Addendum No. 1

Project:	**Midway Business Park Sewer and Natural Gas Extension**
Control No:	**746**
Issued:	**To all listed plan holders**
Date:	**April 10, 2017**

This addendum forms a part of the Agreement described above. The original Contract Documents and any prior addenda remain in full force and effect except as modified by the following, which shall take precedence over any contrary provisions in prior documents.

1. Section 00330sup

- Delete schedule in its entirety and replace with revised section included with this Addendum.
  - Changed Quantity of Pay Item No. 2270a.
  - Deleted "LF" beside Pay Item No. 2656
  - Deleted Pay Item No. 2656c and 2656d. Adjusted sub-lettering of Pay Item No. 2656.
  - Added Pay Item No. 2658 Force Main (Horizontal Directional Drill)
  - Changed quantity of Pay Item No. 4000b.
  - Deleted Pay Item Nos. 4055c-d. Adjusted sub-lettering of Pay Item No. 4055.
  - Added Pay Item No. 4056 Gas Main (Horizontal Directional Drill).

2. Section 00822 – Insurance Requirements

- Changed A.2. to $2M per occurrence and $5M umbrella
- Changed A.5 to $1M Pollution Liability

3. Section 01270 – Measurement and Payment

- DELETE Section 01270, and REPLACE with revised Section 01270, attached. The following changes have been made:
  - Pay Item No. 2650a – Removed references to demolition of existing pump station. There is not an existing pump station at this site.
  - Pay Item No. 2650b – Removed references to demolition of existing pump station. There is not an existing pump station at this site.
  - Pay Item No. 2650b – Clarified that the Division 15 work is not included in this Pay Item.
  - Pay Item No. 2658 – Added to facilitate HDD installation upon request of the Owner.
  - Pay Item No. 4056 – Added to facilitate HDD installation upon request of the Owner.

4. Section 01450 Testing Laboratory Services (For All Testing Except Water Quality)

- DELETE section in its entirety and replace with revised section included with this Addendum.
  - Third party will select and pay independent testing laboratory.

5. **Section 01600 Materials and Equipment**
    - DELETE Paragraph 2.1 in its entirety
        - KUB will not furnish any materials for the electrical work. All materials shall be furnished and installed by the CONTRACTOR.

6. **Section 2534 – Wastewater Force Main**
    - ADD the entire section included in this addendum following Section 02533.
    - CHANGED Part 2.01, Paragraph A.3.a. "Minimum DR 17" to "DR 11".

7. **Section 15901 – Startup and Commissioning**
    - ADD new specification regarding the startup and commissioning of the pump station.

8. **Section 15911 – Controls and Instrumentation Midway Business Park Pump Station**
    - DELETE Section in its entirety and REPLACE with Section 16911 included with this addendum. The following changes have been made:
        - The Section number and subsequent references were changed from Section 15911 to Section 16911.

9. **Drawings: (pdfs of drawing sheets may be found at www.kub.org. Click the Procurement link, then Open Bids & Surplus items, then scroll to find the above referenced project & its attachments)**

    - DELETE Drawing Sheet SA1.08, and REPLACE with revised Drawing Sheet SA1.08, attached. Partial alignment changed from open cut installation to horizontal directional drill.
    - DELETE Drawing Sheet SA1.12, and REPLACE with revised Drawing Sheet SA1.12, attached. Note was added to clarify rotation of sewer into terminal manhole.
    - DELETE Drawing Sheet SA2.01, and REPLACE with revised Drawing Sheet SA2.01, attached. Note was added to require XYPEX admixture in gravity sewer manholes.
    - DELETE Drawing Sheet SA3.03, and REPLACE with revised Drawing Sheet SA3.03, attached. Stray fitting removed from plan.
    - DELETE Drawing Sheet G1.06, and REPLACE with revised Drawing Sheet G1.06, attached. Partial alignment changed from open cut installation to horizontal directional drill.

10. **The following question was received at the Pre-Bid Conference:**
    - **Question:** What conduit is required for construction at the pump station?

      Answer: Please see Sheet E3.01 in the "ELECTRICAL NOTES". Note #2 states "… ALL EXPOSED CONDUIT AND CONDUIT IN CONCRETE SHALL BE GALVANIZED RIGID STEEL. UNDERGROUND CONDUIT SHALL BE SCH. 40 PVC CONDUIT."

11. Clarification Items

- Special work conditions for the easement properties have been included as part of this addendum.

- A geotechnical report of the pump station site has been included as part of this addendum.

END

Each Bidder/Proposer shall acknowledge receipt of this addendum by affixing his signature below, by noting this addendum on his Bid/Proposal Form, and by attaching this addendum to his Bid/Proposal. **Failure to acknowledge this addendum could be cause for bid/proposal rejection.**

ACKNOWLEDGMENT

The undersigned acknowledges receipt of this addendum and the Bid submitted is in accordance with information, instructions and stipulations set forth herein.

BIDDER / PROPOSER _____

AUTHORIZED SIGNATURE_____

DATE _____

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
1000	**Mobilization** (Limited to Unit Price Bid or 8.25% of Project Bid Total, Whichever is Less)	1	LS	$	$
1005	**Erosion and Pollution Control**				
h.	Erosion Control Plan & Implementation (Including SWPPP and ARAP)	1	LS	$	$
1006	Construction Entrance	8	LS	$	$
1010	**Traffic Control**				
a.	Plans	1	LS	$	$
b.	Implementation	1	LS	$	$
1015	**Pre-Construction Site Video Recording**	1	LS	$	$
1016	**Temporary Guying of Utility Poles**	5	EA	$	$
2020	**Gravity Sewer Pipe, PVC, 15 Inches, Unpaved**				
b.	6 – 8 Feet Deep	631	LF	$	$
c.	8 – 10 Feet Deep	454	LF	$	$
d.	10 – 12 Feet Deep	61	LF	$	$
e.	12 – 14 Feet Deep	91	LF	$	$
2270	**Force Main Pipe, HDPE, 6 Inches**				
a.	0 – 6 Feet Deep	12,445	LF	$	$
b.	6 – 8 Feet Deep	330	LF	$	$
b.	8 – 10 Feet Deep	195	LF	$	$
2379	**Air Release/Vacuum Valve Assembly**	13	EA	$	$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
2435	**Manhole, Concrete, 4-Foot Diameter**				
c.	8 - 10 Feet Deep	5	EA	$	$
e.	12 - 14 Feet Deep	1	EA	$	$
f.	14 - 16 Feet Deep	1	EA	$	$
2525	**Lined Manhole, 6-Foot Diameter**				
c.	8 - 10 Feet Deep	1	EA	$	$
2570	**Pipe Connection with Coring to Existing Manhole**				
g.	15-Inch Diameter	1	EA	$	$
2571	**Manhole Invert**	1	EA	$	$
2630	**Sewer Flow Control**	1	LS	$	$
2650	**Midway Road Business Park Pump Station**				
a.	Pump Station Installation (**Excluding electrical work represented on drawing sheets 23-25)**	1	LS	$	$
b.	Pump Station Electrical Work **(represented on drawing sheets 23-25)**	1	LS	$	$
2651	**IPEX Vortex Flow Insert**	1	LS	$	$
2655	**Auger Boring (For a Complete Installation)**				
a.	30" Steel Casing	110	LF	$	$
2656	**Force Main Bore**				
a.	Road Bore 'A'	1	LS	$	$
b.	Road Bore 'B'	1	LS	$	$
c.	Road Bore 'E'	1	LS	$	$
d.	Road Bore 'F'	1	LS	$	$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
	e. Road Bore 'G'	1	LS	$	$
2657	**Force Main Creek Crossing**				
	a. Creek Crossing #1	1	LS	$	$
	b. Creek Crossing #2	1	LS	$	$
2658	**Force Main (Horizontal Directional Drill - As Directed by Owner)**	750	LF	$	$
4000	**MDPE Gas Main Installation - Open Cut,** exclusive of road boring, includes trench excavation providing no less than required minimun cover up to 8' maximum trench depth, pipe, fittings, bedding, testing and purging as required by section 15720 (The CONTRACTOR will furnish all gas line materials required for the gas line installation including tracer wire.).				
	b. 8" MDPE gas main, SDR 13.5	12,660	LF	$	$
	d. 4" MDPE gas main, SDR 11.5	100	LF	$	$
	f. Adder for full clean stone backfill of trench with compaction per Section 02321 for areas in or within 3' of pavement	100	LF	$	$
4005	**Polyethlene Gas Tee & Valve Installation** (complete all labor and installation of tees, couplings, reducers, other fittings as needed, valves, valve boxes, tracer wire, asphalt/concrete restoration, cleanup/restoration, pressure test as required by section 15720)				
	e. 8” Polyethylene Main on New 8” Polyethylene Main Per KUB Fig. 15720-b8	1	EA	$	$
	t. 4” Polyethylene Main on New 4” Polyethylene Main Per KUB 15720-i4	1	EA	$	$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
	Tie-ins to Existing Gas Main / New Mains Tie-Ins & Valve Assemblies (complete all labor and installation for tie-ins to existing gas main including the installation of tees, couplings, reducers, valves, valve boxes, other fittings as needed, tracer wire, pressure test, backfill, asphalt/concrete restoration, cleanup/restoration as required by section				
4010	15720).				
	4" Polyethylene Tee Tie-In to Existing 4" Polyethylene Main w/Valves				
s.	Per KUB Fig. 15720-ee4	1	EA	$	$
	Gas Valve Installation (complete installation per KUB standard drawings. Additional valves, if required, shall be installed at the direction of the OWNER's Resident Project Representative). The installation includes valve, valve box, including bedding, valve box installation, pipe connections, backfill as required, and necessary equipment as required to complete the item in accordance with the Drawings and				
4015	Specifications required by Section 15720.				
b.	8" IPS, MDPE Gas Valve Installation	3	EA	$	$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
4030	**Gas Service Installation- Short Side Service:** The following unit prices will be utilized for the installation/full replacement of new or existing services for properties on the same side of the road as the gas main including up to 150' of pipe from the main to the meter location, tapping tee, valve, valve box, EFV, riser, couplings, tracer wire, tracer wire clip, riser protective sleeve, backfill, asphalt/concrete restoration, cleanup/restoration, pressure test and NGUS as required by Section 15345.				
	2" IPS Downtown & Large Commercial Service Line with a 2" Riser on Polyethylene Main				
o.	Per KUB Fig. 15345-o	1	EA	$	$
4055	**Gas Main Bore**				
a.	Road Bore 'H'	1	LS	$	$
b.	Road Bore 'I'	1	LS	$	$
c.	Road Bore 'M'	1	LS	$	$
4056	**Gas Main (Horizontal Directional Drill - As Directed by Owner)**	550	LF	$	$
4060	**Creek Crossings**				
a.	Creek Crossing #3	1	LS	$	$
b.	Creek Crossing #4	1	LS	$	$
c.	Creek Crossing #5	1	LS	$	$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
6000	**Temporary Pavement Patching: Cold Mix / Hot Mix**	100	LF	$	$
6005	**Permanent Patching:**				
a.	Asphalt Pavement Repair, Base Course + Surface Course	10	LF	$	$
b.	Pavement Repair, Base Course (Base Course Only)	100	LF	$	$
d.	Pavement Repair, Pavement Cutback (As Directed by OWNER)	10	LF	$	$
6010	**Removal and Replacement:**				
d.	Concrete Curb	50	LF	$	$
6011	**Pipeline Marker Installation (Marker Furnished by Owner)**	90	EA	$	$
6020	**Crushed Rock Surfacing, Roadways, and Driveways**	500	SY	$	$
6040	**Riprap**	5	TN	$	$
6045	**Cleanup Restoration & Closeout**	1	LS	$	$

TOTAL OF ALL EXTENDED UNIT PRICE ITEMS LISTED ABOVE $ _____

(Total, numbers)

_____ *Dollars*

Total, words (transfer to bid form, page 3)

END OF SECTION

SECTION 00822

INSURANCE REQUIREMENTS

A. Before commencing the Work, the CONTRACTOR shall procure and maintain at CONTRACTOR'S own expense during the entire term of the Contract the following insurance:

1. Worker's Compensation and Employer's Liability for every worker employed in connection with the Work under the Contract and provided for in each and every statute applicable to Worker's Compensation. The Employer's Liability limit shall be as required by the CONTRACTOR's excess liability insurance carrier for the maintenance of coverage.

