CONTRACT DOCUMENTS

Francis T. Patnaude
Inter-Municipal Pumping Station
Mattabassett Regionalization Project
CT DEEP CWF-487C
BID # 2016-011

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DIVISION 15 - MECHANICAL

Francis T. Patnaude
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EXHIBITS

"A" NOT USED

"B" STATE OF CT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION CONSTRUCTION CONTRACT PROVISIONS

"C" STATE OF CT DEPARTMENT OF TRANSPORTATION REQUIREMENTS

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SUPPORTING DOCUMENTS ON CD

STATE AND FEDERAL PERMITS

A. ARMY CORPS OF ENGINEERS CATEGORY 2 PROGRAMMATIC GENERAL PERMIT APPLICATION, FEBRUARY 2, 2015

B. DEEP FLOOD MANAGEMENT APPLICATION AND CERTIFICATION, JANUARY 2016

C. DEEP GENERAL PERMIT FOR THE DISCHARGE OF GROUNDWATER REMEDIATION WASTEWATER TO A SANITARY SEWER APPLICATION, FEBRUARY 2016

D. DEEP GENERAL PERMIT FOR THE DISCHARGE OF GROUNDWATER REMEDIATION WASTEWATER TO A SURFACE WATER APPLICATION, FEBRUARY 2016

E. DEEP (OLISP) APPLICATION FOR STRUCTURES, DREDGING AND FILL & 401 WATER QUALITY CERTIFICATION, JANUARY 8, 2015, REV. 1 FEBRUARY 15, 2015, REV. 2 MAY 19, 2015

F. DEEP GENERAL PERMIT FOR CONTAMINATED SOIL AND/OR SEDIMENT MANAGEMENT (STAGING AND TRANSFER), FEBRUARY 2016

ENVIRONMENTAL REPORTS

A. PHASE I – ENVIRONMENTAL SITE ASSESSMENT – 34 EAST MAIN STREET, DECEMBER 9, 2011

B. PHASE II – ENVIRONMENTAL SITE ASSESSMENT – 34 EAST MAIN STREET, AUGUST 9, 2013

C. PHASE II – ENVIRONMENTAL SITE ASSESSMENT – 34 EAST MAIN STREET, FEBRUARY 27, 2014

D. PHASE II – ENVIRONMENTAL SITE ASSESSMENT – GRAVITY SEWER LINE AND FORCE MAIN EXT, MARCH 10, 2014

E. PHASE II – ENVIRONMENTAL SITE ASSESSMENT – MAPLE STREET SEWER

F. TEST BORE FOR PROPOSED SANITARY SEWER LINE UNDER ROUTE 9, MARCH 19, 2015

G. WETLAND DELINEATION REPORT MAPLE STREET SEWER

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HAZARDOUS BUILDING MATERIALS ASSESSMENT

A. PRE-DEMOLITION HAZARDOUS BUILDING MATERIALS INSPECTION – 34 EAST MAIN ST, MAY 2, 2013

B. SUPPLEMENTAL HAZARDOUS BUILDING MATERIALS AND UNDERGROUND STRUCTURE ASSESSMENT, FEBRUARY 2016

BORING LOGS

A. NOVEMBER 2011 – B-01 THROUGH B-06

B. APRIL 2013 – B-07 THROUGH B-14 AND DB-01

C. AUGUST 2013 - B-15 THROUGH B-27 AND DB-03

D. AUGUST 2014 – RIVER RD WWTP & CT DOT ROW BORINGS

E. MAY 1995 - MAPLE ST BORINGS

GEOTECHNICAL REPORTS

A. FINAL GEOTECHNICAL ENGINEERING REPORT – 34 EAST MAIN ST- NOVEMBER 2011

B. FINAL GEOTECHNICAL ENGINEERING REPORT – 34 EAST MAIN ST- APRIL 2013

C. FINAL GEOTECHNICAL ENGINEERING REPORT – GRAVITY SEWER AND FORCE MAINEXTENSION, AUGUST 2013

D. FINAL GEOTECHNICAL ENGINEERING REPORT – 42” RIVER ROAD SEWER, AUGUST 2014

E. FINAL GEOTECHNICAL ENGINEERING REPORT – 12” MAPLE STREET SEWER, JULY 17, 2014

INCINERATOR BUILDING DRAWINGS

OLD PUMP STATION BUILDING DRAWINGS (INCLUDES 36 INCH RCP PIPE TO BE ABANDONED)

34 EAST MAIN ST SITE CONTAMINATED SOILS MASS BALANCE ESTIMATE

HISTORICAL FLOWS TO CITY WWTP

CONTRACTOR HAZARD COMMUNICATION

Prior to the commencement of work, the Contractor shall provide the Owner with the following:

- A list of the specific chemicals and other hazardous materials (dust, fumes, gases, etc.) that may generated at the specific work site;
- the Material Safety Data Sheet (MSDS) that accompanies the specified chemicals;
- the control measures to be implemented to ensure proper safety.

Contractors and subcontractors must not bring any substances which may be considered hazardous onto the facility without prior consent of the City of Middletown. Contractors and subcontractors will not use or dispose of in any manner substances which may be considered hazardous within the facility without prior written consent of the City. The City will consider the following factors in the determination to allow the use of any hazardous substance by contractors and subcontractors:

- Relative hazards of its use;
- availability of substitutes;
- disposal of substances; and
- the potential for employee exposure.

Any equipment used by the Contractor and subcontractor in areas where flammable materials are stored or processed must be explosion proof. **The Contractor shall be responsible for ensuring the compliance of all subcontractors with the above requirements.**

The City of Middletown will provide the contractors and contractor personnel with appropriate information and training. Information and training will include the following:

- potential chemical and physical hazards for the area in the contract operations are being conducted;
- location and availability of Material Safety Data Sheets;
- detection of the presence of hazardous materials;
- facility precautions and safety procedures;
- emergency information concerning location of emergency/ first aid equipment;
- Hazardous chemical labeling system.

Contractor personnel must sign the accompanying statement that verifies that they have received and understand the information presented.

CITY OF MIDDLETOWN
CONTRACTOR EMPLOYEE INFORMATION AND
TRAINING VERIFICATION FORM

Part 1

This is to verify that I have provided training information to employees and all subcontractors' employees as required by OSHA's Hazard Communication Standard. Training has included:

1. Information about the physical and health hazards of chemicals in the designated work area.

2. The location and availability of the Material Safety Data Sheets for hazardous chemicals in the designated work area.

3. Detection of the presence of hazardous materials in the designated work area.

4. Precautions and safety procedures which must be followed in the designated work area.

5. Emergency procedures in the event of accidental exposures to hazardous materials, including emergency phone numbers and the location of safety requirement.

