SECTION 2

BID PROPOSAL

Bid Item #	Ref. Spec. Section/Drawing	Est. Qty	Unit of Measure	Item Description Unit Price Words And Figures	Extension In Figures
97	Division 14	1	Lump Sum	Conveying Systems _____ Written Figures	$_____
98	Division 15	1	Lump Sum	Mechanical/HVAC _____ Written Figures	$_____
99	Division 15	1	Lump Sum	Plumbing _____ Written Figures	$_____
100	Division 15	1	Lump Sum	Fire Protection _____ Written Figures	$_____
101	Division 16	1	Lump Sum	Electrical _____ Written Figures	$_____
102	INFORMATION FOR BIDDERS ART. 1.9 - Bonds; SEC 5- GENERAL CONDITIONS, ART. 10.3	1	Lump Sum	Extended Warranty (Maintenance Bond) _____ Written Figures	$_____
103 1	EXHIBIT D	N/A	Allowance	Railroad Inspector – Exhibit D FIFTY THOUSAND AND NO/100 Written Figures	$ 50,000
104	EXHIBIT C	N/A	Allowance	CTDOT Permit Fees, Bonds & Insurances – Exhibit C TEN THOUSAND AND NO/100 Written Figures	$ 10,000
105 3	02305	3,700	LF	Concrete-Filled Pipe Piles _____ Written Figures	$_____

TOTAL AMOUNT OF BID: Sum of Items 1 – 105 inclusive of all equipment, materials, labor, transportation, installation, etc. to complete the project in accordance with the detailed specifications included herein:

(_____($_____)
(Total Bid in Written Figures)

Ref. No.	Item No.	Unit	Description
C-2.4; Civil Details; 673; 02230; 02377; 02378; 02433; 02531; 02615; 03400; EXH C AND EXH D	78	LF	Pipe Crossing Under Railroad
C-2.4; 02377; 02378; 02615; Div. 3; S-9.1; S-9.2	79	LS	Utility Bridge and Support Piers
C-2.4; 02377; 02378; 02615; EXH.C	80	LF	Pipe Crossing Under Highway
C-2.4; DEEP Permit	81	LF	Abandonment of Existing 36 inch Gravity Interceptor Sewer and Timber Utility Bridge
Division 2 and 3	82	LS	Pump Station Foundation
Division 2	83	LS	Miscellaneous Site Work Not Included in Other Bid Items
Division 3	84	LS	Structural Concrete
612	85	LS	Miscellaneous Concrete
Division 4	86	LS	Masonry
Division 5	87	LS	Metals
Division 6	88	LS	Carpentry
Division 7	89	LS	Thermal and Moisture Protection
Division 8	90	LS	Doors and Windows
Division 9	91	LS	Finishes
Division 10	92	LS	Specialties
Division 11	93	LS	Process Equipment
Division 12	94	LS	Furnishings
Division 13	95	LS	Instrumentation and Control
Division 13	96	LS	Hydropneumatic Surge Control System
Division 14	97	LS	Conveying Systems
Division 15	98	LS	Mechanical/HVAC
Division 15	99	LS	Plumbing
Division 15	100	LS	Fire Protection
Division 16	101	LS	Electrical
Information for Bidders - General Conditions	102	LS	Extended Warranty (Maintenance Bond)
Exhibit D	103	Allowance	Railroad Inspection
Exhibit C	104	Allowance	CT DOT Permit Fees, Bonds and Insurances
02305	105	Per Linear Ft	Concrete-Filled Pipe Piles

Addendum 2

Addendum 3

Item 104: CT DOT Permit Fees, Bonds and Insurances – Exhibit C

A. The method of measurement shall be by review of invoices submitted by the CTDOT to the Contractor documenting the insurance, bond and permit application fee.

B. Payment shall be made to cover the actual invoices received by the Contractor. No markup will be allowed.

C. Comply with Section 01020 "Allowances" of these specifications.

D. Work under this Item will be paid for under the contract stated allowance for this Item, and in accordance with "Section 01020 - Allowances" of these Specifications. The allowance amount may be increased or decreased depending upon the actual expenses incurred and approved by the Owner.

Item 105: Concrete-Filled Pipe Piles

A. Work under this item shall be measured for payment by the unit “Per Linear foot” of concrete-filled pipe pile based on the number and dimensions of piles indicated from tip point to cutoff, plus, not less than 12 inches of over length for cutting piles at required cutoff elevations. Measurements will be based on effective length of piles in place with lengths measured to the nearest 12 inches.

B. Payment under this item shall include concrete filled pipe piles on East Main Street Interceptor Sewer and sanitary manholes, beginning at Prop MH110 to Prop. MH105; and, on River Road Interceptor Sewer and sanitary manholes, beginning at Prop MH104 to Prop MH 105. Payment shall include full compensation for all labor, materials, tools, equipment, and incidentals and for performing work for furnishing, driving, cutting off and capping piles, complete in place and Engineer accepted.

C. Test piles that become part of completed system will be considered as an integral part of the Work.

D. No payment will be made for rejected piles, including piles driven out of place, defective piles, or piles damaged during handling or driving.

END OF SECTION

SECTION 02060

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The Work of this Section includes the following:

1. Selective demolition of existing building structures at 34 East Main Street including sewage pump station (aka treatment building), incinerator building, and fire training tower (collectively, "the buildings") within the limits of disturbance as shown on the site plans.

2. Remove and dispose of all mechanical, electrical, plumbing equipment, including non-asbestos and non-PCB containing building materials and surfaces and non-universal waste reclamation building materials from within the interior of the pump station and incinerator buildings. Asbestos abatement, PCB containing material < 50 ppb, and universal waste reclamation are specified elsewhere in these specifications.

3. Remove and dispose former buried treatment tank piles and concrete substructures, including mats and walls which interfere with the proposed new work. Piles shall be exposed and surveyed by the Contractor and reported to the Engineer.

4. Only existing building piles located within the footprint of the proposed site and pump station building improvements which interfere with the proposed new work shall require removal and disposal. All other building piles shall be left undisturbed, or cut and capped a minimum 3 feet below final proposed grade; and backfilled to final grade with compacted granular material, or engineer approved reuse of controlled materials in accordance with Sections 102 and 02316.

5. After remediating for universal waste, PCB and ACM, as specified in other sections of the contract documents, backfill the incinerator basement and pump building basement with surplus soils generated from excavations within the on-site AOEC areas.

6. There is no recorded documentation of pilings for the fire training tower; however, given the site conditions, the Engineer believes they exist.

7. All piles located outside the footprint of the proposed site improvements and do not interfere with the proposed work or final grading shall be left undisturbed.

8. Piles supporting the existing pump building may be left in place if the piles do not interfere with the construction of the surge tank.

9. Remove and dispose asphalt paving within the limits of disturbance.

10. Remove and stockpile site entrance concrete sidewalk and curbing for reuse.

SECTION 02305

CONCRETE FILLED PIPE PILES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and drive production steel pipe piles complete with bottom plates, to the specified design capacity of 150 tons in the founding strata, dense glacial till or bedrock strata, as indicated, and filling with concrete to complete the pile construction work indicated on the Drawings and as specified herein.

B. Implement a Test Pile Program consisting of a minimum of three (3) production location test piles: furnish, drive, PDA monitor, instrument, concrete, static load test one selected pile, perform and submit all test pile program data analyses.

C. Provide wave equation analyses of hammer-pile-soil system proposed to be utilized.

D. Placing concrete and steel reinforcing in pipe piles.

E. Cut off and dispose of cut-off portions of all piles.

F. Performing all survey work required to establish pile locations, tip and cut-off elevations, and establish as-driven pile locations.

G. Cooperate and coordinate with the Owner, the Engineer and the Owner's Special Inspection Agency and Special Testing Agency so that the activities may be performed efficiently and expeditiously.

