipe Gauging:
 - 1. The Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations.
 - 2. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g., dents, buckles, gouges, and internal obstructions) greater than 2% of the nominal pipe diameter, or excessive ovality greater than 5% of the nominal pipe diameter.
 - a. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less.
 - b. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of five feet.

3.8 CLEANUP

- A. During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, existing pipe and appurtenances removed by the Contractor, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operation, and shall leave the entire site of the work in a neat and orderly condition.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Formwork.
- B. Reinforcing Steel.
- C. Expansion and Contraction Joints.
- D. Waterstops
- E. Concrete.

1.2 RELATED REQUIREMENTS

- A. Section 02225 – Excavation, Backfilling and Compacting for Utilities.

1.3 REFERENCES

- A. ACI 350R Environmental Engineering Concrete Structures.
- B. ACI318 - Building Code Requirements for Reinforced Concrete.
- C. ACI347 - Recommended Practice for Concrete Formwork.
- D. CRSI - Manual of Standard Practice.
- E. CRSI - Placing Reinforcing Bars.
- F. ASTM - A-615, A-120, A-185, C-31, C-39

1.4 SUBMITTALS

- A. The Contractor shall submit the following data to the Engineer for review:
 - 1. Mix designs for all mixes proposed or required to be used, including all mixes containing admixtures.
 - 2. Certification by the manufacturer that cement meets the Specification contained herein.
 - 3. Shop drawing for reinforcing steel showing bar schedules, location, and splices.
 - 4. Reports on laboratory compression tests of cylinders taken during concrete placement.
 - 5. Manufacturer's cut sheets for all other concrete related products.

PART 2 - PRODUCTS

2.1 CLASSES OF CONCRETE AND USAGE

- A. Structural concrete of the various classes required shall be proportioned to produce the following 28-day compressive strengths:
 - 1. Selection of Proportions for 4,500 psi Concrete:
 - a. 4,500 psi compressive for strength at 28 days.
 - b. Type I/II cement plus air.
 - c. Maximum water/cement ratio - 0.42.
 - d. Minimum cement content - 564 lbs. (6.0 bags)/cubic yard concrete.
 - e. Nominal maximum size coarse aggregate - No. 67 (3/4-inch maximum) or No. 57 (1-inch maximum).
 - f. Air content - 5% plus or minus 1% by volume.
 - g. Slump - 4 inches in accordance with ASTM C-143, when measured with only an air entraining admixture. Additional slump is allowed by use of water reducing or superplasticizing admixtures.

2. Selection of Proportions for 3,000 psi Concrete:
 - a. 3,000 psi compressive strength at 28 days.
 - b. Type I/II cement plus air.
 - c. Maximum water/cement ratio - 0.56.
 - d. Minimum cement content - 470 lbs. (5.0 bags)/cubic yard concrete.
 - e. Nominal maximum size coarse aggregate - No. 67 (3/4-inch maximum) or No. 57 (1-inch maximum).
 - f. Air content - 5% plus or minus 1% by volume.
 - g. Slump - 4 inches in accordance with ASTM C-143, when measured with only an air entraining admixture.
- B. Concrete shall be used as follows:
 1. 4,500 psi concrete for all concrete work except as noted below.
 2. 3,000 psi concrete for encasement of piping where indicated, and thrust blocking.
- C. All testing of aggregates and determination of proportions shall be or have been performed by a recognized independent testing laboratory.
- D. Cement for exposed concrete shall have a uniform color classification.
- E. Type I/II cement conforming to ASTM C-150 shall be used in all concrete.
- F. Coarse aggregate shall be crushed stone having clean, hard, uncoated particles, and shall be free from injurious amount of soft, friable, thin, elongated or laminated pieces. Coarse aggregates shall conform to all requirements of ASTM C-33.
- G. Fine aggregates shall be natural sand having clean, hard, uncoated grains, free from injurious amounts of clay, dust, organic matter or other deleterious substances, and shall conform to ASTM C-33.
- H. Water for concrete shall be clean, fresh, and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

2.2 ADMIXTURES

- A. An air entraining admixture shall be used on all concrete and shall be the neutralized vinsol resin type such as Master Builders MB-VR, Euclid Chemical Company AIR-MIX or equivalent. The admixture shall meet the requirements of ASTM C-260.
- B. Other admixtures (water reducing agents, accelerating agents, retarding agents, superplasticizing agents) shall be considered where necessary to meet the needs of construction.
- C. Admixtures shall be used in concrete design mixes in the same manner and proportions as in the field so that the effects of the admixtures are included in preliminary test submitted to the Engineer for review prior to the start of construction.

2.3 REINFORCEMENT

- A. The minimum yield strength of the reinforcement shall be 60,000 pounds per square inch. Bar reinforcement shall conform to the requirements of ASTM A-615. All bar reinforcement shall be deformed.
- B. Welded wire fabric shall conform to ASTM A-185 and shall be of weight and gauge as indicated on the Drawings.
- C. Reinforcement supports and other accessories in contact with the forms for members which will be exposed to view in the finished work shall be of stainless steel or shall have approved high-density polyethylene tips so that the metal portion shall be at least one-quarter of an inch from the form or surface. Supports for reinforcement, when in contact with the ground or stone fill, shall be precast stone concrete blocks.

2.4 FORMS

- A. Forms shall be of suitable material, design, and construction so as to be rigid, tight enough to prevent the passage of mortar, and plane surfaces with a tolerance of 1/16-inch in 4 feet.
- B. For surfaces to be given burlap-rubbed finish, the form surface in contact with the concrete shall be made of heavy gauge metal, new plywood (used plywood which, in the opinion of the Engineer, is substantially equal to new plywood may be used), tempered wood fiberboards with smooth surface, or similar materials. Metal forms or form linings shall have square edges so that the concrete will not have fins or fluting. Forms shall not be pieced out by use of materials different from those in the adjacent form or in such manner as will detract from the uniformity of the finished surface.
- C. For surfaces other than those to be given burlap-rubbed finish, forms shall be made of wood, metal, or other acceptable material. Wooden forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots. Plywood shall be reasonable good, as accepted. Metal forms shall be of an acceptable type for the work involved. Edges of forms in contact with concrete shall be flush within 1/16-inch.
- D. Form for walls, columns, or piers shall have removable panels at the bottom for cleaning, inspection, and scrubbing-in of bonding grout. Forms for thin sections (such as walls or columns) of considerable height shall be arranged with suitable openings so that the concrete can be placed in a manner that will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the fresh concrete, unless special spouts are used to place concrete, and so that construction joints can be properly keyed and treated.
- E. Forms for exposed surfaces shall be built with 3/4-inch chamfer strips attached to produce smooth, straight chamfers at all sharp edges of concrete.
- F. Form ties to be encased in concrete shall not be made of through-bolts or common wire, but shall be of a well-established type, so made and installed as to embody the following features:
 - 1. After removal of the protruding part of the tie, there shall be no metal nearer than 1 inch to the face of the concrete.
 - 2. That part of the tie which is to be removed shall be at least 1/2-inch in diameter, or if smaller, it shall be provided with a wood or metal cone 1 inch long placed against the inside of the forms. Cones shall be carefully removed from the concrete after the forms have been stripped.
 - 3. Ties which pass through walls subject to hydrostatic pressure shall be provided with acceptable water stops, such as washers, securely fastened to the ties.

2.5 OTHER MATERIALS

- A. Anchorage items shall be of standard manufacture and of type required to engage with the anchors to be installed therein under other sections of the Specifications and shall be subject to approval by the Engineer.
- B. Premolded expansion-joint filler strips shall conform to ASTM D-1752 and shall be 3/8-inch thick unless otherwise shown.
- C. Joint sealants shall conform to ANSI 116.1. The following joint sealants are acceptable:
 - 1. Colma by Sika Corporation.
 - 2. Hornflex by A. C. Horn, Inc.
 - 3. Sonolastic by Sonneborn Division of Contech, Inc.
- D. Grout:
 - 1. Precision-support grout shall consist of a non-shrink, ready-to-use, precision grout material; proportioned, pre-mixed and packaged at the factory; delivered to the job site to place with only the addition of water; forming, placing and curing as stipulated by the manufacturer.
 - 2. Grouts which depend upon aluminum powders, chemicals, or other agents which produce gas for expansion are not acceptable.
 - 3. Precision-support grout shall also meet the following requirements:

- a. Free of gas producing agents.
 - b. Free of oxidizing catalysts.
 - c. Free of inorganic accelerators, including chlorides.
- E. Construction Joint Waterstops:
1. Polyvinylchloride (PVC) Waterstops:
 - a. Provide PVC waterstops complying with Corps of Engineers CRD-C572.
 - b. Provide serrated type with a minimum thickness of 3/8 inch by a minimum width of 6 inches may be provided in specific applications as approved by the ENGINEER.
 - c. Provide PVC waterstops as manufactured by Greenstreak Plastic Products company; Vinylex Corporation, or equivalent product.
 2. Adhesive Waterstop:
 - a. Provide pre-formed adhesive waterstop in construction joint locations where shown, or as alternative to PVC waterstop where appropriate.
 - b. The preformed waterstop shall meet or exceed all requirements of Federal Specifications SS-S-210A, "Sealing Compounds for Expansion Joints".
 - c. Provide adhesive waterstops as manufactured by Synko-Flex Products, Division of Henry Products, Inc.; or equivalent product.
 3. Hydrophilic Waterstops:
 - a. Hydrophilic waterstop may be used as an alternate to the adhesive waterstop.
 - b. Provide waterstops as manufactured by Greenstreak Plastic Products Company; Adeka, Inc.; or equivalent product.
- F. Membrane Forming Curing compound: ASTM C 309, Type I-D.
1. Provide without fugitive dye when requested by Engineer.
- G. Epoxy Bonding Agent: Provide two-component epoxy resin bonding agent as manufactured by Sika Chemical Corporation; A.C. Horn, Incorporated; or equivalent product.
- H. Adhesive Dowels:
1. Drilling equipment used and installation of adhesive dowels shall be in accordance with manufacturer's instructions.
 2. Assure that embedded items are protected from damage and are not filled in with concrete.
 3. Unless otherwise shown or approved by Engineer, embedment depths shall be based on a compressive strength of 2,500 psi when embedded into existing concrete.)
 4. The Contractor shall comply with the adhesive material manufacturer's installation instructions on the hole diameter. The Contractor shall properly clean out the hole utilizing a synthetic brush and compressed air to remove all loose material from the hole, prior to installing adhesive capsules or material. Proper mixing of the two-component system shall be done to the manufacturer's recommendations.
 5. Adhesive material manufacturer's representative shall observe and demonstrate the proper installation procedures for the adhesive dowels and adhesive material at no additional expense to the Owner. Each installer shall be certified in writing by the manufacturer to be qualified to install the adhesive dowels.
 6. Provide two-component dowel installation adhesive as manufactured by Hilti Corporation, or approved equivalent product.

PART 3 - EXECUTION

3.1 FORMING

- A. Forms shall be so constructed and placed that the resulting concrete will be of the shape, lines, dimensions and to the elevations indicated on the Drawings or specified, and exposed concrete will be substantially free from board or grain marks, poorly matched joints, and other irregularities or defects.
- B. Forms shall be sufficiently rigid to prevent displacement or sagging between supports, and so constructed that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for their adequacy.

- C. All falsework to support structural slabs, beams, girders, etc., shall be designed to safely and adequately support the concrete and forms during placement and curing. The adequacy and safety of the falsework shall be the sole responsibility of the Contractor.
- D. All forms shall be oiled with an acceptable nonstaining oil or liquid form coating before reinforcement is placed.
- E. Before form material is reused, all surfaces that are in contact with the concrete shall be thoroughly cleaned, all damaged places repaired, and all projecting nails withdrawn.
- F. Except as otherwise specifically authorized by the Engineer, forms shall not be removed until the concrete has aged for the following number of days-degrees*:
 - 1. Beams and slabs: 500 day-degrees.
 - 2. Walls and vertical surfaces: 100 day-degrees.
 - 3. *Day-degree: Total number of days times average daily air temperature at surface of concrete. For example, 5 days at a daily average temperature of 60 degrees F, equals 300 day-degrees.
- G. Shores under beams and slabs shall not be removed until the concrete has attained at least 60 percent of the specified compressive strength and also sufficient strength to support safely its own weight and the construction live loads upon it.

3.2 PLACING REINFORCEMENT

- A. Reinforcement shall be bent cold to the dimensions and shapes shown on the Drawings and within tolerances specified in the CRSI Manual of Standard Practice.
- B. Before being placed in position, reinforcement shall be cleaned of loose mill and rust scale, dirt and other coatings that will interfere with development of proper bond.
- C. Reinforcement shall be accurately placed in positions shown on the Drawings and firmly held in place during placement and hardening of concrete by using annealed wire ties. Bars shall be tied at all intersections except where spacing is less than one foot in both directions, then alternate intersections may be tied.
- D. Distance from the forms shall be maintained by means of stays, blocks, ties, hangers or other approved supports. Blocks for holding the reinforcement from contact with the forms shall be precast mortar blocks or approved metal chairs. Layers of bars will be separated by precast mortar blocks or other equally suitable devices; the use of pebbles, pieces of broken stone or brick, metal pipe and other such blocks will not be permitted. If fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.
- E. Before any concrete is placed, the Engineer shall have inspected the placing of the steel reinforcement and given permission to deposit the concrete. Concrete placed in violation of this provision will be rejected and thereupon shall be removed.
- F. Unless otherwise specified, reinforcement shall be furnished in the full lengths indicated on the plans. Splicing of bars, except where shown on the plans, will not be permitted without the approval of the Engineer. Where splices are made, they shall be staggered insofar as possible.

3.3 TESTING AGGREGATES AND DETERMINING PROPORTIONS

- A. No concrete shall be used in the work until the materials and mix design have been accepted by the Engineer.
- B. The conformity of aggregates to the Specifications hereinbefore given shall be demonstrated and determined by tests per ASTM C-33 made with representative samples of the materials to be used on the work.

- C. The actual proportions of cement, aggregates, admixtures and water necessary to produce concrete conforming to the requirements set forth herein shall be determined by making test cylinders using representative samples of the materials to be used in the work. A set of four standard 6-inch cylinders shall be made and cured per ASTM C-31. Two shall be tested at 7 days and two at 28 days per ASTM C-39. The slump shall not be less than the greatest slump expected to be used in the work.
- D. Reports on the tests and a statement of the proportions proposed for the concrete mixture, shall be submitted in triplicate to the Engineer for review as soon as possible, but not less than five days prior to the proposed beginning of the concrete work. If the Contractor furnishes in writing, similar, reliable detailed information from an acceptable source, and of date not more than four months prior to the time when concrete will be used on this project, the above requirements for laboratory test may be modified by the Engineer. Such data shall derive from mixtures containing constituents, including the admixtures where used, of the same types and from the same sources as will be used on this project.
- E. The Engineer shall have the right to make check tests of aggregates and concrete, using the same materials, and to order changes as may be necessary to meet the specified requirements.
- F. The Contractor may request permission to add water at the job site; and when the addition of water is permitted by the Engineer, the quantity added shall be the responsibility of the Contractor and in no case shall the total water per bag of cement exceed the ratio set forth herein.
- G. If concrete of the required characteristics is not being produced as the work progresses, the Engineer may order such changes in proportions or materials or both, as may be necessary to secure concrete of the specified quality. The Contractor shall make such changes at his own expense and no extra compensation will be allowed because of such changes.

3.4 MIXING

- A. All central-plant and rolling-stock equipment and methods shall conform to the Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready Mixed Concrete Association, as well as the ACI Standards for measuring, Mixing and Placing Concrete (ACI 614), and with the ASTM Standard Specification for Ready-Mixed Concrete, Designation C94, insofar as applicable.
- B. Ready-mixed concrete shall be transported to the site in watertight agitator or mixer trucks. The quantity of concrete to be mixed or delivered in any one batch shall not exceed the rated capacity of the mixer or agitator for the respective conditions as stated on the nameplates.
- C. Central-mixed concrete shall be plant-mixed a minimum of 1-1/2 minutes per batch, and then shall be truck-mixed or agitated a minimum of 8 minutes. Agitation shall begin immediately after the premixed concrete is placed in the truck and shall continue without interruption until discharge. For transit-mixed concrete the major portion of the mixing water shall be added and mixing started immediately after the truck is charged.
- D. The amount of water initially added shall be recorded on the delivery slip for the Engineer's information; no additional water shall be added, either in transit or at the site, except as directed. Mixing (at mixing speed) shall be continued for at least 10 minutes followed by agitation without interruption until discharge. Concrete shall be discharged at the site within 1-1/2 hours after water was first added to the mix, and shall be mixed at least 5 minutes after all water has been added.
- E. Concrete which has become compacted or segregated during transportation to or in the site of the work shall be satisfactorily remixed just prior to being placed in the forms.
- F. Partially hardened concrete shall not be deposited in the forms. The retempering of concrete which has partially hardened (that is, the remixing of concrete with or without additional cement, aggregate, or water) will not be permitted.

3.5 COMPRESSION TESTS

- A. During the progress of the work, at least one (1) set of four (4) compression test cylinders shall be made for each 50 cubic yards of concrete or major fraction thereof, and not less than one such set for each type of concrete for each day's pouring. Cylinders made in the field shall be made and cured in accordance with the ASTM Standard Method of Making and Curing Concrete Test Specimens in the Field, Designation C31, except that wherever possible molds shall be left on the cylinders until they have reached the laboratory. Testing services to satisfy the requirements of ACI shall be paid for by the Contractor at his expense. Testing lab must be approved by the Engineer.
- B. One cylinder of each set shall be broken in accordance with ASTM C-39 at seven (7) days and the other two at twenty-eight (28) days. Two copies of these test results shall be submitted to the Engineer on the same day of the tests.
- C. On evidence of these tests, any concrete that fails to meet the specified strength requirements shall be strengthened or replaced as directed by the Engineer at the Contractor's expense.

3.6 METALWORK IN CONCRETE

- A. All trades shall be notified, at the proper time, to install items to be embedded in concrete.
- B. All castings, inserts, conduits, and other metalwork shall be accurately built into or encased in the concrete by the Contractor as directed, and all necessary precautions shall be taken to prevent the metalwork from being displaced or deformed.
- C. Anchor bolts shall be set by means of substantial templates.

3.7 PLACING AND COMPACTING CONCRETE

- A. At least twenty-four (24) hours before the Contractor proposes to make any placement of concrete, he shall notify the Engineer of his intention and planned procedure. Unless otherwise permitted, the work shall be so executed that a section begun on any day shall be completed during daylight of the same day.
- B. No concrete shall be placed until the subgrade has been accepted in accordance with the requirements of Section 01400, Quality Control, nor shall it be placed on frozen subgrade or in water. Placement of concrete shall not be scheduled until the forms, , reinforcing, and preliminary work have been accepted. No concrete shall be placed until all materials to be built into the concrete have been set and have been accepted by the various trades and by the Engineer. All such materials shall be thoroughly clean and free from rust, scale, oil, or any other foreign matter.
- C. Forms and excavations shall be free from water and all dirt, debris, and foreign matter when concrete is placed. Except as otherwise directed, wood forms and embedded wood called for or allowed shall be thorough wetted just prior to placement of concrete.
- D. Concrete placed at air temperatures below 40 degrees shall have a minimum temperature of 50 degrees F. and a maximum of 70 degrees F. when placed.
- E. Concrete shall be transported from the mixer to the place of final deposit as rapidly as practicable and by methods which will prevent separation of ingredients and avoid rehandling.
- F. Chutes for conveying concrete shall be metal or metal-lined and of such size, design, and slope as to ensure a continuous flow of concrete without segregation. The slope of chutes shall be not flatter than 1 on 2 and all parts of a chute shall have approximately the same slope. The discharge end of the chute shall be provided with a baffle, or, if required, a spout; and the end of the chute or spout shall be kept as close as practicable to, but in no event more than 5 feet above the surface of the fresh concrete. When the operation is intermittent, the chute shall discharge into a hopper.

- G. In thin sections of considerable height (such as walls and columns), concrete shall be placed in such a manner as will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the mass of concrete being placed. To achieve this end, suitable hoppers, spouts with restricted outlets, etc., shall be used as required or permitted unless the forms are provided with suitable openings.
- H. Chutes, hoppers, spouts, etc., shall be thoroughly cleaned before and after each run and the water and debris shall not be discharge inside the form.
- I. For any one placement, concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the section, and so as to maintain, until the completion of the unit, an approximately horizontal, plastic surface.
- J. No wooden spreaders shall be left in the concrete.
- K. During and immediately after being deposited, concrete shall be thoroughly compacted by means of suitable tools and methods, such as internal-type mechanical vibrators operating at not less than 5,000 rpm., or other tool spading, to produce the required density and quality of finish. Vibration shall be done only by experienced operators under close supervision and shall be carried on in such a manner and only long enough to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents, "pumping" of air, or other objectionable results. All vibrators shall be supplemented by proper spade puddling approximately 2 to 3 inches away from forms to remove included bubbles and honeycomb. Excessive spading against the forms, causing the deposition of weak mortar at the surface, shall be avoided.
- L. The concrete shall be thoroughly rodded and tamped about embedded materials so as to secure perfect adhesion and prevent leakage. Care shall be taken to prevent the displacement of such materials during concreting.

3.8 BONDING CONCRETE AT CONSTRUCTION JOINTS

- A. In order to secure full bond at construction joints, the surface of the concrete previously placed (including vertical, inclined, and substantially horizontal areas) shall be thoroughly cleaned of foreign materials and laitance, if any, and then roughened.
- B. The previously placed concrete at the joint shall be saturated with clean water and kept thoroughly wet overnight, after which all pools shall be removed. After free or glistening water disappears, the concrete shall be given a thorough coating of neat cement mixed to a suitable consistency. The coating shall be 1/8-inch thick on vertical surfaces and 1/4-inch thick on horizontal surfaces, and shall be well scrubbed in by means of stiff bristle brushes wherever possible. New concrete shall be deposited before the neat cement dries.

3.9 CURING AND PROTECTION

- A. All concrete, particularly slabs and including finished surfaces, shall be treated immediately after concreting or cement finishing is completed, to provide continuous moist curing for at least seven days, regardless of the adjacent air temperature. Walls and vertical surfaces may be covered with continuously saturated burlap, or kept moist by other acceptable means. Horizontal surfaces, slab, etc., shall be ponded to a depth of 1/2-inch wherever practicable, or kept continuously wet by the use of lawn sprinklers, a complete covering of continuously saturated burlap, or by other acceptable means.
- B. For at least seven (7) days after having been placed, all concrete shall be so protected that the temperature at the surface will not fall below 45 degrees F.
 - 1. No manure, salt, or other chemicals shall be used for protection.
 - 2. Wherever practicable, finished slabs shall be protected form the direct rays of the sun to prevent checking and crazing.

3.10 TRIMMING AND REPAIRS

- A. The Contractor shall use suitable forms, mixture of concrete, and workmanship so that concrete surfaces, when exposed, will require no patching.
- B. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be filled, and surface defects which do not impair structural strength shall be repaired.
- C. Defective concrete shall be cut perpendicular to the surface until sound concrete is reached, but less than 1 inch deep. The remaining concrete shall be thoroughly roughened and cleaned. Concrete around the cavity or the form-tie recess shall be thoroughly wetted and promptly painted with a 1/16-inch brush coat of neat cement mixed to the consistency of lead paint. The hole shall then be filled with mortar.
 1. Mortar shall be 1:1-1/2 cement and sand mix with sufficient white cement, or fine limestone screenings in lieu of sand, to produce a surface matching the adjoining work. Cement and sand shall be from the same sources as in the parent concrete.
 2. For filling form-tie recesses, the mortar shall be mixed slightly damp to the touch (just short of "balling"), hammered into the recess until it is dense and an excess of paste appears on the surface, and then troweled smooth. Mortar in patches shall be applied so that after partial set it can be compressed and rubbed to produce a finish flush and uniform in texture with the adjoining work. All patches shall be warm-moist cured as above specified.
- D. The use of mortar patching as above specified shall be confined to the repair of small defects in relatively green concrete. If substantial repairs are required, the defective portions shall be cut out to sound concrete and the masonry replaced by means of a cement gun, or the masonry shall be taken down and rebuilt, all as the Engineer may decide or direct.

3.11 SURFACE FINISH

- A. Fins and irregularities on formed surfaces to receive no other finish shall be smoothed.
- B. The top of concrete on which other concrete or unit masonry will later be placed shall be struck off true at the surface indicated on the Drawings or as permitted by the Engineer, as the concrete is being placed. As soon thereafter as the condition of the concrete permits and before it has hardened appreciably (normally within 2 hours after being deposited), all water, scum, laitance, and loose aggregate shall be removed from the surface by means of wire or bristle brooms in such a manner as to leave the coarse aggregate slightly exposed and the surface clean.
- C. Concrete surfaces shall be finished as follows, except as otherwise required by various sections of the Specifications or shown on the Drawings.
 1. Wood-float finish shall be given to all top, substantially horizontal, exposed surfaces.
 2. Burlap-rubbed finish shall be given to all interior and exterior surfaces placed against forms which will be exposed to view on completion of the work. (Finish shall be to one foot below ground and below normal liquid surface elevations).
 3. All surfaces shaped without forms and over which liquids will flow shall be given a steel-trowel finish.
 4. Concrete surfaces to which roof insulation or roofing are to be applied shall be finished sufficiently smooth to receive the roofing material, as obtained by steel trowel or very smooth wood-float finish.