6. Hazardous chemical labeling systems in use in the designated work area.

7. The appropriate locations and directions to where employees may eat, drink, smoke, and use sanitary facilities.

CITY OF MIDDLETOWN
CONTRACTOR EMPLOYEE INFORMATION AND
TRAINING VERIFICATION FORM

Part 2

1. The following substances are the complete list of hazardous substances, approved by the Owner, which may be brought onto the facility to complete the work contracted:

I understand that my company and subcontractors shall not bring onto the facility any other substances considered hazardous without the prior consent of the Owner.

2. The following substances and disposal methods have been approved by the Owner:

3. I understand that my company or subcontractors may not dispose of by sewer, by garbage dumpster, by burning, or any other disposal method in the designated work area, any other substances which may be considered hazardous.

4. I have given the locations in which contract operations will take place to my employees and subcontractors and they understand how to evacuate safely from these areas in the event of an emergency.

5. Company employees and subcontractor's employees have been given an opportunity to ask questions about the Hazard Communication Standard and to have those questions answered.

I have read and understood the above statements and my company has complied fully.

Contractor Name: _____

Contractor Representative (Name/Title)_____

Signature: _____

Date _____

CONTRACTOR'S OSHA COMPLIANCE
CERTIFICATION FORM

City of Middletown
Francis T. Patnaude Inter-Municipal Pumping Station
Mattabassett Regionalization Project
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I, _____, hereby certify that _____
(name of officer of corporation) (name of firm)

Shall comply with OSHA requirements, particularly regarding (i) having all work directly Supervised by a "Competent Person" and (ii) Permit - required Confined Spaces, at all times During the execution of the work on this Contract. I further certify that at the time of the Preconstruction meeting, I shall provide the City with the name(s) of the Competent Person(s) who Shall be in charge of the field crew(s) during construction and I shall submit copies of the valid Certifications to confirm such person(s) having undergone the training course to qualify as Competent Person(s).

_____
Authorized Signature Date

_____

_____

_____
Name and Address of Firm

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 02085

PCB CONTAMINATED BUILDING MATERIAL AND UNDERGROUND STRUCTURE ABATEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Related Documents

1. Eagle Environmental Pre-Demolition Hazardous Building Materials Inspection report dated May 2, 2013.

2. Tighe & Bond's Supplemental Hazardous Building Materials Assessment (HBMA) Report dated February 25, 2016.

B. Related Sections

1. Section 01350, Health & Safety Plan

2. Section 02080, Asbestos Abatement

3. Section 02082, Universal Waste Removal and Reclamation

4. Section 02090, Lead-Based Paint Awareness

5. Section 02120, Transportation and Disposal of Contaminated Building Materials

C. This Section establishes requirements for removal, segregation, management, and disposal of Polychlorinated Biphenyl (PCB) containing building material and underground structure abatement detailed in this section. If contradictions are identified in this Section immediately inform the Engineer.

D. PCB abatement will be limited to the Pump Building, Incinerator Building, and visible accessible materials encountered during excavation activities associated with the demolition of existing underground structures to the extent required for this project. No additional excavations will be conducted to uncover buried materials.

E. The removal and disposal of building and underground materials with PCBs is regulated by the Toxic Substance Control Act (TSCA) pursuant to Federal regulation 40 CFR 761. Demolition debris with PCBs are regulated as PCB Bulk Product Waste, if PCB concentrations are greater than or equal to 50 parts per million (ppm) as (ref: 40 CFR 761.50 (b) (4)). None of the PCB concentrations detected in materials sampled for the project were found to be greater than 50 ppm.

F. The removal and disposal of PCB contaminated building and underground materials is regulated under the Connecticut General Statutes (CGS) 22a-463 through 22a-469 for PCB concentrations greater than or equal to 1 ppm. PCB concentrations detected in materials sampled for the project range from less than 1 ppm to <25 ppm as summarized in Table 1 below. Note: All substrate samples associated with PCB sources were found to have no PCBs detected to a depth of 1/4".

TABLE 1. LIST OF PCB-CONTAINING MATERIALS

Material and Type	Total PCB Concentration (ppm)	Location and Description	Approximate Quantity
Pump Building			
Source Material White Paint	**5.5** **6.3** ND <0.87	Basement; Associated with concrete walls; 1st Floor CMU Walls; Exterior Foundation	5,100 SF
Source Material Gray/Black Paint	**5.9** **12** **7.4**	Center Stairwell; Associated with metal stair components and adjacent doors	900 SF
Source Material Red Paint	**13** **16** **19**	1st Floor; Associated with concrete floor	1,500 SF
Source Material Gray/Green Paint	**6.4** ND <0.94 **ND <25**	1st/2nd Floor Ceilings; Associated with Plaster	2,135 SF
Source Material Red/Orange Paint	**3.1** **ND <5.4** **ND <5.2**	Associated with steel structural beams	850 SF
Source Material Gray Paint	**22** ND **4**	Both Buildings; Associated with metal window components	18 Windows
Incinerator Building			
Source Material Brown/Red Paint	**1.3** **3** **2.6**	Associated with Structural Steel and Stair Components	1,350 SF
Source Material White Paint	**1.2** ND <0.74 ND <0.94	Associated with concrete ceiling in basement	1,500 SF
Underground (Outside Structures)			
Source Material Red and	**3.0** **5.3**	Associated with buried 6” Pipe Risers; Hatches and Concrete	6 Risers; 20 Hatches (1’x2’); 400

Material and Type	Total PCB Concentration (ppm)	Location and Description	Approximate Quantity
Green Paint	**8.4**		SF Concrete

Notes:

1. The contractor has the option to recycle the painted metal components with PCB containing paint (i.e. stair systems, door systems, and steel I-beams) if documentation can be provided that the proposed metal salvage facility will accept the materials with PCB concentrations <50 PPM. These components were also found to contain lead in paint ranging in concentration from 1.0 to 3.6 mg/cm$^{2.}$

2. The windows also have asbestos-containing caulking and glazing compound. The window units will be removed intact and will require disposal as mixed asbestos and PCB < 50 ppm waste.

G. Estimated quantities of PCB containing building materials are given in Table 1 above and locations are shown on the Abatement Drawings HBM-1.1 (Test Pits) and HBM-1.3 (Buildings). Contractor is responsible for determining actual quantities to form the basis of their bid.