1.02 RELATED WORK

A. Section 102 – Earth Excavation Backfill and Grading.

B. Section 01330 – Submittal Procedures

C. Section 01180 – Testing Laboratory Services

D. Section 03300 – Cast in Place Concrete

1.03 REFERENCES

A. ASTM A27 - Steel castings, Carbon, for General Application.

B. ASTM C31-84 - Methods of Making and Curing Concrete Test Specimens in the Field.

C. ASTM A252 - Welded and Seamless Steel Pipe Piles.

D. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

E. ASTM C150 - Portland cement.

F. ASTM D1143 – Standard Test Methods for Deep Foundations under Static Axial Compressive Load, Quick Test Method.

G. ASTM D 4945 – High Strain Dynamic Pile Testing, PDA Testing.

H. State of Connecticut Building Code, IBC 2003.

1.04 LINES, GRADES AND INSPECTION

A. Pile Layout

1. The Owner will furnish a bench mark and a working point. The Contractor shall be responsible for driving piles in their correct locations.

2. Production pile locations are shown on the Contract Drawings.

3. Piles shall be located, staked out, and the stakes maintained by the Contractor. The Contractor shall establish all elevations.

B. The following testing services shall be performed by the Special Testing Agency selected by the Owner.

1. Review and/or check-test the Contractor's proposed concrete mix design.

2. Conduct field slump tests and laboratory strength tests of the concrete during construction in accordance with Paragraph 2.02 of this section.

3. Pile tip plate weld quality testing, if required by the Special Inspection Agency.

C. The Owner shall provide the Special Inspection Agency to conduct full-time inspection of the test and production pile installation and testing programs as specified herein.

1. A record will be kept by the Special Inspection Agency for each test pile of the number of blows required for each foot of penetration for the entire length of the pile and penetration under the final series of blows (blows per inch for a minimum of the last 12 inches of driving). The record shall include the type and size of hammer used, the rate of hammer operation, type of follower if used, type and dimensions of driving helmet, cushion block type and condition. The record shall also include the date, starting time, total driving time, location, ground elevation from which the pile is driven and final elevation of the pile tip and butt, pile identification number; pile type, size and quantity of concrete placed in piles. The

record shall also include notes of any unusual conditions encountered during pile installation and the Inspector shall immediately report such conditions to the Engineer. Records shall be kept in a systematic manner and shall be up-to-date.

2. A similar record will be kept by the Contractor for each test and production pile. Test and production piles shall be marked by the Contractor at one (1) and five (5) foot intervals to within ten (10) feet of the estimated pile take-up length, at which point the pile shall be marked at one-foot intervals and as required to determine the final driving resistance of the pile.

3. The Contractor shall indelibly and clearly mark all piles as required by the Special Inspection Agency at no additional cost to the Owner.

4. Piles shall be installed under the full-time inspection of the Special Inspection Agency. The Contractor shall notify the Special Inspection Agency a minimum of 48 hours prior to any pile operations in this section. Any pile installed when the representative of the selected Special Inspection Agency is not present to obtain the necessary records shall not be accepted for payment, and the Contractor shall install additional pile(s) as directed at no additional cost to the Owner.

1.05 SUBSURFACE DATA

A. Soil borings have been performed at the site for the purpose of design and have been provided to Contractors in the bid package.

1.06 SUBMITTALS

A. The Contractor shall submit to the Special Inspection Agency a minimum of thirty (30) days prior to any planned pile driving activity: information on the type of equipment proposed to be used; test and production pile components; proposed means, methods, procedures, and schedules for test and production pile operations; proposed sequence of pile driving; details of all pile driving equipment and accessories, and a pile numbering/identification system. This submittal shall, as a minimum, include the following:

1. Wave Equation Analyses for selection of a compatible hammer and a statement of driving procedures for proposed test and production piles.

2. Test pile PDA results. The Pile Driving Hammer form attached shall be completed in full as part of this submittal requirement for the proposed hammer.

3. Production and test pile design, test pile details regarding instrumentation proposed, test pile details relative to capacity isolation and instrumentation of test pile above/below cut off elevation, test pile details identifying any

deviations in design relative to production piles, details of pile tip closure plate.

4. Static Pile Load Test: detailed load testing procedures and set-up, load test equipment specifications and calibrations including hydraulic jack and load cell pair details, load frame structural design, pile loading sequence/schedule, all Static Pile Load Test data, analyses, conclusions, and recommendations in a report format.

5. Submit proposed methods and procedures for insuring a clean pile bottom prior to concreting. Submit means, methods and procedures for placing concrete in pipe piles.

6. Pre and Post construction surveys.

7. Welder qualifications, procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code – Steel; and D1.4 Structural welding Code – Reinforcing steel; welding certificates for any personnel performing pile tip closure plate or pile top reinforcing steel welding.

8. Mill test reports for pile pipe, reinforcing and bottom plate steel.

9. Pile driving records.

10. As-built pile locations.

11. Pile Concrete Mix Design – including revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustment.

B. The Contractor shall provide, within fifteen (15) days of pile driving, detailed calculations of the center of gravity of pile groups. A detailed remedy with calculations shall be submitted for approval when as-driven pile location tolerances are exceeded.

C. All Contractor submittals shall be developed directly by or under the supervision of and stamped by a Registered Professional Engineer in the State of Connecticut with experience in the submittal subject matter. Submit resume of experience for all Registered Engineer(s) developing/submitting Contractor submittals.

1.07 STATEMENT OF PROCEDURE

A. The Contractor shall submit all complete descriptive data as required to demonstrate compliance of the driving equipment with the contract documents, within thirty (30) days prior to starting work. Only one specific model of pile hammer may be used unless otherwise approved.

B. The Engineer will develop a pile driving criteria for production piling based on available data and Contractor submittals.

1.08 MONITORING PILE DRIVING VIBRATIONS AND NOISE LEVELS

A. Pile driving vibrations will be monitored by the Special Testing Agency retained and paid for by the Owner. Pile driving vibration levels shall be kept within acceptable limits for ongoing new and existing construction as contained herein. If the minimum specified levels are exceeded, appropriate changes shall immediately be made to the Contractor's pile driving procedure and/or equipment. The cost of changes in the Contractor's procedure or equipment, as required, shall be at no cost to the Owner.

B. The maximum particle velocity which will be allowed at new or existing construction will be 1 inch per second, or to such lower level established by the Special Inspection Agency. Additionally, no pile driving operation shall be undertaken within 50 feet of young concrete (aged 7 days or less). Pile installation noise levels shall be monitored and documented.

1.09 PRE/POST CONSTRUCTION SURVEYS

A. The Contractor shall perform pre and post-construction surveys of all "CRITICAL" structures, above and below grade, within 100 feet of the proposed work. CRITICAL structures, as defined elsewhere in these specifications, are those structures necessary to maintain sanitary flows during construction. The purpose of the surveys shall be to document the pre and post construction condition of these structures. These surveys as a minimum shall locate, measure, photograph, and otherwise document any visible cracks and other signs of distress prior to and post pile construction. The products shall be original reports and six (6) copies prepared by a State of Connecticut Registered Professional Engineer with experience in the performance of construction surveys, submitted to the Special Inspection Agency (preconstruction survey) prior to commencement of any pile driving and (post construction survey) within two (2) weeks after pile driving completion.

PART 2 - PRODUCTS

2.01 CAST IN PLACE CONCRETE FILLED PIPE PILES

A. The drawings and specifications indicate a minimum size of pipe required for static load consideration. Driving considerations may require an increase in size. The Contractor is responsible to supply a pile of sufficient strength to withstand the stresses due to driving, earth and water conditions and remain watertight and undamaged.

B. Steel pipe piles shall be a minimum of 14 inch outside diameter, 0.625 inch wall thickness meeting the requirements of ASTM Specification A 252, Grade 3, (minimum tensile strength, 60,000 psi; minimum yield point 45,000 psi) all new material.

C. Concrete fill shall be 3/4 inch maximum aggregate size, developing a 28-day compressive strength of 5,000 psi and shall otherwise conform to the requirements for concrete as specified and shall be of such consistency that the aggregates will not separate from the mortar when the concrete is placed.

D. Pile closure at tip shall be cast steel conforming to ASTM A 27 65, shall be a minimum of two (2) inches thick and of sufficient strength to withstand driving stresses, remain watertight, and shall extend to the pile pipe outside diameter. At the discretion of the Special Inspection Agency, pile tip plate weld testing shall be performed by the Special Testing Agency using a method of their choice to verify weld quality. Deficient welds, in the opinion of the Special Inspection Agency, shall be re-worked and retested until satisfactory at no cost to the Owner.

E. If piles are installed from ground surface, pre-auger all pile locations to pile cut off elevation with 14 inch diameter or greater auger tools.