2. Comprehensive or Commercial General Liability including insurance covering work under the Contract with total coverage limits as follows:

   The limits provided for Bodily Injury, Property Damage, Personal Injury arising out of Premises & Operations or Products & Completed Operations shall be $2,000,000.00 per occurrence. Any aggregate limits will apply separately to this Work and be unimpaired at commencement of the Work. In addition, CONTRACTOR shall provide an Umbrella policy in the limit of $5,000,000.00. The following coverage shall also be provided:

   (a) Standard contractual liability to cover the liability assumed by the CONTRACTOR under this contract.

   (b) Broad Form Property Damage or equivalent including completed operations.

   (c) Explosions, collapses and underground damage coverage.

   (d) Watercraft Liability if the use of watercraft is contemplated in the performance of the Work under the Contract.

3. Commercial and Business Automobile Liability for all owned, non-owned, rented, borrowed or hired automobiles or mobile equipment to be used by the Contractor in the performance of the Work with total coverage limits of $2,000,000.00 Combined Single Limit to respond to bodily injury and/or property damage.

4. Railroad Protective Liability insurance, RPL: Not Required.

5. Pollution Liability Insurance: CONTRACTOR shall provide Pollution Liability Insurance for the Construction and/or Construction Subagreement, with limits not less than $1,000,000.00 per occurrence. The required limits above are minimum limits and shall not be construed to limit Contractor's liability.

6. If crane(s) are to be used the CONTRACTOR must have proof of CONTRACTOR Installation Floater.

7. Special policy limits and coverage (if any) shall apply by attaching Schedule (A), "Schedule of Additional Insurance Requirements."

B. The OWNER shall be named as an Additional insured as respects to Commercial General Liability, including products and completed operations, Business Automobile Liability and Umbrella Liability and all insurance policies required hereunder with the exception of Worker's Compensation. All policies shall be endorsed to waive subrogation against KUB. Limits of Liability contained in the Commercial General Liability, Business Automobile and Umbrella policies will be endorsed to apply on a primary and noncontributory basis. At all times the CONTRACTOR shall provide to the OWNER insurance certificates showing that all insurance policies required hereunder are in full force and effect. All insurance policies and certificates shall provide that no less than 30 days notice shall be given to OWNER before such policy can be cancelled or materially changed. Any "endeavor to" language will be deleted from the required insurance certificates.

C. All insurance policies herein required of the CONTRACTOR shall be written by a company approved and authorized to do business in the State of Tennessee and shall be subject to a Bests' rating of not less than A-, vii. Unless otherwise approved by the OWNER in writing. All policies of insurance referred to herein shall be written on an occurrence basis unless otherwise agreed by KUB in writing.

END OF SECTION

SECTION 01270
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

A. The Unit Price Work shall include CONTRACTOR provided labor, materials, equipment, overhead, profit, insurance, incidentals, etc. to cover the finished Work. Cost of all applicable taxes, permits, etc. shall be included in the cost of construction of this Project. Even though an item of the Work is included in the Contract Documents, if it is not both covered herein and specifically itemized on the Unit Price Schedule of Section 00330, Bid Form, payment for it shall not be separately made. Such Work shall be considered a necessary part of or incidental to its related Work. The CONTRACTOR shall be paid only for quantities installed and approved by Resident Project Representative (RPR). Measurement for payment on a unit price basis shall be as described below. Payment for each unit installed shall be made according to the unit price bid, as listed in the Bid Form. Only those items appearing in the Bid Form will be considered for payment on a unit price basis.

B. Applications for payment shall be submitted in accordance with Section 01290, Applications for Payment, Section 00700 - General Conditions, Section 00800 - Supplementary Conditions, and Section 00514 - Agreement. Cost of all applicable taxes, permits, etc., shall be included in the cost of construction of this Project.

1.02 MEASUREMENT

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

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

C. Units of measure shown on Unit Price Schedule included with Bid Form shall be as follows, unless specified otherwise.

Item	Method of Measurement
AC	Acre—Field Measure by OWNER
CY	Cubic Yard—Field Measure in-place by OWNER within limits specified or shown

Item	Method of Measurement
EA	Each—Field Count by OWNER
LF	Linear Foot—Horizontal Field Measure by OWNER
LS	Lump Sum—by OWNER
SF	Square Foot – Field Measure by OWNER
SY	Square Yard—Field Measure by OWNER
VF	Vertical Feet—Field Measure by OWNER
WK	Week—by OWNER

D. Definitions:

1. Acre (AC): Field measured and calculated OWNER. Measurement shall be horizontal distances measured to the nearest foot, calculated in square feet, converted to acres, and rounded to the nearest acre by OWNER.
2. Cubic Yard (CY): Field measured and calculated by OWNER. In-place yards prior to excavation or after placement and compaction. Measured to the nearest 0.5 foot, calculated in cubic feet, converted to cubic yards, and rounded to the nearest cubic yard.
3. Each (EA): Field counted by the OWNER as installed and accepted.
4. Linear Foot (LF): Field measured horizontally by the OWNER. Measured centerline to centerline of manhole or fitting. Manhole diameter and fitting length shall be included in the linear measurement.
    a. Depth for Linear Foot:
        1) If the calculated depth exactly equals a number in two consecutive depths, i.e. 6, 8, 10, it shall be assumed that the lower depth category shall be used for calculating payment.
        2) Manhole, Drop Manhole, Conflict Manhole, and Manhole Removal: Distance measured from manhole rim to lowest pipe invert.
        3) Gravity Sewers: Average distance between manholes measured from manhole rim to lowest pipe invert for the specific sewer reach under consideration.
        4) Force Mains: Average distance between surface grade and pipe invert measured at 100-foot intervals along the pipe route between pipe elbows 45 degrees or greater.
        5) Backfill, Native and Stone: Average distance between surface grade and the top of the pipe envelope (12-inch cover over the pipe) measured between manholes for gravity sewers and 100-foot increments for force mains.
5. Lump Sum (LS): Field verified by OWNER.
6. Square Foot (SF): Field measured and calculated by OWNER. Measurement shall be horizontal distances measured to the nearest 0.1 foot and calculated to the nearest square foot.

7. Square Yard (SY): Field measured and calculated by OWNER. Measurement shall be horizontal distances measured to the nearest 0.5 foot, calculated in square feet, converted to square yards, and rounded to the nearest square yard by the OWNER.
8. Vertical Foot (VF): Field measured by OWNER in accordance with Paragraph D.4.a.2, above.
9. Week (WK): Field determined by OWNER as seven consecutive 24-hour days, rounded to the nearest week. A 1-day allowance for equipment set up and relocation shall be allowed. Multiple location times shall be added together to determine total time in weeks.

1.03 STORED MATERIALS AND EQUIPMENT

A. No applications shall be processed by Owner which includes amounts for stored materials. Owner shall not pay Contractor for stored materials.
   1. For unit price contracts or components Contractor's application for payment shall be based upon installed units identified on the bid form.

   2. For lump sum price contracts or components Contractor's application for payment shall be based upon approved schedule of values.

1.04 ITEMS NOT CONSIDERED AS PAY ITEMS

A. Unless explicitly stated in this Contract Document, the following items are not considered as pay items:

   1. **Clearing and Grubbing** (Section 02230)
   2. **Finish Grading** (Section 02310)
   3. **Control Blasting** (Section 02311)
   4. **General Excavation** (Section 02315)
   5. **Excavation, Bedding, and Backfill for Utilities** (Section 02321)
   6. **Waterlines – Disinfection and Testing** (Section 02516)
   7. **Sanitary Sewers – Air Testing Guidelines** (Section 02533)
   8. **Concrete for Utility Lines** (Section 03303)
   9. **Storage, Handling, and Transportation of Plastic Pipe** (Section 15101)
   10. **Tracer Wire Installation for Non-Electrically Conductive Pipe** (Section 15105)
   11. **Static Electric Discharge Procedure for Polyethylene Pipe** (Section 15265)
   12. **Natural Gas Polyethylene Pipe Joining Procedures** (Section 15350)

B. **Unclassified excavation** for utilities is not a pay item unless explicitly stated in this Contract Document. Unclassified excavation shall be considered and designated a necessary part of the construction for trench depths as defined by the individual unit price for the line installation and as required by the Project Drawings. Unit prices bid for utilities with which unclassified excavation is connected shall be full compensation for this item.

C. **Rock Excavation** is not a pay item unless explicitly stated in this Contract Document. Rock excavation shall be considered and designated a necessary part of the construction, and unit prices bid for items which rock excavation is connected shall be full compensation for this item.

D. Payment will not be made for rejected or unused products. Payment will not be made for the following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.

E. **Site Cleanup** is not a separate pay item unless explicitly stated in this Contract Document. It includes the equipment, material, and labor to maintain the Site on a daily and weekly basis in a clean environment, removing debris, unused material, cleaning, raking, general restoration of disturbed areas to a condition equal to or better than prior to construction. All debris and material shall be removed from the Site and properly disposed of offsite in an approved permitted manner. Site Cleanup is **not** a pay item and shall be considered and designated a necessary part of the construction and unit prices bid for utilities which unclassified excavation is connected shall be full compensation for this item. See Sections 01740, Surface Restoration Special Provisions and 01770, Contract Closeout.

F. **Erosion and Pollution Control – Routine Maintenance and Removal** is not a separate pay item but shall be completed for items that have been installed, including the establishment/replacement of damaged items, removal of accumulated “silt” behind the temporary structures as well as final removal once construction is complete and accepted by the OWNER. See Section 01570, Erosion Control.

1.05 BID ITEM PAYMENT

A. Payment for unit price items covers all the labor, materials, overhead, and services necessary to furnish and install the following items.