H. The Contractor shall determine the actual quantities based on his means and methods for demolition (of mainly the pump station basement walls) versus material abated and left in place (by the abatement contractor) since the Contractor shall be determining how much of the existing structure will interfere with the new work. Actual quantities of work performed (but NOT measured for payment) (Bid items #34 and #35) will depend upon which walls of the pump station basement will be removed and which will be left in place.

I. If during the project, additional suspect PCB containing materials are encountered that were not previously identified, notify the Engineer.

J. This Section specifies requirements for the abatement and management of PCB containing building and underground materials. Contractor **MUST** also reference Section 02080 – Asbestos Abatement, Section 02082 – Universal Waste Reclamation and Section 02090 – Lead Based Paint Awareness when forming the basis of their bid.

K. Contractor must prepare a Contractor Work Plan and submit to Engineer before commencement of any abatement activities.

1.2 WORK INCLUDED

A. Contractor is informed that the work involves proper removal and disposal of items with paints containing PCBs < 50 ppm including paints on concrete walls/floors/ceilings, paints on metal stair components/doors/structural steel/windows, paint on underground (buried) metal pipe risers/hatches and concrete, and paint on ceiling plaster. The intent of this Section is to identify for the Contractor where PCBs have been confirmed to exist and the applicable regulatory responsibilities the Contractor shall comply with in order to perform the demolition work of contaminated

building materials and underground structures. Health and safety concerns, disposal requirements, worker training and demolition procedures are described in this Section.

B. The Contractor shall adhere to specific removal and management requirements as specified in this section and herein. The Contactor is to coordinate with General Contractor and Demolition Contractor to conduct removal of PCB containing building materials and underground structures during demolition activities under a demo-segregate scenario.

C. Contractor shall mitigate dust generating activities in accordance with this Section, Section 02080 – Asbestos Abatement, and Section 02090 – Lead Based Paint Awareness.

D. In general, the following activities are minimum requirements of this Section and affect the demolition performed on buildings and underground structures identified with PCBs:

1. No torch cutting of PCB impacted materials shall be performed.

2. No demolition activities shall occur that can reasonably be expected to increase the worker's exposure above the Permissible Exposure Limits (PEL) for PCBs unless certain worker protection is implemented.

3. Workers shall be informed of the PCB building materials and underground structures to be removed.

4. At a minimum, worker protection shall comply with applicable OSHA standards. Worker Right to Know and Health and Safety Standards of 1926 shall also apply to the work of this Section, as well as Section 02080 – Asbestos Abatement, and Section 02090 – Lead Based Paint Awareness.

5. Unprotected, untrained workers or trades shall not perform any related work within or adjacent to work areas involving abatement of any materials being removed for this project.

1.3 SUBMITTALS

A. Prior to the start of the work, prepare and submit the following items. Do not commence work activities until submittals are approved.

1. Written demolition and PCB abatement work plan that summarizes the Contactor's means and methods related to the demolition, containment, management, and disposal of PCB contaminated building materials and underground structures identified on the Abatement Drawings HBM-1.1 (Test Pits) and HBM-1.3 (Buildings).

2. Certification signed by the Contractor stating that the Contractor will comply with all Toxic Substances Control Act (TSCA) and State of Connecticut requirements for PCB abatement and disposal.

3. The names and operating permits of all proposed receiving facilities that may receive PCB containing materials and wastes.

B. Contract Closeout Submittals (throughout project and prior to authorization of final payment):

1. Records of the amounts of waste generated, by waste type.

2. Evidence of lawful disposal of all PCB wastes generated.

3. Waste Manifests shall be provided to the Engineer and verified before any waste leaves the site.

1.4 REGULATORY REQUIREMENTS

A. CGS 22a-463 through 22a-469 and 40 CFR 761 as it relates to the generation, staging, labeling, removal and off-site management of PCB Waste.

B. Contractor is solely responsible for obtaining permits or approvals which may be required to perform the work including all costs, fees and taxes required or levied.

C. Comply with all applicable federal, state, and local environmental, safety and health requirements regarding the demolition of building structures, buried structures, and other site features as well as recycling of metal components and disposal of demolition debris.

PART 2 PRODUCTS

A. Follow all full containment requirements as described in Section 02080 – Asbestos Abatement, and Section 02090 – Lead Based Paint Awareness.

B. Use ZEP – "Big Orange" an organic, non-petroleum, cleaner/degreaser. Big Orange by ZEP is a natural citrus solvent approved for use by EPA. This product shall be used for all final cleaning and decontamination procedures as described in Section 3.6 – DOUBLE WASH/RINSE CLEANING METHODS.

C. Contractor must establish a remote Decontamination Facility that will remain in operation for worker decontamination throughout the duration of the abatement project.

D. Warning Signs and Labels - Work areas shall be properly demarcated in accordance with OSHA and TSCA requirements. The contactors specific containment approaches may also include the following products:

PART 3 EXECUTION

3.1 ABATEMENT, DEMOLITION, AND REMOVAL METHODS

A. Abatement and Demolition activities shall be conducted in a manner that prevents the potential release of dusts to areas outside the immediate work zone.

B. All demolition debris shall be placed in appropriate dumpsters and disposed in accordance with this Section, Section 02080 – Asbestos Abatement, Section 02090 –

Lead Based Paint Awareness, and Transportation and Disposal of Contaminated Building Materials.

C. Feasible engineering controls (i.e., misters, dust minimization), controlled demolition activities, and ground cover shall be implemented by the Contractor to minimize the possibility of contamination of areas adjacent to the work area.

D. Workers shall be informed of the building materials and underground structures to be removed that have been identified as containing PCBs < 50 ppm.

E. All PCB containing materials shall be disposed of in accordance with state and federal regulations (i.e. PCB's less than <50 ppm and in some cases mixed asbestos/PCB waste).

F. Removal limits are indicated on the Abatement Drawing HBM1.1 and HBM1.3.

G. All abatement, demolition, and removal methods must be included in the Contractor Work Plan and PCB abatement work plan.

3.2 WORKER PROTECTION

A. The Contractor is solely responsible for the health and safety of workers employed by the Contractor, any subcontractor, and anyone directly or indirectly employed by any of them. Also refer to Section 01350 – Health & Safety Plan for Abatement.

B. Contractor personnel involved in the removal or disturbance of PCB building and underground structures shall be advised of contaminants including PCBs, asbestos, and lead based paint.

C. Signage for PCB work areas and PCB storage areas shall be in accordance with 40 CFR 761.40 and RCSA 22a-463 through 22a-469.

D. The Contractor shall be responsible for ensuring OSHA compliance for all personnel working with PCB containing materials, including providing appropriate personal protective equipment and training to use such protective equipment.