F. No pile splicing shall be allowed.

G. Deliver piles to the project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at the project site to prevent physical damage.

H. Pile reinforcing bars: ASTM A 615/A 615M, Grade 60 deformed.

2.02 CONCRETE FILL

A. All pipe piles acceptably installed shall be filled with Portland cement-concrete. All pipe piles shall be inspected and approved immediately prior to filling. Concrete shall not be placed in piles containing any accumulation of water or foreign matter.

B. Placing of concrete shall conform to the requirements as hereinafter specified. Immediately prior to the placing of concrete, a mortar mixed to a homogeneous consistency in the proportion of one bag of Portland cement to two cubic feet (surface dry rodded basis) of fine aggregate, the same as used in the pile concrete, shall be deposited in the pipe pile to a depth of approximately 12 inches.

C. A suitable and approved method shall be used for placing concrete in the piles for the full length of each pile. The concrete shall be placed in a continuous regulated flow without interruption from tip to top of pile, with an annular space provided for escape of air displaced by the concrete as it is deposited.

D. Care shall be used to fill every part of each pile. The top ten feet of concrete shall be thoroughly consolidated by internal vibration.

E. Concrete in each pile shall be carried to the cut-off elevation.

F. A total of three concrete test cylinders (one set) will be taken from each day's pour of concrete used to fill the pipe piles. In addition, one (1) test cylinder shall be taken for each test pile. The Special Testing Agency shall obtain and perform all pile concrete cylinder testing functions.

G. All concrete cylinders shall be tested in accordance with ASTM Specification C-31, latest edition. Two copies of reports of the three-day, load test day, seven-day, and 28-day tests shall be provided to the Special Inspection Agency.

H. Concrete shall conform to the requirements of Section 03300 except as herein modified. All cement shall be Portland Type I/II, conforming to ASTM C-150. Coarse aggregate shall not exceed 3/4 inch size. The slump of the concrete during placing shall be not less than 4 inches nor more than 6 inches. Pile concrete strength shall be 5,000 PSI minimum. No admixtures shall be allowed without the written approval of the Special Inspection Agency.

I. Provide mill certificates and welder certifications for pile reinforcement.

PART 3 - EXECUTION

3.01 WAVE EQUATION ANALYSES

A. Prior to driving any pile, the Contractor shall submit a Wave Equation Analysis). These analyses shall take into account the proposed hammer assembly, pile cap blocks and cushion characteristics, followers if used, the pile properties and estimated lengths, and the anticipated soil properties. Only one specific model of pile hammer shall be used.

B. The Wave Equation Analyses shall demonstrate that the piles will not be damaged during driving, shall determine the safe level of energy transmission to the pile, and indicate the blow count necessary to achieve the required ultimate static pile capacity. The results of the Wave Equation Analyses shall be superseded by the results of the test pile dynamic pile testing program, PDA testing.

C. The cost of performing Wave Equation Analyses will not be paid for separately, but shall be included in the contract price for furnishing and driving piles. The attached pile driving hammer form shall be completed in full as part of the submittal of the results of the Wave Equation Analysis.

3.02 DYNAMIC AND STATIC PILE TESTING

A. The Contractor shall dynamically test (PDA test) three (3) test piles, locations indicated on the contract drawings. Test piles shall be installed similar to proposed production piles; as a proof of means, methods and procedures along with the ability to attain the required pile capacity.

B Test piles shall be PDA monitored by the Contractor during initial driving and minimum 24 hour restrike, with subsequent PDA analyses to include CAPWAPs, as an initial proof of pile capacity development: 150 Tons in design compression capacity, and 300 Tons in ultimate compression capacity, F.S. = 2.0. The structural composition of the test piles may be modified relative to that of a typical production pile to sustain the ultimate pile test load, as approved by the Special Inspection Agency.

C. All test pile data, including PDA test program results, shall be submitted to the Special Inspection Agency for selection of the test pile to be Static Load Tested. A recommendation for test pile selection shall be included.

D. Static Pile Load Testing in compression shall be in accordance with ASTM D 1143, Quick Test Method. A recently calibrated pile load test jack and load cell pair shall be part of the Contractor's static load test equipment. Pile load test evaluation shall be in accordance with the State of Connecticut Building Code, IBC 2003 Chapter 18.

E. If test piles are ground surface driven and tested, the Contractor shall propose to either isolate the load test pile from capacity contribution over the pile length from existing ground surface to initial pile exposure below pile cap bottom or instrument the selected test pile such that the capacity contribution over the pile length from existing ground surface to initial pile exposure below pile cap bottom can be neglected. The Contractor shall also instrument the pile top (cut off elevation) and pile tip with telltale(s) or other approved instrumentation to monitor and analyze pile behavior under load.

F. The Contractor shall:

1. Perform and submit all test pile PDA analyses

2. Design, submit and construct the test pile Static Pile Load Test Frame and appurtenances.

3. Conduct and monitor the Static Pile Load Test in the presence of the Special Inspection Agency. Conduct of the Static Pile Load Test shall be under the direct field supervision of a Registered Professional Engineer in the State of Connecticut having experience with pile testing.

4. Perform and submit the Static Load Test analysis results and recommendations to the Special Inspection Agency for review and approval.

G. All pile driving equipment furnished by the Contractor shall be subject to the approval of the Special Inspection Agency.

H. The cost of performing all dynamic and static pile testing and analyses will not be paid for separately, but shall be included in the contract price for furnishing and driving piles.

I. The field capacities of production piling will be determined by a blow count criterion based on the successful Static Pile load Test results. The final blow count will be taken to be the average number of blows of the approved hammer operating at the rated efficiency within the last six inches of driving, providing the last three feet of continuous driving indicate a comparable increased resistance without any abrupt changes.

3.03 DRIVING

A. The Contractor shall schedule the pile driving sequence so that no piling shall be driven within 50 feet of concrete less than 72 hours old.

B. Equipment

1. Piles shall be driven by a steam, air or diesel hammer of the size and type suitable for the work and approved by the Special Inspection Agency.

2. The hammer used shall be operated at all times at the speed and conditions recommended by the manufacturer. Boiler or compressor capacity shall be sufficient to operate the hammer continuously at full rated speed. Closed-end diesel hammers shall be equipped with a remotely-read, recently calibrated or certified bounce chamber gauge positioned so that the pressure can be continuously monitored by the Special Inspection Agency.

3. A cast or structural steel driving head shall be used to prevent upsetting the pile head when hard driving is encountered.

4. Only one model of pile hammer shall be allowed unless otherwise approved.

5. The pile driver shall be of a rigid frame type and the leads shall be an integral part of the machine extending down to the lowest point the hammer must reach.

6. Pile hammer leads shall be of the adjustable fixed type which will hold the pile firmly in position and in axial alignment with the hammer.

7. The use of a swinging hammer, vibratory pile drivers and drop hammers will not be allowed.

C. All piles shall be driven where indicated and so that the maximum horizontal deviation of any pile from the required location shall be not more than three (3) inches at its cut-off elevation. In this position, the driven piles shall not deviate from the indicated direction of the piles by more than 1/8 inch per foot of length. In addition, a minimum of 50% of the pile tip must be visible upon completion of driving, prior to concrete placement. The Contractor shall provide a mirror and/or sealed beam flashlight for use by the Special Inspection Agency to confirm the required straightness of the piles and to establish the condition of the pile shaft and bottom of the pile.

D. The center of gravity of all piles at the cut-off elevation in a pile group shall not deviate more than two (2) inches from the center of gravity of the pile group indicated on the Drawings.

1. It shall be the Contractor's responsibility to provide detailed calculations indicating the center of gravity of all piles at the cut-off elevation in a pile group.

2. Should the center of gravity of any pile group exceed the 2-inch limit, it will be the Contractor's responsibility to submit a detailed remedy, including all relevant engineering calculations, for approval.

3. The Contractor shall be responsible for carrying out the corrective action required, at no cost to the Owner, to modify the design necessitated by his lack of conformance with the tolerance stated.

E. All piles shall be preaugered to the pile cut-off depth. Preaugering diameter shall be to or greater than the pile diameter. A pile which cannot be driven to the required depth because of an obstruction, after a credible Contractor effort to remove or break through the obstruction, shall be pulled and redriven or the pile shall be cut off, filled with concrete and abandoned and replaced, whichever is directed. The Contractor shall be responsible to propose a design solution for abandoned piles.