B. Payment for the bid items will be as follows:

Pay Item No. 1000 Mobilization to the job site is a lump sum pay item. One time cost to include all CONTRACTOR- incurred mobilization costs associated with such site. **Payment for Mobilization is Limited to Unit Price Bid or 8.25 % of Project Bid Total, Whichever is Less**. Demobilization is not a pay item

and shall be considered a necessary part of the work and the cost of such included herein. If the CONTRACTOR had to pull all men and equipment off the job at the request of the OWNER and subsequently had to re-mobilize then he would be paid the lump sum price for mobilization a second time.

Pay Item No. 1005h - Erosion Control Plan and Implementation (Including SWPPP and ARAP) is a lump sum pay item and includes all erosion control devices required by OWNER and/or agency having jurisdiction. This includes all material, labor, and installation complete. See Section 01570, Erosion Control. All measures shall be monitored and maintained per specifications and shall not be removed until all associated permits or approvals have been obtained.

Pay Item No. 1010a - Traffic Control – Plan is a lump sum pay item once the CONTRACTOR has received back from OWNER all approved traffic control plans, as required for Work, which have been prepared, and stamped by a registered professional engineer and submitted to OWNER for approval. Payments for this lump sum item will be made based on percentage of work complete for the entire project. See Section 01550, Work Zone Traffic Control and Appendix, Policy on Work Zone Traffic Control and Temporary Traffic Control Permit.

Pay Item No. 1010b - Traffic Control – Implementation is a lump sum pay item, which includes temporary facilities, maintenance, relocation, removal, personnel, police officers, signage, and routine coordination with permitting agencies. Item also include installation, maintenance, relocation, and removal of temporary chain link fencing, as required by traffic permits. Payments for this lump sum item will be made based on percentage of work complete for the entire project. See Section 01550, Work Zone Traffic Control and Appendix, Policy on Work Zone Traffic Control and Temporary Traffic Control Permit.

Pay Item No. 1015 - Pre-Construction Site Video Recording is a lump sum pay item. Video recording shall include all materials, equipment, and labor to record the sewer route at the beginning of the project as specified in Section 01380.

Pay Item No. 1016 - Temporary Guying of Utility Poles is a per each pole unit price item. Unit price item includes materials, equipment and labor to guy, anchor, brace, or mechanically hold the utility pole and associated anchors throughout the excavation process and until the excavated area can be properly backfilled and compacted to prevent movement of the pole and anchor(s). Includes CONTRACTOR'S notification of OWNER not less than seven (7) calendar days prior to excavation within twenty (20) feet of any pole and CONTRACTOR'S provision of information to OWNER pertaining to the method that is to be used to stabilize the pole and the name of the licensed electrical contractor responsible for performing the work described.

Pay Item No(s). 2020a-f - Gravity Sewer Pipe, PVC, 15 Inches, Unpaved are linear foot unit price items. Unit price items include trench excavation, dewatering if needed, pipe material as shown on the Unit Price Schedule, pipe zone material, backfill, compaction, testing, and inspection. See Section 02321, Excavation, Bedding, and Backfill for Utilities and Section 02532, Sanitary Sewers.

Pay Item No(s). 2270a-c - Force Main Pipe, HDPE, 6 Inches are linear foot unit price items. Unit price items include trench excavation, dewatering if needed, pipe material as shown on the Unit Price Schedule, fittings, pipe zone material, backfill, compaction, testing, and inspection. See Section 02321, Excavation, Bedding, and Backfill for Utilities and Section 02534, Waste Water Force Main.

Pay Item No. 2379 - Air Release/Vacuum Valve Assembly is a per each unit price pay item which includes trench excavation, dewatering if needed, precast concrete manholes, manhole frame, either standard or watertight manhole cover, piping components, pipe zone material, backfill, compaction, testing, and inspection as depicted in the project drawings or as designated by Owner. See Section 02321, Excavation, Bedding, and Backfill for Utilities, Section 02530, Manholes, and Section 02534, Waste Water Force Main.

Pay Item No(s). 2435a-i - Manhole, Concrete, 4-Foot Diameter are per each unit price pay items. Unit price items include, clearing and grubbing, removal of existing manhole, base, precast sections, concrete riser rings, gaskets, steps, cast-in or core drilled pipe openings, necessary pipe and pipe fittings, grout, vacuum testing, frame and either standard or watertight cover as depicted in project drawings or as designated by Owner. See Section 02530, Manholes.

Pay Item No(s). 2525a-i - Lined Manhole, 6-Foot Diameter are per each unit price pay items. Unit price items include, clearing and grubbing, removal of existing manhole, base, precast sections, concrete riser rings, gaskets, steps, cast-in or core drilled pipe openings, necessary pipe and pipe fittings, grout, vacuum testing, frame and either standard or watertight cover or hatch as depicted in project drawings or as designated by Owner. See Section 02530, Manholes.

Pay Item No(s). 2570a-o - Pipe Connection with Coring to Existing Manhole are per each unit price pay items. Unit price items include core drilling, pipe attachment, removal and offsite disposal of cored material. See Section 02530, Manholes.

Pay Item No. 2571 – Manhole Invert is a per each unit price pay item. Item includes removal of existing manhole invert (if necessary) frame, preparation of the existing structure to receive a new invert, and installation of new concrete invert as directed by the OWNER. See Section 02530, Manholes.

Pay Item No. 2630 Sewer Flow Control is a lump sum pay item. Lump sum price bid for sewer flow control shall be full compensation for this item and includes sewer dams, by-pass pumps with standby units, fuel, maintenance, operation, supervision, suction and discharge piping. Payments for this lump sum item will be made based on percentage of work complete for the entire project. See Section 02542, Sewer Flow Control.

Pay Item No. 2650a –Midway Road Business Park Pump Station is a lump sum pay item. Lump Sum item includes all materials, equipment, labor, and appurtenances necessary for a complete pump station installation in accordance with the plan details and specifications. Work shall include, but not be limited to, clearing and grubbing, excavation, formation of fills and grading, installation of structures and equipment, bypass pumping as required, sewer piping, drainage piping, gravel and asphalt paving, fencing, riprap, site restoration, landscaping, and start-up and testing services. Progress payments shall be made for the percentage of work completed as determined by the OWNER using the Schedule of Values submitted for this pay item. The Schedule of Values shall be submitted in accordance with Section 00700, Paragraph 2.05C.2. Schedule of Values.

Pay Item No. 2650b –Midway Road Business Park Pump Station Electrical Work is a lump sum pay item. Lump Sum item includes all materials, equipment, labor, and appurtenances necessary for the complete electrical and instrumentation component installation as shown on Plan sheets (E3.01, E3.02 & E3.03) and, as described in Divisions 11 and 16 of the Specifications. Work shall include, but not be limited to, installation of conduits, wires, cables, structures and equipment, electrical service and installation of all equipment controls and electrical components, site restoration, and start-up and testing services. Progress payments shall be made for the percentage of work completed as determined by the OWNER using the Schedule of Values submitted for this pay item. The Schedule of Values shall be submitted in accordance with Section 00700, Paragraph 2.05C.2. Schedule of Values.

Pay Item No. 2651 – IPEX Vortex Flow Insert is a lump sum pay item, which includes the labor, materials, and equipment necessary for the complete in-place installation of a prefabricated Vortex Flow Insert into a manhole as depicted in the project drawing or as designated by Owner. The vortex unit shall be installed and fastened to the manhole as recommended by the manufacturer and to the approval of the Owner.

Pay Item No. 2655 – Auger Boring (For a Complete Installation) is a linear foot unit price pay item. Unit price item includes all mobilization, demobilization, labor, materials, and installation of casing and carrier pipe as specified on drawing by augering and excavation of material under public roadways and private driveways for a complete installation. Disposing of excavated materials in appropriate manner is also included. Contractor is responsible for all inspection fees charged by the agency having jurisdiction. Contractor must also maintain

appropriate insurance requirements designated by the agency having jurisdiction, if applicable. Dewatering, if necessary, is also included. See Section 2445, Auger Boring and Alternative Tunneling.

Pay Item No. 2656a-e – Force Main Bore are lump sum pay items relative to the locations shown on the plans. Unit price for Boring shall be full compensation for these items and for all labor, incidental materials and casing if utilized, and equipment required to complete the bore. The per each unit price for boring is considered payment under unclassified excavation. Additional costs incurred for rock boring will be at the CONTRACTOR's expense. The per each price for boring shall include installation of all HDPE force mains, size and number as required and all other incidental items as required to complete the bore(s) and associated Work. Method of boring shall be at the CONTRACTOR's discretion as long as the installation meets the requirements of the Contract Documents.

Pay Item No. 2657a-b – Force Main Creek Crossing is a lump sum pay item. In accordance with ARAP, including surface/bank restoration & stabilization, and environmental protection of waterway is a pay item based on lump sum for designated location from the edges of the creek banks. Any additional footages will be paid in accordance with Pay Item 4000 of this Measurement and Payment Section.

Pay Item No. 2658 – Force Main (Horizontal Directional Drill) is a per linear foot pay item used ONLY at the direction of the OWNER as a substitute for open cut installation. This unit price shall include all labor, incidental materials, and equipment required. Payment will be made under unclassified excavation. Rock boring will be addressed by change order on a case-by-case basis. Instances where the CONTRACTOR elects to install the force main via horizontal directional drilling due to convenience, do not qualify for payment under this item.

Pay Item No(s). 4000a-g - MDPE Gas Main Installation -Open Cut exclusive of road boring, includes trench excavation providing no less than required minimum cover up to 8' maximum trench depth, pipe, fittings, bedding, testing and purging, complete per section 15720. Gas Main Installations are linear foot pay items. The quantities of pipe in place for which payment will be allowed shall be expressed in linear feet of gas main in terms of the horizontal length of **each** pipe installed in place as measured along the centerline of the trench with no deductions for valves or fittings where depth is measured from the top of the pipe to the proposed/finished grade. Such payment shall be full compensation for installing gas main including pipe bedding, excavation, backfill per Section 15720, tracer wire, and all other work necessary for and incidental to completion of the work. **The CONTRACTOR will furnish all gas line materials required for the gas line installation including tracer wire.**

Pay Item No(s). 4005a-y.1. - Polyethylene Gas Tee & Valve Installation (complete all labor and installation for tie-ups including installation of tees, couplings, reducers, valves and valve boxes and other fittings as required by section 15720) are per each pay items only when the valve installation in not included as part of a gas main tie-in or gas service connection. Unit prices bids for each shall be full compensation for this item and for all labor to complete the installation including bedding, valve box installation, pipe connections, backfill as required, and necessary equipment as required to complete the item in accordance with the Drawings and Specifications. **The CONTRACTOR will furnish all gas line materials required for the gas valve installation.**

Pay Item No(s). 4010a-q.2.- Tie-ins to Existing Gas Main / New Mains Tie-Ins & Valve Assemblies (complete all labor and installation for tie-ups including installation of tees, couplings, reducers, backfill, asphalt/concrete restoration, cleanup/restoration, pressure test, & tracer wire, valves and valve boxes and other fittings and bypasses as required by section 15720.) Gas main tie-ins to existing / new mains are per each pay items. Unit price bids for each tie-in shall be full compensation for each specific tie-in including all labor, installation of all fittings, valves, reducers, couplings, and incidentals as required to complete the tie in. **The CONTRACTOR will furnish all gas line materials required for the gas main tie-ins.**