E. During selective demolition activities, Contractor shall ensure that workers are not exposed to any listed contaminant in excess of the permissible exposure limits (PEL). If exposure cannot be reduced to or below the PEL using engineering controls or revised work practices, the Contractor shall provide personal protective equipment including, but not limited to, respiratory and dermal protection.

3.3 BARRIERS AND ISOLATION AREAS

A. The Contractor shall construct and maintain suitable work area barriers to isolate the work areas and to reduce potential for contamination migration. Special consideration is to be provided for minimization of airborne dust and protection of ground surface from building demolition debris.

B. A centralized clean area with remote decontamination facility adjacent to the work area(s) shall be constructed. This clean area shall be of sufficient size for workers to decontaminate.

C. Barriers shall not be removed until the work areas are thoroughly cleaned and approved by Engineer.

3.4 PCB PAINT ABATEMENT

A. The Contractor's Site Supervisor, as the OSHA Competent Person shall be at the site at all times during the performance of the abatement work.

B. The Contractor is expected to remove all metal stair systems, metal door frames, and window units containing PCB < 50 ppm prior to the initiation of building demolition. The Contractor is expected to coordinate with the General Contractor and Demolition Contractor to conduct removal of painted building components (i.e. walls, floors, and ceilings containing PCB < 50 ppm) in conjunction with building demolition activities. This includes removal and disposal of source paint material and adjacent substrate as PCB waste < 50 ppm.

C. Contractor is expected to coordinate with General Contractor to conduct removal of underground structures with PCB paint < 50 ppm (i.e. metal valves and concrete). Only those painted structures encountered will be removed. No additional excavations outside the project scope will be conducted to unearth materials/structures.

D. No one shall eat, drink, smoke, chew gum or tobacco, or apply cosmetics while in the Regulated Work Area.

E. The Contractor shall employ methods to remove PCB contaminated wastes in a manner which minimizes the generation of dust and spread of PCB contamination to the ground surface. The Contractor shall be responsible for all costs associated with decontamination and remediation in the case of improper handling, reckless demolition activities, or general mismanagement of PCB containing material.

F. Mechanical cutting or grinding of PCB materials is not permitted unless the equipment has factory-equipped HEPA filtered exhaust, and is done in a negative air enclosure with HEPA filtration exhaust.

G. In order to minimize the PCB concentrations inside the Regulated Area, the Contractor shall remove the materials in manageable sections. In addition, PCB Waste materials removed from any elevated level shall be carefully lowered to the floor or ground.

H. All identified porous PCB coated materials (i.e. concrete, plaster, wood, etc.) will be removed and disposed of in accordance with this Section.

I. All identified non-porous PCB coated materials (i.e. metal) can either be recycled in accordance with state and federal regulations, or disposed as PCB material containing < 50 ppm.

J. The Contractor shall promptly place the PCB Waste material in disposal containers as it is removed. Large components removed intact may be wrapped in polyethylene sheeting and secured with tape. As the disposal containers are filled, the Contractor shall promptly seal the containers, apply caution labels, and clean the containers before removal from the work area.

K. All waste containers shall be leak-tight. Containers shall be decontaminated by DOUBLE WASH METHOD (s described in Section 3.6) and HEPA vacuuming prior to exiting the regulated area. Clean each container thoroughly before moving to a Waste Holding Area.

L. After completion of abatement work, all surfaces from which PCB Waste has been removed shall be cleaned. All demolition debris must be cleaned from the ground surface.

M. The Contractor shall also remove and containerize all visible accumulations of PCB Waste and/or PCB contaminated debris from within the work areas.

N. The Contractor shall properly decontaminate all equipment inside the Regulated Area via DOUBLE WASH METHOD and HEPA vacuuming.

O. Once the Regulated Area surfaces have been cleaned, the Engineer will perform a thorough post abatement visual inspection. Evidence of debris on the ground surface that would be indicative of PCB contamination (i.e. painted building components) identified during the inspection will necessitate further cleaning as specified. The area shall be re-cleaned at the Contractor's expense, until the standard of no visible residue is achieved. This may include removal of surface soil to ensure PCB containing building materials have been properly abated and no PCB containing demolition debris remains.

3.5 DOUBLE WASH/RINSE CLEANING METHODS

A. First wash. Cover the entire surface with ZEP "Big Orange" natural organic citrus solvent. Contain and collect any runoff solvent for disposal. Scrub rough surfaces with a scrub brush or disposable scrubbing pad and solvent such that each 900 cm2 (1 square foot) of the surface is consistently wet for 1 minute. Wipe smooth surfaces with a solvent-soaked, disposable absorbent pad such that each 900 cm2 (1 square foot) is wiped for 1 minute. Any surface <1 square foot shall also be wiped for 1 minute. Wipe, mop, and/or sorb the solvent using absorbent material until no visible traces of the solvent remain.

B. First rinse. Wet the surface with clean rinse solvent such that the entire surface is consistently wet for 1 minute. Drain and contain the solvent from the surface. Wipe the residual solvent off the drained surface using a clean, disposable, absorbent pad until no liquid is visible on the surface.

C. Second wash. Repeat the procedures in paragraph (A) of this section. The rinse solvent from the first rinse paragraph (B) of this section may be used.

D. Second rinse. Repeat the procedures in paragraph (B) of this section.

3.6 CLEANING PROCEDURES

A. Upon completion of the removal of PCB contaminated building material in any given work area, cleaning will be performed by the Contractor. Cleaning shall be performed at the end of each work day to prevent the migration of dusts or debris to areas beyond the work limits.

B. A thorough final cleaning shall be performed on all equipment using DOUBLE WASH METHODS and HEPA filter-equipped vacuums. Any water used for final cleaning shall be containerized and managed as contaminated by the contractor.

C. Final cleaning includes removal of any contaminated material, equipment or debris (including polyethylene sheeting) from the work area and removal of all visible dusts on surfaces. All polyethylene sheeting shall be packaged for disposal as a PCB waste. Follow all requirements as described in Section 3.6 - DOUBLE WASH/RINSE CLEANING METHODS

D. Special attention shall be given to personal hygiene and cleaning of supplies and/or equipment.

3.7 SAMPLING

A. No bulk sampling of building and underground materials by the Contractor or affiliates of the Contractor (subcontractors, subconsultants, etc.) shall be performed at any point during the performance of the work specified herein, except as specifically authorized herein (i.e. waste disposal purposes for PCB via TCLP). The Contractor must first notify Engineer so that they may be present during sample collection.