F. A pile which has not reached the required blow count when the top has been driven to the cut-off elevation shall be built-up and redriven to a depth sufficient to develop the required driving resistance. The final driving resistance will not be measured until the pile has been driven continuously at least an additional 12 inches. Or the pile shall be filled with concrete and abandoned and the Contractor required to propose a pile/piles solution at the discretion of the Special Inspection Agency and at no added cost to the Owner.

G. It shall be the responsibility of the Contractor to order and drive piles of the necessary lengths. Payment will be made only for piles satisfactorily driven and accepted.

H. Each pile shall be driven to resist without failure all forces imposed upon it by the driving apparatus; and to resist without distortion, collapse, failure or leakage all outside collapsing forces and hydrostatic pressures encountered during installation and thereafter until the pile is filled with concrete.

I. All piles shall be watertight so as to exclude water during and after driving until the concrete is placed. A suitable light and/or mirror shall be provided by the Contractor for inspecting the interior of each pile immediately after it has been driven to the required resistance and just prior to concrete placement.

J. Cut-off portions of the piles shall remain the property of the Contractor. All cut-offs shall be disposed of off-site by the Contractor at no added cost to the Owner.

K. Accurate survey level marks shall be put on each pile and surveyed by the Contractor immediately after driving is completed. After all piles in a group have been driven, the level marks shall be checked by survey conducted by the Contractor. All piles which have uplifted more than 1/4 inch after driving due to adjacent operations shall be re-driven to the required resistance, but in no case to a tip elevation higher than the original tip elevation. This information shall be included in the pile record for each pile so re-driven.

L. In the driving of piles, caution shall be exercised by the Contractor to prevent accidents, obstruction or damage to any and all adjoining structures and utilities. All adjoining "CRITICAL" structures and utilities damaged by, or resulting from work performed by the Contractor shall be replaced by the Contractor at no additional expense to the Owner. The Contractor shall exercise all precautions and provide inspection(s) of adjoining CRITICAL structures and utilities prior to, during and after construction operations, and utilize the most modern techniques to detect and prevent damage to adjoining structures and utilities.

3.04 LENGTH OF PILES

A. Piles shall be driven to sufficient depth and resistance to adequately develop their specified load-supporting capacity in the very dense glacial till or bedrock strata. The Special Inspection Agency will be the sole judge, based on soil data, and the action of the piles during driving of the required depth and driving resistance to develop the load capacity.

B. If, in the opinion of the Special Inspection Agency, the conditions during the driving indicate that the resistance to driving is due to an obstruction, the Contractor shall employ all means and methods satisfactory to the Special Inspection Agency to remove or drive the pile past the obstruction.

C. The estimated quantity of piles provided in the Bid Proposal of the Contract is given only for use in comparing bids and is based on assumed pile lengths for the various locations. The actual length of each pile will be that required to develop a design load capacity of 150 tons in compression (ultimate load capacity of 300 tons) as specified herein. It shall be the responsibility of the Contractor to order and drive the piles of the necessary lengths to conform to the requirements specified herein. For the purposes of determining the correct lengths of piles to order, the Contractor will be permitted to drive preliminary piles, perform additional borings or bedrock probes at locations and times approved by the Special Inspection Agency. Preliminary piles driven or borings/probes performed with the approval of the Special Inspection Agency will be a no cost to the Owner.

3.05 UNSATISFACTORY PILES

A. Piles which are damaged, mislocated, or driven out of alignment shall be withdrawn and replaced by new piles or shall be cut off, filled with concrete and abandoned and additional piles driven, as directed. Where piles must be abandoned, a remedy for achieving the required center of gravity of the pile group shall be provided and carried out by the Contractor as specified hereinbefore.

B. All costs incurred to replace piles, which in the opinion of the Special Inspection Agency, are deemed unsatisfactory, shall be borne by the Contractor.

END OF SECTION

PILE DRIVING HAMMER

INFORMATION FORM

Project: Date:

General Contractor:

Piling Contractor:

Name of Computer Program used for Wave Equation Analysis:

Name of Engineer doing Wave Equation Analysis:

HAMMER

1. Manufacturer
2. Distributor
3. Type Model
4. Serial No.
5. New Used Rebuilt

RAM

1. Weight (kips)
2. Length (in)
3. Number of Ram Segments
4. Diameter (in)

Note: For non-uniform rams, give ram diameters and lengths for each segment of ram.

STROKES AND EFFICIENCIES

1. Maximum Stroke (ft)]
2. Maximum Rated Energy (ft-lb)
3. Minimum Stroke (ft) (see note below)
4. Hammer Efficiency

Notes:

A. For single acting hammers, maximum stroke means the rated stroke; i.e., maximum stroke times ram weight should equal the hammer's rated energy. For double acting hammers, the definition of maximum stroke can vary. For closed end diesels, see the note under the section "Bounce Chamber...". For double acting ECH, see the note following the section entitled, "External Combustion Hammer Information."

B. Minimum stroke applies to diesels only. It should be the lowest (rated) stroke at which the hammer still runs. For step wise adjustable fuel pumps, this is the stroke corresponding to the lowest energy rating. Minimum strike is used as a starting stroke for open end diesels.

IMPACT BLOCK - FOR DIESEL ONLY

1. Impact Block Weight (kips)

2. Impact Block Length (in)

3. Impact Block Diameter (in)

4. Impact Block Coefficient of Restitution

5. Impact Block Round Out Deformation (ft)

COMBUSTION DETAILS - FOR DIESELS ONLY

1. Compressive Stroke (in)

2. Combustion Chamber Area (in^2)

3. Combustion Chamber Volume (in^3)

4. Coefficient of Expansion

5. Liquid Injection Combustion Delay (sec) (see note below)

6. Liquid Injection Combustion Duration (sec) (see below)

7. Atomized Injection Combustion Start Volume (in^3) (see below)

8. Atomized Injection Combustion End Volume (in^3) (see below)

Note: 5 and 6 are for liquid injection diesels only. 7 and 8 are for atomized injection diesels only.

PRESSURES - FOR DIESELS ONLY

1. Atmospheric Pressure (psi)

2. Maximum Combustion Pressure at

   Highest Fuel Setting (psi) (see note below)

3. Maximum Combustion Pressure at

   2nd Highest Fuel Setting (psi)

4. Maximum Combustion Pressure at

   3rd Highest Fuel Setting (psi)

5. Maximum Combustion Pressure at

   4th Highest Fuel Setting (psi)

6. Maximum Combustion Pressure at

   Lowest Fuel Setting (psi)

Notes:

A. For hammers with continuously variable fuel pump settings, give only No. 2. For hammers with less than 5 pump settings, leave bottom setting(s) blank.

B. For hammers which have a number of fuel settings, but only the highest fuel setting is known, indicate the number of settings possible.

BOUNCE CHAMBER - FOR CLOSED END DIESELS ONLY

Refer to the figure.

1. Bounce Chamber Ports to Cylinder Top (in), d_c

2. Bounce Chamber Area or Area of Piston Top (in^2), A_{rt}

3. Total Bounce Chamber Length (in), d

4. Safety Distance (in), d_{sf}

5. Compression Tank Volume (in^3), V_{ct}

6. Reaction Weight (kips) (see note below)

7. Coefficient of Expansion in Bounce Chamber

Note: For double acting diesels Reaction Weight, should be such that rate energy corresponds to expansion energy in bounce chamber when uplift is imminent plus h W_c. This information is to be obtained from the manufacturer and must consider the value of the bounce chamber expansion coefficient.

EXTERNAL COMBUSTION HAMMER INFORMATION

1. Rated Pressure (psi)

2. Effective Piston Area (in^2)

3. Number of Assembly Elements

4. Weight of First Assembly Segment (kips)

5. Stiffness of First Assembly Segment (kips/inch)

6. Weight of Second Assembly Segment (kips)

7. Stiffness of Second Assembly Segment (kips/inch)

8. Weight of Third Assembly Segment (kips)

9. Stiffness of Third Assembly Segment (kips/inch)

10. Coefficient of Restitution of Assembly

11. Round Out Deformation of Assembly (ft)

Note: Rated pressure and effective piston area are for double (differential, compound) acting ECH only.