3.12 METHOD OF FINISHING

- A. Broomed Finish: Surfaces to be given broomed finish shall first be given a steel-trowel finish. Immediately after troweling, the surface shall be lightly brushed in one direction with a hair broom to produce a nonslip surface of uniformly good appearance.
- B. Wood-float Finish:
 1. Surfaces to be given a wood-float finish shall be finished by tamping with special tools to force aggregates away from the surface, and screeding with straight edges to bring the surface to the required line.

2. As soon after the condition of concrete permits and before it has hardened appreciably, all water, film, and foreign material which may work to the surface shall be removed. Rough finishing shall be done with straight edges and derbies. Machine floating if used, shall not be started until the surface will support the float adequately without digging in and bringing excess fines to the surface. At such time, a minimum of machine and hand floating with a wood float shall be employed to bring the finish to a true and uniform surface with no coarse aggregate visible.
 3. Under no circumstances will sprinkling with water or dusting with cement be permitted during finishing of the slab.
- C. Steel Trowel Finish: Surfaces to be given a steel-trowel finish shall first be given a wood-float finish. This shall be followed by hand troweling with steel trowels to bring the surface to a uniform, smooth, hard, impervious surface free from marks and blemishes. Troweling shall not be started until all water has disappeared from the surface. Over-troweling shall be avoided. Dusting with dry cement or other mixtures or sprinkling with water will not be permitted in finishing.
- D. Burlap Rubbed Finish:
1. Immediately after the forms have been stripped and before the concrete has changed in color, all fins and other projections shall be carefully removed by use of a hammer or other suitable means, and imperfections shall be repaired as hereinbefore specified under "Trimming and Repairs". While the surface is still damp, a thin coat of cement slurry of medium consistency shall be applied by means of bristle brushes to provide a bonding coat within pits and minor blemishes in the parent concrete; the coating of large areas of the surface with this slurry shall be avoided.
 2. Before the slurry has dried or changed color, a dry (almost crumbly) grout composed of 1 volume of cement to 1-1/2 volumes of masonry sand shall be applied. The sand shall have a fineness modulus of approximately 2.25 and comply with the gradation requirements of the ASTM Standard Specifications for Aggregate for Masonry Mortar, Designation C144-76.
 3. The grout shall be uniformly applied by means of damp (neither dripping wet nor dry) pads of burlap of convenient size (approximately 6 inches square) and shall be allowed to harden for one to two hours, depending on the weather. In hot, dry weather the surface shall be kept damp by means of a fine fog spray during the hardening period.
 4. When the grout has hardened sufficiently, but before it becomes so hard as to be difficult to remove, excess grout shall be scraped from the surface of the parent concrete by the edge of a steel trowel, without removing the grout from the imperfections. Thereafter, the surface shall be allowed to dry thoroughly and then be rubbed vigorously with burlap to remove all dried grout so that no visible film remains on the surface after the rubbing. The entire cleaning operation for any area shall be so planned that sufficient time is allowed for the grout to dry and be rubbed after it has been cut with the trowel.
 5. On the day following the grouting and burlap rubbing, the concrete surface shall again be rubbed clean with a dry burlap to remove inadvertent dust. If any built-up film remains on the parent surface, it shall be removed by being rubbed with a fine abrasive stone without breaking through the surface film of the original concrete. Such rubbing shall be light and sufficient only to remove excess material without working up a lather of mortar or changing the texture of the concrete. Following the final rubbing with burlap or abrasive stone, the surface shall be thoroughly washed with stiff bristle brushes (worked only along parallel lines) to remove extraneous materials from the surface. The surface shall then be sprayed with a fine fog spray to maintain a continually damp condition for at least three (3) days after application of the grout.
 6. When the burlap-rubbed finish has been completed, the concrete surface shall be smooth, free from discolorations and stains, and of uniformly good appearance.

3.13 HOT WEATHER CONDITIONS

- A. Placing of concrete under conditions of high temperature, low humidity or wind shall be done in accordance with the American Concrete Institute "Hot Weather Conditions" (latest edition).

3.14 COLD WEATHER CONDITIONS

- A. Cold weather concreting procedures precautions shall conform with American Concrete Institute "Cold Weather Concreting" (latest edition).

END OF SECTION

SECTION 09905 PAINTING AND PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. High performance industrial coatings (HPIC).
2. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
3. Minimum surface preparation requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Water Works Association (AWWA)
 - a. C213, Standard for Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
2. NACE International:
 - a. RPO394, Standard Recommended Practice, Application, Performance, and Quality Control of Plant-Applied, Fusion-Bonded Epoxy External Pipe Coating
3. National Association of Pipe Coating Applicators External Application Procedures for Plant Applied Fusion bonded Epoxy (FBE) To Steel Pipe (NAPCA)
4. National Bureau of Standards (NBS):
 - a. Certified Coating Thickness Calibration Standards.
5. National Fire Protection Association (NFPA):
 - a. 101, Life Safety Code.
6. NSF International (NSF).
7. The Society for Protective Coatings (SSPC):
 - a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
 - b. SP 1, Solvent Cleaning.
 - c. SP 2, Hand Tool Cleaning.
 - d. SP 3, Power Tool Cleaning.
 - e. SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
8. The Society for Protective Coatings/NACE International (SSPC/NACE):
 - a. SP 5/NACE No. 1, White Metal Blast Cleaning.
 - b. SP 6/NACE No. 3, Commercial Blast Cleaning.
 - c. SP 7/NACE No. 4, Brush-off Blast Cleaning.
 - d. SP 10/NACE No. 2, Near-White Blast Cleaning.
 - e. SP 12/NACE No. 5, Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating.
 - f. SP 13/NACE No. 6, Surface Preparation of Concrete.

B. Qualifications:

1. Coating manufacturer's authorized representative shall provide written statement attesting that applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.
2. Applicators shall have minimum of 10 years experience in application of similar products on similar project.
 - a. Provide references for minimum of three (3) different projects completed in last five (5) years with similar scope of work.
 - b. Include name and address of project, size of project in value (painting) and contact person.

- C. Deviation from specified mil thickness or product type is not allowed without written authorization of Engineer.
- D. Material shall not be thinned unless approved, in writing, by paint manufacturer's authorized representative.

1.3 DEFINITIONS

- A. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.
- B. Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified or in Specification Section 11005.
- C. Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to condensation, spillage or splash of a corrosive material such as water, wastewater, or chemical solution; or exposure to corrosive, caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions with pH range of 5 to 9.
- D. Highly Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to condensation, spillage or splash of a highly corrosive material such as water, wastewater, or chemical solution; or exposure to highly corrosive, caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions with pH range below five (5) or above nine (9).
- E. Exposed Exterior Surface:
 - 1. Surface which is exposed to weather but not necessarily exposed to view as well as surface exposed to view.
 - 2. Exterior surfaces are considered corrosive environment.
 - a. The following areas are considered highly corrosive:
 - 1) All chemical unloading stations and areas within 10 FT-0 IN of containment areas.
 - 2) All chemical unloading station containment areas.
 - 3) All areas within a 6 FT radius of chemical tank vents.
- F. Finished Area: An area that is listed in or has finish called for on Room Finish Schedule or is indicated on Drawings to be painted.
- G. Immersion Surface:
 - 1. Any surface immersed in water or some other liquid.
 - 2. Surface of any pipe, valve, or any other component of the piping system subject to condensation including the pipe support system.
- H. Paint includes the following:
 - 1. High performance industrial coatings (HPIC) include: Epoxies, urethanes, vinyl ester, waterborne vinyl acrylic emulsions, acrylates, silicones, alkyds, acrylic emulsions and any other coating listed as a HPIC.
- I. Surface Hidden from View: Surfaces such as those within pipe chases, surfaces between top side of ceilings (including drop-in tile ceilings) and underside of floor or roof structures above, surfaces under overhanging walkways if over five feet above adjacent walking surfaces
- J. HPIC: High performance industrial coatings.
- K. SC: Special coatings.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Applicator experience qualifications.

- a. No submittal information will be reviewed until Engineer has received and approved applicator qualifications.
3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's application instructions.
 - c. Manufacturer's surface preparation instructions.
 - d. If products being used are manufactured by Company other than listed {in the MATERIALS Article of this Specification Section}, provide complete individual data sheet comparison of proposed products with specified products including application procedure, coverage rates and verification that product is designed for intended use.
 - e. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.
 - f. Coating manufacturer's recommendation on abrasive blasting.
 - g. Manufacturer's recommendation for universal barrier coat.
 - h. Manufacturer's recommendation for providing temporary or supplemental heat or dehumidification or other environmental control measures.
4. Manufacturer's statement regarding applicator instruction on product use.
5. Certification that High Performance Coating Systems proposed for use have been reviewed and approved by Senior Corrosion Specification Specialist employed by the coating manufacturer.

B. Samples:

1. Manufacturer's full line of colors for Engineer's preliminary color selection.
2. After preliminary color selection by Engineer provide two (2) 3 x 5 IN samples of each final color selected.

C. Informational Submittals:

1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Approval of application equipment.
3. Applicator's daily records:
 - a. Submit daily records at end of each week in which painting work is performed unless requested otherwise by Engineer's on-site representative.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original containers, labeled as follows:

1. Name or type number of material.
2. Manufacturer's name and item stock number.
3. Contents, by volume, of major constituents.
4. Warning labels.
5. VOC content.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, only the following manufacturers are acceptable:

1. High performance industrial coatings:
 - a. Tnemec.
 - b. ICI Devco.
 - c. Carboline Protective Coatings.
 - d. Sherwin Williams.
 - e. Dampney Company, Inc.
 - f. PPG Industries/Amercoat.

B. Submit request for substitution in accordance with Specification Section 01640.

1. Product VOC content will be an important factor when determining acceptability of substitution.

2.2 MATERIALS

A. For unspecified materials such as thinner, provide manufacturer's recommended products.

B. Paint Systems - General:

1. P = prime coat.
2. F1, F2 . . . Fn = first finish coat, second finish coat . . . nth finish coat, color as selected by Engineer.
3. If two (2) finish coats of same material are required, Contractor may, at his option and by written approval from paint manufacturer, apply one (1) coat equal to mil thickness of two (2) coats specified.

C. HPIC products listed in the MATERIALS Article, Paint Systems paragraph are manufactured by Tnemec.

1. Products of other listed manufacturers are acceptable for use providing the product is of the same generic resin, requires comparable surface preparation, has comparable application requirements, meets the same VOC levels or better, provides the same finish and color options and will withstand the atmospheric conditions of the location where it is to be applied.

D. Paint Systems (Systems not shown are not used):

1. HPIC SYSTEM #15 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy Top Coat.
 - a. Prime coat:
 - 1) P1 = 1 coat, 4 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
 - b. Finish coat:
 - 1) Interior:
 - a) F1 = 1 coat, 6 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
 - b) F2 = 1 coat, 6 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
 - 2)
2. HPIC SYSTEM #36 - Epoxy Modified Surfacer/Filler with Polyamine Novolac Epoxy Top Coats.
 - a. Filler/surfacer coat:
 - 1) Filler = 1 coat, 0.0625 IN thick, Series 218 Mortar Clad.
 - b. Prime coat:
 - 1) P1 (horizontal surface) = 1 coat, 10 to 12 mils, Series 282 Tneme-Glaze.
 - 2) P1 (vertical surface) = 1 coat, 6 to 8 mils, Series 282 Tneme-Glaze.
 - c. Finish coat:
 - 1) F1 (horizontal surface) = 1 coat, 10 to 12 mils, Series 282 Tneme-Glaze.
 - 2) F1 (vertical surface) = 1 coat, 6 to 8 mils, Series 282 Tneme-Glaze.
3. HPIC SYSTEM #43 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy Top Coat.
 - a. Prime coat:
 - 1) P1 = 1 coat, 2.5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
 - b. Finish coat:
 - 1) Interior:
 - a) F1 = 1 coat, 3 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).

PART 3 - EXECUTION

3.1 ITEMS TO BE PAINTED

A. Exposed Exterior Surfaces including:

1. Piping, valves, fittings and supports.
2. Steel pipe bollards (not galvanized).
3. Structural steel.

4.
 - 1) Piping, valves and fitting, and supports.
 - 2) Miscellaneous ferrous metal surfaces.
- B. Seamless Carbon Steel Line Pipe
 1. The carbon steel line pipe shall have fusion-bonded epoxy internal linings and external coatings for pipeline corrosion protection.
 2. The carbon steel pipe used for the horizontal directional drill shall have a double coat of the FBE coating.
 3. Weld areas, nicks, scrapes and other damaged coating areas shall be repaired with a liquid epoxy coating.

3.2 ITEMS NOT TO BE PAINTED

- A.General: Do not paint items listed in this Article unless specifically noted in the Contract Documents to be painted.
- B.Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.
- C.Electrical Equipment:
1. Do not field paint electrical equipment except where painting is specifically stated elsewhere in these Contract Documents, or where the equipment is subject to a corrosive environment and is specifically noted to be painted.
- D.Other Items:
1. Stainless steel surfaces except:
 - a. Piping where specifically noted to be painted.
 - b. Banding as required to identify piping.
 2. Aluminum surfaces except:
 - a. Where specifically shown in the Contract Documents.
 - b. Where in contact with concrete.
 - c. Where in contact with dissimilar metals.
 3. Fiberglass surfaces except:
 - a. Fiberglass piping where specifically noted to be painted.
 - b. Piping supports where specifically noted to be painted.
 4. Code labels and equipment identification and rating plates.

3.3 SCHEDULE OF ITEMS TO BE PAINTED AND PAINTING SYSTEMS

- A.Pipe, Valves, and Fittings:
1. Bare steel pipe bollards: SYSTEM #2.
- B.Field painting of fusion bonded epoxy coated piping, valves, couplings, etc.: SYSTEM #43.

3.4 PREPARATION

- A.General:
1. Verify that atmosphere in area where painting is to take place is within paint manufacturer's acceptable temperature, humidity and sun exposure limits.
 - a. Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.
 - 1) Provide temporary dehumidification equipment properly sized to maintain humidity levels required by paint manufacturer.
 - 2) Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 HR basis.
 - a) Vent exhaust gases to exterior environment.
 - b) No exhaust gases shall be allowed to vent into the space being painted or any adjacent space.
 2. Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.

- a. Where discrepancy between coating manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.
 3. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.
 4. Adhere to manufacturer's recoat time surface preparation requirements.
 - a. Surfaces that have exceeded coating manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional coating in accordance with manufacturer's published recommendations.
 - 1) Minimum SSPC SP 7/NACE No. 4 unless otherwise approved by Engineer.
- B. Protection:
1. Protect surrounding surfaces not to be coated.
 2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
- C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.
- D. Ferrous Metal:
1. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and NAPF.
 - a. All piping, pumps, valves, fittings and any other component used in any water piping system that requires preparation for painting shall be prepared in accordance with requirements for immersion service.
 - 1) Pipe: NAPF 500-03-04.
 - 2) Fittings: NAPF 500-03-05
 - b. Prepare all areas requiring patch painting in accordance with recommendations of manufacturer and NAPF.
 - c. Remove bituminous coating per piping manufacturer, paint manufacturer and NAPF recommendations.
 - 1) The most stringent recommendations shall apply.
 2. Complete fabrication, welding or burning before beginning surface preparation.
 - a. Chip or grind off flux, spatter, slag or other laminations left from welding.
 - b. Remove mill scale.
 - c. Grind smooth rough welds and other sharp projections.
 3. Solvent clean in accordance with SSPC SP 1 or detergent and low-pressure water clean in accordance with SSPC SP 12/NACE No. 5 all surfaces scheduled to receive additional SSPC surface preparation.
 4. Surfaces subject to corrosive or highly corrosive environment and all surfaces subject to immersion service:
 - a. Near-white blast clean in accordance with SSPC SP 10/NACE No. 2.
 5. All interior and exterior structural steel not included in corrosive, highly corrosive or immersion service surfaces:
 - a. Minimum commercial blast clean in accordance with SSPC SP 6/NACE No. 3.
 6. Surfaces subject to high temperatures.
 - a. Heat in excess of 600 DegF: SSPC SP 10/NACE No. 2.
 - b. Heat in excess of 200 DegF but less than 600 DegF: SSPC SP 6/NACE No. 3.
 7. Surfaces of steel joists and steel trusses:
 - a. Commercial blast clean the major portion of the truss in accordance with SSPC SP 6/NACE No. 3.
 - b. Power tool or hand tool clean tight connection areas and other difficult to access areas in accordance with SSPC SP 2 or SSPC SP 3.
 8. Steel surfaces scheduled to receive SYSTEM #24 or #35:
 - a. White metal blast clean in accordance with SSPC SP 5/NACE No. 1.
 - b. Provide 2-1/2 to 3 mil anchor profile for SYSTEMS #24 and #35.
 9. All fusion bonded epoxy coated surfaces identified to be field painted:
 - a. Remove all traces of gloss finish by sanding or by abrasive brush blasting.

- b. Clean surface after removing gloss finish to remove sanding or blasting residue.
- 10. Restore surface of field welds and adjacent areas to original surface preparation.
- 11. Black iron piping: Remove surface varnish by solvent or waterjet and detergent cleaning or brush-off blast cleaning in accordance with SSPC SP 7/NACE No. 4.

E. Preparation by Abrasive Blasting:

- 1. All abrasive-blasted ferrous metal surfaces shall be inspected {and approved in writing by NACE certified coatings inspector} immediately prior to application of paint coatings.
 - a. Inspection shall be performed to determine cleanliness and profile depth of blasted surfaces and to certify that surface has been prepared in accordance with these Specifications.
- 2. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
- 3. Perform additional blasting and cleaning as required to achieve surface preparation required.
 - a. Prior to painting, reblast surfaces allowed to set overnight and surfaces that show rust bloom.
 - b. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be reinspected {and approved by NACE certified coatings inspector} prior to paint application.
- 4. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless required otherwise by coating manufacturer.
- 5. Provide compressed air for blasting that is free of water and oil.
 - a. Provide accessible separators and traps.
- 6. Confine blast abrasives to area being blasted.
 - a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.
 - b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.
- 7. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.
- 8. Reblast surfaces not meeting requirements of these Specifications.
- 9. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.
- 10. Properly dispose of blasting material contaminated with debris from blasting operation not scheduled to be reused.

F. All Plastic Surfaces and Non-Ferrous Surfaces Except Galvanized Steel:

- 1. Sand using 80-100 grit sandpaper to scarify surfaces.

3.5 APPLICATION

A. General:

- 1. Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.
 - a. Application equipment must be inspected and approved in writing by coating manufacturer.
 - b. Hollow metal shall be spray applied only.
- 2. Temperature and weather conditions:
 - a. Do not paint surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.
 - b. Avoid painting surfaces exposed to hot sun.
 - c. Do not paint on damp surfaces.
- 3. Immediately after surface has been inspected {and accepted by NACE certified coatings inspector}, apply structural steel and miscellaneous steel {and steel joist} {and steel truss} prime coat in the factory.
 - a. Finish coats shall be applied in the {field} {factory}.
 - b. Prime coat referred to here is prime coat as indicated in this Specification.

- 1) Structural steel and miscellaneous steel {and steel joist} {and steel truss} prime coating applied in factory (shop) as part of Fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.
4. Provide complete coverage to mil thickness specified.
 - a. Thickness specified is dry mil thickness.
 - b. All paint systems are "to cover."
 - 1) In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.
 - c. When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
5. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
6. Apply materials under adequate illumination.
7. Evenly spread to provide full, smooth coverage.
8. Work each application of material into corners, crevices, joints, and other difficult to work areas.
9. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination.
 - a. Clean contaminated surfaces before applying next coat.
10. Smooth out runs or sags immediately, or remove and recoat entire surface.
11. Allow preceding coats to dry before recoating.
 - a. Recoat within time limits specified by coating manufacturer.
 - b. If recoat time limits have expired re-prepare surface in accordance with coating manufacturer's printed recommendations.
12. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
13. Coat all aluminum in contact with dissimilar materials.
14. When coating rough surfaces which cannot be backrolled sufficiently, hand brush coating to work into all recesses.
15. Backroll concrete and masonry {and gypsum board} {and plaster} {and abuse resistant panel} {and wood} surfaces with a roller if paint coatings are spray applied.

B. Prime Coat Application:

1. Prime all surfaces indicated to be painted.
 - a. Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Specification Section.
2. Ensure field-applied coatings are compatible with factory-applied coatings.
 - a. {Ensure new coatings applied over existing coatings are compatible}.
 - b. Employ services of coating manufacturer's qualified technical representative.
 - 1) Certify through material data sheets.
 - 2) Perform test patch.
 - c. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
 - d. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.
 - 1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.
3. Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.
4. Back prime all wood scheduled to be painted, prior to installation.
5. After application of primer to gypsum board surfaces, inspect surface and repair in accordance with the PREPARATION Article of this Specification Section.
 - a. Re-prime repaired surfaces to uniform finish before application of finish coat(s).
6. Apply zinc-rich primers while under continuous agitation.
7. Ensure abrasive blasting operation does not result in embedment of abrasive particles in paint film.

8. Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.
9. Touch up damaged primer coats prior to applying finish coats.
 - a. Restore primed surface equal to surface before damage.
10. All surfaces of steel lintels and steel components of concrete lintels used in wall construction shall be completely painted with both prime and finish coats prior to placing in wall.

C. Finish Coat Application:

1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Specification Section; manufacturer instructions take precedent over these Specifications.
2. Touch up damaged finish coats using same application method and same material specified for finish coat.
 - a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.

3.6 FIELD QUALITY CONTROL

A. Contractor to provide protection for surfaces painted with epoxy coatings to prevent chalking.

1. Surfaces showing chalking will not be accepted regardless of condition of paint film.

B. Maintain Daily Records:

1. Record the following information during application of each coat of paint applied:
 - a. Date, starting time, end time, and all breaks taken by painters.
 - b. For exterior painting:
 - 1) Sky condition.
 - 2) Wind speed and direction.
 - c. Air temperature.
 - d. Relative humidity.
 - e. Moisture content and surface temperature of substrate prior to each coat.
 - f. Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate wind blown dust and debris from contaminating the wet paint film.
 - g. Record environmental conditions, substrate moisture content and surface temperature information not less than once every four (4) hours during application.
 - 1) Record hourly when temperatures are below 50 DegF or above 100 DegF.

3.7 CLEANING

A. Clean paint spattered surfaces.

1. Use care not to damage finished surfaces.

B. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.

END OF SECTION

SECTION 15061

GAS PIPE AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall furnish all labor, material, and equipment necessary to install natural gas piping together with all appurtenances as shown and detailed on the Drawings and specified herein.

1.2 RELATED WORK

- A. Section 02225 – Excavating, Backfilling and Compacting for Utilities
- B. Section 015104 – Gas Valves and Meters

1.3 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B1.2, Gages and Gaging for Unified Inch Screw Threads
 - b. B16.5, Pipe Flanges and Flanged Fittings
 - c. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings
 - d. B16.11, Forged Steel Fittings, Socket Welding and Threaded
 - e. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges
 - f. B31.8, Gas Transmission and Distribution Piping Systems
 - g. Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
 - 2. American Petroleum Institute (API)
 - a. 5L, Specification for Line Pipe
 - b. 1104, Standard for Welding of Pipelines and Related Facilities
 - 3. 49 CFR Part 192 – Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards
 - 4. ASTM International (ASTM):
 - a. A193, Standard for Alloy-Steel for High Pressure Service and Other Special Purpose Applications
 - b. A194, Standard for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
 - c. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 5. American Water Works Association (AWWA):
 - a. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
 - 6. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
 - a. SP-83, Class 3000 Steel Pipe Unions Socket Welding and Threaded
 - b. SP-95, Swage(d) Nipples and Bull Plugs
 - c. SP-97, Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Buttwelding Ends
- B. Qualifications:
 - 1. Use only certified welders meeting procedures and performance outlined in section 6 of API 1104 or ASME Section IX, and other codes and requirements per local building and utility requirements.