Pay Item No(s). 4015a-e - Gas Valve Installation are per each pay items only when the valve installation is not included as part of a gas main tie-in or gas service connection. Unit prices bids for each shall be full compensation for this item and for all labor to complete the installation including bedding, valve box installation, pipe connections, backfill as required, and necessary equipment as required to complete the item in accordance with the Drawings and Specifications. **The CONTRACTOR will furnish all gas line materials required for the gas valve installation.**

Pay Item No(s). 4030a-o - Gas Service Installation – Short Side Service: The following unit prices will be utilized for the installation/full replacement of new or existing services for properties on the same side of the road as the gas main including 150' of pipe from the gas main to the meter location, tapping tee, valve, valve box, EFV, riser, couplings, tracer wire, tracer wire clip, riser protective sleeve backfill, asphalt/concrete restoration, cleanup/restoration, pressure test and NGUS as required by Section 15345. Gas Service Installation – Short Side Service is a per each pay item and shall be full compensation for this item and for all labor to complete the installation including connections, pipe, fittings, valves, valve boxes, EFV, backfill, restoration, and necessary equipment as required to complete the item in accordance with the Drawings and Specifications 15345. **The CONTRACTOR will furnish all gas line materials required for Gas Service Installation – Short Side Service.**

Pay Item No(s). 4055a-f. - Gas Main Bore are lump sum pay items relative to the locations shown on the plans. Unit price for Boring shall be full compensation for these items and for all labor, incidental materials and casing if utilized, and equipment required to complete the bore. The per each unit price for boring is considered payment under unclassified excavation. Additional costs incurred for rock boring will be at the CONTRACTOR's expense. The per each price for boring shall include installation of all MDPE gas mains, size and number as required and all other incidental items as required to complete the bore(s) and associated Work. Method of boring shall be at the CONTRACTOR's discretion as long as the installation meets the requirements of the Contract Documents.

Pay Item No. 4056 – Gas Main (Horizontal Directional Drill) is a per linear foot pay item used ONLY at the direction of the OWNER as a substitute for open cut installation. This unit price shall include all labor, incidental materials, and equipment required. Payment will be made under unclassified excavation. Rock boring will be addressed by change order on a case-by-case basis. Instances where the CONTRACTOR elects to install the gas main via horizontal directional drilling due to convenience, do not qualify for payment under this item.

Pay Item No. 4060a-c. – Gas Main Creek Crossing is a lump sum pay item. In accordance with ARAP, including surface/bank restoration & stabilization, and environmental protection of waterway is a pay item based on lump sum for designated location from the edges of the creek banks. Any additional footages will be paid in accordance with Pay Item 4000 of this Measurement and Payment Section.

Pay Item No. 6000 - Temporary Pavement Repair: Cold / Hot Mix is a linear foot unit price pay item. Unit price item includes asphalt cold / hot mix pavement material, installation, compaction, and maintenance, or as otherwise directed by OWNER. See KUB Standards Section 02740, Pavement Repair and Section 01740 Surface Restoration Special Provisions.

Pay item 6005a - Pavement Repair (Installed by Contractor): Permanent Patching, Base Course + Surface Course (to be installed as directed) is a linear foot unit price pay item. Unit price item includes excavation of temporary pavement repair, excavation of stone base as needed, material (Base Grade B or B-M and Surface Course Grade D), compaction, cleanup, striping (if needed), milling (as directed), and straight line truing of existing surface as needed. See KUB Standards Section 02321 General Excavation, Bedding and Backfill for Utilities; Section 02740 Pavement Repair; and Section 1740 Surface Restoration Special Provisions. Pay item 6005a shall be paid exclusive of Pay Item Nos. 6005b and 6005c and shall not be priced in combination with pay items 6005b or 6005c for any area(s) of work (payment for any given unit of measure shall be made for either Item Nos. 6005a, 6005b, or 6005c). Payment for this unit price item will be made based on the length of trenches, to the limits of excavation,

including manhole excavations, as specified in the bid documents OR as approved in writing by OWNER.

Pay item 6005b - Pavement Repair (Installed by Contractor): Permanent Patching, Base Course is a linear foot unit price pay item. Unit price item includes excavation of temporary pavement repair, excavation of stone base as needed, material (Base Grade B or B-M), compaction, cleanup, striping (if needed), milling (if needed), and straight line truing of existing surface as needed. See KUB Standards Section 02321 General Excavation, Bedding and Backfill for Utilities; Section 02740 Pavement Repair; Section 02770 Concrete for Utilities and Concrete Pavement Construction; and Section 1740 Surface Restoration Special Provisions. Pay item 6005b shall be paid exclusive of Pay Item Nos. 6005a and 6005c and shall not be priced in combination with pay items 6005a or 6005c for any area(s) of work (payment for any given unit of measure shall be made for either Item Nos. 6005a, 6005b or 6005c). Payment for this unit price item will be made based on the length of trenches, to the limits of excavation, including manhole excavations, as specified in the bid documents OR as approved in writing by OWNER.

Pay Item No. 6005c - Pavement Repair (Installed by Contractor): Permanent Patching, Portland Cement Concrete Pavement is a linear foot unit price pay item. Unit price item includes excavation of temporary pavement repair, excavation of stone base as needed, additional compacted stone base as needed, dowelling to existing slab and rebar installation, as required, forming as needed, material (Portland Cement Concrete Pavement), Placement, finishing, and curing, cleanup, striping (if needed), milling (if needed), and straight line truing of existing surface as needed. See KUB Standards Section 02321 General Excavation, Bedding and Backfill for Utilities; Section 02740 Pavement Repair; Section 02770 Concrete for Utilities and Concrete Pavement Construction; and Section 1740 Surface Restoration Special Provisions. Pay item 6005c shall be paid exclusive of Pay Item Nos. 6005a and 6005b and shall not be priced in combination with pay items 6005a or 6005b for any area(s) of work (payment for any given unit of measure shall be made for either Item Nos. 6005a, 6005b or 6005c). Payment for this unit price item will be made based on the length of trenches, to the limits of excavation, including manhole excavations, as specified in the bid documents OR as approved in writing by OWNER.

Pay Item No(s). 6010d & f - Removal and Replacement are linear foot unit price pay items. Unit price items include excavation, removal and disposal of material, replacement material to duplicate material type and specification, depth, width, and length of removed materials, cleanup, and 30 days of maintenance. Compensation will be per linear foot of repair for Owner approved areas surrounding the work. See Section 02321, Excavation, Bedding, and Backfill for Utilities, Section 02770, Concrete for Utilities and Concrete Pavement Construction, and Section 02740, Pavement Repair.

Pay Item No. 6011 – Pipeline Marker Installation (Marker Furnished by Owner) is a per each marker unit price pay item. Unit price bid for each pipeline marker shall be full compensation for each installed pipeline marker. Pipeline markers shall be provided by the OWNER.

Pay Item No. 6020 - Crushed Rock Surfacing, Roadways and Driveways is a square yard unit price pay item. Unit price item includes excavation, removal and disposal of material, replacement material to duplicate material, depth, width, and length of removed material, cleanup, and 30 days of maintenance. See KUB Standards Section 02321, Excavation, Bedding, and Backfill for Utilities, Section 02770, Concrete for Utilities and Concrete Pavement Construction, and Section 02740, Pavement Repair.

Pay Item No. 6040 - Riprap is a per ton unit price pay item. Unit price item includes geotextile, base, and riprap material, placement and cleanup. See Section 02372, Geotextiles and Section 02371, Riprap.

Pay Item No. 6045 - Cleanup Restoration & Closeout is a lump sum price pay item. Lump sum price bid for site restoration, lawn repair, landscape repair, etc., shall be full compensation for this item and for all labor, materials, water and equipment required to complete the restoration to its original or better condition. Payments for this lump sum item will be made based on percentage of work complete for the entire project. **It is highly recommended that the CONTRACTOR photograph existing conditions at the Site prior to commencing with the Work.**

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

HOME

SECTION 01450
TESTING LABORATORY SERVICES
(FOR ALL TESTING EXCEPT WATER QUALITY)

PART 1. GENERAL

1.1 SELECTION AND PAYMENT

A. THIRD PARTY shall employ and pay for services of an independent testing laboratory to perform specified inspection and testing, subject to the approval of OWNER.

B. Employment of testing laboratory shall in no way relieve CONTRACTOR of obligation to perform work in accordance with requirements of Contract Documents.

C. If OWNER is required to retest because of non-conformance to specified requirements; the same independent firm on instructions shall perform the tests for OWNER. Payment for retesting will be charged to CONTRACTOR by deducting inspection or testing charges from the Contract Sum/Price.

1.2 CONTRACTOR'S RESPONSIBILITIES

A. Submit proposed concrete mix design to OWNER in accordance with sections 00700 and 00800 prior to construction for approval

B. Deliver to laboratory at designated location adequate samples of materials proposed which may require testing.

C. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities.

D. Provide incidental labor and facilities to allow access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, and to facilitate tests and inspections, storage and curing of test samples.

E. Notify OWNER and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

Not Used

END OF SECTION

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1. GENERAL

This section covers the transportation, handling, storage, and substitution of materials and equipment. Section 15101, "Material Handling, Storage and Transporting of Polyethylene Pipe," is hereby incorporated into this section by reference.

PART 2. PRODUCTS

New material, machinery, components, equipment, fixtures, and systems shall be used in forming the work. This does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the work. Products may also include existing material or components required for reuse. Do not use materials and equipment removed from existing premises, except as specifically permitted by OWNER.

2.1 NOT USED

2.2 When any CONTRACTOR vehicle assigned to do the Work leaves KUB grounds for any reason other than to travel to the Project site, all OWNER furnished material shall at the CONTRACTOR'S expense be unloaded before leaving and loaded upon return. Said OWNER furnished material shall be unloaded and stored at a location approved by the Manager of KUB Overhead Construction, or his representative.

2.3 It shall be CONTRACTOR'S responsibility to gather material in advance for the Work especially if CONTRACTOR is approved to work after normal storeroom hours of 7:00 AM to 3:30 PM Monday through Friday. To expedite the pickup of materials, CONTRACTOR must fax a list of materials required to (865) 558-2519 one-day prior to pickup. It is CONTRACTOR'S responsibility to send a written request to the Resident Project Representative if materials will be needed after normal working hours.

PART 3. EXECUTION

3.1 TRANSPORTATION AND HANDLING

A. CONTRACTOR must provide an adequate number of personnel to load and secure OWNER supplied materials. OWNER'S personnel will not load or secure products for transport.

B. Transport and handle products in accordance with manufacturer’s instructions.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

3.2 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place above ground on supports that are sloped for drainage.

C. Provide off-site storage and protection for materials. OWNER is not responsible for material storage or parking.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

3.3 PRODUCT OPTIONS

A. Products specified by reference standards or by description only: Any product meeting those standards or description.

B. Products specified by naming one or more manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products specified by naming one or more manufacturers with a provision for substitutions: Submit a request for substitution for any manufacturer not named.