DRIVING SYSTEM, PILE AND SOIL DATA

1. Striker Plate

    a) Weight, kips

    b) Diameter, in

    c) Thickness, in

    d) Material

2. Hammer Cushion

    a) Material Name

    b) Cross sectional area, in^2

    c) Modulus, ksi

    d) Thickness, in

    e) Coef. of restitution

3. Helmet (including adaptors)

    a) Weight

4. Pile Cushion (for concrete piles)

    a) Material name

    b) Cross sectional area, in^2

    c) Thickness, in

    d) Modulus, ksi

    e) Coef. of restitution

5. Pile (if nonuniform, attach a figure indicating variation with depth)

    a) Material description

    b) Length, ft

    c) Cross sectional area, in^2

    d) Modulus, ksi

    e) Specific weight, pcf

6. Soil

    a) Skin quake, in

    b) Skin damping, s/ft

    c) Toe quake, in

d) Toe damping, s/ft

e) Maximum ultimate capacity, kips

f) Skin friction, %

g) Distribution of skin friction -
sketch relative magnitude versus
depth below top of pile

Submitted by Date

Note: Manufacturer's literature may accompany this form but it shall not be submitted in lieu of completing this form.

E. Install casing spacers to maintain the carrier pipe at its proper line and grade as shown on the Drawings and in accordance with the manufacturer's instructions. Protect carrier pipe, pipe joints and coatings as necessary to prevent damage. All damage shall be repaired and restored as directed by the Engineer and at no additional expense to the Owner.

F. Verify upstream and downstream elevations of the carrier pipe prior to installing casing end seals.

G. After the carrier pipe is satisfactorily installed within the steel pipe casing and successfully pressure tested, each end of the casing pipe shall be doubly sealed as shown on the Drawings to fill the annular space between the steel casing pipe ends and the carrier pipe. Casing end seals shall be installed per the manufacturer's instructions.

PLATE IV

PIPE CROSSING DATA SHEET (FROM PROVIDENCE AND WORCESTER RAILROAD COMPANY SPECIFICATIONS FOR PIPELINE OCCUPANCY)

RAILROAD CROSSING	PIPE DATA	
	CARRIER PIPE	*CASING PIPE*
CONTENTS TO BE HANDLED	SEWAGE	N/A
OPERATING PRESSURE	GRAVITY SEWER	N/A
NOMINAL SIZE OF PIPE	36"	54"
OUTSIDE DIAMETER	43.35" BELL / 38.30" BARREL	54"
INSIDE DIAMETER	37.46"	52.25"
WALL THICKNESS	0.42"	0.875"
MATERIAL	DUCTILE IRON	STEEL
WEIGHT PER FOOT	153 LB/FT	496 LB/FT
SPECIFICATION	AWWA C151	ASTM A139
GRADE OR CLASS	THICKNESS CLASS 54 (RAILROAD XING)	ASTM A139
MANUFACTURING PROCESS	CENTRIFUGALLY CAST	ASTM A139
TEST PRESSURE		N/A
JOINT TYPE	RESTRAINED PUSH-ON	WELD
COATING TYPE	ASPHALTIC	N/A
DETAILS OF CATHODIC PROTECTION	N/A	N/A
DETAILS OF SEALS OR PROTECTION AT ENDS OF CASINGS	N/A	SEE DETAILS
METHOD OF INSTALLATION	PUSH WITH CASING SPACERS	JACK/BORE

2.4 ROOF HATCH

A. Roof Hatches: OSHA compliant, metal roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counter flashing and weather tight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers:
   a. Bilco Company (The).
   b. Bristolite Skylights.
   c. OR Equal.

B. Type and Size:
1. Single-leaf lid, refer drawings for sizes.
2. Double-leaf lid, refer drawings for sizes

C. Loads: Minimum 40-lbf/sq. ft. external live load with a maximum deflection of 1/150 th of the span.

A. Hatch Material: Aluminum sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
2. Finish: Mill Finish.

B. Construction:
1. Insulation: Fiberglass or eurethane R- value according to ASTM C 1363.
2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
6. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
7. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

C. Hatch-Lid Glazing: Operable Double dome polycarbonate glazing of thickness capable of resisting indicated loads. Size-6 ft square.
1. Outer Double-Dome Color: Colorless, transparent.
2. Inner Double-Dome Color: Colorless, transparent.

D. Hardware: Stainless-steel spring latch with turn handles, and padlock hasps inside and outside.

E. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a

and they shall be screw-adjustable.

G. 304 Stainless steel components with 316 stainless steel hardware will be required in Class 1, Division 1 areas. As a minimum, components to be stainless steel include clevis hangers, pipe clamps, pipe supports, plate bases, pipe saddles, U-bolts, floor stanchions, threaded rod with nuts, rod couplings, brackets and all miscellaneous connecting and supporting hardware.

H. As a minimum, all valving supports other than ceiling suspended shall have hot-dipped galvanized coatings where installed for all other valving and equipment.

I. Steel anchors shall be furnished and installed as required to hold the valves in position and alignment. The anchors shall be designed for rigid fastening to the structures and they shall be subject to approval. All thrust restraint rods anchored to walls or floors shall be stainless steel.

J. Inserts for fastening pipe-supporting devices to the building structure shall be 304 stainless steel (316 SS hardware) and shall be installed in the concrete construction. Inserts shall be of approved types and they shall be designed to carry safely the maximum load that can be imposed by the rod which they engage.

2.07 GATE VALVES

A. Gate valves 3" and smaller shall be bronze, solid wedge, rising stem or non-rising stem as selected by the Owner, with Class 125 threaded ends and shall be rated for 200 psi non-shock cold working pressure. Bronze gate valves shall meet or exceed MSS SP-80 specifications. Bronze gate valves shall be as manufactured by Crane, NIBCO, or approved equal.

B. Gate valves 4"-12" shall be resilient-seated wedge with flanged ends and shall be in full compliance with the latest revision of AWWA C509. Valves shall have a working pressure rating of 250 psig. The valve body, bonnet, stuffing box, and disc shall be composed of ASTM A126 Class B grey iron or ASTM A395 or A536 ductile iron. The valve shall be non-rising (NRS) stem type, opening left (counter-clockwise) and equipped with a handwheel with the word "Open" and an arrow cast into the metal to indicate the direction to open. The NRS stem stuffing box shall be of the O-ring seal type with two O-rings above the thrust collar and one O-ring below. The two upper O-rings shall be replaceable while the valve is fully open and subject to the full rated working pressure. Valve wedge shall be fully encapsulated with rubber. All internal and external ferrous surfaces shall be coated with a fusion bonded thermosetting powder epoxy coating of 10 mils nominal thickness. The coating shall conform to AWWA C550. All hardware shall be Type 304 stainless steel. Resilient-seated gate valves shall be Mueller A2360, Clow F-6100, equivalent by DeZurick, or equal.

2.08 PLUG VALVE SCHEDULE

Qty.	Size	Location	Direction (Direct or Bi-Directional)	Environ-ment	Function	Manufacturer / Model No. (SEE NOTE)	Hand wheel Dia.	Pressure Rating, psig	
								Rev-erse	Dir-ect
1	4"	Screenings and Grit	Bi-Directional	Class I, Division 1 Hazardous Class I, Division 1 Hazardous	Grit Washer Inlet	Val-Matic 5804R/7A08	8”	175	175
1	4"	Screenings and Grit	Bi-Directional		Grit Washer Inlet	Val-Matic 5804R/7A08	8”	175	175
2	4"	Inlet Works	Bi-Directional		Grit Slurry Pumps - Influent	Val-Matic 5804R/7A08	8”	175	175
3	4"	Inlet Works	Bi-Directional		Grit Slurry Pumps - Discharge	Val-Matic 5804R/7A08	8”	175	175
2	12"	Valve Vault	Bi-Directional		Dry Weather pump discharge	Val-Matic 5812R/7D24	24”	175	175
4	16"	Valve Vault	Bi-Directional		Wet Weather pump discharge	Val-Matic 5816R/7G14	14”	150	150
2	16"	Pump Room	Bi-Directional	Non-Hazardous	Dry Weather pump suction	Val-Matic 5816R/7G14	14”	150	150
4	24"	Pump Room	Directional		Wet Weather pump suction	Val-Matic 5824R/7M24	24”	50	100

NOTE: Manufacturer and model number provided for reference only. Alternate manufacturers are DeZurik, Series PEC, or equal.