PART 2 - PRODUCTS

2.1 CARBON STEEL PIPE AND FITTINGS

- A. Carbon steel pipe shall conform to ASME B31.8, 49CFR Part 192 and API 5L Specification for line pipe. **The line pipe shall be API 5L seamless Grade X-52 pipe with a wall thickness of 0.250"**. All fittings and joints should be capable of accommodating pressure of not less than 675 psi.
- B. Underground pipe and fittings shall be fusion bond epoxy coated. **Piping used for the horizontal directional drill under McCools Creek shall have a double coating of fusion bonded epoxy.** The exterior of pipe and fittings shall be cleaned and receive a factory applied coating of fusion bonded epoxy resin. Epoxy coating shall conform to AWWA C213. Joints may be field epoxy coated as specified in AWWA C213.
- C. Above ground pipe and fittings shall be painted per Section 09905.
- D. All steel pipe shall be supplied with mill test reports and shall have markings when received which include as a minimum the purchase order number and all markings required by the manufacturing specification.
- E. All pipe larger than 2-inch diameter shall be joined by butt-welding joints. Pipes 2-inch and smaller may be threaded or butt-welded, or socket-welded. Unless specified otherwise, threaded joints and connections and flanged joints and connections are restricted to above ground piping.
- F. All butt-weld Fittings shall be carbon steel and shall conform to ANSI B16.9 and ASTM A234, Gr WPB, latest editions. All threaded and socket weld fittings shall conform to ANSI B16.11, latest edition.
- G. Elbows may be trimmed for odd angle changes in direction if needed. Miter bends shall not be used.
- H. Unions shall conform to Class 3000 MSS SP-83.
- I. Mueller bypass fittings shall conform to ASME B31.8
- J. Weld-o-lets shall conform to Class 3000 MSS SP-97
- K. Swaged nipples and bull plugs shall be schedule 80 and conform to ASTM A234, Grade WPB, MSS SP-95.
- L. All flanges shall have a bore equal to the internal diameter of the pipe or fitting to which it will be welded and a pressure class equal to or greater than the design pressure of 450psi.
- M. If a flange is to be welded to pipe or a component whose required yield strength is calculated to be 35,000 psig or less based on its actual nominal wall thickness, the flange shall conform to the latest DOT referenced edition of ANSI B16.5, material group 1.1.
- N. Flange gaskets shall conform to ANSI B16.21 and B16.5. Gaskets shall be metallic spiral-wound. Gaskets containing asbestos should not be utilized.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. In general, gas piping shall be laid with a minimum cover of 48 inches, except as otherwise indicated on the drawings.
- B. All pipes shall be laid in accordance with ASME B31.8 with ends abutting and true to the lines and grades indicated on the plans. Supporting of pipe shall be as set out in Section 02225 and in no case shall the supporting of pipe on blocks be permitted.
- C. Joining Methods - Flanges:
 - 1. Joining method:

- a. Leave 1/8 to 3/8 IN of flange bolts projecting beyond face of nut after tightening.
 - b. Coordinate dimensions and drillings of flanges with flanges for valves, pumps, equipment, tank, and other interconnecting piping systems.
 - c. When bolting flange joints, exercise extreme care to assure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or cause unnecessary stress, bending or torsional strains being applied to cast flanges or flanged fittings.
 - 1) Allow one (1) flange free movement in any direction while bolts are being tightened.
 - d. Do not assemble adjoining flexible coupled, mechanical coupled or welded joints until flanged joints in piping system have been tightened.
 - e. Gradually tighten flange bolts uniformly to permit even gasket compression.
 - f. Do not overstress bolts to compensate for poor installation.
- D. Joining Method - Welded Joints:
1. Perform welding in accordance with API 1104, or ASME Section IX.
 2. Weldolets may be used for 2 IN and smaller pipe. All slag shall be removed from inside the pipe.
- E. Joining Method - Threaded and Coupled (T/C):
1. Provide T/C end conditions that meet ASME B1.2 requirements.
 2. Furnish pipe with factory-made T/C ends.
 3. Field cut additional threads full and clean with sharp dies.
 4. Leave not more than three (3) pipe threads exposed at each branch connection.
 5. Ream ends of pipe after threading and before assembly to remove burrs.
 6. Use Teflon thread tape on male thread in mating joints. When using Teflon tape upstream of components such as regulators and meters, the tape wrap should be started past the second thread.
- F. Joining Method – Flange Joints and Connections
1. Studs and bolts shall be alloy steel conforming to ASTM A 193, Gr B7; hex nuts shall conform to ASTM A 194, Gr 2H.
 2. Use a clean, properly sized gasket of the proper material for the type of flange face to be joined. Install the gasket in strict accordance with manufacturer's instructions using no foreign substance such as cement, lubricant or sealant unless specifically allowed by the manufacturer. It is important to center the gasket on the flange face.
 3. The condition of threads on all studs, bolts and nuts should be such that the nuts can be finger tightened. Bolts, studs or nuts, which have deformed threads or burrs which may affect proper tightening or which show evidence of cracks shall not be used.

3.2 TESTING OF GAS PIPE

- A. Test the gas mains and service lines after construction and before being placed in service. Follow all testing recommendations and safety precautions as recommended by ASME B31.8, and 49 CFR Part 192.
1. Test Medium: water
 2. Test Pressure: 675 psi
 3. Test Duration: 24 hrs
- B. At no time shall the test pressure exceed 100 percent of the pipe's rated working pressure. A pipe section shall be accepted if the test pressure does not fall more than 5 psi during the minimum 2-hour test period.
- C. Allowable leakage rates:
1. All natural gas systems (all exposed piping systems, all pressure piping systems and all buried systems) which are hydrostatically pressure tested shall have zero leakage at the specified test pressure throughout the duration of the test.

- D. Suitable test plugs, water pump or other equipment and apparatus, and all labor required to properly conduct the tests shall be furnished by the Contractor at no expense to the Owner. Contractor shall furnish, drain, and dispose of hydrotest water.
- E. All joints, including welds, are to be left exposed for examination during the test. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.
- F. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing the leaks and retesting as the Engineer may require without additional compensation. All visible leaks are to be repaired regardless of the amount of leakage.
- G. If in the judgment of the Engineer, it is impracticable to follow the foregoing procedures for any reason, modifications in the procedures shall be made as required and as acceptable to the Engineer, but in any event, the Contractor shall be responsible for the ultimate tightness of the line within the above test requirements.
- H. For fabricated units and short sections of pipe to be installed for which a post installation test is impractical, a pre-installation test of eight (8) hours duration may be used provided all of the piping is visible and is checked for leaks periodically during the test.
- I. After test is completed, all piping shall be drained and purged with air for drying to a dew point of -40degF.

3.3 FIELD QUALITY CONTROL

- A. All visual and non-destructive testing of field welds shall be in accordance with API 1104.
- B. An independent third party shall complete radiographic testing of all pipeline welds.

END OF SECTION

SECTION 15090

PIPE SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe support and anchor systems.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 09905 - Painting and Protective Coatings.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B31.1, Power Piping.
 - b. B31.3, Process Piping.
 - 2. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A510, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
 - c. A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
 - d. A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
 - 3. American Welding Society (AWS):
 - a. D1.1, Structural Welding Code - Steel.
 - 4. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
 - a. SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - b. SP-69, Pipe Hangers and Supports - Selection and Application.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
 - d. Scale drawings showing guides, hangers, supports, anchors, structural members and appurtenances to describe the pipe support system.

1.4 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01640.

1.5 MANUFACTURED UNITS

- A. Hanger Rods:
 - 1. Material:
 - a. ASTM A36.
 - b. {ASTM A510, Grade 1020.}
 - c. ASTM A575, Grade M1020.
 - d. ASTM A576, Grade 1020.

- e. Minimum allowable tensile stress of 12,000 psi at 650 DegF per MSS SP-58.
- 2. Continuously threaded.
- 3. Electro-galvanized or cadmium plated after threads are cut.
- 4. Load limit:

NOMINAL ROD DIAMETER	MAXIMUM SAFE LOAD, (LBS)
3/8 IN DIA (min)	610
1/2 IN DIA	1,130
5/8 IN DIA	1,810
3/4 IN DIA	2,710
7/8 IN DIA	3,770
1 IN DIA	4,960

B. Hangers:

- 1. Hangers for use directly on copper pipe: Copper or cadmium plated.
- 2. Hangers for use other than directly on copper pipe: Cadmium plated or galvanized.
- 3. Hanger type schedule:

APPLICATION	PIPE SIZE	HANGER TYPE
All except noted	4 IN and less	ANVIL Figure 108 with Figure 114
All except noted	Over 4 IN	ANVIL Figure 590
Steam, condensate and hot water	All	ANVIL Figure 181, Figure 82

C. Concrete Inserts for Hanger Rods:

- 1. Continuous slots: Unistrut #P1000.
- 2. Individual inserts: ANVIL Figure 281.
- 3. Self-drilling expansion anchors: Phillips flush-end or snap-off end type.

D. Beam Clamps for Hanger Rods:

- 1. {Standard} {Heavy} duty.
- 2. ANVIL Figure {133} {134}.

E. Trapeze Hangers for Suspended Piping:

- 1. Material: Steel.
- 2. Galvanized.
- 3. Angles, channels, or other structural shapes.
- 4. Curved roller surfaces at support point corresponding with type of hanger required.

F. Vertical Pipe Supports:

- 1. At base of riser.
- 2. Lateral movement:
 - a. Clamps or brackets:

G. Expanding Pipe Supports:

- 1. Spring hanger type.
- 2. MSS SP-58.

H. Pipe Support Saddle:

- 1. For pipe located 3 FT or less from floor elevation, except as otherwise indicated on Drawings.
- 2. ANVIL Figure 264.

I. Pipe Support Risers:

- 1. Schedule 40 pipe.
- 2. Galvanized.
- 3. As recommended by saddle manufacturer.

J. Pipe Support Base Plate:

1. 4 IN larger than support.
 2. Collar 3/16 IN thickness, circular in shape, and sleeve type connection to pipe.
 3. Collar fitted over outside of support pipe and extended 2 IN from floor plate.
 4. Collar welded to floor plate.
 5. Edges ground smooth.
 6. Assembly hot-dipped galvanized after fabrication.
- K. Pipe Covering Protection Saddle:
1. For insulated pipe at point of support.
 2. ANVIL Figure 167, Type B.
- L. Pipe Anchors:
1. For locations shown on the Drawings.
 2. 1/4 IN steel plate construction.
 3. Hot-dipped galvanized after fabrication.
 4. Designed to prevent movement of pipe at point of attachment.
- M. Pipe Guides:
1. For locations on both sides on each expansion joint or loop.
 2. To ensure proper alignment of expanding or contracting pipe.
 3. ANVIL Figure 256.

1.6 DESIGN REQUIREMENTS

- A. Supports capable of supporting the pipe for all service and testing conditions.
1. Provide 5 to 1 safety factor.
- B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.
- C. Design supports and hangers to allow for proper pitch of pipes.
- D. For chemical and waste piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
1. ASME B31.3.
 2. MSS SP-58 and MSS SP-69.
 3. Except where modified by this Specification.
- E. For steam and hot and cold water piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
1. ASME B31.1.
 2. MSS SP-58 and MSS SP-69.
- F. Check all physical clearances between piping, support system and structure.
1. Provide for vertical adjustment after erection.
- G. Support vertical pipe runs in pipe chases at base of riser.
1. Support pipes for lateral movement with clamps or brackets.
- H. Place hangers on outside of pipe insulation.
1. Use a pipe covering protection saddle for insulated pipe at support point.
 2. Insulated piping 1-1/2 IN and less: Provide a 9 IN length of 9 LB density fiberglass insulation at saddle.
 3. Insulated piping over 1-1/2 IN: Provide a 12 IN length of 9 LB density fiberglass insulation on saddle.
- I. Provide 20 GA galvanized steel pipe saddle for fiberglass and plastic support points to ensure minimum contact width of 4 IN.
- J. Pipe Support Spacing:
1. General:
 - a. Factor loads by specific weight of liquid conveyed if specific weight is greater than water.

- b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the Drawings.
 - c. Provide at least one (1) support for each length of pipe at each change of direction and at each valve.
2. Steel, stainless steel, cast-iron pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/2 and less	5
2 thru 4	10
5 thru 8	15
10 and greater	20

3. Copper pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
2-1/2 and less	5
3 thru 6	10
8 and greater	15

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
 - 1. Included in this requirement are movements from:
 - a. Trap discharge.
 - b. Water hammer.
 - c. Similar internal forces.
- B. Weld Supports:
 - 1. AWS D1.1.
 - 2. Weld anchors to pipe in accordance with ASME B31.3.
- C. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.
- D. Inspect hangers for:
 - 1. Adequacy of clearance for piping and supports in the hot and cold positions.
 - 2. Guides to permit movement without binding.
 - 3. Adequacy of anchors.
- E. Inspect hangers after erection of piping systems and prior to pipe testing and flushing.
- F. Install individual or continuous slot concrete inserts for use with hangers for piping and equipment.
 - 1. Install concrete inserts as concrete forms are installed.
- G. Welding:
 - 1. Welding rods: ASTM and AWS standards.
 - 2. Integral attachments:
 - a. Include welded-on ears, shoes, plates and angle clips.
 - b. Ensure material for integral attachments is of good weldable quality.
 - 3. Preheating, welding and postheat treating: ASME B31.3, Chapter V.
- H. Field Painting:
 - 1. Comply with Specification Section 09905.

END OF SECTION

SECTION 15100 VALVES: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Valving, actuators, and valving appurtenances.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 09905 - Painting and Protective Coatings.
 - 2. Section 11005 - Equipment: Basic Requirements.
 - 3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B1.20.1, Pipe Threads, General Purpose.
 - b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - c. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
 - c. D638, Standard Test Method for Tensile Properties of Plastics.
 - d. D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
 - e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
 - f. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
 - 3. American Water Works Association (AWWA):
 - a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
 - b. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
 - c. C504, Standard for Rubber-Seated Butterfly Valves.
 - d. C507, Standard for Ball Valves, 6 IN through 48 IN (150 MM through 1200 MM).
 - e. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.
 - f. {C541, Standard for Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.}
 - g. {C542, Standard for Electric Motor Actuators for Valves and Slide Gates.}
 - h. C550, Standard for Protective Coatings for Valves and Hydrants.
 - i. C606, Standard for Grooved and Shouldered Joints.
 - 4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 5. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. MG 1, Motors and Generators.

1.3 DEFINITIONS

- A. The following are definitions of abbreviations used in this Specification Section or one (1) of the individual valve sections:
 - 1. CWP: Cold water working pressure.

2. SWP: Steam working pressure.
3. WOG: Water, oil, gas working pressure.
4. WWP: Water working pressure.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Valve pressure and temperature rating.
 - d. Valve material of construction.
 - e. Special linings.
 - f. Valve dimensions and weight.
 - g. Valve flow coefficient.
 - h. Wiring and control diagrams for electric or cylinder actuators.
 3. Test reports.
- B. Operation and Maintenance Manuals:
 1. See Specification Section 01342 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.
- C. Informational Submittals:
 1. Verification from valve actuator manufacturer that actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted, and that the valve actuator responds correctly to the valve position command.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

2.2 MATERIALS

- A. Refer to individual valve Specification Sections.

2.3 VALVE ACTUATORS

- A. Valve Actuators - General:
 1. Provide actuators as shown on Drawings or specified.
 2. Counter clockwise opening as viewed from the top.
 3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
 4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 foot-pounds torque on the operating nut.
 5. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.
 6. Extension stem:
 - a. Install where shown or specified.
 - b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
 - c. Pin all stem connections.
 - d. Center in valve box or grating opening band with guide bushing.
- B. Buried Valve Actuators:

1. Provide screw or slide type adjustable cast iron valve box, 5 IN minimum diameter, 3/16 IN minimum thickness, and identifying cast iron cover rated for traffic load.
 2. Box base to enclose buried valve gear box or bonnet.
 3. Provide 2 IN standard actuator nuts complying with AWWA C500, Section 3.16.
 4. Provide at least two (2) tee handle keys for actuator nuts, with 5 FT extension between key and handle.
 5. Extension stem:
 - a. Provide for buried valves greater than 4 FT below finish grade.
 - b. Extend to within 6 IN of finish grade.
 6. Provide concrete pad encasement of valve box as shown for all buried valves unless shown otherwise.
- C. Plastic Valve Vault:
1. Provide in non-traffic areas only on valve applications 3-1/2 IN and less.
 2. Nominal 7-1/2 IN DIA top section.
 3. Design unit for screw type extension section having nominal 9 IN DIA bell.
 4. Cast iron ring and lid.
 5. Constructed of injection molded polyolefin compound with fibrous inorganic component reinforcing and UV stabilization.
 6. Armor Access Boxes.
- D. Exposed Valve Manual Actuators:
1. Provide for all exposed valves not having electric or cylinder actuators.
 2. Provide handwheels for gate and globe valves.
 - a. Size handwheels for valves in accordance with AWWA C500.
 3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
 - a. Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock positions between full open and full close.
 - b. Provide at least two (2) levers for each type and size of valve furnished.
 4. Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and larger.
 5. Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.
 6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
 7. Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.
 - a. Cadmium-plated chain looped to within 3 FT of finish floor.
 - b. Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without "gagging" the wheel.
 8. Provide cast iron floor stands where shown on Drawings.
 - a. Stands to be furnished by valve manufacturer with actuator.
 - b. Stands or actuator to include thrust bearings for valve operation and weight of accessories.
- E. Submerged Actuators:
1. Mount the valve actuator on top of an extension bonnet 3 FT above any adjacent personnel access.
 2. The valve and bonnet connection shall be flanged and watertight.
 3. Provide a top brace support for the bonnet.
 - a. Mount the brace 6 IN below the top of the wall as shown.
 4. Materials:
 - a. Extension bonnet: Cast iron ASTM A126 or steel.
 - b. Brace and anchor bolts: Type 304 stainless steel.
 5. Handwheel:
 - a. Permanently attached for manual operation.
 - b. Positive declutch mechanism to engage and disengage handwheel.
 - c. Handwheel shall not rotate during motor operation.
 - d. Inoperable motor shall not prevent manual operation.

6. Limit torque and thrust loads in both closing and opening directions by torque limit switches.
 - a. Provide torque switches with micrometer adjustment and reference setting indicator.
 - 1) Assure adjustment variation of approximately 40 percent in torque setting.
 - b. Provide switches having rating of not less than 6 A at 120 Vac and 2.2 A at 115 Vdc.
 - c. Limit and torque switches shall have totally sealed contacts.

2.4 FABRICATION

- A. End Connections:
 1. Provide the type of end connections for valves as required in the Piping Schedules presented in Specification Section 15060 or as shown on the Drawings.
 2. Comply with the following standards:
 - a. Threaded: ASME B1.20.1.
 - b. Flanged: ASME B16.1, Class 125 unless otherwise noted or AWWA C207.
 - c. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.
 - d. Soldered: ASME B16.18.
 - e. Grooved: Rigid joints per Table 5 of AWWA C606.
- B. Refer to individual valve Specification Sections for specifications of each type of valve used on Project.
- C. Nuts, Bolts, and Washers:
 1. Wetted or internal to be bronze or stainless steel.
 - a. Exposed to be zinc or cadmium plated.
- D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.
- E. Epoxy Interior Coating: Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Painting Requirements: Comply with Specification Section 09905 for painting and protective coatings.
- C. Setting Buried Valves:
 1. Locate valves installed in pipe trenches where buried pipe indicated on Drawings.
 2. Set valves and valve boxes plumb.
 3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
 4. Install in closed position.
 5. Place valve on firm footing in trench to prevent settling and excessive strain on connection to pipe.
 6. After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.
- D. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.
- E. For grooved coupling valves, install rigid type couplings {or provide separate support to prevent rotation of valve from installed position}.
- F. For threaded valves, provide union on one (1) side within 2 FT of valve to allow valve removal.

- G. Install valves accessible for operation, inspection, and maintenance. Specifier: The FIELD QUALITY CONTROL Article is used to define tests and inspections of installed or complete work. Include manufacturer's field services.

END OF SECTION

SECTION 15104 BALL VALVES AND METERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall furnish all labor, material, and equipment necessary to install valves and meters together with all appurtenances as shown and detailed on the Drawings and specified herein.

1.2 RELATED WORK

- A. Section 15061 – Gas Pipe and Fittings

1.3 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Gas Association (AGA)
 - a. ANSI B109.1, Diaphragm Type Gas Displacement Meters (Under 500 cubic feet per hour capacity)
 - b. ANSI B109.2, Diaphragm Type Gas Displacement Meters (500 cubic feet per hour capacity and over)
 - 2. American Society of Mechanical Engineers (ASME):
 - a. B16.34, Valves Flanged, Threaded, and Welding End
 - b. B31.8, Gas Transmission and Distribution Piping Systems
 - c. B40.100, Pressure Gauges and Gauge Attachments
 - 3. American Petroleum Institute (API)
 - a. 6D, Specification for Pipeline Valves
 - 4. National Fire Protection Association (NFPA)
 - a. 54, National Fuel Gas Code

1.4 SUBMITTALS

- A. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer in accordance with the requirements of Section 01300.
- B. The manufacturer shall furnish the Engineer two (2) copies of an affidavit stating that the valve and all materials used in its construction conform to the applicable requirements of the latest revision of the applicable API 6D and ASME B16.34 Standard, and that all tests specified therein have been performed and that all test requirements have been met.

PART 2 - PRODUCTS

2.1 BALL VALVES

- A. All steel ball valves smaller than 2 inches shall comply with ASME B16.34 and be provided with threaded ends with wrench operators. All steel ball valves **2-inches and larger** shall comply with API 6D and be provided with flanges ends, Class 300 with handwheel or wrench operator.
- B. Above grade ball valves shall be manufactured by Balon Corporation or Grove.**

2.2 PRESSURE REGULATORS

- A. All pressure regulators shall have ferrous bodied pressure regulators for individual service lines as indicated on the drawings, capable of reducing line pressure to pressures required for users. Provide regulators with an internal relief function set at a lower pressure than would cause an unsafe operation of any connected user.

- B. All pressure regulators shall have a single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Provide regulator valve vent of resilient materials designed to withstand flow conditions when pressed against the valve port, capable of regulating downstream pressure within limits of accuracy and limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Pressure regulators shall be self contained service regulators, and pipe not exceeding 2 inch diameter.

2.3 PLUG VALVES

- A. **Plug valves shall conform to ASME B16, API 6D and application sections of MSS.**
- B. **Plug valves shall be minimum AMSE Class 300 as manufactured by Nordstrom or Grove.**

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Valves, pressure regulators, and meters shall be installed as nearly as possible in the positions indicated on the Drawings consistent with conveniences of operating the handwheel or wrench. All valves shall be carefully erected and supported in their respective positions free from all distortion and strain on appurtenances during handling and installation.
- B. All material shall be carefully inspected for defects in workmanship and material, all debris and foreign material cleaned out of valve openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness.
- C. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.
- D. Valves shall not be installed with stems below the horizontal.
- E. Valves shall be set plumb and supported adequately in conformance with the instructions of the manufacturer.
- F. **Excess flow valves shall be installed at the tap location of the gas main.**

3.2 PAINTING

- A. Valves and regulators shall be factory primed and fully coated, inside and out, in accordance with manufacturer requirements.
- B. Meters shall be prepared per manufacturers requirements.

END OF SECTION

TECHNICAL SPECIFICATIONS
for
US 42 SEWER LINE RELOCATION
Carrollton Utilities

February 2016

Prepared by:
HDR Engineering, Inc.
One Riverfront Plaza
401 West Main Street, Suite 500
Louisville, Kentucky 40202
(502) 909-3234

**TECHNICAL SPECIFICATIONS
US 42 SEWER LINE RELOCATION
CARROLLTON UTILITIES**

TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
DIVISION 1 - GENERAL REQUIREMENTS		
01010	SUMMARY OF WORK	1 - 1
01015	WORK SEQUENCE	1 - 1
01300	SUBMITTALS	1 - 3
01730	OPERATING AND MAINTENANCE DATA	1 - 3
DIVISION 2 - SITE WORK		
02150	SHORING AND BRACING	1 - 1
02221	ROCK REMOVAL	1 - 5
02225	EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES	1 - 4
02446	HORIZONTAL DIRECTIONAL DRILLING	1 - 6
02630	ENCASEMENT PIPE	1 - 3
02641	SEWAGE VALVES	1 - 3
02732	SEWAGE FORCE MAIN	1 - 6
02735	PRECAST CONCRETE MANHOLE STRUCTURES	1 - 3
DIVISION 3 - CONCRETE		
03300	CAST-IN-PLACE CONCRETE	1 - 11
DIVISIONS 4 - THROUGH 10 - NOT USED		
DIVISION 11 - EQUIPMENT		
11310	PACKAGE SEWAGE PUMP STATION	1 - 5
DIVISIONS 12 - THROUGH 15 - NOT USED		
DIVISION 16 - ELECTIRCAL		
16050	ELECTRIC SERVICE FOR PACKAGE PUMP STATION	1 - 5

END OF TABLE OF CONTENTS

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Relocation of approximately 10,910 lineal feet of sewer force main, pumping station and appurtenances in Carroll County, Kentucky.
- B. The Contractor shall provide all materials, labor and equipment necessary for completion of the Project. The Contract Documents are intended to provide the basis for proper completion of the work suitable for the intended use of the Owner. Anything not expressly set forth but which is reasonably implied or necessary for proper performance of the Project shall be included.
- C. Continuous Operations: The existing system must be maintained in continuous operation in such a manner that it meets all local, state, and federal requirements. The Contractor is responsible not to deactivate, demolish, or interfere with any system component required for the continuous operation until a new or temporary permanent-like system has been installed and is operational. The Contractor is responsible for payment of all fines resulting from any action or inaction on his part or the part of his subcontractors during performance of the Work that causes the facility/facilities to operate in an illegal manner or fail to operate in a legal manner.
- D. The construction of the following major Work items are included in the Contract:
 - 1. 10,910 lineal feet of 6-inch DR 11 HDPE force main pipe
 - 2. 650 lineal feet of HDD of 6-inch DR 11 HDPE pipe across McCools Creek
 - 3. 95 lineal feet of 8-inch steel encasement pipe, bore and jack
 - 4. 150 lineal feet of 3-inch PVC SDR 21 force main pipe
 - 5. Five (5) force main tie-ins to existing force main
 - 6. Five (5) gate valves
 - 7. Four (4) combination air valves
 - 8. By-pass pumping
 - 9. Duplex grinder pump station
 - 10. Abandonment and removal of manholes, wet well and vault structures

1.2 PERMITS

- A. The Contractor shall obtain any permits related to or required by, the Work in this Contract.