B. If suspect PCB containing materials are identified that were not previously identified, notify the Engineer.

3.8 MANAGEMENT OF PCB WASTES

A. **All PCB waste must be removed from the site within 30 days of generation.**

B. The abated PCB containing materials and wastes generated throughout the project **MUST** be managed in accordance with appropriate Sections. Also refer to Section 02120 – Transportation and Disposal of Contaminated Building Materials.

E. All disposal facilities require pre-approval by the Engineer.

F. Provide evidence that the PCB waste has been received at a licensed disposal or recycling facility approved for accepting PCB waste. Such proof shall be truck weight slips from an approved disposal facility. Transport of all materials off site shall be in accordance with applicable Department of Transportation Regulations. All materials leaving the site shall become the property of the Contractor.

END OF SECTION

SECTION 11540A

DRY WEATHER SUBMERSIBLE SEWAGE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. As specified in this Section and as shown on the Drawings, the Contractor shall furnish, install, and place into satisfactory operating condition two (2) “dry weather submersible sewage pumps” and accessories, including but not limited to:

1. Two (2) suction elbows

2. Two (2) dedicated control pump monitoring system modules for connection of pump sensors to each module; include at a minimum:

a. 3 motor thermal sensors

b. One motor temperature sensor RTD

c. One main bearing sensor RTD

d. One moisture leakage sensor-motor

e. One vibration sensor in connection housing

f. One support bearing sensor RTD

g. One leakage sensor in oil chamber

B. Pumps shall be constructed under ISO 9001 Quality Control Standards

C. Pumps shall meet or exceed factory and field testing and certification requirements as specified in this Section

1.2 RELATED SECTIONS

A. All of the Contract Documents, including the General Conditions, Special Conditions, General Specifications, Pollution Control and Environmental Protection, Division 1, Technical Specifications and the Exhibits apply to this Section.

B. Section 01650 – Starting of Systems

C. Section 03100 Concrete Formwork

D. Section 03200 Concrete Reinforcement

E. Section 03300 Cast In Place Concrete

F. Section 06105 Miscellaneous Rough Carpentry

G. Section 09960 – High Performance Coatings

H. Section 11060 Interior Piping and Appurtenances

I. Section 11070 Interior Valves and Appurtenances

J. Section 11540B Wet Weather Submersible Sewage Pumps

K. Section 13420 Instrumentation

L. Section 13460 PLCs

M. Section 13461 SCADA System

N. Section 13465 Sequence of Operation

O. Section 13965 Hydropneumatic Surge Control System

P. Section 16120 Conductors and Cables

Q. Section 16137 Control Cabinets and Enclosures

R. Section 16220 AC Motors

S. Section 16265 AC Adjustable Frequency Drives

T. Section 16420 Reduced Voltage Solid State Motor Starters

1.3 REFERENCES

A. At a minimum, the products and fabrication of the equipment specified herein shall meet the minimum requirements defined by the following agencies:

1. ANSI (American National Standards Institute)

2. ASTM (American Society of Testing and Materials)

3. ISO 9001 (International Organization for Standardization)

4. AFBMA (Antifriction Bearing Manufacturer's Association)

5. Hydraulic Institute (HI)

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Design Conditions

1. Reference Pump Station System Head Conditions

2.	365-day, 24 hour average flow, MGD	4.5
3.	Average Monthly Minimum Flow, MGD	1.3
4.	Average Monthly Maximum Flow, MGD	14.9
5.	Average Daily Minimum Flow (Low Instantaneous), MGD	2.6
6.	Average Daily Maximum Flow (High Instantaneous), MGD	7.5
7.	Historical Peak Hour Flow, MGD	26

B. Pump Rated Conditions

1.	Suction, maximum, inches	14
2.	Discharge maximum, inches	12
3.	Minimum Flow, 1 pump operating, MGD	2.0
4.	Minimum Efficiency at BEP, %	81.1
5.	Total Static Head, feet	28.5
6.	Maximum NPSH Required, feet	28
7.	Maximum Pump Speed, RPM	1,185
8.	Maximum Motor Horsepower, HP	100
9.	Motor Power Characteristics, Phase/Voltage	3/480
10.	Configuration	2 Duty
11.	Maximum Full Load Amps, A	125

C. Pumps shall operate fully within the Acceptable Operating Range at all times. At no time shall a pump operate less than 50% and greater than 125% of flow at Best Efficiency.

D. Pumps shall operate under two (2) system head conditions, depending on force main conditions. The first operating condition is with two (2) 24-inch Fusible PVC pipes open and available to accept flow. The second operating condition is with one (1) 24-inch FPVC pipe open and available to accept flow.

E. Depending upon system head conditions, with two pumps running, combined pump output would be expected to range between 10.0 MGD and 15.0 MGD.

F. Any deviations, exceptions or exclusions from conditions B-E above shall be clearly indicated in writing for Engineer’s review

Francis T. Patnaude inter-Municipal Pumping Station System Head Curves		
Flow vs. Head Condition Through Two (2) Parallel FPVC 24 inch Force Mains and One 30 inch PC 200 DIP Force Main		
Flow, MGD	**Total Dynamic Head Required, Feet**	**Pump Discharge Pressure, PSIG**
0.0	28.0	12.1
1.0	28.2	12.2
1.5	28.5	12.3
2.0	28.8	12.5
3.0	29.7	12.9
4.0	31.0	13.4
4.5	31.7	13.7
5.0	32.5	14.1
6.0	34.3	14.9
7.0	36.5	15.8
7.5	37.7	16.3
8.0	38.9	16.9
9.0	41.6	18.0
10.0	44.6	19.3
10.5	46.3	20.0
12.0	51.5	22.3
13.5	57.4	24.9
14.0	59.5	25.8
15.0	63.8	27.7

Francis T. Patnaude inter-Municipal Pumping Station System Head Curves		
Flow vs. Head Condition Through Two (2) Parallel FPVC 24 inch Force Mains and One 30 inch PC 200 DIP Force Main		
Flow, MGD	**Total Dynamic Head Required, Feet**	**Pump Discharge Pressure, PSIG**
16.0	68.5	29.7
18.0	78.6	34.1
20.0	89.7	38.9
21.0	95.7	41.5
24.0	115.2	49.9
27.0	137.0	59.3
30.0	161.0	69.8