2.08 CHECK VALVE SCHEDULE

Qty.	Size	Location	Environment	Function	Manufacturer / Model No. (SEE NOTE)	Pressure Rating, psig
2	4”	Grit Slurry Pumps-Discharge	Class I, Division 1 Hazardous	Grit Slurry Pump Discharge	Val-Matic 7200	150
2	12"	Valve Vault	Class I, Division 1 Hazardous	Dry Weather pump discharge	Val-Matic 7200	150
4	16"	Valve Vault		Wet Weather pump discharge	Val-Matic 7200	150

NOTE: Manufacturer and model number provided for reference only. Alternate manufacturers are DeZurik/APCO CRF Series 100, or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine concrete vault conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Handle valves and accessories using lifting hoists or skidding to avoid shock or damage. Do not drop such materials. Protect the valve coatings and lining from damage during delivery and handling.

B. Installation of valves and appurtenances shall be as shown on the Drawings and as directed, according to manufacturer's written instructions and specific equipment and piping arrangement indicated. Valves shall have interiors cleaned of all foreign matter before installation. Valves shall be inspected in opened and closed positions to insure that all parts are in approved condition and working order.

C. All metal valves and appurtenances specified herein and exposed to view shall be field painted as specified in Section 09960.

3.04 FIELD QUALITY CONTROL

A. Installer Qualifications: Engage an experienced Installer to perform work of this Section who has specialized in installing types of valves and appurtenances similar to those required for this Project and who is acceptable to manufacturer of primary materials.

SECTION 13420

INSTRUMENTATION – BID ADDENDUM 3

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Installation and start-up of instrumentation provided under this section.

B. Related Sections

1. Refer to Division 11 for equipment furnished by other sections but requiring wiring diagrams developed under this section to reflect complete integration of the systems, instrumentation, interlocking, interfacing and installation under this section.

2. Refer to Division 16, Electrical for wiring standards and practices.

3. Refer to Section 13465 (Sequence of Operations) for commissioning coordination.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications - Firms regularly engaged in the manufacture of instrumentation systems (the "System Supplier"), whose products have functioned satisfactorily in similar service, and has demonstrated proficiency and extensive experience with current technology.

B. Installer’s Qualifications - Firms regularly engaged in the installation, calibration, and adjustment of instrumentation systems, with a minimum of five years of experience, whose systems have functioned satisfactorily in similar service and have demonstrated proficiency and extensive experience with current technology.

1.3 SUBMITTALS

A. Provide complete equipment specifications, details of connections, wiring, range and dimensions. Submittals consisting of only general sales literature will not be acceptable. Shop drawings shall be bound in separate three ring binders with an index and section, sub-section, etc., dividers. The dividers shall be arranged so its individual tabs can locate each item being referenced.

B. Submit detailed information for each instrument or control device, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:

1. Product (item) name used herein and Tag number as shown on the Contract Drawings.

2. Manufacturers complete model number.

3. Location of the device.

4. Input - output characteristics.

5. Range, size, and graduations.

6. Physical size with dimensions, enclosure NEMA classification and mounting details.

7. Materials of construction of all components.

C. Exceptions to the Specifications or Drawings shall be clearly defined by the System Supplier. Data shall contain sufficient details so the Engineer may make a proper evaluation.

1.4 PRODUCT HANDLING

A. Identification

1. Each component shall be tagged per the users standard numbering system or as defined herein and in the contract drawings. To identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

2. A permanent stainless steel tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this section. In the case where any supplied instrument is too small or of such a material as to make a stainless steel tag impossible to attach, a method of indelible marking, demonstrating the intent of this paragraph shall be submitted to the engineer for approval.

B. Storage

1. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, the System Supplier at his own cost and expense shall repair such damage. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the System Supplier, or the System Supplier at his own expense shall replace the apparatus.

1.5 INSTRUMENTATION GENERAL

A. Type

1. Instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals that are established standards for the water and wastewater industries.

2. Electronic instrumentation shall be of the solid-state type. Analog control signals shall be linear and be industry standard currents of 4 to 20 mA DC (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current), or the like. No zero based signals shall be allowed.

3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised an/or converted to compatible standards signals for remote transmission. No zero-based signals shall be allowed.

4. Instruments shall be provided with stainless steel mounting hardware and/or galvanized steel floor stands, wall brackets, or instrument racks as appropriate for each location.

5. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Contract Electrical Drawings, to comply with the National Electrical Code.

6. Indicators and recorder readouts shall be linear in the process units.

7. Transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to ±2 percent.

8. Electronic equipment shall be of the manufacturer's latest design. Circuit boards and associated components shall have suitable conformal coating to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose to assure optimum long-term performance and dependability over normally anticipated atmospheric conditions of temperature, pressure and humidity. The field-mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

9. Equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

1.6 ELECTRICAL

A. Equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 110 volts, plus or minus 10 percent except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

B. Analog transmitter and controller outputs shall be 4-20 milliamps into a minimum load range of 0-750 ohms, unless specifically noted otherwise.

C. Switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA unless specifically noted otherwise.

D. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.

E. Equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation upon manual resetting when power is restored.

1.7 LIGHTNING/SURGE PROTECTION

A. General - Lightning/surge protection shall be provided to protect the system from inducted surges propagating along the signal and power supply lines. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, and be

maintenance-free and self-restoring. Instruments shall be housed in a suitable metallic case, properly grounded. Ground wires for all surge protectors shall be connected to a good earth ground, and where practical each ground wire run individually and insulated from each other. These protectors shall be mounted within the instrument enclosure or a separate NEMA 4X junction box coupled to the enclosure. The units shall be as manufactured by EDCO, MCG Electronics, MTL Electronics, or equal.

1. Power Supply - Protection of all instrument power supply lines shall be provided. Cabinet(s)/Panel(s) and groups of field instruments, as approved by the Engineer shall be protected by isolation transformers and surge suppressors. Individual gas-tube surge suppressors shall protect individual field instruments.

2. Communication Line - Protection of all communication lines shall be provided. Protection devices shall be installed at both ends and as close to the equipment being protected as possible. Protection devices shall provide the equipment manufacturer's recommended protection levels but shall not interfere with communication. The protection devices shall be standard devices listed by the protection device manufacturer as suitable for the specific type of communication line.

PART 2 PRODUCTS

2.1 MAGNETIC FLOW METERS

A. Tags: FE/FIT-250

B. Magnetic flow meters shall be provided in order to provide local readout of flow rate and transmit to the control system as indicated on the Drawings. The flow meter shall be of the low frequency electromagnetic induction type and the coils shall be excited by a pulsed DC signal. The meter shall be designed for operation on 120 VAC ± 10%, 60 Hz ±5% with a power consumption of less than 15 watts.

C. The same manufacturer shall manufacture flow tubes and transmitters.

D. Flow Transmitter Tags: FIT-250

1. The flow transmitter portion of the magnetic flow meter shall be remote from the flow tube unless otherwise indicated and include both a magnet driver to power the magnet coils and the signal converter electronics. Provide manufacturer's recommended interconnecting cable for both the driver coil and the signal. Lengths shall be provided as required by the runs shown on the drawings. Cable shall be installed in a separate RGS (PVC coated where applicable) conduit from all other wiring.

2. The electronics shall be of the solid state, feedback type, utilize integrated circuitry and be microprocessor controlled. The converter shall be provided with a back lighted, dot matrix-type, liquid crystal display for flow and configuration data. The display shall have two rows of not less than 16 alphanumeric characters for instantaneous flow rate in percent or direct engineering units, field selectable, and accumulated total flow. A keypad shall be provided for fast, easy configuration.

3. Display shall provide full diagnostics with a clear message describing any and all faults. The diagnostics shall provide a 4 to 20 mA output calibration function capable of forcing the transmitters 4 to 20 mA output to the zero scale, half scale and full scale values.

4. Can detect and report reverse flow.

5. Input and output signals shall be fully isolated. The converter output shall be 4 to 20 mA dc.

6. The Transmitter shall provide the Hart Protocol.

7. The meter shall be hydraulically calibrated to N.I.S.T. Standards at a minimum of 3 flow rates with an accuracy of 0.3% or better of flow velocities of 3 to 30 feet per second. Accuracy below 1 foot per second shall be less than 5% at velocities as low as 0.2 ft/sec.