1.3 CODES

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

1.4 EXISTING CONDITIONS AND DIMENSIONS

- A. The Work in this Contract will primarily be performed in or around existing facilities of which a portion must remain functional. The Contractor must maintain the required items and/or systems functional without additional effort by the Owner's personnel and at no extra costs to the Owner.
- B. The Contractor is responsible for verifying all existing conditions, elevations, dimensions, etc., and providing his finished work to facilitate existing conditions.

END OF SECTION

SECTION 01015 WORK SEQUENCE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall conform to all miscellaneous requirements as contained in the Contract.
- B. The Contractor shall perform all Work included in the Contract Documents [Drawings].
- C. The Contractor shall perform the entire Work incidental to the items shown in the Contract Documents [Drawings] even though it may not be specifically enumerated.
- D. The Contractor will have to perform the work in a sequence acceptable to the Owner, and in some instances the Work will have to be performed in a sequence directed by the Owner.
- E. Further, the Contractor shall have to perform all the Work included in this project in a sequence that does not cause undue hardships on day-to-day operating personnel.

1.2 RELATED REQUIREMENTS

- A. Section 01010 - Summary of Work.
- B. Section 01040 - Coordination.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 SCHEDULING THE SEQUENCE OF CONSTRUCTION OPERATIONS

- A. The Contractor shall submit to the Engineer, for review and approval, a complete schedule (progress chart) of his proposed sequence of construction operations prior to commencement of the work.
- B. The Engineer will neither consider nor approve a construction schedule that fails to utilize the entire time allocated by the Contract for the construction of the Project.
- C. The Contractor shall schedule the various construction activities to complete the Project throughout the entire Contract time period. This schedule requirement shall not prevent the Contractor from completing the Project in a shorter time frame than illustrated in the schedule. The construction schedule along with a cost breakdown schedule shall be reviewed and approved by the Owner prior to the submission of the first partial payment request in accordance with the General Conditions.
- D. A copy of the construction schedule shall be submitted to the Owner with each pay request, appropriately marked to indicate the actual progress of the work compared to the planned schedule. This revised schedule must be approved by the Owner prior to payment.

END OF SECTION

SECTION 01300 SUBMITTALS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Shop drawings, descriptive literature, project data and samples (when samples are specifically requested) for all manufactured or fabricated items shall be submitted by the Contractor to the Engineer for examination and review in the form and in the manner required by the Engineer. All submittals shall be furnished in at least three (3) copies to be retained by the Engineer and shall be checked and reviewed by the Contractor before submission to the Engineer. The review of the submittal by the Engineer shall not be construed as a complete check, but will indicate only that the general method of construction and detailing is satisfactory. Review of such submittal will not relieve the Contractor of the responsibility for any errors which may exist as the Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work.

1.2 DEFINITIONS

- A. The term "submittals" shall mean shop drawings, manufacturer's drawings, catalog sheets, brochures, descriptive literature, diagrams, schedules, calculations, material lists, performance charts, test reports, office and field samples, and items of similar nature which are normally submitted for the Engineer's review for conformance with the design concept and compliance with the Contract Documents.

1.3 CONTRACTOR'S ULTIMATE RESPONSIBILITY

- A. Review by the Engineer of shop drawings or submittals of material and equipment shall not relieve the Contractor from the responsibilities of furnishing same of proper dimension, size, quantity, materials and all performance characteristics to efficiently perform the requirements and intent of the Contract Documents. Review shall not relieve the Contractor from responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. Review of shop drawings shall not be construed as releasing the Contractor from the responsibility of complying with the Specifications.

1.4 GENERAL REQUIREMENTS FOR SUBMITTALS

- A. Shop drawings shall be prepared by a qualified detailer. Details shall be identified by reference to sheet and detail numbers shown on Contract Documents. Where applicable, show fabrication, layout, setting and erection details. Shop drawings are defined as original drawings prepared by the Contractor, subcontractors, suppliers, or distributors performing work under this Contract. Shop drawings illustrate some portion of the work and show fabrication, layout, setting or erection details of equipment, materials and components. The Contractor shall, except as otherwise noted, have prepared the number of reviewed copies required for his distribution plus three (3) which will be retained by the Engineer and Owner. Shop drawings shall be folded to an approximate size of 8-1/2 inch x 11 inch and in such manner that the title block will be located in the lower righthand corner of the exposed surface.
- B. Project data shall include manufacturer's standard schematic drawings modified to delete information which is not applicable to the Project, and shall be supplemented to provide additional information applicable to the Project. Each copy of descriptive literature shall be clearly marked to identify pertinent information as it applies to the Project.

- C. Where samples are required, they shall be adequate to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged. Provide sufficient size and quantity to clearly illustrate functional characteristics of product and material, with integrally related parts and attachment devices, along with a full range of color samples.
- D. All submittals shall be referenced to the applicable item, section and division of the Specifications, and to the applicable Drawing(s) or Drawing schedule(s) and shall be accompanied by transmittal forms in the format provided by the Engineer.
- E. The Contractor shall review and check submittals, and indicate his review by initials and date.
- F. If the submittals deviate from the Contract Drawings and/or Specifications, the Contractor shall advise the Engineer, in letter of transmittal of the deviation and the reasons therefor. All changes shall be clearly marked on the submittal with a bold mark other than red. Any additional costs for modifications shall be borne by the Contractor.
- G. In the event the Engineer does not specifically reject the use of material or equipment at variance to that which is shown on the Drawings or specified, the Contractor shall, at no additional expense to the Owner, and using methods reviewed by the Engineer, make any changes to structures, piping, controls, electrical work, mechanical work, etc., that may be necessary to accommodate this equipment or material. Should equipment other than that on which design drawings are based be accepted by the Engineer, shop drawings shall be submitted detailing all modification work and equipment changes made necessary by the substituted item.
- H. Additional information on particular items, such as special drawings, schedules, calculations, performance curves, and material details, shall be provided when specifically requested in the technical Specifications.
- I. Submittals for all electrically operated items (including instrumentation and controls) shall include complete wiring diagrams showing lead, runs, number of wires, wire size, color coding, all terminations and connections, and coordination with related equipment.
- J. Equipment shop drawings shall indicate all factory or shop paint coatings applied by suppliers, manufacturers and fabricators; the Contractor shall be responsible for insuring the compatibility of such coatings with the field-applied paint products and systems.
- K. Fastener specifications of manufacturer shall be indicated on equipment shop drawings.
- L. Where manufacturer's brand names are given in the Specifications for building and construction materials and products, such as grout, bonding compounds, curing compounds, masonry cleaners, waterproofing solutions and similar products, the Contractor shall submit names and descriptive literature of such materials and products he proposes to use in this Contract.
- M. No material shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed by the Engineer and returned to the Contractor.
- N. All bulletins, brochures, instructions, parts lists, and warranties packaged with and accompanying materials and products delivered to and installed in the Project shall be saved and transmitted to the Owner through the Engineer.

1.5 CONTRACTOR RESPONSIBILITIES

- A. Verify field measurements, field construction criteria, catalog numbers and similar data.
- B. Coordinate each submittal with requirements of Work and Contract Documents.
- C. Notify Engineer, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.
- D. Begin no work, and have no material or products fabricated or shipped which required submittals until return of submittals with Engineer's stamp and initials or signature indicating review.

1.6 SUBMITTAL SCHEDULE

- A. At a minimum the following submittals shall be submitted for review and approval:
1. Work Sequence
 2. Tie-In Details
 3. HDPE Pipe and Fittings
 4. Steel Encasement Pipe, Spacers and End Seals
 5. Sewer Line Markers
 6. Combination Air/Vacuum Valves
 7. Pump Station, Control Panel and Electrical Drawings
 8. By-pass Pumping Plan
 9. Tracer Wire, and Identification Tape

END OF SECTION

SECTION 01730 OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile product data and related information appropriate for Owner's maintenance and operation of equipment furnished under the contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in the maintenance and operation of equipment and systems as outlined herein.
- C. In addition to maintenance and operations data, the manufacturer's printed recommended installation practice shall also be included. If not part of the operations and maintenance manual, separate written installation instructions shall be provided, serving to assist the Contractor in equipment installation.

1.2 RELATED REQUIREMENTS

- A. Section 00710 - General Conditions.
- B. Section 01340 - Submittals.
- C. Section 01720 - Project Record Documents.
- D. Section 01740 - Warranties and Bonds.

1.3 MAINTENANCE AND OPERATIONS MANUAL

- A. Every piece of equipment furnished and installed shall be provided with the following maintenance and operations manuals:
 - 1. One (1) copy in electronic format, on compact disk, furnished for the Engineer's review as to adequacy and completeness. Preferred electronic format is .pdf file. Following review, the Contractor shall cause any changes required to be made, and shall store all manuals until the completion of the project or until requested by the Engineer. The manuals will be stored and delivered to the Engineer, organized as described in this specification.
 - 2. Two (2) final copies, with all required changes, in print format, furnished to the Owner.
 - 3. Four (4) final copies, with all required changes, on compact disk. Two (2) copies furnished to Owner, two (2) copies furnished to Engineer. Format shall be .pdf file.
- B. The final form of the manuals shall be utilized in instructions of the Owner's personnel.

1.4 FORM OF SUBMITTALS

- A. Prepare data in the form of an instructional manual for use by Owner's personnel.
- B. Format for hard copies:
 - 1. Size: 8-1/2 x 11 in.
 - 2. Paper: 20 pound minimum, white, for typed pages.
 - 3. Text: Manufacturer's printed data, or neatly typewritten.
 - 4. Drawings:
 - a. Provide reinforced punched binder tab, bind with text.
 - b. Fold large drawings to the size of the text pages where feasible.
 - c. For all drawings included within manuals, furnish a 8 mil mylar copy in standard size drawings 36" x 24", 8" x 16" or 8-1/2" x 11".
 - d. For flow or piping diagrams that cannot be detailed on the standard size drawings, a larger, appropriate size drawing may be submitted.

5. Provide fly-leaf for each separate product, or each piece of operating equipment.
 - a. Provide typed description of product, and major component parts of equipment.
 - b. Provide indexed tabs.
 6. Cover: Identify each volume with types or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
 - a. Title of Project.
 - b. Identity of separate structure as applicable.
 - c. Identity of general subject matter covered in the manual.
- C. Binders:
1. Commercial quality, durable and cleanable, 3-hole, 3" or 4" post type binders, with oil and moisture resistant hard covers.
 2. When multiple binders are used, correlate the data into related consistent grouping.
 3. Labeled on the front cover and side of each binder shall be the name of the Contract, the Contract Number and Volume Number.

1.5 CONTENT OF MANUAL

- A. Neatly typewritten table of contents for each volume, arranged in systematic order.
1. Contractor, name of responsible principal, address and telephone number.
 2. A list of each product required to be included, indexed to the content of the volume.
 3. List, with each product, the name, address and telephone number of:
 - a. Subcontractor or installer.
 - b. Maintenance contractor, as appropriate.
 - c. Identify the area of responsibility of each.
 - d. Local source of supply for parts and replacement.
 4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
- B. Product Data:
1. Include only those sheets which are pertinent to the specific product. References to other sizes and types or models of similar equipment shall be deleted or lined out.
 2. Annotate each sheet to:
 - a. Clearly identify the specific product or part installed.
 - b. Clearly identify the data applicable to the installation.
 - c. Provide a parts list for all new equipment items, with catalog numbers and other data necessary for ordering replacement parts.
 - d. Delete references to inapplicable information.
 3. Clear and concise instructions for the operation, adjustment, lubrication, and other maintenance of the equipment including a lubrication chart.
- C. Drawings:
1. Supplement product data with drawings as necessary to clearly illustrate:
 - a. Relations of component parts of equipment and systems.
 - b. Control and flow diagrams.
 2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 3. Do not use Project Record Documents as maintenance drawings.
- D. Written text, as required to supplement product data for the particular installation:
1. Organize in a consistent format under separate headings for different procedures.
 2. Provide a logical sequence of instructions for each procedure.
- E. Copy of each warranty, bond and service contract issued: Provide information sheet for Owner's personnel.
1. Proper procedures in the event of failure.
 2. Instances which might affect the validity of warranties or bonds.

- F. The electronic copies of the manuals shall be submitted to the Engineer for review at the same time that the equipment to which it pertains is delivered at the site. The manuals must be approved by the Engineer before final payment on the equipment is made.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 02150 SHORING AND BRACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Shore and brace sidewalls in excavations with steel sheet piles with wale systems or soldier piles with timber lagging and tie back system as required to protect existing buildings, utilities, roadways, and improvements.
- B. Maintain shoring and bracing during construction activities, and remove shoring and bracing if practical when construction and filling is complete.
- C. Geotechnical investigation borings, if applicable, were drilled for this project where indicated on the drawings in the report. The geotechnical report was not prepared for purposes of bid development and the accuracy of the report is limited. The Contractor should confer with a geotechnical engineer and/or conduct additional study in the area to obtain the specific type of geotechnical information required for construction and for preparation of bids.

1.2 SUBMITTALS

- A. Provide copies of information on methods of the shoring and bracing system proposed for the work, design basis, calculations where applicable, and copies of shop drawings for inclusion in the project and job-site record files.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Shoring and bracing system design shall be prepared and sealed by a registered professional engineer or structural engineer. The system design shall provide the sequence and method of installation and removal. Shoring and bracing system design shall be in accordance with Occupational Safety and Health Administration (OSHA) requirements 29 CFR Section 1926.652.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet Piles: Heavy-gauge steel sheet.
- B. Soldier Piles: Steel H-beams.
- C. Timber Lagging: Heavy timber. Pressure treated with wood preservative for use below water table for extended time period.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in proper relation with adjacent construction. Coordinate with work of other sections.
- B. Locate shoring and bracing to avoid permanent construction. Anchor and brace to prevent collapse.

END OF SECTION

SECTION 02221 ROCK REMOVAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall excavate rock, if encountered, as required to perform the required work, and shall dispose of the excavated material, and shall furnish acceptable material for backfill in place of the excavated rock.
- B. In general, rock in pipe trenches shall be excavated so as to be not less than 6 inches from the pipe after it has been laid.

1.2 REFERENCES

- A. NFPA 495 - Code for the Manufacture, Transportation, Storage and use of Explosive Materials.
- B. Commonwealth of Kentucky Department of Mines and Minerals, Laws and Regulations Governing Explosives and Blasting.

1.3 REGULATORY REQUIREMENTS

- A. Conform to Kentucky Department of Mines and Minerals code for explosive disintegration of rock.
- B. Obtain permits from local authorities having jurisdiction before explosives are brought to site or drilling is started.
- C. KRS 351.330
- D. 805 KAR Chapter 4

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Rock definition: Solid mineral material that cannot be removed with a power shovel.
- B. Explosives: Type recommended by explosives firm and required by authorities having jurisdiction.
- C. Delay devices: Type recommended by explosives firm and conforming to state regulations.
- D. Blasting mat materials: Type recommended by explosives firm and conforming to state regulations.

PART 3 - EXECUTION

3.1 EXPLOSIVES

- A. The Contractor shall keep explosives on the site only in such quantity as may be needed for the Work under way and only during such time as they are being used. He shall notify the Engineer, in advance, of his intention to store and use explosives. Explosives shall be stored in a secure manner and separate from all tools. Caps or detonators shall be safely stored at a point over 100 feet distance from the explosives. When the need for explosives has ended, all such materials remaining on the Work shall be promptly removed from the premises.
- B. The Contractor shall observe all state, federal and municipal laws, ordinances and regulations relating to the transportation, storage, handling and use of explosives. In the event that any of the above-mentioned laws, ordinances or regulations require a licensed blaster to perform or supervise the Work of blasting, said licensed blaster shall, at all times have his license on the Work and shall permit examination thereof by the Engineer or other officials having jurisdiction.

3.2 BLASTING PRECAUTIONS

- A. No explosives shall be used within 20 feet of:
 - 1. Building and/or structures existing, constructed or under construction.
 - 2. Underground and/or overhead utilities whether existing or partially constructed.
- B. Permission for any deviation from the restriction set forth above shall be secured from the Engineer, in writing; however, permission for any such deviations shall not relieve the Contractor from any responsibility in the event of damage to buildings, structures or utilities.
- C. All operations involving explosives shall be conducted with all possible care to avoid injury to persons and property. Blasting shall be done only with such quantities and strengths of explosives and in such a manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not to be excavated in an unshattered condition. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, and to prevent injury to existing pipes or other structures and property above or below ground. Rock shall be well covered with logs or mats, or both, where required. Sufficient warning shall be given to all persons in the vicinity of the Work before a charge is exploded.
- D. The Contractor shall be solely responsible for his blasting operations. The Contractor shall not hold the Owner and/or the Engineer liable for any damages resulting from his blasting operations on this project.

3.3 PREBLAST STRUCTURE SURVEY

- A. Perform a preblast survey to determine and document with pictures the condition of adjacent structures, utilities, wells, buried cables, and other features within a minimum of 400 ft. of the blast area unless otherwise required by applicable regulatory authorities. Determine safe distances to structures or other facilities according to NFPA 495, Appendix B. Where facilities are closer than these distances, and natural barriers are not present, or when the amount of explosive cannot be reduced economically, blasting mats shall be used. Provide mats to protect environmentally sensitive areas, trees within 20 feet from the blasting area, streams, and rock formations from throw rock.
- B. Purpose of survey is to document existing condition of structures prior to blasting, and is intended to be used as evidence in ascertaining whether and to what extent damage may have occurred as result of blasting.
- C. Conduct survey prior to start blasting.
- D. Record information for each structure surveyed:
 - 1. Age and type of construction.
 - 2. Location and character of cracks.
 - 3. Evidence of settlement and leakage.
 - 4. Other pertinent information.
- E. Record preblast survey information on forms prepared specifically for preblast surveys.
- F. Supplement written records with photographs or videotape recordings.
- G. Submit copies of written records and photographs or videotapes to respective property owner, as well as, OWNER and ENGINEER, prior to start of blasting.

3.4 BLAST DESIGN

- A. Design each blast to avoid damage to existing facilities, adjacent property, and completed Work. Consider effects of blast-induced vibrations and air blast, and fly rock potential in design of each blast.
- B. Whenever peak particle velocity exceeds vibration limits, change design of subsequent blasts, as necessary to reduce peak particle velocity to within limits established by BIC.
- C. Whenever air blast exceeds limits, change design of subsequent blasts or provide controls necessary to reduce air blast to within specified limits.

3.5 VIBRATION LIMITS

- A. General: Establish appropriate maximum limit for vibration for each structure or facility that is adjacent to or near blast sites. Base maximum limits on expected sensitivity of each structure or facility to vibration, and federal, state, or local regulatory requirements, but not to exceed 1.25 in/sec.

3.6 AIR-BLAST LIMITS

- A. Establish appropriate maximum limit for air blast for each structure or facility that is adjacent to or near blast sites. Base maximum limits on expected sensitivity of each structure or facility to air blast, and federal, state, or local regulatory requirements, but not to exceed 0.015 psi peak overpressure (133 decibels).

3.7 FLY ROCK CONTAINMENT

- A. Where fly rock may damage existing facilities, adjacent property, or completed Work, cover area to be blasted with blasting mats or provide other means that will contain and prevent scattering of blast debris.

3.8 VIBRATION AND AIR-BLAST MONITORING

- A. Monitor and record blast-induced vibrations and air blast using suitable sensors and recording equipment for each blast.
- B. Contractor shall provide two (2) seismographs during blasting operations capable of the following:
 - 1. Designed for monitoring blast-induced vibrations and air blast. Capable of recording particle velocity in three mutually perpendicular directions in range from 0 to 6 inches per second.
 - 2. Flat vibration frequency response between 4- and 200-Hz.
 - 3. Capable of recording air-blast overpressure up to 140 decibels.
 - 4. Flat air-blast frequency response between 2- and 500-Hz.
- C. Monitor on, or at, structures or other facilities that are closest to point of blasting. Monitoring more distant facilities that are expected to be sensitive to blast-induced vibrations and air blast.
- D. BIC shall supervise establishment of monitoring programs and initial operation of equipment; review interpretation of records and recommend revisions of blast designs.
- E. Include following information in blasting plan.
 - 1. Vibration and air-blast limits as recommended by BIC.
 - 2. Name of qualified BIC who will be responsible for monitoring program and interpretation of records.
 - 3. Types and models of equipment proposed for monitoring.
 - 4. Numbers and locations of proposed monitoring stations.
 - 5. Procedures to be used for coordinating recording of each blast.
 - 6. Steps to be taken if blasting vibrations or air blast exceed limits.

3.9 EXPLOSIVES

- A. The CONTRACTOR shall keep explosives on the site only in such quantity as may be needed for the Work under way and only during such time as they are being used. Notify the OWNER, in advance, of provisions to store and use explosives.

3.10 BLASTING PRECAUTIONS

- A. Permission for any deviation from the blasting plan and other specified restrictions shall be secured from the OWNER and applicable authorities, in writing; however, permission for any such deviations shall not relieve the CONTRACTOR from any responsibility in the event of damage to buildings, structures or utilities.
- B. All operations involving explosives shall be conducted with all possible care to avoid injury to persons and property. Blasting shall be done only with such quantities and strengths of explosives and in such a manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not to be excavated in an unshattered condition. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, and to prevent injury to existing pipes or other structures and property above or below ground. Rock shall be well covered with logs or mats, or both, where required. Sufficient warning shall be given to all persons in the vicinity of the Work before a charge is exploded.

- C. The CONTRACTOR shall be solely responsible for his blasting operations. The CONTRACTOR shall not hold the OWNER and/or the ENGINEER liable for any damages resulting from his blasting operations on this project.

3.11 BLASTING RECORDS

- A. For each blast, document the following:
1. Location of blast in relation to Project stationing or state plane coordinate system and elevation.
 2. Date and times of loading and detonation of blast.
 3. Name of person in responsible charge of loading and firing.
 4. Details of blast design, as previously specified.
 5. Vibration records including location and distance of seismograph geophones to blast and to nearest structure, and measured peak particle velocity. Report peak particle velocity in units of inches per second.
 6. Air-blast records. Report peak air blast values in units of pounds per square inch overpressure above atmospheric or in decibels at linear response.
 7. Comments by BIC regarding damage to existing facilities, adjacent property, or completed Work, misfires, fly rock occurrences, unusual results, or unusual effects as required.

3.12 SUSPENSION OF BLASTING

- A. In event damage to existing facilities, adjacent property, or completed Work occurs due to blasting, immediately suspend blasting and report damage to ENGINEER and OWNER. CONTRACTOR shall be responsible for all costs of repairs or replacement due to damage from blasting.
- B. Before resuming blasting operations, adjust design of subsequent blasts, or take other appropriate measures to control effects of blasting, and submit complete description of proposed changes for reducing potential for future damage.
- C. Do not resume blasting until authorized by OWNER and applicable regulatory authorities.

3.13 ROCK REMOVAL B MECHANICAL METHOD

- A. Excavate and remove rock by the mechanical method. Drill holes and utilize mechanical impact to fracture rock.
- B. In utility trenches, excavate 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- C. Stockpile excavated materials and reuse select materials for site landscaping. Remove and dispose of excess materials offsite at approved location.
- D. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 02220.

3.14 PAYMENT

- A. Rock excavation shall be bid as unclassified and will **not** be paid for separately.

END OF SECTION

SECTION 02225

EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall make excavations in such widths and depths as will give suitable room for below grade vaults, laying pipe to the lines, grades and elevations, furnish, place and compact all backfill materials specified herein or denoted on the Drawings. The materials, equipment, labor, etc., required herein are to be considered as part of the requirements and costs for installing the various pipes, structures and other items they are incidental to.