Francis T. Patnaude inter-Municipal Pumping Station System Head Curves		
Flow vs. Head Condition Through One (1) FPVC 24 inch Force Mains and One 30 inch PC 200 DIP Force Main		
Flow, MGD	**Total Dynamic Head Required, Feet**	**Pump Discharge Pressure, PSIG**
0.0	28.0	12.1
1.0	28.4	12.3
1.5	28.8	12.5
2.0	29.4	12.7
2.5	30.1	13.0
3.0	31.0	13.4
4.0	33.1	14.3
4.5	34.3	14.9
5.0	35.7	15.5
6.0	38.9	16.8
7.0	42.5	18.4
7.5	44.6	19.3
8.0	46.7	20.2
9.0	51.3	22.2
10.0	56.5	24.5
10.5	59.2	25.7
12.0	68.1	29.5
12.5	71.3	30.9
13.5	78.1	33.8

Francis T. Patnaude inter-Municipal Pumping Station System Head Curves		
Flow vs. Head Condition Through One (1) FPVC 24 inch Force Mains and One 30 inch PC 200 DIP Force Main		
Flow, MGD	**Total Dynamic Head Required, Feet**	**Pump Discharge Pressure, PSIG**
14.0	81.6	35.4
15.0	89.1	38.6
16.0	97.0	42.0
17.5	109.7	47.5
18.0	114.1	49.4
20.0	133.0	57.6
21.0	143.1	62.0
22.5	159.1	69.0
24.0	176.1	76.3
25.0	187.9	81.4
27.0	212.9	92.3
30.0	253.6	109.9

1.5 SUBMITTALS

A. Submit each item in this Section according to Division 1 and General Specifications, Section 7, Article 9 “Shop and Working Drawings” and Section 11330 “Submittals.”

B. Eight (8) Sets of General Arrangement drawings that illustrate the layout of the equipment, equipment weight, principal dimensions with related verifications required for installation including anchorage locations.

C. Other related data including descriptive literature, Electrical Control Drawings including wiring diagrams, similar to those shown in Contract Drawings, Catalog Cut Sheets for individual components and Drive Motor Data.

D. Computational Fluid Dynamics (CFD) analysis and report with recommendations

E. A list of manufacturer's recommended Spare Parts including any Special Tools required for routine maintenance of the equipment as specified in Part 2 of this Section.

F. Eight (8) Sets of O & M Manuals, including final erection mounting details, controls and accessories shall be provided in digital format after equipment ship for inclusion in the Close-Out Submittal process.

G. Contents of Submittals

1. Product Data including rated capacities as a function of pump speed, of selected models and certified performance curves, weights (shipping, installed, and operating), accessories, and controls. Include start-up instructions and factory test reports.

2. Certified shop and erection drawings showing all details of construction, dimensions and anchor bolt sizes and locations. Drawings showing layout and all connections of pumping units, specialty equipment, accessories, controls, and piping. Include Setting Drawings with templates, directions for installing foundation and anchor bolts, and other anchorages.

3. Descriptive literature, bulletins, catalogs and local supplier of the equipment

4. A complete bill of materials including buy out items for all equipment supplied by the manufacturer.

5. Wiring diagrams detailing wiring for power, signal, and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

6. Product certificates signed by manufacturers of pumping units, certifying accuracies under specified operating conditions and that their products comply with specified requirements.

7. Factory witnessed Startup test report.

8. Operations and Maintenance data for pumping units, accessories, and controls specified, to be included in the Operation and Maintenance manual as specified in Division 1.

9. Complete description of surface preparation and shop prime painting for surfaces to be painted.

10. Startup and testing procedures including testing plan.

11. Commissioning Plan to demonstrate that all necessary mechanical, instrumentation and control, and electrical interfaces have been furnished and installed to ensure successful operation prior to commissioning

12. Manufacturer’s Field Test Reports

    a. Description of all test procedures and equipment.

    b. Copies of all performance test results

13. Furnish eight (8) copies of a draft version of the O&M Manual. Respond to Owner and Engineer comments and furnish eight (8) final copies of final O&M Manual in 3-ring binders. The instructions shall be prepared specifically for this installation and shall include all required catalog cuts, drawings, equipment lists, and descriptions necessary to instruct operating and maintenance personnel unfamiliar with such equipment. Installation drawings, wiring diagrams, and maintenance requirements shall all be included.

14. Certificates of compliance with American Iron and Steel Act requirements.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended location and application.

B. ISO 9001 factory certified.

C. To ensure unity of responsibility, all pumping units supplied under this Specification shall be of the same manufacturer, and shall be supplied, tested, and warranted by the pump original equipment manufacturer (OEM).

D. The pumping units specified under this section are to be standard sewage pumping equipment manufactured by a company with no less than fifteen (15) years of experience in the manufacture of sewage pumping equipment. Upon request by the engineer, the manufacturer shall provide proof of such experience by providing installation lists, brochures, catalog cuts, etc.

E. Comply with "Hydraulic Institute Standards for Centrifugal, Rotary & Reciprocating Pumps."

F. Comply with Hydraulic Institute Standards for Rotodynamic Pumps for Pump Intake Design, ANSI/HI 9.8-2012

1.7 DELIVERY, STORAGE AND HANDLING

A. Package spare parts in containers bearing labels clearly designating contents and pieces of equipment for which they are intended. Each box or package shall be properly marked to show its net weight in addition to its contents.

B. Store and safeguard equipment, material, and spare parts in accordance with the Manufacturer’s instructions.

C. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

E. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

F. Retain shipping flange protective covers and protective coatings during storage.

G. Protect bearings and couplings against damage.

H. Comply with pump manufacturer's written rigging instructions for handling.

1.8 MANUFACTURERS STANDARD WARRANTY

A. Original Equipment Manufacturer shall provide to the Owner a standard five (5) year prorated limited warranty from date of Project Substantial Completion of pump system against defects in materials and workmanship. Coverage shall include replacement parts, labor, travel expenses, and labor to remove/reinstall equipment per the Manufacturer's limited warranty. Labor charges (i.e., removal or replacement of pumps, and motors) are excluded from this warranty except that manufacturer will be responsible, subject to standard rate limitations, for cost of partial removal, installation, and transportation for a failure occurring within ninety days of authorized and registered start-up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide one of the following pump types:

1. Flygt/Xylem Model- N-3301.820 ("N" Hydraulics Impeller)
   Representative Peter R. Pastore PE
   Vice President, Manager Municipal Group
   G.A. Fleet Associates, Inc.
   Fleet Pump and Service Group, Inc
   55 Calvert Street
   Harrison, NY 10528
   Direct: 914-381-7905
   Cell: 914-490-2280
   fax: 914-835-1331
   ppastore@gafleet.com
   www.gafleet.com

2. HOMA Pump Technology Inc. - Model AKX12610-530/74HL-FM
Representative Mr. Ray Bahr
Cell: 860 986 1072
Blake Equipment
East Windsor, CT

3. Grundfos A/S Model S2.45.A100.1070.8.70H.D.520.G.N.D. (“Smart Trim” Impeller)
Representative Mr. Tim Fortner
Grundfos Water Utility, Inc.
District Sales Manager
Water Utility-Northeast
Mobile 610-297-5412
E-mail: tfortner@grundfos.com

4. Or Equal

2.2 PUMP TYPE

A. Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal non-clog effluent pump as defined in HI 1.1-1.2 and HI 1.3.