D. For similar components, provide interchangeable components of the same manufacturer.

3.4 SUBSTITUTIONS

A. OWNER will consider requests for substitutions only within 15 days after date of OWNER-CONTRACTOR Agreement.

B. Substitutions may be considered when a product becomes unavailable through no fault of CONTRACTOR.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. A request constitutes a representation that CONTRACTOR:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work, which may be required for the work to be complete with no additional cost to OWNER.
4. Waives claims for additional costs or time extension, which may subsequently become apparent.
5. Will reimburse OWNER for review or redesign services associated with re-approval.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitutions Submittal Procedure

1. Submit three copies of request for Substitution for consideration in accordance with sections 00700 and 00800. Limit each request to one proposed substitution.
2. Submit shop drawing, product data, and certified test results attesting to the proposed product equivalence.
3. OWNER will notify CONTRACTOR, in writing, of decision to accept or reject request.

END OF SECTION

SECTION 02534
WASTEWATER FORCE MAIN

PART 1. GENERAL

1.01 SCOPE

A. The Work to be performed shall consist of the installation of wastewater force mains according to the Specifications and the Standard Drawings herein.

B. CONTRACTOR shall be responsible for safely storing materials needed for the Work until they have been incorporated into the completed Project. CONTRACTOR shall keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

1.02 DEFINITIONS

A. DR: Standard Dimension Ratio.

B. HDPE: High-density polyethylene pipe.

C. Pipe Stiffness Classification: Referred to as SN.

D. Pressure Class: Referred to as PN.

1.03 SUBMITTALS

A. Action Submittals:
   1. Information on gasket polymer properties.
   2. Tee fabrication details.
   3. Application methods, application requirements, and chemical resistance data for coating and lining products.
   4. Joint and fitting restraints.

B. Informational Submittals:
   1. Certificates:
      a. Manufacturer's Certificate of Compliance for each type of pipe that products furnished meet requirements of this section.
      b. Certification of Calibration: Approved testing laboratory certificate if pressure gauge for hydrostatic test has been previously used. If pressure gauge is new, no certificate is required.
      c. Certified statement from manufacturer of gaskets, setting forth that basic polymer used in gaskets and test results of physical properties of compound

are in accordance with AWWA C900 or AWWA C905 for PVC pipe and AWWA C111 for Ductile Iron Pipe.

2. Manufacturer's Written In-Plant Quality Control Program: Quality control procedures and materials testing to be used throughout manufacturing process. Submit prior to manufacture of any pipe for this Project.
3. Test or historical performance data to verify joint design meets requirements of these Specifications.
4. Provide pipe test results with delivery of pipe. Do not deliver pipe not meeting test requirements to Site.
5. Manufacturer's written recommendations for pipe handling and installation.
6. PVC and HDPE pipe deflection test results.
7. Field Leakage Testing Plan: Submit at least 15 days in advance of the testing and include at least the following:
   a. Testing dates.
   b. Piping systems and sections to be tested.
   c. Test type.
   d. Method of isolation.
   e. Method of conveying water from source to system being tested.
   f. Calculation of maximum allowable leakage for piping section(s) to be tested.
   g. Method for disposal of test water, if applicable.

PART 2. PRODUCTS

2.01 PIPE

A. Materials will be visually inspected by PROGRAM MANAGER at the Site for conformance to the Specifications. At OWNER's discretion, CONTRACTOR may be required to supply certified mill tests, samples, or other suitable form of verification that the material meets the required specifications.

1. Polyvinyl chloride (PVC) pipes and fittings may be used for force mains from 4 inches to 24 inches in diameter, in accordance with the requirements of AWWA C900 or AWWA C905 and the Materials Specifications herein. The pressure class rating shall be selected based upon the design requirements of the system. PVC pipe shall be a minimum of DR 18, Class 150 for AWWA C900 pipe and DR 25 Class 165 for AWWA C905 pipe.
2. Ductile Iron Pipe and fittings may be used for force mains 8 inches and larger:
   a. Made of good quality ductile iron in conformance with latest revision of AWWA/ANSI C151/A21.51. The pipe shall be push-on joint with a minimum pressure class of 150 psi, thickness design according to AWWA/ANSI C150/A21.58, ceramic epoxy lined and coated outside with an

asphaltic coating. Ductile iron pipe and fittings shall conform to the requirements of the Materials Specifications herein.

b. Ceramic Epoxy Lining:
   1) 40-mil nominal lining consisting of amine cured novolac epoxy containing a minimum of 20 percent by volume quart pigment manufactured under the name of Protecto 401 by the Vulcan Group.
   2) Line interior of bell and exterior of spigot in joint sealing areas with 6 to 10 mils of specified lining.
   3) Surface Preparation: SP10 near-white abrasive blast.
   4) Pinhole Detection: 2,500 volts minimum over 100 percent of lined surfaces.

3. HDPE pipe and fittings may be used for force mains:
   a. Pipe Larger than 4 Inches: **DR 11**, meeting requirements of AWWA C906, ASTM F714, and ASTM D3035.
   b. Pipe 4 Inches and Smaller: Minimum DR 11, meeting requirements of AWWA C906, ASTM F714, and ASTM D3035.
   c. HDPE pipe shall have a co-extruded green cover or extruded green stripes designating use for sanitary sewer. Color print lines are not an acceptable method for designation of sewer mains. Pipe with extruded green stripes shall have a minimum of three equally spaced stripes. Pipe shall have a heat indented print line containing the information required in ASTM D 3035.
   d. Pipe Manufacturers:
      1) Performance Pipe.
      2) Rinker Polypipe.
      3) Uponor North America.
      4) ARNCO, Elyria, OH.
   e. Fittings:
      1) Fittings shall be molded. Fabricated fittings are not acceptable, unless approved in writing by OWNER. Butt fusion fittings shall comply with ASTM D3261 requirements.
      2) Butt heat fusion or electrofusion fittings.
      3) Install butt fusion fittings with butt fusion welding, as specified in Paragraph Pipe Joining.
      4) Electrofusion joint fittings shall have ISO 9001 and NSF 61 certification.
      5) Manufacturers:
         a) Central Plastics Company; Central Electrofusion System.
         b) IPEX, Inc.; Friatec.

2.02 JOINT RESTRAINT

A. Fitting and joint restraints for all pipe types specified, except HDPE pipe, shall be Megalug type restraints by EBAA Iron Sales Inc

B. Restraints shall be supplied with bolts consisting of high strength annealed, corten steel, T-head type having hexagonal nuts. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface.

C. Mechanical restrained type joints for ductile iron pipe shall be factory type and fabricated at the factory. Field welding for joint fabrication is not acceptable. Approved restrained type joints shall be T.R. Flex Joints as manufactured by U.S. Pipe or Lok-Ring joints as manufactured by American Ductile Iron Pipe or similar as manufactured by McWane, Clow, or Griffen Pipe.

D. One manufacturer shall supply all components of the restraining method and accessories.

E. Restraints on HDPE pipe joints and fittings are not required for butt heat fusion joints and fittings, or electrofusion fittings conforming to Specifications.

F. HDPE pipe shall not be allowed with mechanical joint fittings.

PART 3. EXECUTION

3.01 INSTALLATION OF FORCE MAIN

A. Force mains shall be installed at the lines and grades required by Drawings. All fittings shall be at the required locations, and the spigots well centered in the bells.

B. All PVC, Ductile Iron and HDPE pipe shall be installed with a 12-gauge copper wire for tracing purposes as specified in Section 02321, Excavation, Bedding, and Backfill for Utilities.

C. Unless otherwise indicated by the Drawings, all force mains shall have at least 36 inches of cover. The pipe shall slope continuously between high and low points to

eliminate the formation of air pockets. The pipe shall have a minimum of 60 inches of cover at the high points. OWNER shall approve any exceptions.

D. CONTRACTOR shall provide and use tools and facilities that are satisfactory and that will allow the Work to be done in a safe and convenient manner. Suitable equipment shall be used to lower all pipe and fittings into the trench one piece at a time. Each piece shall be lowered carefully so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances shall force main materials be dumped or dropped.

E. Pipes and fittings shall not be lowered into the trench until they have been swabbed to remove any mud, debris, etc., which may have accumulated within them. After the pipe has been lowered, all unnecessary materials shall be removed from it. Before any pipe is laid, the outside of its spigot end and the inside of its bell shall be cleaned and left dry and oil-free.

F. Every precaution shall be taken to keep foreign material from getting into the pipe while it is being installed. No debris, tools, clothing, or other materials shall be placed in the pipe during laying operations.

G. After a length of pipe has been placed in the trench, the spigot end shall be centered in the bell of the adjacent pipe, and then inserted to the depth specified by the manufacturer.

H. Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, the bottom of the trench shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length.

I. Whenever pipe laying is not in progress, the open ends of the pipe shall be closed either with a watertight plug or by other means approved by OWNER.

J. Pipe shall be cut so fittings can be inserted in a workmanlike manner and without any damage to the pipe. The manufacturer's recommendations shall be followed concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis. A carborundum saw shall be used for ductile iron pipe, PVC and HDPE pipe. OWNER may consider other methods for 12-inch

diameter and larger pipe. HDPE pipe shall be joined in accordance with Paragraph HDPE Pipe Joining.

K. Pipe shall be installed with the bell ends facing in the direction of laying unless otherwise directed by OWNER.

L. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor more than 75 percent of that recommended by the pipe manufacturer, and shall be approved by OWNER. Bend fittings shall only be used when the pipe deflections are inadequate, according to manufacturer's recommendations, or as directed by OWNER. Pipe bending of PVC pipe shall not be allowed, fittings or joint deflections shall be utilized.

M. No pipe shall be installed in water or when it is OWNER's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, its use is considered incidental to the Project.

N. Joint restraints shall be installed wherever the force main changes direction (at tees and bends), at dead ends, or at any other point recommended by the manufacturer or

required by OWNER. Joint restraints shall be considered an integral part of the force main work.

O. All pipe shall be jointed in the exact manner specified by the manufacturer of the pipe and jointing materials.

P. Air valves shall be located at all high points on the pipeline as shown on the Drawings or as directed by OWNER.

Q. Force main outlets shall be installed in manholes as shown on the Standard Drawing herein (See Figure 1-02534-a). Force mains 2 inches and smaller may be tied directly into a manhole as approved by OWNER at a minimum of 3 feet.