8. Provide integral transient protection circuitry.

9. Provide panel mount display if available. If not available, provide a panel display as described in Section 2.6 below.

10. Environmental:

    a. NEMA 4X housing for FIT-240

E. Flow Tube Tags: FE-250

1. Flow tubes shall be constructed of stainless steel. The flow tube and magnetic coils shall be housed in a cast steel housing with secondary containment.

2. Flow tubes shall be supplied with integral ANSI Class 150 carbon steel flanges. Flangeless tubes will not be acceptable.

3. The flow tube lining shall be PTFE.

4. The electrodes shall be Hastelloy C or equivalent.

5. Environmental:

    a. NEMA 6P (IP68) housing for FE-250

    b. Factory Mutual Approved for Class 1 Division 2 Group D Environments with remote transmitter provided. Remote transmitter not located in hazardous area.

6. Provide flange mounted grounding rings.

7. Provide protection washers for liners.

F. Remote Unit Tags

1. Transmitter: FIT-250

2. Flow Tube: FE-250

G. Size as shown on the Drawings

H. Manufacturers

1. ABB Process Master FEP300 Series

2. Krohne OPTIFLUX Series

3. Or Equal.

2.2 ULTRASONIC LEVEL TRANSMITTER

A. Tags: LE -310 & LIT-310

B. Transducer/Transmitter Tag: LE-310

1. The level transmitter shall be loop powered and of the combination ultrasonic transducer/transmitter type that will be used to measure the level of fluid at the locations shown on the Drawings.

2. Housing: Tank mounted IP67

3. Blanking Distance: Not to exceed 10 inches

4. Range: Up to 4meters (9 feet)

5. Accuracy: 0.25% of maximum range or 6mm, whichever is greater

6. Resolution: 2 mm

7. Display: 4 line graphic display

8. Output: Analog: 4-20 mA DC isolated signal proportional to the level

9. Beam Angle: 7°.

10. Thread size: 2" NPT.

11. Approvals: UL and FM Listed

12. Manufacturers

a. Hawk – MiniWave MWN1A transducer.

b. Equivalent by Siemens

c. Or equal.

C. Level Transmitter Tag: LIT-310

1. The level transmitter shall be panel mounted in the LAH-310 enclosure.

2. Inputs: 4-20mA

3. Outputs:

a. 4-20mA, proportional to input

b. Form C contact, programmable to activate alarm horn as shown on wiring diagram

4. Manufacturers

a. Rosemount, 3490 Series Controller

b. Equivalent by Siemens

c. Or equal.

2.3 PRESSURE INDICATING TRANSMITTER (ABSOLUTE 2-WAY)

A. Tag: PE-240/PIT-240

B. Performance

1. Accuracy: 0.075% of calibrated span
2. Stability: 0.125% of upper range limit for 5 years
3. Range: 100 psig – minimum calibrated range of 1.0 psig

C. Construction

1. Housing - NEMA 4X Aluminum or CF-3M (Cast version of 316L SST)
2. Viton O-rings
3. 316 stainless steel wetted parts
4. Dual compartment housing with moisture barrier totally isolating electronics circuitry from field wiring terminals
5. Capacitance sensing element
6. Vertical Mount
7. Provide with two valve manifolds by the same manufacturer.

D. Outputs: 4-20 mA signal proportional to measured variable

E. Supply mounting hardware and all accessories needed to install transmitter and primary element.

F. Provide stainless steel tubing and accessories required for a complete installation as shown on the drawings.

G. Transmitters to use HART Protocol to Communicate Transmitter Parameters to Control System and/or to Field Communicator.

H. Provide integral lightning protection with each transmitter.

I. Acceptable Manufacturers

1. Rosemount – 3051T Transmitter with 306AT two valve manifold
2. Equivalent by Siemens
3. Equivalent by Endress & Hauser
4. or equal

2.4 GAS DETECTION SYSTEM DESCRIPTION:

A. The system shall include a multi-channel wall mounted gas detection controller that will monitor 4-20mAdc signals from remotely mounted Combustibles (LEL), Oxygen (O2), and Hydrogen Sulfide (H2S) gas sensor/transducers.

1. LEL sensors shall be mounted near the ceiling.
2. H2S sensors shall be mounted as low as possible.

3. O2 sensors shall be mounted at shoulder level.

4. Sensor/transmitters will be mounted where shown on drawings within NEMA 7 enclosures and will be wired to the controller under division 16.

5. The system shall be provided with alarm output contacts for connection to the SCADA system (SCADA by others).

B. All sensor/transmitters shall be rated for Class I, Div. 1, Groups B, C and D.

C. Oxygen Sensor Tags: AE-170B, AE-172B, AE-260B

1. O2 specific sensor shall be a galvanic cell type sensor. The sensor will measure 0-25% vol. and generate 4-20 ma DC signal to the controller. The electronics shall be encased in a potted package to avoid damage from mechanical abuse or corrosion.

D. Combustibles Sensor Tags: AE-170C, AE-172C, AE-260C

1. LEL sensor shall be infrared type and provide continuous monitoring, type XIR by MSA or approved equivalent by General Monitors or RKI Instruments. Sensor will measure 0-100% LEL and generate 4-20 ma DC signal to the controller. The electronics shall be encased in a potted package to avoid damage from mechanical abuse or corrosion.

E. Hydrogen Sulfide Sensor Tags: AE-170A, AE-172A, AE-260A

1. H2S sensor shall be electrochemical and provide continuous monitoring. Sensor will measure 0-100 PPM and generate 4-20 ma DC signal to the controller. The electronics shall be encased in a potted package to avoid damage from mechanical abuse or corrosion.

F. Transmitter Tags: AIT-170, AIT-172, AIT-260 (“Screenings/Treatment Room Gas Panel” and “Pump Room Gas Panel”)

1. Features

a. Inputs: Capable of monitoring up to eight (8) 4-20 ma DC channels (either 2 or 3-wire)

b. 2 digital displays with 4 alphanumeric lines each for identifying gas type and concentration for up to eight channels simultaneously

c. Four (4) visual LED alarms on front cover for alarm indications, pilot, and malfunction

d. Enclosure: NEMA 4

e. An external reset switch which allows alarms to be silenced from outside the enclosure

f. Relays

1) Two (2) relays per channel: 10 amp rating, SPDT isolated contacts

2) One (1) set of common relays: 2 for gas alarm levels and 1 for malfunction

g. Built in audible alarm with reset button

h. Provide battery backup

i. Operating Temp: 14°F to 122°F

j. Relative Humidity: 0 – 100%

G. The system shall be manufactured by:

1. MSA – Ultima XE series with a Gasgard display is the basis of design.

2. Equivalent by General Monitors

3. Equivalent by RKI Instruments

4. Or equal.

2.5 LEVEL SWITCH

A. Tag: LSH-100, LSH-210, LSHH-210, LSH-220, LSHH-220, LSHH-231, LSHH-232, LSHH-233, LSH-240, LSHH-240, LSH-250, LSHH-250, LSH-310

B. Type

1. Tilting float actuation.

2. SPDT non-mercury switch.

3. Polypropylene casing.

C. Operation

1. Function – To produce a contact output at a predetermined liquid level. Multiple switch functions shall be provided where shown on the Loop Diagrams.

2. Operating Principle – the tilting motion of the float actuates a sealed switch encased in a weighted float freely suspended from a cable when the liquid level displaces it.

D. Functional

1. Output – Form C (SPDT) micro switch, rated 10 amps at 250 volts AC resistive.

E. Physical

1. Float – molded polypropylene casing.

2. Cable – Three conductor PVC – jacketed.

3. Mounting – Cable suspended by waterproof compression connector.

4. Support bracket with adjustable clamp for setting switch height.

F. Electrical

1. Provide intrinsically safe barriers for LSH-100, LSH-210, LSHH-210, LSH-220, LSHH-220, LSH-240, LSHH-240, LSH-250, LSHH-250, LSH-310

G. Manufacturers

1. Flygt Corporation - type ENM-10

2. Equivalent by Hitech Technologies, Inc.

3. Equivalent by Conery Mfg. Inc.

4. Or equal

2.6 PANEL INDICATOR

A. Display: 0.56 inch red LEDs

B. Housing: NEMA 4X

C. Power Requirements: 85-265 VAC, 50/60 Hz

D. Input: 4-20mAdc

E. Isolation: 4kV

F. Manufacturers:

1. Precision Digital PD 765 Series

2. Red Lion

3. Or equal

2.7 LEVEL TRANSMITTER

A. Tag: LE-210, LE-220

B. Furnish and install two (2) level transmitters for the wet well as work of this Section.

C. Description: Submersible pressure transducer specifically designed for sewage/wastewater service

D. Construction: Silicon pressure cell fitted into a 316 stainless steel housing with an integral convoluted molded Viton diaphragm that provides a water tight pressure seal.