2.3 PUMP DESCRIPTION

A. Pump shall be capable of operating in a continuous non-submerged condition in a vertical position in a dry pit pump room installation, permanently connected to inlet and outlet pipes. Pump shall be of submersible construction and will continue to operate satisfactorily should the dry pit be subjected to flooding. An inlet elbow as shown on the drawings with an inspection cover shall be provided.

2.4 PUMP REQUIREMENT

A. Furnish and install two (2) submersible non-clog wastewater pumps. Each pump shall be equipped with a submersible electric motor, connected for operation on 460 volts, 3 phase, 60 hertz, 4 wire service, with sufficient submersible cable suitable for submersible pump applications. Pump power cabling shall be interchangeable between pumps. The power cable shall be sized according to NEC and ICEA standards. Sufficient multi-conductor submersible cable will be used to convey pump monitoring device signals. Multi-conductor shall likewise be interchangeable between pumps.

2.5 PUMP CONSTRUCTION

A. Major pump components shall be of AISI 80-55- 06 ductile iron or ASTM A-48, Class 35B, or Class 40B cast iron with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be constructed from 316 stainless steel. All exposed nuts or bolts shall be of 316 stainless steel construction. All metal surfaces coming into contact with the sewage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump or a two coat high build epoxy finish.

2.6 PUMP VOLUTE

A. The pump volute shall be a single piece construction, non-concentric design with smooth passages of sufficient size to pass five (5) inch minimum solids that may enter the impeller.

2.7 PUMP IMPELLER

A. The impeller shall be gray cast iron Class 35B or better, dynamically balanced, semi-open, multi-vane, back swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction.

B. The impeller vanes shall have screw shaped leading edges that are hardened Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in sewage.

C. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. Clearance shall not require routine adjustment. The clearance may be adjusted if the impeller or insert ring becomes worn.

D. The impeller shall be locked to the shaft or held by a stainless steel impeller bolt and shall be coated with alkyd resin primer. The shaft shall be tapered and keyed to facilitate impeller removal.

E. Acceptable: Flygt “N” Hydraulics impeller; Grundfos “S” impeller, HOMA Multi-Channel impeller, or equal.

2.8 PUMP AND MOTOR SHAFT

A. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. The shaft shall be AISI 329 Stainless Steel. Shaft sleeves or shafts using mechanical couplings shall not be acceptable. The pump shaft shall be completely isolated from the pumped liquid.

2.9 MECHANICAL SEALS

A. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

B. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be accepted. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

C. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two totally independent seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant silicon carbide or tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant silicon carbide or tungsten-carbide seal ring.

D. The following seal types shall not be acceptable: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to affect sealing shall be used. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal.

E. All seal rings shall be individual rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable.

F. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. Any intrusion of fluid shall not come into contact with the lower bearings.

G. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

H. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

I. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

1. Acceptable Alternative: Seal leakage monitored by analog sensor impeded in the oil chamber that details the amount of water in the oil discerning 5% differences.

2.10 BEARINGS

A. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two row angular contact ball bearing. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.

B. The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down.

2.11 PUMP MOTOR

A. The motor and the pump shall be produced by the same manufacturer.

B. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.

C. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled watertight chamber.

D. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%.

E. The motor shall be Premium Efficiency and inverter duty rated in accordance with NEMA MG1, Part 31. Motor efficiency at full load shall be 93% minimum.

F. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable.

G. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum.

H. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the drive control panel.

I. One PT-100 type temperature sensor shall be installed in the stator winding.

J. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded

compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable.

K. A mechanical float switch (FLS) or probe shall be mounted in the junction chamber to signal if there is water intrusion.

L. A pump memory module shall be provided to record pump run time, number of starts as well as contain the motor unit performance and manufacturing data and service history.

M. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

N. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off condition to full run-out.

2.12 SHIELDED PUMP POWER CABLE

A. The pump power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The power cable shall be of a shielded design in which an overall tinned copper shield is included and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

2.13 PUMP PILOT CABLE

A. The pilot cable shall be designed specifically for use with submersible pumps. The cable shall be multi-conductor type with stainless steel braided shielding, a chlorinated polyethylene rubber outer jacket and tinned copper conductors insulated with ethylene-propylene rubber. The conductors shall be arranged in twisted pairs. The cable shall be rated for 600 Volts and 90°C (194°F) with a 40°C (104°F) ambient temperature. The cable length shall be adequate to reach the junction box without the need for splices. The pilot cables shall be interchangeable between each of the two pumps.

2.14 PUMP COOLING SYSTEM

A. Each pump/motor unit shall be provided with an integral cooling system. The motor water jacket shall encircle the stator housing and shall be of cast iron, ASTM A-48, Class 35B, or Type 316 Stainless. The water jacket shall thus provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air. The cooling system shall provide for continuous submerged or completely non-submerged pump operation in liquid or in air having a temperature of up

to 40°C (104°F), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures at levels less than 40°C are not acceptable.

2.15 PUMP PROTECTIVE DEVICES

A. The pump manufacturer shall provide a pump monitoring system that will protect the pump in case of failure, transmit warnings and alarms to operations personnel, and record pump operating data for historical recordkeeping. The monitoring system shall consist of a base unit, operator interface and pump memory module.

B. The Pump Monitor shall have provision to communicate to a higher level control system via MODBUS RS-485 network or Ethernet connection. All sensors located in the pump shall connect to the pump monitor and shall include:

1) Three (3) thermal switches embedded in the stator windings

2) One (1) RTD sensor in the stator windings

3) One (1) RTD sensor on the pump main bearing

4) One (1) moisture leakage sensor in pump stator housing

5) One (1) moisture leakage sensor in pump connection housing

6) One (1) vibration sensor in pump connection housing

7) One (1) RTD sensor on pump support bearing

8) Minimum One (1) RTD sensors in the stator windings

9) One (1) moisture leakage sensor in the pump oil chamber

C. The pump monitor shall include three (3) relay contacts to provide annunciation of warning (NO/NC), annunciation of alarm (NO/NC), and to shut down the pump (NC).