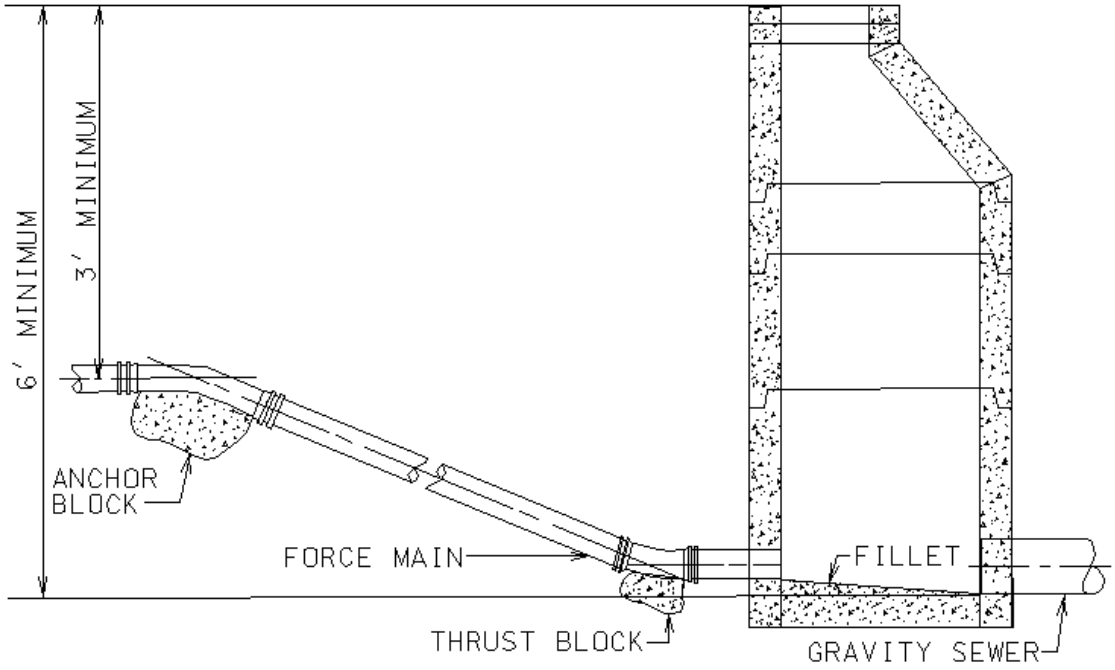

Figure 1-02534-a
Standard Detail for Connection of Force Main to Gravity Sewer

Notes:

I. Crown of force main must be installed at same elevation as crown of receiving gravity sewer.
II. Manhole invert must be formed to provide smooth transition channel to sufficient depth to direct force main discharge with minimum turbulence.
III. Manhole frame and lid not shown.
IV. Joints restraints shall be provided at change in direction.

3.02 HDPE PIPE JOINING

A. Assemble and join at the Site using the butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted.

B. All equipment and procedures used in shall be in strict compliance with ASTM D2657 and with the manufacturer's recommendations.

C. Fusion shall be preformed by technicians certified by manufacturer of pipe fusion equipment.

D. Prior to pipe installation, two trial fusion welds shall be performed, and reviewed and approved by the PROGRAM MANAGER. Full penetration welds shall provide homogeneous material across the cross section of weld. Fusion machine employed for trial welds shall be same machine utilized for project installation.

E. The butt-fused joint shall be true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. Excessive interior bead depth is cause to have the joint cut out and replace.

F. The fused joint shall be watertight and shall have tensile strength equal to or greater than that of the pipe.

G. All joints shall be subject to acceptance by the OWNER prior to insertion.

H. The CONTRACTOR shall cut out and replace defective joints at no additional cost to the OWNER.

I. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent of the wall thickness (ASTM 585), shall not be used and shall be removed from the Site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.

J. Any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other

defect of manufacturing or handling as determined by the OWNER shall be discarded and not used.

K. All connections shall be in conformance with the manufacturer's installation procedures.

3.03 LEAKAGE TEST

A. All newly installed and backfilled pipe shall be subjected to a leakage test, conducted in the presence of OWNER.

B. Test pressure shall be 150 percent of system operating pressure based on pressure as measured at lowest point in pipeline**.**

C. The force main shall be slowly filled with water, and the specified test pressure shall be applied (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to OWNER. CONTRACTOR shall furnish the pump, pipe, connections, gauges, and all necessary apparatus.

D. Before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, CONTRACTOR shall make taps at the points of highest elevation before testing, and shall insert plugs after the test has been completed.

E. The leakage test shall be conducted by measuring, through a calibrated meter, the amount of water which enters the test section for a period of at least 2 hours. No installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

For Ductile Iron Pipe:

$$L = \frac{ND\sqrt{P}}{1{,}850}$$

For PVC Pipe:

$$L = \frac{ND\sqrt{P}}{7{,}400}$$

L = allowable leakage, gallons/hour
N = number of joints in length of pipe tested
D = nominal diameter of the pipe, inches
P = average test pressure during the leakage test, psig

The following table has been developed for the commonly used sizes of ductile iron pipe and PVC pipe with nominal laying lengths of 20 feet, under a test

pressure of 150 psi. The leakage formulas above may be used when conditions differ from those stated parameters.

Allowable Leakage Per 100 Feet (gallons/hour)		
Pipe Diameter (Inches)	**Ductile Iron Pipe**	**PVC Pipe**
4	0.13	0.033
6	0.20	0.050
8	0.26	0.066
12	0.40	0.099
16	0.53	0.132
Greater than 16	Use formula above.	Use formula above.

For HDPE Pipe:

1. Make-up Water Allowance:
   a. Maximum allowable make-up water at conclusion of test phase shall not exceed recommended amounts stated in the following table.
   b. Table is based on test pressure equal to 1.5 times pressure class of pipe. If lower pressure is used for test, allowances shall be reduced by ratio of test pressure to pressure class of pipe.

Make-Up Water Allowance for Test Phase (U.S. Gallons per 100 feet of Pipe)		
Nominal Pipe Size (inches)	**1-Hour Test (gallons)**	**2-Hour Test (gallons)**
3	0.10	0.15
4	0.13	0.25
6	0.30	0.60
8	0.50	1.0
10	0.75	1.3
12	1.1	2.3
14	1.4	2.8
16	1.7	3.3
18	2.2	4.3
20	2.8	5.5
24	4.5	8.9
28	5.5	11.1
32	7.0	14.3
36	9.0	18.0

Note: No observed leaks.

F. Any cracked or defective pipes or fittings discovered in consequence of this leakage test shall be replaced with sound material in the manner specified at no cost to OWNER. The test shall be repeated until the results are satisfactory to OWNER.

3.04 CLEANUP

A. After completing each section of the force main, all debris and construction materials shall be removed from the Site and disposed of in compliance with all applicable laws and regulations and with Section 02321, Excavation, Bedding, and Backfill for Utilities. Then the surface shall be graded and smoothed on both sides of the line. The entire area shall be left clean and in a condition satisfactory to OWNER. CONTRACTOR shall keep cleanup operations as close to active pipe laying activities as practical, generally following by less than 300 feet, or as approved by OWNER.

END OF SECTION

SECTION 15901

STARTUP AND COMMISSIONING

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section describes the requirements for the startup, commissioning, and final documentation for all equipment and appurtenances required to enable the **Midway Road Business Park Sewer Pump Station** facility to operate as an integrated system as described in the Specifications and shown on the Drawings.

B. Startup is generally defined as the process of testing and verifying operational parameters of individual components that comprise the overall system.

C. Commissioning is generally defined as insuring that all systems and components are designed, installed, tested, operated, and maintained according to the operational requirements outlined in the Specifications and Drawings.

D. The work shall include the complete testing, recommended by respective equipment manufacturers, of all equipment and, the overall system, and shall also include any changes or adjustments necessary for the proper functioning of the system and equipment.

E. It shall be the responsibility of the Contractor to coordinate the work and equipment, as set forth in the Specifications and the Drawings in order to provide a complete and satisfactory installation. No changes in the work shall be made without written approval of the Owner and the Engineer.

1.02 GENERAL

A. Contractor shall provide adequate notice (30 days minimum) to the Owner in advance of the startup and commissioning process.

B. Contractor shall submit a written plan outlining the process by which the equipment will be tested and the overall system will be evaluated to insure complete system functionality and operation within the design parameters.

C. Contractor shall submit a written plan a minimum of 30 days to any planned startup and commissioning exercises at the site. The plan shall contain specific tests, measurements, recordings, etc. to be performed to verify that the system will operate in accordance with the Specifications and Drawings and the scope of the project.

D. The written plan will be reviewed by the Owner's personnel in accordance with the requirements outlined for other submittals.

E. After the written plan is approved by the Owner, the Contractor shall coordinate with the Owner's representative with respect to any planned preliminary startup and equipment testing exercises.

1.03 TESTING AND STARTUP

A. All elements of the system shall be tested to demonstrate that the total system satisfies all of the requirements of the Drawings and Specifications. All special testing materials and equipment shall be provided by the Contractor. The Contractor shall coordinate and schedule all of his testing and startup work with the Owner. Testing requirements are as follows:

1. All major system components shall be tested at the factory prior to shipment to the job site and shall meet the requirements specified for the project.

2. Factory testing of equipment, systems, or subsystems shall be performed in an input/result format. An input initiated shall produce the correct result for the item being tested.

3. Testing shall be performed in accordance with Owner approved procedures. Each specific test to be performed shall be described in the testing procedure and a space for the tester(s) to sign off on the test shall be provided.

4. Signed forms documenting the results of the test shall be submitted to the Owner and Engineer prior to shipment of the equipment or system.

5. The Owner reserves the right to require a retest of any equipment that the Owner deems marginal with respect to its performance in a test.

6. No equipment shall be shipped until the Owner receives the test data and approves the equipment for shipping.

7. All system components shall be field checked to verify that they have been installed properly and that all connections and terminations have been made correctly.

8. Witnessed field tests of each system component shall be performed along with testing of the complete system. Each test shall be witnessed and signed off by the Contractor and the Owner or the Owner's designated representative upon satisfactory completion. The Contractor shall notify

the Owner a minimum of two (2) weeks prior to the commencement date of the field tests.

9. The Contractor shall be responsible to provide the services of all factory personnel, all calibration and test equipment, and all labor necessary to perform the field testing.

10. All deficiencies in materials or workmanship shall be corrected by the Contractor at no cost to the Owner. Retesting of equipment with corrected deficiencies shall be performed at the direction of the Owner, at no additional cost to the Owner.

1.04 TRAINING

A. The training program shall educate operators, maintenance, engineering, and management personnel with the required levels of system familiarity to provide a common working knowledge concerning all significant aspects of the system being supplied. The training program shall be conducted at a time and place agreed upon by the Owner and the Contractor, typically at the Project site. At least two weeks prior to the requested start of the program, the proposed date of training shall be submitted to the Owner for approval.

B. Detailed manuals shall be provided by the Contractor to supplement the training exercise. The manuals shall contain job specific information.

C. The training program shall cover all aspects of the operation and maintenance of the system components. The level of training shall be based on the experience and understanding of the Owner's staff present.

D. The Owner, at his discretion, may video tape the training.

PART 2 PRODUCTS- NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Coordinate all startup and commissioning tasks with the Owner to avoid conflicts, errors, delays and unnecessary interference with operation of the new and, if it is still in operation, existing system during installation, testing, startup, and commissioning.

B. Multiple startup and commissioning dates for separate portions of the system shall not be acceptable, without prior approval of the Owner.

3.02 TESTS AND SETTINGS

A. Test equipment and systems and repair or replace all defective equipment and installations. Specific equipment testing requirements are outlined in the specific Specification sections.

B. Make adjustments to equipment and systems as necessary to meet the requirements of the overall system design.

C. Perform the following minimum tests and adjustments, in addition to the specific testing requirements listed in specific Specification Sections:

1. Mechanical inspection, testing and settings of all circuit breakers, disconnects, starters, overload relays, control circuits and other equipment.

2. Check and record the full load current draw and amp rating of thermal overloads of each motor. Note MCC cube or control panel identifier, motor service factor, horsepower, and Code letter for each motor.