E. Body Diameter: 1.25” with a 2.5” non-fouling process convoluted molded Viton diaphragm designed to fit in a 4 inch PVC stilling well.

F. Output: 4 to 20 mA DC

G. Accuracy: ±0.25%

H. Provide intrinsically safe barriers for rated operation in a Class I Division 1 area.

I. Vented reference

J. Provide aneroid bellows for atmospheric pressure compensation. Mount bellows in break-out box as shown on drawings.

K. Level Range: 0 to 35 ft

L. Provide factory cable with shielding jacket molded cable seal at necessary length to reach from the bottom of the well to the sensor aneroid bellows breakout box.

M. Provide a 4-inch perforated schedule 80 PVC stilling well for mounting the transducer. The stilling will shall be securely fastened in wet well using all 316 stainless steel hardware.

N. Manufacturer

1. Measurement Specialties - KPSI Transducer Series Model 745
2. Equivalent by Siemens
3. Equivalent by Endress-Hauser
4. Or equal.

2.8 ANALOG SIGNAL ISOLATOR/MULTIPLIER

A. Provide 24VDC for the signal multiplier as required.

B. Inputs

1. One 4-20 mA DC input.

C. Outputs

1. Two 4-20 mA DC outputs.

D. Accuracy: 0.2%

E. Manufacturers

1. Phoenix Contact – MCR Signal Multiplier
2. Equivalent by API Inc
3. Equivalent by Omniflex
4. Or equal

2.9 TEMPERATURE SENSORS - ROOM

A. Tag: TE-252, TE-254

B. 4-20 ma output

C. Sensor: Platinum RTD, Negative Temperature Coefficient (NTC) type

D. Accuracy: ±1.0 °F

E. Manufacturers

1. Devar Model RTT
2. Equivalent by Tekmar Controls
3. Or equal

2.10 TEMPERATURE SENSORS – HAZARDOUS AREA

A. Tag: TE-164

B. 4-20 ma output

C. Sensor: Platinum RTD, Negative Temperature Coefficient (NTC) type

D. Accuracy: ±1.0 °F

E. Manufacturers

1. Devar Model RTT
2. Equivalent by Tekmar Controls
3. Or equal

F. Temperature sensors for hazardous areas shall be housed in a NEMA-4X rated polycarbonate enclosure, and shall be provided with intrinsically safe barrier.

2.11 FIELD COMMUNICATOR

A. Type – Field communicator is a battery-powered device that establishes two-way communications between smart transmitters and a operator over the existing transmitter signal lines using the Hart Protocol.

B. Performance – The field communicator shall provide the ability to configure, diagnose, calibrate and checkout the operation of the smart transmitter or signal line while in use.

C. Physical – Provide an LCD display to read out all configured parameters from the transmitter and measured input values in engineering units.

D. Quantity – Provide one Universal Hart field communicator to communicate with all smart transmitter supplied.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The location of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of process control work and in case of any interference with other work, proceed as requested by the Engineer. Furnish all labor and materials necessary to complete the work in an approved manner.

B. The System Supplier shall make all necessary mechanical changes to install new instrumentation equipment provided under this Contract. This work includes all fittings, fabrications, supports, guides, restraints, bolting, gaskets, and accessories. All work shall be done in a workmanlike manner.

C. The instrumentation drawings indicate the intent of the interconnections between the individual instruments. Any exceptions should be noted.

D. Work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances, and regulations, the System Supplier shall bear full responsibility for such violations and assume all costs arising there from.

E. Equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required on the Electrical Drawings for the locations. All installations shall be in strict accordance with codes.

F. Instrument cabinets located outdoors or in unheated locations shall be provided with heating and/or cooling devices as necessary to maintain all instruments and or electronics installed in those cabinets within their design temperature limits.

G. Brackets and hangers required for equipment mounting shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

H. The System Supplier shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the System Supplier

shall be required to ship his material in sections sized to permit passing through restricted areas in the building. The System Supplier shall also investigate, and make any field modifications to the allocated space for each cabinet, enclosure, and panel to ensure proper space and access (front, rear, side).

I. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment, but in no case shall more than one ground point be employed for each shield.

J. Lifting rings from cabinets/assemblies shall be removed. Hole plugs shall be provided for the holes of the same color as the cabinet.

K. The System Supplier shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices. He shall be responsible to ensure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation.

L. Refer to Section 13465 – Sequence of Operations for additional requirements including factory acceptance testing and commissioning of equipment and work performed under this section.

3.2 SYSTEM TESTS AND ACCEPTANCE

A. After the equipment has been delivered and installed at the site, a field acceptance test shall be performed to verify the integrity of the system. The Engineer shall witness the test. Satisfactory completion of the test, as approved in writing by the Engineer, shall constitute conditional approval of the system. The system must operate without failure for a period of 100 hours before this test will be considered successful, and the system fully accepted.

B. Before this test is started, the System Supplier shall satisfy himself that the system is operating correctly with live plant data.

C. Any malfunctions during the test shall be analyzed and corrections made by the System Supplier. The Owner's Project Representative will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

3.3 FIELD TESTS

A. The System Supplier shall furnish the services of the Manufacturer's servicemen, all special tools, calibration equipment and labor to perform the tests. Certified copies of the tests shall be furnished in duplicate to the Engineer.

B. Following connection, checkout, and final adjustment of all panels, instruments, meters, monitoring, and control devices, a performance check shall be made on each. Analog inputs shall be tested at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of scale, as required. All status and alarm switches as well as all monitoring and control functions shall also be checked. Each device on the Electrical Schematic\Logic Diagrams must be signed-off by the Engineer as being acceptable.

C. If, during running of the tests, one or more points appear to be out by more than the specified amount, the Manufacturer's servicemen shall make such adjustments or alternations as are necessary to bring equipment up to specification performance.

Following such adjustments, the tests shall be repeated for all specified points to ensure compliance.

3.4 INSTRUCTION - STAFF TRAINING

A. All plant personnel will need training on the instrument systems. The System Supplier shall be responsible for providing detailed Operation and Maintenance (O&M) Manuals. The O&M Manuals shall include specific details of equipment supplied and details of operations specified to this project. The training will be conducted at the facilities.

B. The O&M Manuals shall include descriptions of all equipment, the nature and intended modes of operation, testing procedures of all units in the System, and safety measures to be taken in operation. All necessary procedures and methods for effective operation of the System shall be included.

C. O&M Manuals shall include record drawings and instructions necessary for the planned maintenance of all equipment in the system. The O&M Manuals will incorporate maintenance procedures and schedules, and they will coordinate and be cross-referenced to detailed operation procedures provided by the manufacturers.

D. The system training shall be structured such that the operating personnel will understand the system's operation, and the functions available in the system. The amount of training will be a minimum of 3 separate days, scheduled as convenient for the Owner. Preventive and corrective maintenance of hardware shall be presented.

3.5 MANUFACTURER'S STANDARD WARRANTY

A. The Manufacturer shall warrant the equipment against defects in manufacturing and materials for a minimum of one (1) year from the date of Project Substantial Completion. If the equipment should fail during the warranty period due to a defective part(s), the equipment shall be replaced and the unit(s) restored to service at no additional cost to the Owner. The manufacturer shall provide a written warranty.

3.6 SYSTEM DETAILS

A. Unless specifically stated otherwise, the System Supplier shall be responsible for providing all instrumentation, control equipment and auxiliary devices necessary to perform the functions specified herein and as shown and described on the contract drawings.

B. Any auxiliary devices such as lightning/surge protectors, relays, times, signal isolators, signal boosters, etc., which are necessary for complete operation of the system, or to perform the functions specified, shall be included, whether or not they are specifically shown or tabulated on the diagrams.

END OF SECTION