1.2 RELATED WORK

- A. Section 02221-Rock Removal
- B. Section 02732 – Sewage Force Mains

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Crushed stone material shall conform with the requirements of the applicable sections of the Kentucky Bureau of Highways Standard Specifications and shall consist of clean, hard, and durable particles or fragments, free from dirt, vegetation or objectionable materials.
- B. Two classes of crushed stone material are used in this Section. The type of material in each class is as follows:
 - 1. Class I - No. 9 Aggregate.
 - 2. Class II - Dense Graded Aggregate (DGA).

PART 3 - EXECUTION

3.1 EXCAVATION OF TRENCHES

- A. Unless otherwise directed by the Engineer, trenches are to be excavated in open cuts.
 - 1. Where pipe is to be laid in gravel bedding or concrete cradle, the trench may be excavated by machinery to, or just below, the designated subgrade, provided that the material remaining at the bottom of the trench is no more than slightly disturbed.
 - 2. Where pipe is to be laid directly on the trench bottom, the lower part of trenches in earth shall not be excavated to subgrade by machinery. However, just before the pipe is to be placed, the last of the material to be excavated shall be removed by means of hand tools to form a flat or shaped bottom, true to grade, so that the pipe will have a uniform and continuous bearing and support on firm and undisturbed material between joints except for limited areas where the use of pipe slings may have disturbed the bottom.
- B. Trenches shall be sufficient width to provide working space on each side of the pipe and to permit proper backfilling around the pipe.
 - 1. The Contractor shall remove only as much of any existing pavement as is necessary for the prosecution of the Work. The pavement shall be cut with pneumatic tools, without extra compensation to the Contractor, to prevent damage to the remaining road surface. Where pavement is removed in large pieces, it shall be disposed of before proceeding with the excavation.
- C. All excavated materials shall be placed a safe distance back from the edge of the trench.

- D. Unless specifically directed otherwise by the Engineer, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew, and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew. Watchmen or barricades, lanterns and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions, shall be provided by and at the expense of the Contractor.
- E. When so required, or when directed by the Engineer, only one-half of street crossings and road crossings shall be excavated before placing temporary bridges over the side excavated, for the convenience of the traveling public. All backfilled ditches shall be maintained in such manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged at the direction of the Engineer.
- F. Trench excavation shall include the removal of earth, rock, or other materials encountered in the excavating to the depth and extent shown or indicated on the Drawings.

3.2 SEWER PIPE BEDDING

- A. Piping for sewer mains shall be supported as follows:
 - 1. The trench bottom for sewer main piping shall be stable, continuous, relatively smooth and free of frozen material, clodded dirt, foreign material and rock or granular material larger than 1/2 inch in diameter. The foundation for sewer main piping shall be prepared so that the entire load of the backfill on top of the pipe will be carried uniformly on the barrel of the pipe. Any uneven areas in the trench bottom shall be shaved-off or filled-in with Class I granular bedding. When the trench is made through rock, the bottom shall be lowered to provide 6 inches of clearance around the pipe. Class I granular bedding shall be used to bring the trench bottom to grade.
- B. After each pipe has been brought to grade, aligned, and placed in final position, earth material for sewer main piping in areas not subject to vehicular traffic and Class I material for sewer mains in paved areas, shall be deposited and densified under the pipe haunches and on each side of the pipe up to the spring line of the pipe to prevent lateral displacement and hold the pipe in proper position during subsequent pipe jointing, bedding, and backfilling operations.
- C. In wet, yielding and mucky locations where pipe is in danger of sinking below grade or floating out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.
- D. Where an unstable (i.e., sewer, mud, etc.) trench bottom is encountered, stabilization of the trench bottom is required. This is to be accomplished by undercutting the trench depth and replacing to grade with a foundation of crushed stone aggregate.
- E. The depth of the foundation is dependent upon the severity of the trench bottom. The size of stone aggregate used in the foundation will be determined by the condition of the unstable material. Once the trench bottom has been stabilized, the required Class I bedding material can be placed.
- F. It should be noted that no pipe shall be laid on solid or blasted rock.
- G. Pipe bedding as required in Paragraphs A, B, C, and D of this Section is **not** considered a separate pay item.

3.3 SEWER PIPE BACKFILLING

- A. Initial Backfill:
 - 1. This backfill is defined as that material which is placed over the pipe from the spring line to a point 6 inches above the top of the pipe. For sewer main piping in areas not subject to vehicular traffic, initial backfill material shall be earth material free of rocks, acceptable to the Engineer or with Class I material when a condition exists mentioned in Paragraph A, 3. below. For sewer main piping in paved areas, initial backfill shall be Class I material.

2. Material used, whether earth or Class I, in the initial backfilling is **not** a separate pay item. Payment for the material is included in the unit price per linear foot of sewer main.
 3. In areas where large quantities of rock are excavated and the available excavated earth in the immediate vicinity is insufficient for placing the required amount of backfill over the top of the pipe as set forth in Paragraph A.1, the Contractor shall either haul in earth or order Class I material for backfilling over the pipe. Neither the hauling and placement of earth nor the ordering and placement of Class I material to fulfill the backfill requirements set forth herein is considered a separate pay item.
- B. Final Backfill:
1. There are two cases where the method of final backfilling varies. The various cases and their trench situations are as follows:
 - a. Case I - Areas not subject to vehicular traffic.
 - b. Case II - Paved areas including streets, drives, parking areas, and walks.
 2. In all cases, walking or working on the completed pipelines, except as may be necessary in backfilling, will not be permitted until the trench has been backfilled to a point 6 inches above the top of the pipe. The method of final backfilling for each of the above cases is as follows:
 - a. Case I - The trench shall be backfilled from a point 6 inches above the top of the pipe to a point 8 inches below the surface of the ground with earth material free from large rock (greater than 6 inches in the longest dimension), acceptable to the Engineer. The remainder of the trench shall be backfilled with earth material reasonably free of any rocks.
 - b. Case II - The trench shall be backfilled from a point 6 inches above the top of the pipe to a point 12 inches below the existing pavement surface with Class I (No. 9 crushed stone aggregate) material. The backfill shall be mechanically tamped in approximately 6-inch layers to obtain the maximum possible compaction. The remaining backfill shall be as follows:
 - c. For gravel surfaces - Class II (dense graded aggregate) material mechanically tamped to maximum possible compaction. The trench may be left with a slight mound if permitted by the Engineer.
 - d. For bituminous and concrete surfaces - Bituminous and concrete pavement sections as detailed on the Drawings and as specified for Bituminous Pavement Replacement and Concrete Pavement Replacement.
 3. Earth and Class I material used in final backfill is not a separate pay item. Payment shall be included in the price of sewer main.
 4. Class II material used in final backfill shall be included in the unit price of the pipe.
- C. A sufficient amount of Class II material shall be stockpiled to insure immediate replacement by the Contractor of any settled areas. No extra payment will be made for the filling in of settled or washed areas by the Contractor.
- D. Excavated materials from trenches, in excess of quantity required for trench backfill, shall be disposed of by the Contractor. It shall be the responsibility of the Contractor to obtain location or permits for its disposal, unless specific waste areas have been designated on the Drawings or noted in these Specifications. The cost of disposal of excess excavated materials, as set forth herein, no additional compensation being allowed for hauling or overhaul.

3.4 COMPACTION

- A. Place backfill in 6- to 8-inch lifts and compact thoroughly.
- B. Granular Material
 1. Field compaction shall consist of vibratory plate
 2. Obtain 85% relative density (ASTM-4253 and D-4254)
- C. Earth Material
 1. Field compaction shall consist of self propelled sheepsfoot or pad foot
 2. Obtain 90% standard density (ASTM D-698)

3.5 PLACEMENT OF IDENTIFICATION TAPE

- A. Detectable underground marking tape shall be placed over all utility lines. Care shall be taken to insure that the buried marking tape is not broken when installed and shall be Lineguard brand encased aluminum foil, Type III. The identification tape is manufactured by Lineguard, Inc., P.O. Box 426, Wheaton, IL 60187.
- B. The identification tape shall bear the printed identification of the utility line below it, such as "Caution - Buried Below". Tape shall be reverse printed; surface printing will not be acceptable. The tape shall be visible in all types and colors of soil and provide maximum color contrast to the soil. The tape shall meet the APWA color code, and shall be 2 inches in width. Colors are: yellow - gas, green - sewer, red - electric, blue - sewer, orange - telephone, brown - force main.
- C. The tape shall be the last equipment installed in the trench so as to be first out. The tape shall be buried 4 to 6 inches below top of grade. After trench backfilling, the tape shall be placed in the backfill and allowed to settle into place with the backfill. The tape may be plowed in after final settlement, installed with a tool during the trench backfilling process, unrolled before final restoration or installed in any other way acceptable to the Owner or Engineer.

3.6 PLACEMENT OF LOCATION WIRE

- A. Detectable underground location wire shall be placed above all non-metallic sewer mains and force mains. Care shall be taken to insure that the buried wire is not broken.
- B. The location wire shall be no smaller than #10 AWG solid copper-coated steel wire with minimum 550 lb. tensile strength or #12 AWG stranded wire, either copper-coated steel or solid copper with minimum 300 lb. tensile strength; each with HDPE insulating jacket. Wire requirements are based on electrical resistance per 1000 foot length. Copper-coated steel wire is preferred to reduce the likelihood of vandalism theft.
- C. The location wire shall be continuous from valve box to valve box and shall be terminated (unconnected) with a wire nut and enough "loose" wire to extend 24 inches outside the valve box.

END OF SECTION

SECTION 02446 HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Labor, materials, machinery, and construction equipment required to construct entry and exit pits and associated shoring and sheeting (actual size and depth to be determined by the Contractor) and perform in a good workmanlike manner all horizontally-controlled directional drilling for the installation of approximately 650 lineal feet of sewage force main under McCool's Creek as indicated on the Drawings.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 02732 – Sewage Force Mains

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. F1962, Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.
- B. Qualifications:
 - 1. Directional drilling and pipe installation shall be done only by an experienced Contractor specializing in directional drilling and whose key personnel have at least 5 years experience in this work. Furthermore, the Contractor shall have the following minimum experience:
 - a. Successfully completed a minimum of five (5) HDD installations in the last 5 years that were 36-IN or greater in diameter and 1,000 feet or longer.
 - b. At least three (3) of the projects shall have utilized HDPE.
 - c. At least three (3) of the projects shall have been a water/sewer (river) crossing.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Certification from the pipe and fitting manufacturer that all of the materials used to manufacture the pipe and fittings meet the requirements of this specification and the referenced standards.
 - b. Products information, material specifications, material composition, and handling procedures.
 - c. Material safety data sheets and special precautions required.
 - d. Method of mixing and application.
 - 3. The Contractor shall prepare and submit a detailed schedule for the work. The schedule shall include all major tasks including, but not limited to, the following:
 - a. Manufacture of HDPE/Fusible PVC pipe and fittings.
 - b. Pipe delivery to the project site.
 - c. Drill rig mobilization and setup.
 - d. Pipe stringout and assembly.
 - e. Beginning and completing the pilot hole drilling.
 - f. Beginning and completing the pre-reaming.
 - g. Beginning and completing the pipe pull-back.
 - h. Hydrostatic pressure testing.
 - i. Disposal of drilling fluids.
 - j. Cleanup, site restoration and demobilization.

4. At least 15 days prior to mobilizing drilling equipment, the Contractor shall submit a detailed plan to the Engineer for review. The plan shall include the following:
 - a. Pilot hole drilling procedure, reaming operation, pullback procedure, ballasting, internal gauging, hydrostatic testing, and dewatering procedures.
 - b. Equipment, solids control plant, and pipe string layout plan.
 - c. Calculations showing anticipated maximum pipe stresses during pull-back, required and maximum drilling fluid pressures, and safety factors for potential inadvertent return of drilling fluid due to soil hydrofracture.
 - 1) The calculations shall be sealed by a Professional Engineer.
 - d. Emergency response plan for inadvertent return of drilling fluid.
5. It is anticipated that the pipeline will be installed in one continuous length; therefore no pipe joining during pull-back is anticipated. If proposed by the Contractor, such pipe joining must be submitted with full details of methods and performance for approval by the Engineer at least ten (10) days in advanced of proposed operations. Contractor bears sole risk and responsibility for proving the acceptability of such pipe joining and associated work.
6. Following completion of the pilot hole drilling, the Contractor shall submit a detailed plan and profile of the bore plotted at a scale no smaller than 1 IN equals 20 FT horizontally and 1 IN equals 10 FT vertically. (The Contractor may make changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points, provided these changes are first submitted in writing and agreed to by the Owner and Engineer.)

1.4 COMPLETION OF DIRECTIONAL DRILLING

- A. If a directional drilled pipeline is not successfully installed or the Contractor abandons the effort, he will forfeit all payments for that HDD crossing under this Contract.
- B. Completion and successful testing of the approved pipeline will entitle the Contractor to full payment for the Contract unit price for the HDD crossing, less retainage for site restoration, which sum shall be determined by the Owner, but in no case greater than ten (10) percent of the Contract lump sum price.
- C. In the event of his failure to install the directional drilled pipeline, the Contractor shall retain possession of the HDPE/Fusible PVC pipe and remove it from the site. The bore hole beneath land shall be completely filled with grout or sand to prevent future settlement. If the HDPE/Fusible PVC pipe cannot be withdrawn, it shall be cut off at least 3 feet below the ground and capped with a blind flange. The annular space shall be grouted at the Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall provide all materials, equipment, and labor for completing the subaqueous crossings and for adequate protection of the Work.

2.2 MATERIALS

- A. Refer to Specification Section 15067 for HDPE pipe and tracer wire.
- B. Refer to Specification Section 15065 for Fusible PVC pipe and tracer wire.
- C. Drilling Materials:
 1. The drilling materials used by the Contractor to aid in the horizontal drilling operations shall be of the Contractor's choosing. Products shall comply with environmental regulations applicable to this project.
- D. Drilling Fluids:

1. Drilling fluids used in the drilling operation shall be a mixture of bentonite and water or such other fluids of the Contractor's choosing.
2. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor's drilling plan presented to the Owner.
3. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.

PART 3 - EXECUTION

3.1 COORDINATION OF WORK

- A. The Contractor shall coordinate his work with the agencies, corporations, and individuals owning or having jurisdiction of land in the project vicinity including, but not necessarily limited to:
 1. Corps of Engineers
 2. KYTC
- B. The Contractor shall be required to construct test pits to locate existing underground utilities and/or structures in advance of construction. Test pits shall be excavated and backfilled by the Contractor so as not to create a hazardous area. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Owner.
- C. The Contractor shall have the option of securing additional construction easements in different locations if desired to accommodate his construction method. In this case, the Contractor shall notify the Engineer of his intention to secure additional easements. The cost of negotiating and obtaining these easements shall be borne by the Contractor.
- D. Drilling water required for drilling may be purchased from Carroll County Water District or Carrollton Utilities. Contractor is responsible for purchasing, transporting and storing any water required. River or pond water shall not be used for any purpose in the construction. Securing permission to use water from any other source is the responsibility of the Contractor.
 1. The Contractor shall coordinate with CU to identify available source points for water. Any source point is subject to the approval of CU.
 2. The Contractor shall furnish and install any required backflow preventers, valves and adapters.
 3. The quantity of water that the Contractor may use for construction purposes may be limited by flow rate (gallons per minute), time of day, and/or the needs of the water utility, including firefighting.
 4. All water for drilling shall be paid for by the Contractor at the water utility's prevailing rates.

3.2 CONSTRUCTION LAYOUT

- A. The Contractor shall employ Kentucky licensed land surveyors to locate the positions of the entry and exit points, established elevation and horizontal datum for the borehead control, and layout for the pipe assembly area.

3.3 INSTALLATION

- A. General:
 1. The Contractor shall install the pipeline under the river and its adjacent banks by the horizontally drilled, directionally controlled method of construction. The horizontally drilled, directionally controlled method shall consist of the drilling of a small diameter pilot hole in a vertical arc from one side of the river to the other followed by an enlarged diameter hole for the HDPE pipeline insertion. The exact method and techniques for completing the directionally drilled crossing shall be determined by the Contractor, subject to the requirements of these Specifications.
 2. The Contractor shall comply with the applicable portions of ASTM F1962.

- B. Pipe Stringout:
1. The Contractor shall elevate the pipe stringout if required, to provide access to private property.
 2. The Contractor shall comply with any and all additional restrictions of affected property owners.
 3. Utilities may be present in the stringout area, and adequate precautions must be taken by the Contractor to prevent damage to the utilities, as required by each utility owner.
- C. Instrumentation:
1. The Contractor will provide and maintain instrumentation which will accurately locate the pilot hole at all times. The Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible.
 2. The Contractor will provide and maintain instrumentation which will accurately measure drilling fluid flow discharge rate and pressure.
 3. The Contractor shall provide continuous access to these instruments and their readings to the Owner and Engineer at all times.
- D. Tolerances:
1. HDPE pipe installed by the horizontally drilled directionally controlled method must be located in plan as shown on the Drawings, and must be within the elevation limits shown on the Drawings. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 50 feet. This "as-built" plan and profile shall be updated continuously as the pilot bore is advanced. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot bore shall be withheld from the Owner or Engineer. At the completion of the pilot hole, the Contractor shall provide the Engineer with the coordinates of the pilot hole. The entry point location of the pilot hole shall initially penetrate the ground surface at the location shown on the Plan and Profile Drawings. The Contractor will stake this location in the field.
 2. The Contractor shall make every effort to have the exit point located where shown on the Plans. In no case shall the actual exit point be located farther than 10 feet (along the length of the pipe) from the intended exit point or more than 5 feet on either side perpendicular to the pipe at the exit point location shown. The entire pipe must be within the permanent easement and/or permitted location.
 3. The alignment of the pilot boring must be such that the pipe can be strung out in a straight line. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require a new pilot boring be made, at no additional cost the Owner. The Contractor will stake this location in the field.
 4. The Contractor shall at all times handle the high density polyethylene pipe in a manner that does not overstress the pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The maximum allowable tensile load imposed on the HDPE/FUSIBLE PVC pipe shall be within the limits of the pipe grade and wall section strengths. The Contractor shall be responsible for determining pulling loads required for his method of installation. Such loads shall be minimized as required to prevent failure of the pipeline during installation. Protect interior and exterior surfaces at all times.
- E. Entry and Exit Pits:
1. Approximate locations of entry and exit pits are shown on the Drawings, subject to the restrictions of the landowners and applicable provisions below:
 - a. Erosion protection and sediment control BMPs shall be installed in accordance with LMSD and Hardin County Fiscal Court requirements. The BMPs shown on these Drawings are minimum requirements. The Contractor shall implement BMPs to accommodate his sequence and method of construction.
 - b. Trenching shall be in accordance with Specification Sections 02225.

3.4 REAM AND PULL BACK

- A. Prereaming: Prereaming operation shall be conducted at the discretion of the horizontal drilling Contractor. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to prereaming operations.
- B. Pulling Loads: The Contractor shall be responsible for determining pulling loads required for this method of installation. Such loads shall be minimized as required to prevent failure of the pipeline during installation.
- C. Torsional Stress: A swivel shall be used to connect the pipeline pull section to the reaming assembly to minimize torsional stress imposed on the section.
- D. Buckling Stress: Contractor shall fill the pipe with clean water, as installation proceeds, as required to prevent buckling and reduce buoyancy.
- E. Pull Section Support: The pull section shall be supported as it proceeds during pull back so that it moves freely and the pipe exterior is not damaged.
- F. Pull Section Length: If space allows, the pull section shall be installed in one continuous length with no tie-in joints. If space is not available, tie-in joints shall be minimized and fully inspected prior to installation.

3.5 OVERPULLING

- A. After the high density polyethylene pipeline has been pulled into the reamed pilot hole, the pipe shall be pulled so that at least 3% of the HDD pipeline length is exposed on the end of the bore. The pulling force shall be relieved, and the pipe allowed to “relax” while the pipe is still connected to the pulling head. The Contractor shall allow a time period equal to the total pullback time for the pipe to recover from its elastic strain and visco-elastic stretch, but in no case shall this time be less than 24 hours.

3.6 HANDLING OF DRILLING MUD AND CUTTINGS

- A. The HDD operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to nearby waterways. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.
- B. The general work areas on the entry and exit sides of the crossings shall be enclosed by a berm to contain unplanned spills or discharge.
- C. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desilter/desander, centrifuges, material handlers, and haulers, all in a quantity sufficient to perform the cleaning/separating operations without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by Contractor to the extent necessary for legal disposal in off-site landfills. Water from the dewatering process shall be treated by Contractor to meet permit requirements and disposed of locally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.
- D. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.
- E. Disposal of drilling fluids and cuttings shall be the responsibility of the Contractor and shall be conducted in compliance with all relevant environmental regulations, right-of-way and work space agreements and permit requirements. Bentonite slurry used during the horizontal drilling process shall not be disposed of on-site, but shall be hauled away in watertight trucks to a legal disposal facility. All costs related to disposal shall be borne by the Contractor.

- F. Inadvertent drilling fluid returns at locations other than the entry and exit points shall be minimized. Contractor shall immediately clean-up any inadvertent returns.

3.7 TESTING

- A. Leakage Testing:
 - 1. Pre-Test: After all fusing on the strung-out pipeline is completed but prior to installation of the pipe, the Contractor shall conduct a hydrostatic pressure test using the procedure in Specification Section 02610 or a low pressure air test at 3 psi to assure there are no holes or gouges in the pipe.
 - 2. Acceptance Test: After installation, the pipe and fittings shall be hydrostatic pressure tested in place using the procedure in Specification Section 02610.
- B. Pipe Gauging:
 - 1. The Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations.
 - 2. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g., dents, buckles, gouges, and internal obstructions) greater than 2% of the nominal pipe diameter, or excessive ovality greater than 5% of the nominal pipe diameter.
 - a. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less.
 - b. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of five feet.

3.8 CLEANUP

- A. During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, existing pipe and appurtenances removed by the Contractor, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operation, and shall leave the entire site of the work in a neat and orderly condition.

END OF SECTION

**SECTION 02630
ENCASEMENT PIPE**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall furnish all labor, material, and equipment necessary to install encasement pipe together with all appurtenances as shown and detailed on the Drawings and specified herein.

1.2 RELATED WORK

- A. Section 02225 - Excavating, Backfilling and Compacting for Utilities
- B. Section 02732 – Sewage Force Mains

PART 2 - PRODUCTS

2.1 STEEL PIPE

- A. Steel seamless pipe shall be new Grade B steel material, with a minimum yield of 35,000 psi and a wall thickness as shown below unless otherwise required by a permitting authority. The material shall conform to the chemical and mechanical requirements of the latest revision of ASTM A139 "Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over)," unless otherwise stated herein.
- B. The minimum wall thickness shall be in accordance with the following table:

Steel Casing Pipe Wall Thickness

Casing Diameter (inches)	(Minimum Wall Thickness Under Railroads (inches)	Minimum Wall Thickness All Other Uses (inches)
16 and under	0.250	0.250

- C. Welds of the steel casing pipe shall be solid butt-welds with a smooth non-obstructing joint inside and conform to all specifications as required by American Welding Society (AWS). The casing pipe shall be installed without bends. All welders and welding operators shall be qualified as prescribed by AWS requirements.
- D. The wall thickness at any point shall be within 12.5% inches of the nominal metal thickness specified.
- E. Hydrostatic testing shall not be necessary.
- F. A protective internal and external coating shall be applied to each length of pipe. Following an SSPC SP-7 "Brush-Off Blast Cleaning" surface preparation, 3 (dry) mils of Thnemec-Primer 10-99 (red), or Porter International Primer 260FD (red), or an equivalent thickness of an approved equivalent paint shall be applied in the manner recommended by the respective paint manufacturer.
- G. Each length of pipe shall be legibly marked, stating: manufacturer, diameter, wall thickness and primer.
- H. Precaution shall be taken to avoid deforming the pipe and damaging the primer during shipping.

2.3 PVC PIPE

- A. PVC SDR 17/21 pressure rated pipe with integral bell joints with O-ring seals or PVC SDR 35 pipe conforming to ASTM D 3034 and ASTM F-679.

2.4 CARRIER PIPE SPACERS

- A. Carrier pipes installed inside encasement pipes shall be centered throughout the length of encasement pipe. Centering shall be accomplished by the installation of polyethylene pipeline spacers attached to the carrier pipe in such manner as to prevent the dislodgement of the spacers as the carrier pipe is pulled or pushed through the encasement pipe. Spacers shall be of such dimensions to provide: full supportive load capacity of the pipe and contents; of such thickness to allow installation and/or removal of the pipe; and to allow no greater than 1/2 inch movement of the carrier pipe within the cover pipe after carrier pipe is installed.
- B. Spacers shall be located immediately behind each bell and at a maximum spacing distance as follows:

Carrier Pipe Diameter (inches)	Maximum Spacing (feet)
2 - 2-1/2	4
3 - 8	7
10 - 26	10

- C. The materials and spacing to be used shall be accepted by the Engineer prior to installation. The polyethylene pipeline spacers shall be manufactured by Pipeline Seal and Insulator, Inc. (PSI), Raci Spacers, Inc., or equivalent. Installation shall be in accordance with manufacturer's recommendations.