3. Verify power and control fuse ratings and replace if they are found to be incorrect.

4. Verify settings of motor circuit protectors and adjust the settings to the lowest setting which will allow the motor to be started under load.

5. Verify that motor nameplates include the correct phase and voltage. Verify that bearings are properly lubricated.

6. Check motor rotation prior to any tests under load. Correct motor connections at the terminal box if necessary.

7. Check all wiring for each system and/or portion of a system to verify system functionality.

8. Inspect all equipment installed in hazardous locations to verify proper equipment ratings.

9. Verify terminations at all transformers, equipment, panels and enclosures.

10. Field set all transformer taps as required to obtain proper secondary voltage.

11. Perform infra-red hot spot inspection of all electrical equipment, under load conditions.

D. Provide a written report with the results of all tests and inspections to the Owner.

END OF SECTION

SECTION 16911
CONTROLS AND INSTRUMENTATION
MIDWAY BUSINESS PARK PUMP STATION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. This section covers work necessary for the design, testing, installation, field testing, and startup and final documentation for the installation of all equipment and software required to enable the Midway Road Business Park Pump Station to have telemetry to and from the Knoxville Utilities Board (KUB) SCADA system as described in this specification and shown on the drawing(s).

B. The SCADA system shall include monitoring and control of the new equipment

C. The work shall include the complete testing, recommended by respective equipment manufacturers, of all equipment and shall also include any changes or adjustments necessary for the proper functioning of the system and equipment.

D. It shall be the responsibility of the Contractor to coordinate the work and equipment, as set forth in this section, with work and equipment specified under other sections of the Specifications in order to provide a complete and satisfactory installation. No changes in the work shall be made without written approval of the Engineer.

E. Equipment and installation covered under Section 16911.

1. **Programmable Logic Controllers (PLCs) -** Hardware and software required for the various data acquisition and control sub-systems.
2. **Communications & Radio Equipment** – Hardware required for the radio communication system
3. **Field Instruments -** Process measurement and control devices.
4. **Execution –** Labeling, wiring, and calibration requirements.

F. Contractor shall submit his bid on the basis of the equipment (installed by Electrical Contractor) herein described in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service with the KUB system.

1.2 GENERAL

A. Major components of this system shall include the specified materials, equipment and installation required to implement a complete and operational SCADA System along with associated instrumentation and control functions.

B. Requirements for the electrical work associated with the installation of the SCADA System and ancillary equipment are as specified in Division 16 – Electrical.

1.3 RESPONSIBILITY FOR COMPLETE SYSTEM

A. The Contractor shall be responsible for and shall provide for the design, supply, delivery, installation, certification, calibration, and adjustment, software configuration, testing and startup, of a complete, coordinated system which shall perform the specified functions.

B. The Contractor shall employ a SCADA System Supplier to implement and integrate the SCADA system. The SCADA System Supplier shall:

1. Provide all required submittals for the SCADA panel and system equipment.
2. Provide complete shop drawings for the SCADA system.
3. Provide the PLC System components as specified in this and subsequent sections.
4. Provide the Communication Equipment as specified in this and subsequent section.
5. Integrate the SCADA System and ensure proper functionality as specified in this section.
6. Coordinate with the Contractor to ensure proper installation of the SCADA System components.
7. Provide on-site startup of the SCADA System components.
8. Provide all required testing and calibration.
9. Provide six (6) hard copies and one (1) digital copy of the Operation and Maintenance manuals.

C. The Contractor shall have overall system responsibility and shall provide all additional materials and work as necessary to meet the requirements of this specification. In particular, the Contractor shall:

1. Provide complete installation of the SCADA system equipment.
2. Provide any mechanical mountings, and mount panels and instrumentation.
3. Provide and install all required conduit, wiring, electrical fittings and devices required for a complete system.
4. Coordinate system startup with other trades and equipment suppliers.

C. Related Sections:

1. Submittals shall be in accordance with the requirements set forth in:

   a. Section 01340 - Shop Drawings, Product Data, and Samples
   b. Section 01600 - Material and Equipment.
   c. Division 16 - Electrical Work.

2. Electrical raceways and wiring external to panels covered under this section are part of the ELECTRICAL work specified in Division 16. Except for certain special communication cables, which may be called out here, all instrumentation wiring and cables and the proper termination of same shall be provided and installed under Division 16.

1.4 PRE-BID SUBMITTALS

A. General:

1. All system suppliers must submit a pre-bid submittal document fourteen (14) days prior to project bid date as applicable to the system as hereinafter specified. Provide three (3) bound copies, with tabbed dividers and contents organized and presented as hereinafter specified and one (1) digital copy.
2. Pre-bid approval does not exempt the contractor from meeting all the requirements of the Contract Documents, nor does it give any prior acceptance of any equipment software or services. The Contract Documents are the final authority for acceptance of the work provided. The Pre-Bid Submittal is not a part of the Contract Document and as such does not exempt the contractor from the requirements of contract submittals described hereinafter.
3. Information contained in the Pre-Bid Submittal shall be considered public information. All data submitted will become and remain the property of the Owner; none will be returned.
4. It is the intent that the Owner shall receive the full benefit of any savings in cost involved in materials substitution, as a result in reduction of the contract price, should they decide to accept an alternate or substitution.
5. The Engineer's decision as to pre-bid approval shall be final. The Consulting Engineer and the Owner shall be considered the sole judges of the merits of the system, and the Engineer shall indicate pre-approval of the system via a written addendum to the specifications prior to the actual bid date.
6. The right is reserved to reject any and all proposals, to waive any informality, irregularity, mistake, error or omission in any proposals received and to accept the proposal, as determined by the Engineer or Owner, deemed most favorable to the Owner's interest.

B. Contents:

1. Equipment List: Provide an equipment list with descriptive literature and specifications for the proposed system which includes all major items, manufacturer quantity provided, and model.
2. Project Schedule: Provide a tentative construction schedule for completion of the project within the specified Contract period.

1.5 SUBMITTALS

A. Before any components are fabricated, and/or integrated into assemblies or shipped to the job site, furnish to the Engineer for his review six (6) hard copies and one (1) digital copy of submittal documents. Submittals shall include full details, shop drawings, catalog cuts and such other descriptive matter and documentation, as may be required to fully describe the equipment and to demonstrate its conformity to these specifications. Specifically, the Contractor shall submit the following materials:

1. Block diagram and operational description of the system showing all major components and their interconnections and interrelationships. Label each diagram and specify all external power and communications interfaces. All diagrams shall be in an 11 by 17 format.
2. Drawings of equipment to be supplied shall include, as a minimum: overall dimension details for each panel, console, etc., including internal and external arrangements and door mounted operator devices with nameplate designations. Wiring diagrams of

equipment including field device connections shall be included and specific installation/wiring requirements identified. See electrical plans for available space.

3. Operational Description shall include the principal functions/capabilities of the SCADA Control Cabinet, as provided and configured/programmed. Included shall be a description of system communications.
4. Provide a Bill of Materials along with descriptive literature identifying component name, manufacturer, model number, and quantity supplied.
5. Field Instrument manufacturer's data sheets showing dimensions, mounting, and external connecting details. Data sheets shall be marked indicating pertinent data and identifying each component by item number and nomenclature.
6. Acceptance Test procedures descriptions shall be in sufficient detail to fully describe the specific tests to be conducted to demonstrate conformance with this specification.

1.6 PROJECT RECORD DOCUMENTS

A. Following Site Acceptance, the Contractor shall furnish six (6) complete sets of hard-covered ring bound loose-leaf Operation & Maintenance Manuals and one (1) digital copy required by relevant paragraphs in Sections 01340 and 01720, containing the following:

1. "As Built" drawings showing all equipment as actually installed. This set of drawings shall include all installed change orders, field condition changes, and other departures from the original plans and Specifications.
2. Shop drawings and other data required by the Specifications reflecting the manufacturer's shop fabrication of the materials and equipment as installed. Data sheets shall be provided for all instruments, controllers, and computers detailing as-installed hardware configuration and setup.
3. Program listings for each programmable control device. Listings shall include a descriptive heading containing at least the controller identifier, program version number, and release date.
4. Instruction manuals detailing operation procedures, computer user interface, and special maintenance. Manuals shall give thorough attention to system management from an operator's viewpoint, including normal operation and adjustments, access to "Help" functions, emergency procedures, and failure recovery.
5. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing and maintenance of each component and/or instrument.

B. The contents of the O&M manuals shall be generally organized as follows:

1. System Hardware/Installation
2. System Software
3. Operation
4. Maintenance and Troubleshooting

1.7 ON SITE SUPERVISION

A. The Contractor shall provide experienced personnel to supervise, perform, and coordinate the installation, adjustment, testing, and startup of the SCADA system. The personnel shall be present on-site as required to effect a complete and operating system.

1.8 TESTING AND STARTUP

A. All elements of the RADIO TELEMETRY system shall be tested to demonstrate that the total system satisfies all of the requirements of this Specification. All special testing materials and equipment shall be provided by the Contractor. The Contractor shall coordinate and schedule all of his testing and startup work with the Owner. Testing requirements are as follows:

1. All system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly. Witnessed field tests shall be performed on the complete system. Each test shall be witnessed and signed off by the Contractor and the Engineer upon satisfactory completion. The Contractor shall notify the Owner at least one (1) week prior to the commencement date of the field tests.

1.9 TRAINING

A. The training program shall educate operators, maintenance, engineering, and management personnel with the required levels of system familiarity to provide a common working knowledge concerning all significant aspects of the system being supplied. The training program shall consist of one (1) hour. At least two weeks prior to the requested start of the program, the proposed date of training shall be submitted to the Owner for approval.

1.10 QUALIFICATIONS, ACCEPTABLE SYSTEM INTEGRATORS, AND PRODUCTS

A. Only those determined by the Engineer as meeting the qualifications will be acceptable.

B. The System Supplier shall have been regularly engaged in the type of work called for under these Specifications for at least ten years to date, and shall have recent and pertinent experience with systems of comparable scope and complexity.

C. The System Supplier shall demonstrate systems capabilities by having the resources to successfully complete the work as called for in the Specifications.

D. The System Supplier shall be fully certified according to Underwriters Laboratories Subject 508A at the time of contract award.

E. List of Acceptable SCADA Panel Contractors:

1. MESA ASSOCIATES, INC.
55 Marley Drive, Suite 2.
Greeneville, Tennessee 37745
www.mesainc.com
Contact: Rodney Huffman
Office: (423) 783-2301
Fax: (615) 469-1674
email: rhuffman@mesainc.com

2. STA-CON INCORPORATED
2525 South Orange Blossom Trail
Apopka, Florida 37703
www.stacon.com

Contact: Howard Tuttle
Office: (407) 298-5940 Ext 37
Fax: (407) 298-2227
email: howard_tuttle@stacon.com

3. REVERE CONTROL SYSTEMS
2072 Remington Park Road
Old Hickory, Tennessee 37138
www.reverecontrol.com
Contact: David Abel
Office: (615) 847-2325 / (877) 847-2320
Fax: (866) 861-3895
email: dabel@reverecontrol.com

4. C2i CONTROL INSTRUMENTS, INC.
5253 Oakdale Road
Smyrna, GA 30082
www.c2iinc.com
Contact: Mark Healey
Office: (404) 351-1085
Fax: (404) 794-5784
email: mhealey@c2iinc.com

1.11 INSTALLATION

A. All wiring, controls, switches, alarms, components, and accessories shall be sized and installed per the manufacturer's recommendation.