2.5 ENCASEMENT PIPE END SEALS

After installation of the carrier pipe within the encasement pipe, the ends of the casing shall be sealed with either a wraparound or a pull-on casing end seals fabricated of minimum 1/8-inch thick neoprene rubber. The seals shall be attached to the encasement pipe and the carrier pipe by 304 stainless steel band clamps not less than 1/2-inch wide. The casing end seals shall be as manufactured by Advance Products & Systems, Inc., or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Where shown on the Drawings, the Contractor shall install encasement pipe. Install encasement pipe to maintain alignment, grade and the circular shape of the encasement pipe. The encasement pipe shall be straight and true in alignment; and any significant deviation from line or grade, in the opinion of the Engineer or permitting authority, shall be sufficient cause for disapproving or rejecting the installation.
- B. Two methods of installation are designated, the open-cut method and the boring method.
 - 1. The open-cut method shall consist of placing the encasement pipe in the excavated trench, then installing the carrier pipe inside the encasement pipe. Excavation, bedding and backfilling shall be in accordance with Section 02225.

2. The boring and jacking method consists of pushing or jacking the encasement pipe into the subsurface material as an auger cuts out the material or after the auger has completed the bore. Where designated on the drawings, crossings beneath state maintained roads, railroads, or other surfaces not to be disturbed, shall be installed by boring and jacking of steel casing pipe followed by installation of the carrier pipe within the casing pipe. The Contractor shall provide a jacking pit, bore through the earth, and/or rock, jack the casing pipe into proper line and grade and then install the carrier pipe within the casing pipe. The approach trench shall be large enough to accommodate one section of casing pipe, the jacks and blocking. The Contractor shall furnish and use adequate equipment to maintain the line and grade.
- C. The carrier pipe shall be ductile iron, polyvinyl chloride, or polyethylene pipe as designated on the Drawings. The carrier pipe shall be installed using pipe spacers as described in this Section. Carrier pipe will not be permitted to rest on bells or couplings.
- D. Following installation of the carrier pipe, the ends of the encasement pipe shall be sealed with products of the type described in this Section.

3.2 DAMAGE

- A. The cost of repairing damage to the highway or railroad which is caused by a boring and jacking installation shall be borne by the Contractor.

END OF SECTION

SECTION 02641 SEWAGE VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall furnish all labor, material, and equipment necessary to install sewage combination air valves together with all appurtenances as shown and detailed on the Drawings and specified herein.

1.2 RELATED WORK

- A. Section 02225 - Excavating, Backfilling and Compacting for Utilities
- B. Section 02732 – Sewage Valves

1.3 SUBMITTALS

- A. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer in accordance with the requirements of Section 01300.
- B. The manufacturer shall furnish the Engineer two (2) copies of an affidavit stating that the valve and all materials used in its construction conform to the applicable requirements of the latest revision of AWWA C512.
- C. The Engineer shall be furnished two (2) copies of an affidavit that the "Valve Protection Testing" has been done and that all test requirements have been met.

PART 2 - PRODUCTS

2.1 COMBINATION AIR VALVE

- A. Acceptable manufacturers:
 - 1.
 - a) A.R.I. Model D-025
 - 2) Materials:
 - a) Body and cover: Reinforced Nylon/Stainless Steel SAE 316.
 - b) Float: Foamed Polypropylene.
 - c) Seat: Buna-N.
 - 3) Design requirements:
 - a) Size: 2 IN.
 - b) Working pressure: 100 to 140 psi.
 - c) Provide isolation valve, type as shown.
 - d) Flush accessories:
 - (1) Blow-off valve.
 - (2) Clean water inlet valve.
 - (3) Hose and quick connect coupling.

2.2 VALVE BOXES

- A. Non-Traffic Areas - each combination air valve shall be installed in plastic meter box with cast iron frame and lid as shown on the drawings.
- B. Traffic Areas - each combination air valve shall be installed in a concrete meter box and traffic rated cast iron frame and lid as shown on the drawings.
- C. Covers for valves shall be close fitting and substantially dirt-tight.

2.3 FIBERGLASS LINE MARKER FOR BURIED VALVES

A. General:

1. Design: The continuous fiberglass reinforced composite line marker shall be a single piece marker capable of simple, permanent installation by one person using a manual driving tool. The marker, upon proper installation, shall resist displacement from wind and vehicle impact forces. The marker shall be of a constant flat "T" cross-sectional design with reinforcing support ribs incorporated longitudinally along each edge to provide sheeting protection and structural rigidity. The bottom end of the marker shall be pointed for ease of ground penetration.
2. Material: The marker shall be constructed of a durable, UV resistant, continuous glass fiber and marble reinforced, thermosetting composite material which is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40⁰ F to +140⁰ F.
3. Workmanship: The marker shall exhibit good workmanship and shall be free of burns, discoloration, cracks, bulges or other objectionable marks which would adversely affect the marker's performance or serviceability.
4. Marking: Each marker shall be permanently marked "Sewer Line Below." The letters shall be a minimum of 2 inches in height. A black line shall be stamped horizontally across the front of the marker near the bottom to indicate proper burial depth as shown in the standard detail. The marker shall be a CRM-375 as manufactured by Carsonite International, or approved equivalent.

B. Physical and Mechanical Requirements:

1. Dimensions: The marker shall conform to the shape and overall dimensions shown in the standard detail.

Property	ASTM Test Method	Minimum Value
Ultimate Tensile Strength	D-638	50,000 psi
Ultimate Compressive Strength	D-638	45,000 psi
Specific Gravity	D-792	1.7
Weight % Glass Reinforcement	D-2584	50%
Barcol Hardness	D-2583	47

2. Mechanical Properties: The marker shall have the minimum mechanical properties as follows:
3. Color Fastness: The marker shall be pigmented throughout the entire cross-section so as to produce a uniform color which is an integral part of the material. Ultraviolet resistant materials shall be incorporated in the construction to inhibit fading or cracking of the delineator upon field exposure.
4. Vehicle Impact Resistance: The marker shall be capable of self-erecting and remain functional after being subjected to a series of ten head on impacts by a typical passenger sedan at 35 miles per hour. The marker shall retain a minimum of 60 percent of its sheeting.

C. Reflectors:

1. The reflector shall be of impact resistant, pressure sensitive retro-reflective sheeting which shall be subject to approval by the Engineer. The sheeting shall be of appropriate color to meet MUTCD requirements.
2. Mounting: The retro-reflective sheeting shall consist of a minimum of a 3-inch wide strip placed a maximum of 2 inches from the top of the post unless otherwise specified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Combination air valves shall be installed as nearly as possible in the positions indicated on the Drawings. All valves shall be carefully erected and supported in their respective positions free from all distortion and strain on appurtenances during handling and installation.
- B. All material shall be carefully inspected for defects in workmanship and material, all debris and foreign material cleaned out of valve openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness.

3.2 FIELD QUALITY CONTROL

- A. Clean, inspect, and operate valve to ensure all parts are operable and valve seats properly.
- B. Check and adjust valves and accessories in accordance with manufacturer's instructions and place into operation.

END OF SECTION

SECTION 02732

SEWAGE FORCE MAIN

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall furnish all labor, material, and equipment necessary to install force main piping together with all appurtenances as shown and detailed on the Drawings and specified herein.

1.2 RELATED WORK

- A. Section 02225 - Excavating, Backfilling, and Compacting for Utilities.
- B. Section 02630 - Encasement Pipe.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) FORCE MAIN PIPE

- A. Polyvinyl chloride (PVC) pipe for force mains shall be PVC SDR 21 pressure rated pipe with integral bell joints with rubber O-ring seals.
- B. All PVC pipe shall conform to the latest revisions of ASTM D-1784 (PVC Compounds), ASTM D-2241 (PVC Plastic Pipe, SDR) and ASTM D-2672 (Bell - End PVC Pipe). PVC pipe shall have a minimum cell classification of 12454B or 12454C as defined in ASTM D-1784. Rubber gasketed joints shall conform to ASTM D-3139. The gaskets for the PVC pipe joint shall conform to ASTM F-477 and D-1869.
- C. Fittings for all lines 4 inches in diameter or larger shall be ductile iron and in accordance with AWWA C153 and have a body thickness and radii of curvature conforming to ANSI A21.10 or ANSI A21.53 for compact fittings. Cement mortar lining and seal coating shall be in accordance with ANSI/AWWA C104/A21.4. Bituminous outside coating shall be in accordance with ANSI/AWWA C110/A21.10. All fittings shall be rated at 250 psi sewer working pressure plus sewer hammer and be ductile cast-iron grade 70-50-05 per ASTM Specification A339.
- D. All pipe and couplings shall bear identification markings that will remain legible during normal handling, storage and installation, which have been applied in a manner that will not reduce the strength of the pipe or the coupling or otherwise damage them. Pipe and coupling markings shall include the nominal size and OD base, material code designation, dimension ratio number, ASTM Pressure Class, ASTM designation number for this standard, manufacturer's name or trademark, seal (mark) of the testing agency that verified the suitability of the pipe material for sanitary sewer service. Each marking shall be applied at intervals of not more than 5 feet for the pipe and shall be marked on each coupling.

2.2 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- A. General:
 - 1. Provide PE 3408 HDPE piping with fittings and appurtenances to locations shown on Drawings.
 - 2. All HDPE pipe shall conform to ASTM F714. All HDPE pipe and fittings shall be the product of single manufacturer.

3. Provide DR 11 6-IN IPS/DIPS pipe with a minimum wall thickness of 3.273 IN for pipe and fittings.
4. Fittings (bends and reducing tees) shall be fabricated from HDPE pipe of a compound matching the compound used in the pipe manufacturing. Mitered bends shall be fabrication as follows:
 - a. 45-degree bends shall be fabricated with three (3) segments with 22.5-degree miter angles.
 - b. Bends with a 22.5-degree and below shall be constructed of two (2) segments.

B. HDPE Pipe and Fittings

1. Shall be manufactured in accordance with AWWA C906. Materials used for manufacturing the polyethylene pipe and fittings shall be PE 4710 HDPE meeting ASTM D3350 cell classification of PE 445474C, as specified in the following table:

Cell Classification	Property	Test Method	Cell Classification Limits	Units
4	Density	ASTM D1505	0.947 to 955	g/cm ³
4	Melt Index	ASTM D1238	less than < 0.15	gm/10 min
5	Flexural Modulus	ASTM D790	110,000 to 160,000	psi
5	Tensile Strength	ASTM D638	3,500 to 4,000	psi
7	Slow Crack Growth (ESCR)	ASTM D1693	greater than 5,000 (in 100% Igepal solution)	hours
	Slow Crack Growth (PENT)	ASTM F1473	greater than 500	hours
4	HDB (at 73 DegF)	ASTM D2837	1,600	psi
C	UV Stabilizer	ASTM D1603	2 to 2.5%	carbon-black content by weight

2. The material shall a minimum Hydrostatic Design Basis (HDB) of 1,600 psi at 73 DegF when tested in accordance with PPI TR-3 and shall be listed in the name of the pipe manufacturer in PPI TR-4.
3. Identify each length of pipe clearly at intervals of 5 FT or less.
 - a. Name and/or trademark of the pipe manufacturer.
 - b. Nominal size of pipe.
 - c. Dimension ratio.
 - d. The letters PE followed by the polyethylene grade in accordance with ASTM D1248 followed by the hydrostatic design basis.
 - e. Manufacturing standard reference (e.g. ASTM F714).
 - f. A production code from which the date and place of manufacture can be determined.
 - g. NSF Approval.

2.3 FIBERGLASS LINE MARKER

A. General:

1. Design: The continuous fiberglass reinforced composite line marker shall be a single piece marker capable of simple, permanent installation by one person using a manual driving tool. The marker, upon proper installation, shall resist displacement from wind and vehicle

impact forces. The marker shall be of a constant flat "T" cross-sectional design with reinforcing support ribs incorporated longitudinally along each edge to provide sheeting protection and structural rigidity. The bottom end of the marker shall be pointed for ease of ground penetration.

2. **Material:** The marker shall be constructed of a durable, UV resistant, continuous glass fiber and marble reinforced, thermosetting composite material which is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40⁰ F to +140⁰ F.
3. **Workmanship:** The marker shall exhibit good workmanship and shall be free of burns, discoloration, cracks, bulges or other objectionable marks which would adversely affect the marker's performance or serviceability.
4. **Marking:** Each marker shall be permanently marked "Sewer Line Below." The letters shall be a minimum of 2 inches in height. A black line shall be stamped horizontally across the front of the marker near the bottom to indicate proper burial depth as shown in the standard detail. The marker shall be a CRM-375 as manufactured by Carsonite International, or approved equivalent.

B. Physical and Mechanical Requirements:

1. **Dimensions:** The marker shall conform to the shape and overall dimensions shown in the standard detail.
2. **Mechanical Properties:** The marker shall have the minimum mechanical properties as follows:

Property	ASTM Test Method	Minimum Value
Ultimate Tensile Strength	D-638	50,000 psi
Ultimate Compressive Strength	D-638	45,000 psi
Specific Gravity	D-792	1.7
Weight % Glass Reinforcement	D-2584	50%
Barcol Hardness	D-2583	47

3. **Color Fastness:** The marker shall be pigmented throughout the entire cross-section so as to produce a uniform color which is an integral part of the material. Ultraviolet resistant materials shall be incorporated in the construction to inhibit fading or cracking of the delineator upon field exposure.
4. **Vehicle Impact Resistance:** The marker shall be capable of self-erecting and remain functional after being subjected to a series of ten head on impacts by a typical passenger sedan at 35 miles per hour. The marker shall retain a minimum of 60 percent of its sheeting.

C. Reflectors:

1. The reflector shall be of impact resistant, pressure sensitive retro-reflective sheeting which shall be subject to approval by the Engineer. The sheeting shall be of appropriate color to meet MUTCD requirements.
2. **Mounting:** The retro-reflective sheeting shall consist of a minimum of a 3-inch wide strip placed a maximum of 2 inches from the top of the post unless otherwise specified.

PART 3 - EXECUTION

3.1 LAYING DEPTHS

- A. In general, force mains shall be laid with a minimum cover of 48 inches, except as otherwise indicated on the Drawings.

3.2 SEWER PIPE CROSSING CONCRETE ENCASEMENT

- A. At locations shown on the Drawings, required by the Specifications, or as directed by the Engineer, steel encasement pipe or concrete encasement shall be used when the clearance between the proposed sewage force main and any existing sewer pipe is 18 inches or less.
- B. Whether the proposed sewage force main is above or below the existing sewer pipe, if concrete encasement is utilized, the concrete encasement shall fully encase the sewer pipe and extend to the spring line of the sewer pipe. Concrete encasement or steel encasement pipe shall extend in each direction along the sewer pipe until the encased sewer pipe is 10 feet from the sewer pipe, measured perpendicular to the sewer pipe.
- C. Concrete shall be 3000 psi and shall be mixed sufficiently wet to permit it to flow between and under pipes to form a continuous bridge. In tamping the concrete, care shall be taken not to disturb the grade or line of either pipe or damage the joints. Steel encasement pipe shall meet the requirements of Section 02630.

3.3 PIPE LAYING – PVC PIPE

- A. All pipe shall be laid with ends abutting and true to the lines and grades indicated on the Drawings. Pipe shall be fitted and matched so that when laid in the Work, it will provide a smooth and uniform invert. Supporting of pipe shall be as set out in Section 02225 and in no case shall the supporting of pipe on blocks be permitted.
- B. Before each piece of pipe is lowered into the trench, it shall be thoroughly swabbed out to insure it being clean. Any piece of pipe or fitting which is known to be defective shall not be laid or placed in the lines. If any defective pipe or fittings shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe. Bevel can be made with hand or power tools.
- C. The interior of the pipe, as the Work progresses, shall be cleaned of dirt, jointing materials, and superfluous materials of every description. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted so as to exclude earth or other material and precautions taken to prevent floatation of pipe by runoff into trench.
- D. Anchorage of Bends:
 - 1. At all tees, plugs, caps and bends of 11-1/4 degrees and over, and at reducers or in fittings where changes in pipe diameter occur, movement shall be prevented by using suitable harness, thrust blocks or ballast. Thrust blocks shall be as shown on the Drawings, with sufficient volumes of concrete being provided; however care shall be taken to leave weep holes unobstructed and allow for future tightening of all nearby joints. Unless otherwise directed by the Engineer, thrust blocks shall be placed so that pipe and fitting joints will be accessible for repair.
 - 2. Bridles, harness or pipe ballasting shall meet with the approval of the Engineer. Steel rods and clamps shall be galvanized or otherwise rust-proofed or painted.
 - 3. No extra pay shall be allowed for work on proper anchorage of pipe, fittings or other appurtenances. Such items shall be included in the price bid for the supported item.

3.4 PIPE LAYING – HDPE PIPE

- A. GENERAL
 - 1. HDPE pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the Drawings, and as specified herein.
 - 2. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe. Pipe shall not be dropped. All pipe shall be examined before installation and no pipe shall be installed that is found to be defective.

3. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Chains, cables, or hooks shall not be used.
4. Pipe shall be stored on level ground free of sharp objects that could damage the pipe. Stacking of the pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipe in the anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

B. INSTALLATION

1. Joining Procedures:
 - a. Joining method of the pipe and fittings shall be the butt fusion method in accordance with ASTM D3261 and ASTM F2620.
 - b. All joint fusion shall be performed in accordance with the joining equipment and HDPE pipe manufacturer's recommendations.
 - c. All fusion equipment must be approved by the HDPE pipe manufacturer and operated by operators certified by the HDPE pipe manufacturer.
 - d. Fusion joiner must be qualified by type of fusion (e.g. butt fusion) and fuse pipe only as qualified.
 - e. Cost for testing and certifying personnel shall be born by the Contractor.
 - f. Fuse HDPE joints on the surface prior to installation. Each joint must be visually inspected inside and outside for damage, dirt, moisture, or any other abnormalities prior to fusing.

3.5 TRACER WIRE

- A. All pipe shall be installed with a tracer wire for pipeline location purposes by means of an electronic line tracer.
- B. The wires shall be installed along the entire length of the pipe.
- C. Sections of wire shall be spliced together using approved splice caps and sewerproof seals. Twisting the wires together is not acceptable.

3.6 FIELD QUALITY CONTROL (HDPE PIPE)

- A. Fusion reports shall be submitted for each fusion joint performed on the project, including any joints that are rejected. The reports shall include the following:
 1. Pipe size and DR.
 2. Fusion equipment size and identification.
 3. Fusion technician identification.
 4. Job identification number.
 5. Fusion number and joining parameters.
 6. Ambient temperature.

3.7 TESTING OF FORCE MAINS

- A. The completed work shall comply with the provisions listed herein, or similar requirements which will insure equal or better results. Suitable test plugs, sewer pump or other equipment and apparatus, and all labor required to properly conduct the tests shall be furnished by the Contractor at no expense to the Owner.
- B. Force main piping shall be pressure tested to 250 percent of the normal system operating pressure or to 100 percent of the rated pressure of the pipe, whichever is less. At no time shall the test pressure exceed 100 percent of the pipe's rated pressure. A pipe section shall be accepted if the test pressure does not fall more than 5 percent during the 4-hour period.

- C. All piping shall be tested for leakage at a pressure no less than that specified for the pressure test. The leakage shall be less than an allowable amount determined by the following equation:

$$L = \frac{ND (P)^{1/2}}{7,400}$$

Where: L = allowable leakage (gallon/hour)
N = number of joints in length of pipeline tested
D = nominal diameter of pipe (inches)
P = test pressure (psig)

- D. Should the sections under test fail to meet the requirements, the Contractor shall do all work locating and repairing the leaks and retesting as the Engineer may require without additional compensation.
- E. If in the judgment of the Engineer, it is impracticable to follow the foregoing procedures for any reason, modifications in the procedures shall be made as required and as acceptable to the Engineer, but in any event, the Contractor shall be responsible for the ultimate tightness of the line within the above test requirements.

END OF SECTION

SECTION 02735

PRECAST CONCRETE MANHOLE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete manhole structures and appurtenant items.
 - a. Sanitary sewer manholes and appurtenances.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 02225 - Trenching, Backfilling, and Compacting for Utilities.
2. Section 03300 – Cast-In-Place Concrete

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. A48/A48M, Standard Specification for Gray Iron Castings.
 - b. C150/C150M, Standard Specification for Portland Cement.
 - c. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - d. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
 - e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
 - f. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
3. Fabrication and/or layout drawings:
 - a. Include detailed diagrams of manholes showing typical components and dimensions, reinforcements and other details.
 - b. Itemize, on separate schedule, sectional breakdown of each manhole structure with all components and refer to drawing identification number or notation.
 - c. Indicate knockout elevations for all piping entering each manhole.

B. Unless approved prior to submittal, submit all products from this Specification Section in one complete submittal package. Include all products and accessories together.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Manhole rings, covers and frames:
 - a. Neenah Foundry and Neenah Enterprises, Inc.
 - b. Deeter Foundry.
2. Black mastic joint compound:
 - a. Kalktite 340.

- b. Tufflex.
- c. Plastico.
3. Premolded joint compound:
 - a. RAM-NEK.
 - b. Kent Seal.
4. Emulsified fibrated asphalt compound:
 - a. Sonneborn Hydrocide 700B.

2.2 SANITARY SEWER MANHOLE STRUCTURE COMPONENTS

A. Manhole Components:

1. Reinforcement: ASTM C478.
2. Minimum wall thickness: 5 IN.
3. Minimum base thickness: 12 IN.
4. Provide the following components for each manhole structure:
 - a. Base (precast) with integral bottom section or (cast-in-place).
 - b. Precast bottom section(s).
 - c. Precast barrel section(s).
 - d. Precast eccentric transition section.
 - e. Precast adjuster ring(s).
 - f. Precast concrete transition section.
 - g. Precast flat top.
5. Unless dimensioned or specifically noted on Drawings, provide manhole section with minimum 48 IN inside dimensions.

B. Nonpressure Type Frames and Cover:

1. Cast iron frame and covers: ASTM A48/A48M, Class 35 (minimum).
2. Use only cast {ductile} iron of best quality, free from imperfections and blow holes.
3. Furnish frame and cover of heavy-duty construction a minimum total weight of 450 LBS.
4. Machine all horizontal surfaces.
5. Furnish unit with solid nonventilated lid with concealed pickholes.
 - a. Letter covers "SEWER" for all collection system manholes
6. Ensure minimum clear opening of 24 IN DIA.

C. Pressure Type Frame and Cover:

1. Provide covers meeting the requirements of the Nonpressure Type Frames and Cover paragraph above and as modified below.
2. Furnish frame and bolted cover of heavy-duty construction.
 - a. Equip unit with six (6) stainless steel countersunk 3/8 IN DIA by 1-1/2 IN long bolts with stainless steel washers.
3. Provide solid lid and minimum 1/8 IN thick x 1/2 IN wide continuous strip neoprene gasket.
4. Furnish unit with a minimum of six (6) anchorage holes and six (6) 6 IN long x 3/4 IN DIA stainless steel anchor bolts.

D. Sanitary Sewer Manhole Concrete:

1. Provide all sanitary manholes constructed with Portland ASTM C150/C150M, Type I or II cement with a tricalcium aluminate content not to exceed 8 percent.
2. Mix aggregate shall be a minimum of 50 percent crushed limestone.
3. Provide 3000 psi nonshrink grout.

PART 3 - EXECUTION

3.1 MANHOLE CONSTRUCTION

A. General:

1. Construct cast-in-place concrete base slabs.
2. Make inverts with a semi-circular bottom conforming to the inside contour of the adjacent sewer sections.
3. On all straight runs, lay pipe through manhole and cut out top half of pipe.

- a. See detail on Drawings.
- b. If pipes deflect at manhole, shape as specified in Paragraphs 2 and 4 in this General Paragraph.
4. Shape inverts accurately and steel trowel finish.
 - a. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert using as large a radius as manhole inside diameter will permit.
 - b. Pour base slab integral with bottom barrel section.
- B. Build each manhole to dimensions shown on plans and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.
- C. For all horizontal mating surfaces between concrete and concrete or concrete and metal, above established high groundwater elevation shown trowel apply to clean surface black mastic joint compound to a minimum wet thickness of 1/4 IN immediately prior to mating the surfaces.
- D. For horizontal joints that fall below established high groundwater elevation shown, install a resilient O-ring type gasket or pre-molded joint compound.
- E. Seal all pipe penetrations in manhole.
 1. Form pipe openings smooth and well shaped.
 2. After installation, seal cracks with, non shrink grout.
 3. After grout cures, wire brush smooth and apply two coats emulsified fibrated asphalt compound to minimum wet thickness of 1/8 IN to ensure complete seal.
- F. Set and adjust frame and cover final 6 IN (minimum) to 18 IN (maximum) to match finished pavement or finished grade elevation using precast adjuster rings.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Formwork.
- B. Reinforcing Steel.
- C. Expansion and Contraction Joints.
- D. Waterstops
- E. Concrete.

1.2 RELATED REQUIREMENTS

- A. Section 00710 - General Conditions.
- B. Section 02225 – Excavation, Backfilling and Compacting for Utilities.

1.3 REFERENCES

- A. ACI 350R Environmental Engineering Concrete Structures.
- B. ACI318 - Building Code Requirements for Reinforced Concrete.
- C. ACI347 - Recommended Practice for Concrete Formwork.
- D. CRSI - Manual of Standard Practice.
- E. CRSI - Placing Reinforcing Bars.
- F. ASTM - A-615, A-120, A-185, C-31, C-39

1.4 SUBMITTALS

- A. The Contractor shall submit the following data to the Engineer for review:
 - 1. Mix designs for all mixes proposed or required to be used, including all mixes containing admixtures.
 - 2. Certification by the manufacturer that cement meets the Specification contained herein.
 - 3. Shop drawing for reinforcing steel showing bar schedules, location, and splices.
 - 4. Reports on laboratory compression tests of cylinders taken during concrete placement.
 - 5. Manufacturer's cut sheets for all other concrete related products.

PART 2 - PRODUCTS

2.1 CLASSES OF CONCRETE AND USAGE

- A. Structural concrete of the various classes required shall be proportioned to produce the following 28-day compressive strengths:
 - 1. Selection of Proportions for 4,500 psi Concrete:
 - a. 4,500 psi compressive for strength at 28 days.
 - b. Type I/II cement plus air.
 - c. Maximum water/cement ratio - 0.42.
 - d. Minimum cement content - 564 lbs. (6.0 bags)/cubic yard concrete.
 - e. Nominal maximum size coarse aggregate - No. 67 (3/4-inch maximum) or No. 57 (1-inch maximum).

- f. Air content - 5% plus or minus 1% by volume.
 - g. Slump - 4 inches in accordance with ASTM C-143, when measured with only an air entraining admixture. Additional slump is allowed by use of water reducing or superplasticizing admixtures.
2. Selection of Proportions for 3,000 psi Concrete:
- a. 3,000 psi compressive strength at 28 days.
 - b. Type I/II cement plus air.
 - c. Maximum water/cement ratio - 0.56.
 - d. Minimum cement content - 470 lbs. (5.0 bags)/cubic yard concrete.
 - e. Nominal maximum size coarse aggregate - No. 67 (3/4-inch maximum) or No. 57 (1-inch maximum).
 - f. Air content - 5% plus or minus 1% by volume.
 - g. Slump - 4 inches in accordance with ASTM C-143, when measured with only an air entraining admixture.
- B. Concrete shall be used as follows:
- 1. 4,500 psi concrete for all concrete work except as noted below.
 - 2. 3,000 psi concrete for encasement of piping where indicated, and thrust blocking.
- C. All testing of aggregates and determination of proportions shall be or have been performed by a recognized independent testing laboratory.
- D. Cement for exposed concrete shall have a uniform color classification.
- E. Type I/II cement conforming to ASTM C-150 shall be used in all concrete.
- F. Coarse aggregate shall be crushed stone having clean, hard, uncoated particles, and shall be free from injurious amount of soft, friable, thin, elongated or laminated pieces. Coarse aggregates shall conform to all requirements of ASTM C-33.
- G. Fine aggregates shall be natural sand having clean, hard, uncoated grains, free from injurious amounts of clay, dust, organic matter or other deleterious substances, and shall conform to ASTM C-33.
- H. Water for concrete shall be clean, fresh, and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

2.2 ADMIXTURES

- A. An air entraining admixture shall be used on all concrete and shall be the neutralized vinsol resin type such as Master Builders MB-VR, Euclid Chemical Company AIR-MIX or equivalent. The admixture shall meet the requirements of ASTM C-260.
- B. Other admixtures (water reducing agents, accelerating agents, retarding agents, superplasticizing agents) shall be considered where necessary to meet the needs of construction.
- C. Admixtures shall be used in concrete design mixes in the same manner and proportions as in the field so that the effects of the admixtures are included in preliminary test submitted to the Engineer for review prior to the start of construction.

2.3 REINFORCEMENT

- A. The minimum yield strength of the reinforcement shall be 60,000 pounds per square inch. Bar reinforcement shall conform to the requirements of ASTM A-615. All bar reinforcement shall be deformed.
- B. Welded wire fabric shall conform to ASTM A-185 and shall be of weight and gauge as indicated on the Drawings.

- C. Reinforcement supports and other accessories in contact with the forms for members which will be exposed to view in the finished work shall be of stainless steel or shall have approved high-density polyethylene tips so that the metal portion shall be at least one-quarter of an inch from the form or surface. Supports for reinforcement, when in contact with the ground or stone fill, shall be precast stone concrete blocks.

2.4 FORMS

- A. Forms shall be of suitable material, design, and construction so as to be rigid, tight enough to prevent the passage of mortar, and plane surfaces with a tolerance of 1/16-inch in 4 feet.
- B. For surfaces to be given burlap-rubbed finish, the form surface in contact with the concrete shall be made of heavy gauge metal, new plywood (used plywood which, in the opinion of the Engineer, is substantially equal to new plywood may be used), tempered wood fiberboards with smooth surface, or similar materials. Metal forms or form linings shall have square edges so that the concrete will not have fins or fluting. Forms shall not be pieced out by use of materials different from those in the adjacent form or in such manner as will detract from the uniformity of the finished surface.
- C. For surfaces other than those to be given burlap-rubbed finish, forms shall be made of wood, metal, or other acceptable material. Wooden forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots. Plywood shall be reasonable good, as accepted. Metal forms shall be of an acceptable type for the work involved. Edges of forms in contact with concrete shall be flush within 1/16-inch.
- D. Form for walls, columns, or piers shall have removable panels at the bottom for cleaning, inspection, and scrubbing-in of bonding grout. Forms for thin sections (such as walls or columns) of considerable height shall be arranged with suitable openings so that the concrete can be placed in a manner that will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the fresh concrete, unless special spouts are used to place concrete, and so that construction joints can be properly keyed and treated.
- E. Forms for exposed surfaces shall be built with 3/4-inch chamfer strips attached to produce smooth, straight chamfers at all sharp edges of concrete.
- F. Form ties to be encased in concrete shall not be made of through-bolts or common wire, but shall be of a well-established type, so made and installed as to embody the following features:
 - 1. After removal of the protruding part of the tie, there shall be no metal nearer than 1 inch to the face of the concrete.
 - 2. That part of the tie which is to be removed shall be at least 1/2-inch in diameter, or if smaller, it shall be provided with a wood or metal cone 1 inch long placed against the inside of the forms. Cones shall be carefully removed from the concrete after the forms have been stripped.
 - 3. Ties which pass through walls subject to hydrostatic pressure shall be provided with acceptable water stops, such as washers, securely fastened to the ties.

2.5 OTHER MATERIALS

- A. Anchorage items shall be of standard manufacture and of type required to engage with the anchors to be installed therein under other sections of the Specifications and shall be subject to approval by the Engineer.
- B. Premolded expansion-joint filler strips shall conform to ASTM D-1752 and shall be 3/8-inch thick unless otherwise shown.
- C. Joint sealants shall conform to ANSI 116.1. The following joint sealants are acceptable:
 - 1. Colma by Sika Corporation.
 - 2. Hornflex by A. C. Horn, Inc.
 - 3. Sonolastic by Sonneborn Division of Contech, Inc.

- D. Grout:
1. Precision-support grout shall consist of a non-shrink, ready-to-use, precision grout material; proportioned, pre-mixed and packaged at the factory; delivered to the job site to place with only the addition of water; forming, placing and curing as stipulated by the manufacturer.
 2. Grouts which depend upon aluminum powders, chemicals, or other agents which produce gas for expansion are not acceptable.
 3. Precision-support grout shall also meet the following requirements:
 - a. Free of gas producing agents.
 - b. Free of oxidizing catalysts.
 - c. Free of inorganic accelerators, including chlorides.
- E. Construction Joint Waterstops:
1. Polyvinylchloride (PVC) Waterstops:
 - a. Provide PVC waterstops complying with Corps of Engineers CRD-C572.
 - b. Provide serrated type with a minimum thickness of 3/8 inch by a minimum width of 6 inches may be provided in specific applications as approved by the ENGINEER.
 - c. Provide PVC waterstops as manufactured by Greenstreak Plastic Products company; Vinylex Corporation, or equivalent product.
 2. Adhesive Waterstop:
 - a. Provide pre-formed adhesive waterstop in construction joint locations where shown, or as alternative to PVC waterstop where appropriate.
 - b. The preformed waterstop shall meet or exceed all requirements of Federal Specifications SS-S-210A, "Sealing Compounds for Expansion Joints".
 - c. Provide adhesive waterstops as manufactured by Synko-Flex Products, Division of Henry Products, Inc.; or equivalent product.
 3. Hydrophilic Waterstops:
 - a. Hydrophilic waterstop may be used as an alternate to the adhesive waterstop.
 - b. Provide waterstops as manufactured by Greenstreak Plastic Products Company; Adeka, Inc.; or equivalent product.
- F. Membrane Forming Curing compound: ASTM C 309, Type I-D.
1. Provide without fugitive dye when requested by Engineer.
- G. Epoxy Bonding Agent: Provide two-component epoxy resin bonding agent as manufactured by Sika Chemical Corporation; A.C. Horn, Incorporated; or equivalent product.
- H. Adhesive Dowels:
1. Drilling equipment used and installation of adhesive dowels shall be in accordance with manufacturer's instructions.
 2. Assure that embedded items are protected from damage and are not filled in with concrete.
 3. Unless otherwise shown or approved by Engineer, embedment depths shall be based on a compressive strength of 2,500 psi when embedded into existing concrete.)
 4. The Contractor shall comply with the adhesive material manufacturer's installation instructions on the hole diameter. The Contractor shall properly clean out the hole utilizing a synthetic brush and compressed air to remove all loose material from the hole, prior to installing adhesive capsules or material. Proper mixing of the two-component system shall be done to the manufacturer's recommendations.
 5. Adhesive material manufacturer's representative shall observe and demonstrate the proper installation procedures for the adhesive dowels and adhesive material at no additional expense to the Owner. Each installer shall be certified in writing by the manufacturer to be qualified to install the adhesive dowels.
 6. Provide two-component dowel installation adhesive as manufactured by Hilti Corporation, or approved equivalent product.

PART 3 - EXECUTION

3.1 FORMING

- A. Forms shall be so constructed and placed that the resulting concrete will be of the shape, lines, dimensions and to the elevations indicated on the Drawings or specified, and exposed concrete will be substantially free from board or grain marks, poorly matched joints, and other irregularities or defects.
- B. Forms shall be sufficiently rigid to prevent displacement or sagging between supports, and so constructed that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for their adequacy.
- C. All falsework to support structural slabs, beams, girders, etc., shall be designed to safely and adequately support the concrete and forms during placement and curing. The adequacy and safety of the falsework shall be the sole responsibility of the Contractor.
- D. All forms shall be oiled with an acceptable nonstaining oil or liquid form coating before reinforcement is placed.
- E. Before form material is reused, all surfaces that are in contact with the concrete shall be thoroughly cleaned, all damaged places repaired, and all projecting nails withdrawn.
- F. Except as otherwise specifically authorized by the Engineer, forms shall not be removed until the concrete has aged for the following number of days-degrees*:
 - 1. Beams and slabs: 500 day-degrees.
 - 2. Walls and vertical surfaces: 100 day-degrees.
 - 3. *Day-degree: Total number of days times average daily air temperature at surface of concrete. For example, 5 days at a daily average temperature of 60 degrees F, equals 300 day-degrees.
- G. Shores under beams and slabs shall not be removed until the concrete has attained at least 60 percent of the specified compressive strength and also sufficient strength to support safely its own weight and the construction live loads upon it.

3.2 PLACING REINFORCEMENT

- A. Reinforcement shall be bent cold to the dimensions and shapes shown on the Drawings and within tolerances specified in the CRSI Manual of Standard Practice.
- B. Before being placed in position, reinforcement shall be cleaned of loose mill and rust scale, dirt and other coatings that will interfere with development of proper bond.
- C. Reinforcement shall be accurately placed in positions shown on the Drawings and firmly held in place during placement and hardening of concrete by using annealed wire ties. Bars shall be tied at all intersections except where spacing is less than one foot in both directions, then alternate intersections may be tied.
- D. Distance from the forms shall be maintained by means of stays, blocks, ties, hangers or other approved supports. Blocks for holding the reinforcement from contact with the forms shall be precast mortar blocks or approved metal chairs. Layers of bars will be separated by precast mortar blocks or other equally suitable devices; the use of pebbles, pieces of broken stone or brick, metal pipe and other such blocks will not be permitted. If fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.
- E. Before any concrete is placed, the Engineer shall have inspected the placing of the steel reinforcement and given permission to deposit the concrete. Concrete placed in violation of this provision will be rejected and thereupon shall be removed.
- F. Unless otherwise specified, reinforcement shall be furnished in the full lengths indicated on the plans. Splicing of bars, except where shown on the plans, will not be permitted without the approval of the Engineer. Where splices are made, they shall be staggered insofar as possible.

3.3 TESTING AGGREGATES AND DETERMINING PROPORTIONS

- A. No concrete shall be used in the work until the materials and mix design have been accepted by the Engineer.
- B. The conformity of aggregates to the Specifications hereinbefore given shall be demonstrated and determined by tests per ASTM C-33 made with representative samples of the materials to be used on the work.
- C. The actual proportions of cement, aggregates, admixtures and water necessary to produce concrete conforming to the requirements set forth herein shall be determined by making test cylinders using representative samples of the materials to be used in the work. A set of four standard 6-inch cylinders shall be made and cured per ASTM C-31. Two shall be tested at 7 days and two at 28 days per ASTM C-39. The slump shall not be less than the greatest slump expected to be used in the work.
- D. Reports on the tests and a statement of the proportions proposed for the concrete mixture, shall be submitted in triplicate to the Engineer for review as soon as possible, but not less than five days prior to the proposed beginning of the concrete work. If the Contractor furnishes in writing, similar, reliable detailed information from an acceptable source, and of date not more than four months prior to the time when concrete will be used on this project, the above requirements for laboratory test may be modified by the Engineer. Such data shall derive from mixtures containing constituents, including the admixtures where used, of the same types and from the same sources as will be used on this project.
- E. The Engineer shall have the right to make check tests of aggregates and concrete, using the same materials, and to order changes as may be necessary to meet the specified requirements.
- F. The Contractor may request permission to add water at the job site; and when the addition of water is permitted by the Engineer, the quantity added shall be the responsibility of the Contractor and in no case shall the total water per bag of cement exceed the ratio set forth herein.
- G. If concrete of the required characteristics is not being produced as the work progresses, the Engineer may order such changes in proportions or materials or both, as may be necessary to secure concrete of the specified quality. The Contractor shall make such changes at his own expense and no extra compensation will be allowed because of such changes.

3.4 MIXING

- A. All central-plant and rolling-stock equipment and methods shall conform to the Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready Mixed Concrete Association, as well as the ACI Standards for measuring, Mixing and Placing Concrete (ACI 614), and with the ASTM Standard Specification for Ready-Mixed Concrete, Designation C94, insofar as applicable.
- B. Ready-mixed concrete shall be transported to the site in watertight agitator or mixer trucks. The quantity of concrete to be mixed or delivered in any one batch shall not exceed the rated capacity of the mixer or agitator for the respective conditions as stated on the nameplates.
- C. Central-mixed concrete shall be plant-mixed a minimum of 1-1/2 minutes per batch, and then shall be truck-mixed or agitated a minimum of 8 minutes. Agitation shall begin immediately after the premixed concrete is placed in the truck and shall continue without interruption until discharge. For transit-mixed concrete the major portion of the mixing water shall be added and mixing started immediately after the truck is charged.
- D. The amount of water initially added shall be recorded on the delivery slip for the Engineer's information; no additional water shall be added, either in transit or at the site, except as directed. Mixing (at mixing speed) shall be continued for at least 10 minutes followed by agitation without interruption until discharge. Concrete shall be discharged at the site within 1-1/2 hours

after water was first added to the mix, and shall be mixed at least 5 minutes after all water has been added.

- E. Concrete which has become compacted or segregated during transportation to or in the site of the work shall be satisfactorily remixed just prior to being placed in the forms.
- F. Partially hardened concrete shall not be deposited in the forms. The retempering of concrete which has partially hardened (that is, the remixing of concrete with or without additional cement, aggregate, or water) will not be permitted.

3.5 COMPRESSION TESTS

- A. During the progress of the work, at least one (1) set of four (4) compression test cylinders shall be made for each 50 cubic yards of concrete or major fraction thereof, and not less than one such set for each type of concrete for each day's pouring. Cylinders made in the field shall be made and cured in accordance with the ASTM Standard Method of Making and Curing Concrete Test Specimens in the Field, Designation C31, except that wherever possible molds shall be left on the cylinders until they have reached the laboratory. Testing services to satisfy the requirements of ACI shall be paid for by the Contractor at his expense. Testing lab must be approved by the Engineer.
- B. One cylinder of each set shall be broken in accordance with ASTM C-39 at seven (7) days and the other two at twenty-eight (28) days. Two copies of these test results shall be submitted to the Engineer on the same day of the tests.
- C. On evidence of these tests, any concrete that fails to meet the specified strength requirements shall be strengthened or replaced as directed by the Engineer at the Contractor's expense.

3.6 METALWORK IN CONCRETE

- A. All trades shall be notified, at the proper time, to install items to be embedded in concrete.
- B. All castings, inserts, conduits, and other metalwork shall be accurately built into or encased in the concrete by the Contractor as directed, and all necessary precautions shall be taken to prevent the metalwork from being displaced or deformed.
- C. Anchor bolts shall be set by means of substantial templates.

3.7 PLACING AND COMPACTING CONCRETE

- A. At least twenty-four (24) hours before the Contractor proposes to make any placement of concrete, he shall notify the Engineer of his intention and planned procedure. Unless otherwise permitted, the work shall be so executed that a section begun on any day shall be completed during daylight of the same day.
- B. No concrete shall be placed until the subgrade has been accepted in accordance with the requirements of Section 01400, Quality Control, nor shall it be placed on frozen subgrade or in water. Placement of concrete shall not be scheduled until the forms, reinforcing, and preliminary work have been accepted. No concrete shall be placed until all materials to be built into the concrete have been set and have been accepted by the various trades and by the Engineer. All such materials shall be thoroughly clean and free from rust, scale, oil, or any other foreign matter.
- C. Forms and excavations shall be free from water and all dirt, debris, and foreign matter when concrete is placed. Except as otherwise directed, wood forms and embedded wood called for or allowed shall be thorough wetted just prior to placement of concrete.
- D. Concrete placed at air temperatures below 40 degrees shall have a minimum temperature of 50 degrees F. and a maximum of 70 degrees F. when placed.
- E. Concrete shall be transported from the mixer to the place of final deposit as rapidly as practicable and by methods which will prevent separation of ingredients and avoid rehandling.

- F. Chutes for conveying concrete shall be metal or metal-lined and of such size, design, and slope as to ensure a continuous flow of concrete without segregation. The slope of chutes shall be not flatter than 1 on 2 and all parts of a chute shall have approximately the same slope. The discharge end of the chute shall be provided with a baffle, or, if required, a spout; and the end of the chute or spout shall be kept as close as practicable to, but in no event more than 5 feet above the surface of the fresh concrete. When the operation is intermittent, the chute shall discharge into a hopper.
- G. In thin sections of considerable height (such as walls and columns), concrete shall be placed in such a manner as will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the mass of concrete being placed. To achieve this end, suitable hoppers, spouts with restricted outlets, etc., shall be used as required or permitted unless the forms are provided with suitable openings.
- H. Chutes, hoppers, spouts, etc., shall be thoroughly cleaned before and after each run and the water and debris shall not be discharge inside the form.
- I. For any one placement, concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the section, and so as to maintain, until the completion of the unit, an approximately horizontal, plastic surface.
- J. No wooden spreaders shall be left in the concrete.
- K. During and immediately after being deposited, concrete shall be thoroughly compacted by means of suitable tools and methods, such as internal-type mechanical vibrators operating at not less than 5,000 rpm., or other tool spading, to produce the required density and quality of finish. Vibration shall be done only by experienced operators under close supervision and shall be carried on in such a manner and only long enough to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents, "pumping" of air, or other objectionable results. All vibrators shall be supplemented by proper spade puddling approximately 2 to 3 inches away from forms to remove included bubbles and honeycomb. Excessive spading against the forms, causing the deposition of weak mortar at the surface, shall be avoided.
- L. The concrete shall be thoroughly rodded and tamped about embedded materials so as to secure perfect adhesion and prevent leakage. Care shall be taken to prevent the displacement of such materials during concreting.

3.8 BONDING CONCRETE AT CONSTRUCTION JOINTS

- A. In order to secure full bond at construction joints, the surface of the concrete previously placed (including vertical, inclined, and substantially horizontal areas) shall be thoroughly cleaned of foreign materials and laitance, if any, and then roughened.
- B. The previously placed concrete at the joint shall be saturated with clean water and kept thoroughly wet overnight, after which all pools shall be removed. After free or glistening water disappears, the concrete shall be given a thorough coating of neat cement mixed to a suitable consistency. The coating shall be 1/8-inch thick on vertical surfaces and 1/4-inch thick on horizontal surfaces, and shall be well scrubbed in by means of stiff bristle brushes wherever possible. New concrete shall be deposited before the neat cement dries.

3.9 CURING AND PROTECTION

- A. All concrete, particularly slabs and including finished surfaces, shall be treated immediately after concreting or cement finishing is completed, to provide continuous moist curing for at least seven days, regardless of the adjacent air temperature. Walls and vertical surfaces may be covered with continuously saturated burlap, or kept moist by other acceptable means. Horizontal surfaces, slab, etc., shall be ponded to a depth of 1/2-inch wherever practicable, or kept continuously wet by the use of lawn sprinklers, a complete covering of continuously saturated burlap, or by other acceptable means.

- B. For at least seven (7) days after having been placed, all concrete shall be so protected that the temperature at the surface will not fall below 45 degrees F.
 - 1. No manure, salt, or other chemicals shall be used for protection.
 - 2. Wherever practicable, finished slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

3.10 TRIMMING AND REPAIRS

- A. The Contractor shall use suitable forms, mixture of concrete, and workmanship so that concrete surfaces, when exposed, will require no patching.
- B. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be filled, and surface defects which do not impair structural strength shall be repaired.
- C. Defective concrete shall be cut perpendicular to the surface until sound concrete is reached, but less than 1 inch deep. The remaining concrete shall be thoroughly roughened and cleaned. Concrete around the cavity or the form-tie recess shall be thoroughly wetted and promptly painted with a 1/16-inch brush coat of neat cement mixed to the consistency of lead paint. The hole shall then be filled with mortar.
 - 1. Mortar shall be 1:1-1/2 cement and sand mix with sufficient white cement, or fine limestone screenings in lieu of sand, to produce a surface matching the adjoining work. Cement and sand shall be from the same sources as in the parent concrete.
 - 2. For filling form-tie recesses, the mortar shall be mixed slightly damp to the touch (just short of "balling"), hammered into the recess until it is dense and an excess of paste appears on the surface, and then troweled smooth. Mortar in patches shall be applied so that after partial set it can be compressed and rubbed to produce a finish flush and uniform in texture with the adjoining work. All patches shall be warm-moist cured as above specified.
- D. The use of mortar patching as above specified shall be confined to the repair of small defects in relatively green concrete. If substantial repairs are required, the defective portions shall be cut out to sound concrete and the masonry replaced by means of a cement gun, or the masonry shall be taken down and rebuilt, all as the Engineer may decide or direct.

3.11 SURFACE FINISH

- A. Fins and irregularities on formed surfaces to receive no other finish shall be smoothed.
- B. The top of concrete on which other concrete or unit masonry will later be placed shall be struck off true at the surface indicated on the Drawings or as permitted by the Engineer, as the concrete is being placed. As soon thereafter as the condition of the concrete permits and before it has hardened appreciably (normally within 2 hours after being deposited), all water, scum, laitance, and loose aggregate shall be removed from the surface by means of wire or bristle brooms in such a manner as to leave the coarse aggregate slightly exposed and the surface clean.
- C. Concrete surfaces shall be finished as follows, except as otherwise required by various sections of the Specifications or shown on the Drawings.
 - 1. Wood-float finish shall be given to all top, substantially horizontal, exposed surfaces.
 - 2. Burlap-rubbed finish shall be given to all interior and exterior surfaces placed against forms which will be exposed to view on completion of the work. (Finish shall be to one foot below ground and below normal liquid surface elevations).
 - 3. All surfaces shaped without forms and over which liquids will flow shall be given a steel-trowel finish.
 - 4. Concrete surfaces to which roof insulation or roofing are to be applied shall be finished sufficiently smooth to receive the roofing material, as obtained by steel trowel or very smooth wood-float finish.