B. The Contractor, SCADA System Supplier, and all sub-contractors shall familiarize themselves, coordinate, and cooperate with other trades in installation of the instruments and SCADA System.

C. The Contractor shall notify the Engineer of conflicts with electrical, structural, architectural, or mechanical work arising from installation of instrumentation, communication equipment, and SCADA components.

1.12 DEFINITION OF ACEPTANCE

A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:

1. All O&M documentation has been submitted, reviewed and approved.
2. The complete SCADA system and instrumentation have successfully completed all testing requirements specified herein and have successfully been started up.
3. All Owner's staff personnel training programs have been completed.
4. Owner/Engineer sign a document indicating SCADA system has formally been accepted.

PART 2 - PRODUCTS

2.1 GENERAL

A. It will be the responsibility of the SCADA System Supplier to provide the PLC programming required to make the system perform as required by Knoxville Utilities Board (KUB). The System Supplier will also be responsible for programming and configuring the Operator Interface Computer to provide the desired operator interface system as required by KUB.

B. The SCADA system supplier shall coordinate with KUB during the development of the PLC programming, to ensure system compatibility.

C. The functions and features specified hereunder are the minimum acceptable requirements for the SCADA system. The provided system shall equal or exceed each requirement.

D. In some cases, the specifications may allow the accomplishing of certain functions by means of more than one hardware/firmware/software approach. Any approach that is proposed shall equal or exceed all functional, operational, convenience and maintenance aspects of the one described.

E. Major equipment, component and software items are specified; however the Contractor shall, at no additional cost, provide all appurtenant items, whether specifically referenced herein or not, but which may be required for operation as hereinafter specified.

2.2 MONITOR AND ALARM POINTS – WASTEWATER PUMP STATION

A. BMXDAI1604 M340 Discrete Input Card (Off/On)

1. SCADA Cabinet Power Failure Alarm
2. Phase Fault Alarm
3. High Wet well Float Switch
4. Ultrasonic (ULC) High Wet well Alarm
5. Secondary Mode Reset Switch
6. Ultrasonic (ULC) Low Wet well Alarm
7. Motor Control Power Failure Alarm
8. TVSS Monitor Alarm
9. Mode Selector Switch (Ultrasonic/Secondary)
10. Secondary Mode Active Alarm
11. Generator Run Status
12. Generator Fault Status
13. Generator Low Fuel Switch
14. Spare
15. Spare
16. Spare

B. BMXDAI1604 M340 Discrete Input Card (Off/On)

1. #1 Pump Auto Switch Position
2. #1 Pump Run Status
3. Spare
4. #1 Pump (VFD/LINE) Selector Switch
5. #1 Pump VFD Fault Alarm
6. #1 Pump Overload Fault Alarm
7. #1 Pump HIGH Temperature Alarm
8. #1 Pump Seal Failure
9. #2 Pump Auto Switch Position
10. #2 Pump Run Status
11. Spare
12. #2 Pump (VFD/Line) Selector Switch
13. #2 Pump VFD Fault Alarm
14. #2 Pump Overload Fault Alarm
15. #2 Pump HIGH Temperature Alarm
16. #2 Pump Seal Failure

C. BMXDDM16025 M340 Mixed Discrete Input & Output Card (Off/On)

Inputs

1. Flow Meter Pulse
2. Spare
3. Spare
4. Spare
5. Spare
6. Spare
7. Spare
8. Spare

Outputs

1. #1 Pump (VFD) Start/Stop
2. #1 Pump (LINE) Start/Stop
3. #2 Pump (VFD) Start/Stop
4. #2 Pump (LINE) Start/Stop
5. Secondary Mode Enable
6. Spare
7. Spare
8. Spare

D. BMXAMIO410 M340 Analog Input Card (4-20 mA)

Inputs

1. Wet well Level (Milltronics)
2. Wet well Level (Pressure Transducer)
3. Flow Meter
4. Chemical Storage Tank Level (Milltronics)

2.3 PLC FUNCTIONS

A. The PLC shall be provided with the logic, alarm and data logging required by KUB. The following description of operation is general and preliminary. All setpoint and detailed operation will be as required by the Engineer and KUB.

B. The pump station shall include two modes of operation, NORMAL and SECONDARY. In NORMAL mode the station will operate in a flow pace mode based on the Milltronics Wet well Level Setpoints. SECONDARY mode the station will operate in a flow pace mode based on the Wet well level pressure transducer setpoints within the PLC program.

C. NORMAL Mode Setpoints

1. Normal Setpoints shall be coordinated with KUB and the Engineer once a pump is selected.

D. SECONDARY Mode Setpoints:

Float Switch	Wetwell Level Summer Mode
High Wet Well Float	981.00 ft.

Pressure Transducer	Wetwell Level
Lead Pump On	6.75 ft.
Lead Pump Off	5.75 ft.
Lag Pump On	5.5 ft.
Lag Pump Off	4.5 ft.
Low Wet well Cutout	2.0 ft.

NOTE: All setpoints are PRELIMINARY and must be coordinated with the Engineer and KUB.

E. Any of the following conditions will place the station operation in the SECONDARY Mode:

- Operator Selects SECONDARY with selector switch.
- LOW Wet well Level Alarm becomes active.
- HIGH Wet well Level Alarm becomes active.
- HIGH Wet well Float becomes active.

F. Once the station is operating in the SECONDARY mode, the pumps will remain in the SECONDARY mode until the "MODE RESET PUSHBUTTON" is pressed.

G. A status light will indicate the station is operating in the SECONDARY mode.

2.4 SYSTEM COMPONENTS

A. Panel Enclosure

1. The electrical equipment shall be mounted within a NEMA 4X enclosure.
2. Panel shall be fed by 480V, 3 phase, 60 Hz.
3. Control switches, indicating lights, and any other operator interface shall be mounted on the hinged inner door.
4. A main terminal block and ground bar shall be furnished for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the pump station loads. The main terminal block shall be mounted to allow incoming wire bending space in accordance with Article 373 of the National Electric Code (NEC).

B. UL Label Requirement: Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The

enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.

C. The PLCs shall be manufactured by MODICON as described in this specification. The number and types of cards shall be as listed below.

D. Control Panel Major Equipment
Shall include, but is NOT limited to the following components.

Item	Qty	Description	Manufacturer	Model #
1	1	Panel Enclosure NEMA 4X	Hoffman	Appropriately Sized by Integrator for Equipment and Cooling
2	1	Sub-Panel	Hoffman	-
3	1	3 Point Latch	Hoffman	-
4	1	Thermostat	Hoffman	ATEMNO
5	1	Ventilation Fan	Hoffman	A-6AXFN
6	2	Ventilation Filter	Hoffman	A-FLT66
7	2	Ventilation Louvers	Hoffman	AVK66SS6
8	1	M340 PLC - Processor	MODICON	BMXP342020
9	1	M340 PLC - Rack	MODICON	BMXXBP0800
10	1	M340 PLC - Power Supply	MODICON	BMXCPS2000
11	2	M340 PLC - Discrete Input Module	MODICON	BMXDAI1604
12	1	M340 PLC - Mixed Discrete Input/Output Module	MODICON	BMXDDM16025
13	2	M340 PLC – Analog Input Module	MODICON	BMXAMIO410
14	1	Radio Transceiver	MDS	SD-9
15	1	UPS	APC	BP700UC
16	1	24 Volt DC Power Supply	Idec	PS5R-SF24
17	1	12 Volt DC Power Supply	Idec	PS5R-SC12

E. Communication Equipment:

Item	Qty	Description	Manufacturer	Model #
18	Lot	7/8” Foam Heliax Cable	Andrew	LDF5-50A
19	2	N-Male 7/8” Foam Connector for LDF5-50A	Andrew	L5TNM-PS
20	1	900 Mhz, 11dBi Yagi Antenna	Pacific Wireless	YA9-11
21	1	Bulkhead Surge Arrestor	Poly Phasor	IS-B50HN-C2

F. Miscellaneous Materials:

Provide all required relays, terminal blocks, fuses, jumpers, wiring, labels, and other miscellaneous materials for completion of the system

2.5 Control Panel

A. This project includes one (1) SCADA/Control Panel for the Wastewater Pump Station.

B. The Control Panel includes components that are listed in the Control Panel Equipment listing above.

C. The SCADA System Supplier shall perform the detailed design, which shall conform with the basic design standards and guidelines for KUB panels. The SCADA Panel Contractors listed in the specification are familiar with the KUB requirements.

D. The SCADA System Supplier shall prepare detailed design drawing for the SCADA Control Panel and submit them to the Engineer for review prior to commencing fabrication.

E. The SCADA Control Panels shall be designed to the requirements for the standard SCADA panels for KUB which the approved SCADA system suppliers are familiar with.

F. It is the responsibility of the System Supplier to provide the detailed panel design, panel component bill of material and panel wiring design. The System Supplier shall furnish all required control panel components and completely assemble the panel with the specified components. The Engineer will review all panel component selections. The Engineer must approve any deviation from the specified components.

G. Below are the requirements for the fabrication and assembly of the control panels.

1. All panel enclosure shall be NEMA 4X rated.
2. All of the panel components shall be installed in the panel in accordance with the manufacturer's recommendations and requirements.
3. All control components contained in the control panels shall be mounted on a removable sub-plate.
4. All panel components and terminal block line-ups shall be labeled.
5. Control circuits shall be wired with a minimum #16 AWG stranded copper wire with MTW or approved equal insulation.
6. Instrumentation wiring shall be wired with single pair #16 AWG twisted shielded wire.
7. The wire color-coding shall be in accordance with KUB requirements
8. Power wiring shall be sized as required for the load.
9. All terminal block points shall be permanently identified with the terminal number.
10. Each end of every wire shall be permanently identified with the wire number.
11. Different voltage level wiring shall not be bundled together or run together. Control voltage 115 VAC wiring must be run separately from 24VDC control and instrumentation wiring.

2.6 FIELD INSTRUMENTS

A. All instrumentation to be supplied by the Systems Integrator is specified in this section.

B. Wastewater Pump Station Instrumentation (See Drawings):

Item	Qty	Description	Manufacturer	Model #
1	1	Submersible Level Transmitter	GP 50	311Z-M351-PN2
2	1	Ultrasonic level Controller	Siemens	Multiranger 100
3	1	Pressure Sensor	Red Valve	Series 42
4	2	Float Switches	Flygt	ENM-10

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate all work with the engineer/owner to avoid conflicts, errors, delays and unnecessary interference with operation of the existing system during installation, testing, turn over and startup.

B. Install all new equipment in accordance with the manufacturer's instructions and approved submittals.

3.2 CALIBRATION

A. Calibration Records

1. The Systems Integrator shall calibrate all field instruments supplied in this section as part of site start-up. Each calibrated instrument shall be provided with a calibration sticker, showing when it was calibrated and who performed the calibration.

END OF SECTION