3.12 METHOD OF FINISHING

- A. Broomed Finish: Surfaces to be given broomed finish shall first be given a steel-trowel finish. Immediately after troweling, the surface shall be lightly brushed in one direction with a hair broom to produce a nonslip surface of uniformly good appearance.
- B. Wood-float Finish:
1. Surfaces to be given a wood-float finish shall be finished by tamping with special tools to force aggregates away from the surface, and screeding with straight edges to bring the surface to the required line.
 2. As soon after the condition of concrete permits and before it has hardened appreciably, all water, film, and foreign material which may work to the surface shall be removed. Rough finishing shall be done with straight edges and derbies. Machine floating if used, shall not be started until the surface will support the float adequately without digging in and bringing excess fines to the surface. At such time, a minimum of machine and hand floating with a wood float shall be employed to bring the finish to a true and uniform surface with no coarse aggregate visible.
 3. Under no circumstances will sprinkling with water or dusting with cement be permitted during finishing of the slab.
- C. Steel Trowel Finish: Surfaces to be given a steel-trowel finish shall first be given a wood-float finish. This shall be followed by hand troweling with steel trowels to bring the surface to a uniform, smooth, hard, impervious surface free from marks and blemishes. Troweling shall not be started until all water has disappeared from the surface. Over-troweling shall be avoided. Dusting with dry cement or other mixtures or sprinkling with water will not be permitted in finishing.
- D. Burlap Rubbed Finish:
1. Immediately after the forms have been stripped and before the concrete has changed in color, all fins and other projections shall be carefully removed by use of a hammer or other suitable means, and imperfections shall be repaired as hereinbefore specified under "Trimming and Repairs". While the surface is still damp, a thin coat of cement slurry of medium consistency shall be applied by means of bristle brushes to provide a bonding coat within pits and minor blemishes in the parent concrete; the coating of large areas of the surface with this slurry shall be avoided.
 2. Before the slurry has dried or changed color, a dry (almost crumbly) grout composed of 1 volume of cement to 1-1/2 volumes of masonry sand shall be applied. The sand shall have a fineness modulus of approximately 2.25 and comply with the gradation requirements of the ASTM Standard Specifications for Aggregate for Masonry Mortar, Designation C144-76.
 3. The grout shall be uniformly applied by means of damp (neither dripping wet nor dry) pads of burlap of convenient size (approximately 6 inches square) and shall be allowed to harden for one to two hours, depending on the weather. In hot, dry weather the surface shall be kept damp by means of a fine fog spray during the hardening period.
 4. When the grout has hardened sufficiently, but before it becomes so hard as to be difficult to remove, excess grout shall be scraped from the surface of the parent concrete by the edge of a steel trowel, without removing the grout from the imperfections. Thereafter, the surface shall be allowed to dry thoroughly and then be rubbed vigorously with burlap to remove all dried grout so that no visible film remains on the surface after the rubbing. The entire cleaning operation for any area shall be so planned that sufficient time is allowed for the grout to dry and be rubbed after it has been cut with the trowel.
 5. On the day following the grouting and burlap rubbing, the concrete surface shall again be rubbed clean with a dry burlap to remove inadvertent dust. If any built-up film remains on the parent surface, it shall be removed by being rubbed with a fine abrasive stone without breaking through the surface film of the original concrete. Such rubbing shall be light and sufficient only to remove excess material without working up a lather of mortar or changing the texture of the concrete. Following the final rubbing with burlap or abrasive stone, the surface shall be thoroughly washed with stiff bristle brushes (worked only along parallel lines) to remove extraneous materials from the surface. The surface shall then be sprayed

with a fine fog spray to maintain a continually damp condition for at least three (3) days after application of the grout.

6. When the burlap-rubbed finish has been completed, the concrete surface shall be smooth, free from discolorations and stains, and of uniformly good appearance.

3.13 HOT WEATHER CONDITIONS

- A. Placing of concrete under conditions of high temperature, low humidity or wind shall be done in accordance with the American Concrete Institute "Hot Weather Conditions" (latest edition).

3.14 COLD WEATHER CONDITIONS

- A. Cold weather concreting procedures precautions shall conform with American Concrete Institute "Cold Weather Concreting" (latest edition).

END OF SECTION

SECTION 11310

PACKAGE SEWAGE PUMP STATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Package sewage pumping station, structural components, process equipment, piping, valves, electrical and control components, and appurtenant items.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 02732 – Sewage Force Main
2. Section 02735 –Precast Concrete Manhole Structures
3. Section 16050 – Electric Service for Package Pump Station.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
2. American Welding Society (AWS):
 - a. A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
 - b. D1.1, Structural Welding Code - Steel.
3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 6, Industrial Control and Systems Enclosures.
4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
5. Occupational Safety and Health Administration (OSHA).
6. Underwriters Laboratories, Inc. (UL).

B. Qualifications:

1. Manufacturer shall be regularly engaged in the manufacture of packaged sewage pumping stations for not less than five (5) years.
2. Structural design of the pumping station shall be accomplished by a licensed structural engineer.

C. Single Source Responsibility:

1. Provide single source responsibility for all station components and systems through supplier of package pump station.

1.3 SYSTEM DESCRIPTION

- A. A prefabricated duplex grinder pump station shall be furnished and installed as shown on the plans.
- B. The pumps shall be submersible grinder pumps of the centrifugal type with recessed type impeller and integrally built in grinder unit and submersible type motor. Pumps shall be installed on a lift-out rail type system in such a way that solids are fed in an up-flow direction to the grinder impeller with no feet, rails or other obstruction below grinder inlet.
- C. The grinder shall be capable of macerating all material in normal domestic and commercial sewage including reasonable amount of foreign objects such as wood, plastics, glass, rubber, sanitary napkins, disposable diapers and the like into a fine slurry.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
2. Scaled (1/4 IN = 1 FT minimum) fabrication and/or layout drawings (plan(s) and Specification Section(s)) showing all equipment piping, mechanical and electrical components.
3. Information as required by other related narrow-scope Specification Sections.
4. Submit Shop Drawing for station and all mechanical, electrical, and instrumentation components, complete, in single, coordinated submittal.
 - a. Provide separate tabs for each major section of work being provided.
5. Certifications:
 - a. Provide Owner with a written certification that station has been installed properly and started up and is ready for operation by Owner's personnel.
 - b. Factory checkout certification for all systems in pump station.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
 - a. See Specification Section 01730 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 WARRANTY

- A. Provide Owner with manufacturer's warranty guaranteeing pumping station to be free from defects for 2 years from date of Owner acceptance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Package pump station:
 - a. AK Industries
 - b. Topp Industries
 - c. Approved Equivalent
2. Ladder fall protection system:
 - a. Miller Equipment.
 - b. DBI/SALA.
 - c. North Specialty Products.
3. Control panel enclosure:
 - a. Hoffman.
 - b. Hennessey
 - c. Approved Equivalent

2.2 MATERIALS OF CONSTRUCTION

A. Structure

1. Precast Concrete
2. Reinforced Fiberglass

B. Conduits: Steel.

2.3 PUMP STATION COMPONENTS

A. Combination Wetwell and Valve Vault

1. Provide a 5-ft diameter structure to the dimensions as shown on the drawings. The structure may be made of either pre-cast concrete or reinforced fiberglass
2. Precast Concrete – Per Section 02735
3. Reinforced Fiberglass Basin

- a. The fiberglass basin shall be molded of fiberglass reinforced polyester resin of the lay-up and spray technique to assure that the interior surface is smooth and resin rich.
- b. Twenty-five percent (25%) glass fibers shall be used and resin shall be POLYCOR 939-X-100 as manufactured by Cook Paint and Varnish Company or equal.
- c. The basin shall have a minimum wall thickness of one-quarter inch (1/4"). The basin wall shall be designed to withstand a wall collapse based on the assumption of hydrostatic type loading by back-fill with a minimum density of 120 pounds per cubic foot. The basin wall laminate shall be constructed to withstand or exceed two times the assumed loading for any depth of basin.
- d. The basin bottom shall be of sufficient thickness to withstand applicable hydrostatic uplift pressure with a safety factor of two. In saturated conditions, the center deflection of the empty basin bottom shall be less than 3/8" (elastic deflection) and shall not interfere with bottom pump mounting requirements.
- e. Anti-flotation means shall be provided with each basin. A fiberglass anti-flotation collar shall be provided as an integral part of all 24" diameter basins; the anti-flotation collar shall extend a minimum of 3" beyond the O.D. of the basin wall. A steel anti-flotation plate shall be molded into the bottom of all basins with diameters of 30", 36", or 48". The plate shall have holes for securing basin to an anti-flotation base.
- f. Corrosion resistant nuts shall be embedded in the top flange of the basin for securing the basin cover. A quantity of six (6) shall be provided; the nuts shall be totally encapsulated in fiberglass to prevent turning and corrosion.

B. Grinder Pumps:

1. Pentair (Myers) Model WG50H, 5.5 Inch Impeller or Approved Equivalent
 - a. Rated to meet the two operating points:
 - 1) 44 gpm @ 100' TDH
 - 2) 84 gpm @ 70' TDH

C. Motors:

1. Pump motors shall be of the sealed submersible type rated 5 H.P. at 3450 RPM. The motor voltage is 3 phase, 460 volts.
2. Stator winding shall be of the open type, with insulation good for 150 degrees Celsius maximum operating temperature. Winding housing shall be filled with clean high-grade dielectric oil that lubricates bearings and seals and transfers heat from winding to outer shell.
3. Motors shall have three bearings, two ball bearings to support motor rotor and a lower sleeve guide bearing to take radial load from the grinder impeller. Ball bearings shall be designed for a B-10 life of 30,000 hours.
4. A heat sensor thermostat shall be attached to the top end of the winding and be connected in series with the motor stator coil in the control box to stop motor if temperature rises in motor to over 220 degrees Fahrenheit. Thermostats shall reset automatically and re-start motor when temperature drops to safe limit.

D. Seal Chamber:

1. The motors shall be protected by two mechanical seals mounted in tandem with an oil-filled chamber between the seals for lubricating seal faces. Upper seal faces shall be carbon and ceramic lapped to a flatness tolerance of one light band. Lower seal faces shall be tungsten carbide.
2. A double electrode shall be mounted in lower end of seal chamber to detect any water leakage into seal chamber. Electrodes are to be connected to a red signal light in control panel. This seal leakage shall not stop motor but merely indicate leakage so that pump lower seal can be serviced before motor is damaged.

E. Pump Impeller:

1. Impeller shall be of the recessed type to provide an open unobstructed passage through the volute. Impeller shall be of 85-5-5-5 bronze and shall thread onto stainless shaft.

F. Grinder Construction:

1. Grinder assembly shall consist of a grinder impeller and a shredding ring mounted directly below pump volute inlet. Grinder impeller is to thread onto shaft and be locked with screw and washer. The shredding ring shall be pressed in a cast iron flange. Both shredding ring and impeller shall be removable from the outside without dismantling the pump.
2. Both the grinding impeller and shredding ring shall be of 440C stainless steel, hardened to 58-60 Rockwell.

G. Pump and Motor Castings:

1. All castings shall be of high tensile cast iron and shall be treated with phosphate and chromic rinse and be painted inside and out with baked-on epoxy paint before machining. All fasteners shall be 302 stainless steel.

H. Power Cords:

1. Motor power cord shall be #10 type SO (4 conductor cord) of length to suit installation and motor cord to be #16 SO (5 conductor cord) with length to suit installation. Both cords shall be potted into motor end cap with epoxy potting compound.
2. In addition, a rubber grommet that seals both cords shall be clamped onto cord by end holding cap. Cords shall withstand a pull of 150 pounds without loosening.

I. Lift-out Rail System:

1. Each lift out rail system shall consist of: a ductile iron discharge base, pump attaching and sealing plate, pump guide plate, and cast iron elbow. All exposed nuts, bolts, and fasteners shall be of 300 series stainless steel. No fabricated steel parts shall be used.
2. Discharge base shall be of the design that allows the installation of a variety of increasing elbows, therefore eliminating the need for eccentric reducers after the pump base.

J. Access Cover:

1. An aluminum cover shall be provided for the combined wet well & valve vault. The cover shall include an access door for the wet well and valve vault. The wet well access door shall be sized appropriately to allow adequate room for pump removal. Each shall be equipped with a drop handle and hold open arm.

K. Piping and Valves:

1. Piping – stainless steel
2. Valves – stainless steel check and ball valves
 - a. Float control system:
 - 1) Provide four (4) field adjustable floats in wet well for wastewater pump control.
 - 2) See Drawing for float function and respective elevation.
 - 3) Level switches:
 - a) Tilt type.
 - b) Sealed mercury switch in float.
 - c) Provided complete with flexible electrical cable length required for application.
 - d) Contact rated at 4.5 A at 120 Vac.
 - 4) 1 IN DIA stainless steel support pipe connected to wet well wall using stainless steel mounting brackets and hardware.

L. Control Panel:

1. A NEMA 4X aluminum control panel shall be furnished and installed appropriate for the electrical characteristics of the pump station.

2. Each panel shall contain a main circuit breaker for each pump, a magnetic contactor or starter with quick trip ambient compensated overload relays in each phase, main circuit breaker for alarm and 115 volt control circuit, yellow run light for each pump, a spring loaded oil tight H-O-A switch for each pump, red seal failure light for each pump, alarm switch for on-off and test, outside flashing successive cycle, an alternator override switch, and override circuit to start all pumps if level rises in sump or to start second pump if one pump fails. A separate alarm circuit shall be provided as well as a terminal strip for connecting pumps and controls. When the alarm is activated, it shall remain on until manually reset. Panel shall also include lightning arrestor condensation heater with thermostat, phase monitor, elapsed time meters, duplex GFI receptacle.
3. The panel mounting stand shall be aluminum pedestal type with access opening. There shall be included a gas tight connection between the panel and pump pit so as to allow no gases into the panel. The pedestal shall contain a screened vent to allow escape of gases. The control panel shall be aluminum and shall contain only stainless steel fasteners.

M. Level Control

1. Float Switches and Switch Support:
 - a. Sealed mercury float switches shall be provided and installed as shown on the plans. Four floats shall be required for duplex stations. Floats shall be provided with a stabilizing weight.
 - b. An aluminum float mounting bracket with strain relief grommets shall be provided and installed as shown on the plans to allow for easy adjustment of the float levels.
 - c. Provide as shown on the drawings.
2. Hydrostatic Type Level Transmitters
 - a. KPSI or approved equivalent
 - b. Provide as shown on the drawings.

N. Miscellaneous:

1. Fall Protection:
 - a. Provide safety grates on access hatch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install concrete base under entire pump station structure.
- B. Attach 5-ft diameter package pump station to concrete base with anchor bolts.
- C. Seal annular space between wall sleeves and piping/conduit with modular mechanical seals for watertight seal.
- D. Seal all conduits between classified and unclassified areas in accordance with NFPA 70.
- E. Terminate level switch cables in common junction box located in pump chamber.
- F. Install floats and level transmitters at elevations shown on Drawing.
- G. Make main power connection to station in accordance with NFPA 70.

3.2 SOURCE QUALITY CONTROL

- A. Testing:
 1. All components of pump station shall be given an operational test at factory to check for excessive vibration, for leaks in piping or seals, and for correct operation of automatic control system and auxiliary equipment.
 - a. Correct all deficiencies.
 2. Adjust automatic control to start and stop pumps at approximate levels required by job conditions.

3.3 START-UP

A. Start-Up:

1. After the station is installed, but prior to putting it into service, the manufacturer or the manufacturer's authorized distributor must provide start-up services to include: voltage check; amp check; installation check; rotation check; and draw down test to establish pump capacity. A written report to the engineer must be submitted after start-up.

3.4 OPERATION AND MAINTENANCE MANUAL

- A. Contractor shall provide Operation and Maintenance Manual for all parts, equipment, pumps and controls for the packaged pump station for Engineer's review and approval.
- B. Provide three (3) hard copies and one electronic copy of operation and maintenance manual of the pump station.

END OF SECTION

SECTION 16050

ELECTRIC SERVICE FOR PACKAGE PUMPING STATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section includes the site work for providing electrical service to the package sewage pump station.
- B. The work for this project includes all labor, tools, equipment, and materials necessary to completely install, test, place in service and deliver to the Owner a complete electrical system in accordance with the following specifications and associated drawings.
- C. The electrical subcontractor shall be a licensed electrical contractor in the state of Kentucky.
- D. Project Description:
 - 1. Provide 480 Volt, 3 phases, 4 wire, 200 amp electrical service to the booster pump station. This shall include provision and installation of a utility pole, conduit, wire, fuses, meter socket, grounding, and associated devices.
 - 2. The Contractor shall coordinate with Kentucky Utility (KU) for the installation of electrical service to the site. Contractor shall pay KU any costs associated with the installation. Obtain electrical permit and inspection.
 - 3. Provide "as built" mark ups of electrical drawings.

1.2 RELATED WORK

- A. Package Sewage Pumping Station – Section 11310
- B. Electrical Work – Section 16000

1.3 SUBMITTALS

- A. Shop Drawings, clearly marked to show only items applicable to this specific contract, shall be submitted for review and shall include complete sizing of components.
- B. Any items substituted by the Contractor without the approval of the Project Manager shall be subject to replacement by the Contractor at no cost to the Owner and at no impact on the project schedule.

1.4 REFERENCES

- A. American National Standards Institute (ANSI)
- B. Kentucky and Local Building Codes
- C. National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA)
- E. National Electric Safety Code (NESC)
- F. National Fire Protection Code (NFPA)
- G. Underwriter's Laboratories Inc (UL)

PART 2 – PRODUCTS

2.1 GENERAL

- A. The Contractor shall furnish and install the items listed.
- B. Note that the manufacturers and part numbers provided are considered minimum design requirements and are not meant to inhibit the Contractor from providing components of equal or better quality. However, the Contractor shall receive written approval from the Project Manager for any component substituted. The materials used shall be new, unused and as hereinafter specified.

2.2 MATERIALS

- A. Utility Metering
 - 1. Provide materials as required by Electric Utility for installation of metering equipment, service conductors, and mounting of utility company equipment.
- B. Service Rated Automatic Transfer Switch
 - 1. 480V, 3-pole, 4-wire, 200Amp
 - 2. NEMA 3R with inner door for operator interface devices and deadfront, padlockable outer door
 - 3. Delayed transition operation
 - 4. Anti-condensate heater
 - 5. Microprocessor controller and keypad with display
 - 6. Test-Automatic-Bypass delay selector switch
 - 7. Switch position and source availability indicator lights
 - 8. 120VAC, dry contacts for the following SCADA signals:
 - a. Normal Source Available
 - b. Normal Source Available
 - c. Switch in Normal Position
 - d. Switch in Emergency Position
 - 9. Manufactured by Russelectric or equal.
- C. Conduit
 - 1. All exposed conduit shall be rigid metal conduit (RMC), hot dip galvanized with threaded ends and cast fittings and condulets.
 - 2. Underground conduit to the pump station shall be rigid, heavy wall, steel conduit, encased in concrete with threaded watertight connections and shall be adequately sized to handle the type, number, and size of the incoming service conductors.
 - 3. Conduit sizes shall be as indicated on the drawings, minimum 3/4”.
 - 4. Exposed conduit stubs for future use shall be terminated with galvanized pipe caps.
- D. Wire and Cable
 - 1. All conductors shall be 98% conductive stranded copper unless noted otherwise.
 - 2. All conductors shall be rated for 600 Volts with XHHW, 90° C insulation.
 - 3. Power wires shall not be less than #12 AWG and control wires shall not be less than #14 AWG.
- E. Ground Rods
 - 1. The ground rods shall be 3/4” x 10’ copper or copper-clad steel.
- F. Electrical Service Cabinet
 - 1. Fabricate as shown on drawings and as necessary in field.
 - 2. Provide all equipment supports as necessary, including conduit and raceway supports and enclosure supports.
 - 3. All materials shall be stainless steel.
 - 4. Unistrut shall be P1000.
 - 5. Include end caps for unistrut.

PART 3 - EXECUTION

3.1 GENERAL CONSTRUCTION

- A. Continuous Work
 - 1. The Contractor shall be aware that work on this project shall be continuous. Periods of intermittent work shall not be permitted.
- B. Workmanship
 - 1. All devices shall be mounted, fabricated and wired with the highest quality workmanship by builders and electricians with at least 3 years experience building and wiring controls and enclosures.
- C. Construction Coordination
 - 1. The Contractor shall be responsible for coordination with the appropriate utility for termination of power and phone conductors.
 - 2. Power shall be provided to pump station concurrent with the installation of the station.

3.2 INSTALLATION

- A. Equipment Installation - All equipment supplied shall be installed in accordance with manufacturers' recommendation.
- B. Code Inspection
 - 1. This installation shall in all respects conform to all local and state codes and to the latest edition of the National Electrical Code including use of hand tools and temporary services.
 - 2. All electrical work shall be inspected by the local Electrical Inspector.
 - 3. Any concealed work shall be inspected by the Electrical Inspector prior to concealment. If concealed work must be exposed for inspection, all additional costs shall be the responsibility of the Contractor.
- C. Grounding
 - 1. The ground rods shall be driven below grade in direct contact with earth.
 - 2. The grounding clips shall be connected to the ground conductor.
 - 3. The ground conductors shall be connected by Cadweld to the ground rods.
 - 4. Provide foundation grounding where required.
 - 5. Provide equipment grounding conductor in all branch panel feeder circuits and in all branch circuits serving lighting fixtures, receptacles, equipment, etc.
 - 6. Size conductor per NEC Table 250-122.
- D. Conduit Installation
 - 1. The conduit routings shown on the contract drawings are for concept only, actual routings may vary.
 - 2. The Contractor shall layout all conduit systems so as to avoid conflict with other services or systems. Routing of conduit shall be such that it is not near moving machinery, piping, or equipment. Conduit routing shall not prevent or block access to other equipment, piping, or inhibit maintenance functions.
 - 3. All conduit shall be installed with runs parallel or perpendicular to wall structural members or intersection of vertical planes and ceilings, with right angle turns consisting of metal fittings or symmetrical bends.
 - 4. Conduit shall be capped during construction to prevent entrance of dirt, trash, and water. Caps shall be threaded PVC or galvanized rigid steel.
 - 5. Underground conduit shall be galvanized Rigid Metallic Conduit concrete encased (2500 psi, Class A concrete) with 3" of concrete all around and at least 24 inches of earth cover, native backfill. Metal underground marking tape shall be placed near top of trench for future detection.

- E. Wiring Practice
 - 1. No more than two wires shall be landed on a termination point.
 - 2. All wires shall be marked at every termination point using printed labels.
- F. Wire Identification
 - 1. Conductor identification of branch control circuits shall be by color coding.
 - 2. Wire shall be color coded and sized per the following chart, unless noted otherwise on the contract drawings:

a.	24 VDC	Control	Orange, Min. #14 AWG
b.	24 VDC	Negative	Blue, Min. #14 AWG
c.	120 VAC	Control	Red, Min. #14 AWG
d.	120 VAC	Hot	Black, Min. #12 AWG
e.	120 VAC	Neutral	White, Min. #12 AWG
f.	All AC	Ground	Green, Min. #12 AWG
g.	480 VAC	Motor Leads	Black, Min. #12 AWG
- G. Wire Markers
 - 1. All conductors shall be identified by plastic-coated sleeved printed markers or stamped metal foil markers which are oil resistant and permanently attached.
 - 2. Conductor identification shall be provided within each enclosure where tap, splice or termination is made.
 - 3. Control circuit termination shall be properly identified per the engineering drawings or documents.
- H. Splices
 - 1. Splices shall be made on terminal blocks only.
 - 2. Splices shall not be made with wire nuts or bolted connection wrapped with electrical tape.
- I. Connectors
 - 1. Staycon fork-style connectors shall be used for all stranded conductor connections to wiring devices.
 - 2. Landing stranded wire directly on the wiring devices will not be acceptable.
- J. Pole-Mounted Equipment
 - 1. Provide hot-dipped galvanized uni-strut and lag screw to mount any electrical equipment to wooden poles and posts.
 - 2. Cap uni-strut ends.
- K. Enclosure Penetration
 - 1. The Contractor shall not penetrate enclosures unless required.
 - 2. Penetrations shall not violate the NEMA rating of the enclosure.
 - 3. Unused holes or conduits shall be properly sealed with hole plugs or conduit plugs.
- L. Sealing of Equipment
 - 1. All outdoor equipment shall be permanently sealed at the base, and all openings into equipment shall be screened or sealed with concrete grout to keep out rodents and insects the size of wasps and mud daubers.
 - 2. Small cracks and openings shall be sealed from inside with silicone sealant, Dow-Corning "795" or General Electric "SCS 1200".

3.4 ACCEPTANCE AND TESTING

- A. Inspection
 - 1. All equipment installed with this project shall be inspected and adjusted prior to placing installation in service.
 - 2. It shall be the Contractor's responsibility to prove to the Project Manager that the electrical system provided complies with this specification and the contract documents.
 - 3. Proper connection of the anodes shall be verified on the test panels.