D. The pump monitor shall include a lit display, along with keypad, or touch screen. Pump sensor data shall be viewable on the display. The pump monitor shall indicate presence of warnings and/or alarms. A means of reset shall also be included on the pump monitor.

E. The pump monitoring system shall be capable of providing historical data of pump sensor information and present it in trend-chart format. Upon alarm condition, sensor data shall be preserved as an alarm log.

2.16 ACCESSORIES

A. Pump OEM shall furnish standard base plate, leveling plate and suction nozzle accessories.

PART 3 - EXECUTION

3.1 COMPUTATIONAL FLUID DYNAMICS ANALYSIS

A. The Pump OEM shall submit at time of shop drawing submittal a computational Fluid Dynamics (CFD) analysis of the wet well to ensure that swirl angles entering the pump suction do not exceed HI Standards.

B. As part of the analysis, the OEM shall employ industry acceptable computer modeling methods for modeling the general approach flow in the wet well, as configured and shown on Drawings EP-1.2, EP-3.2 and EP-3.3, at three (3) design flows; including 4.5 MGD, 14.9 MGD and 26 MGD.

C. The analysis shall include a set of .pdf slides demonstrating flow and velocity vectors, as-well-as; a written report certifying and summarizing the analysis raw data. If swirl angles greater than 5 Degrees (as required by HI) are shown to potentially exist, the OEM shall offer recommendations to alter flow patterns to acceptable levels and re-model the wet well to demonstrate acceptable swirl angle levels. These recommendations shall take the form of modifications to internal baffles, benching and anti-vortex prisms. The length, width and depth of the wet well will not be changed.

D. The manufacturer's analysis and report shall thoroughly describe any conditions (e.g., potential formation of swirl, vortices or uneven velocity distributions at the intake) which could lead to undesirable conditions that may potentially overload their motors, reduce their pump efficiencies, cause an unbalanced load on the their impellers or bearings, cause premature wear on rotational parts, or result in cavitation across their impeller.

3.2 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of pumps.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Pump Installation Standards:

1. Comply with HI 1.4 for installation of centrifugal pumps.

B. Offloading is the responsibility of the Contractor. Supervision of installation will be provided by the OEM or representative of the sewage pumping system. Installation shall be done after the foundation is completed, and the level floor of the pump room has been poured, and properly cured. The pumping system will be installed over the foundation

and concrete base topping slab and shall be leveled as necessary as per the Structural Drawings or per the Engineer's Direction.

C. Equipment Mounting: Install submersible sewage pumps on concrete base in accordance with the Structural drawings. Use suction elbow and base plate provided by Pump Manufacturer. Install base plate in accordance with manufacturer's direction. Comply with requirements for concrete base specified in Division 3 Section "Cast-in-Place Concrete."

D. Wiring Method: Comply with requirements in Division 16

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

F. Install equipment tag numbers and/or operating instruction signs permanently attached to equipment or mount on wall adjacent to equipment.

G. Power cable(s) shall be supported with new 316 stainless steel cable grips, detachable from new stainless steel anchorage. Make electrical connections for power to motor and associated electrical devices specified in this Section, and/or shown on the drawings. Refer to Division 16 Sections for electrical power, wiring, and controls.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Sections 11060 Interior Piping and Appurtenances and Section 11070 Interior Valves and Appurtenances

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Make final connection of pumps to their Adjustable Frequency Drives.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for submersible sewage pump marking

B. A permanently-marked, legible, stainless steel nameplate shall be securely attached to the pump or bedplate where it shall be easily visible. The nameplate shall include the following information:

1. Manufacturer's name and address and telephone number;

2. Model or type designation;

3. Serial number

4. Rated capacity;

5. Rated total head;

6. Rated speed;

7. Motor HP, rpm and frame size

8. Maximum power required;

9. Impeller diameter(s);

C. Pumps that are produced at more than one location shall be identified as the product of a particular location.

D. A corrosion resistant metal nameplate bearing the arrow shall be considered acceptable if permanently fastened to the pump body.

E. The model or type identification shall correspond with the manufacturer's catalog designation. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.

F. All markings shall be legible and durable.

3.6 FACTORY ACCEPTANCE TESTING

A. Each pump shall be factory acceptance tested. All tests shall be performed in accordance with the Hydraulic Institute Test Standards for Centrifugal Pumps - 1.6 (Latest Revision). Test data shall be taken as described below. Owner and/or Owner's representative(s) shall witness the test and shall be given sufficient notice of the testing dates. Pump Manufacturer shall pay all costs associated with Owner-witnessed pump testing including costs for mid-week, most-direct-air transportation for 2 people, and 2 motel rooms for 2 mid-week nights for the Owner's representatives. Pump manufacturer will not be responsible for automobile rental or for meals.

B. Manufacturer shall include travel expenses for two persons for 2 days in accordance with this Section.

C. Each pump case shall undergo a certified hydrostatic test at 150% of the pressure developed at shut-off head.

D. As part of the pre-test preparations prior to witness testing:

1. Pump type, size and configuration shall be checked for compliance with customer specifications.

2. Pump motor and power cable insulation shall be tested for moisture content or insulation defects with a mega-ohm meter.

3. Stator winding resistance phase to phase shall be recorded

E. The pump shall be connected to an AFD controller similar to the unit which will operate the pump at the job site

F. The pump shall be run dry briefly (bumped) to establish correct impeller rotation and to record “No Load Amps”.

G. The pump shall be submerged in clear water at ambient temperature and lowered onto a discharge connection in a wet pit

H. The flow shall be measured with a flow meter and transmitter that is annually calibrated in-house in accordance with Hydraulic Institute Standards

I. The discharge pressure shall be measured with a differential pressure transducer calibrated quarterly in house and in accordance with Hydraulic Institute Standards

J. Power input to the pump motor shall be measured using a power meter equipped with potential taps and current transformers. The meter shall be annually calibrated in accordance with Hydraulic Institute Standards by an outside agency.

K. All measuring or monitoring equipment shall be calibrated in accordance with Hydraulic Institute standard ANSI/HI Para 11.6.9.1.2.

L. Each pump shall be started and run at full speed for ten (10) minutes prior to recording any test data.

M. Pump sensors shall be monitored during pump testing

N. Data readings of pump performance (flow, head, and voltage, current and input KW) shall be taken at not less than seven (7) points. These shall include shutoff, specified duty points and run out.

O. At the duty points, the tolerance criteria shall be in accordance with Acceptance Level 1B of the American National Standard for Submersible Pump Tests ANSI/HI 11.6-2001.

P. While testing, the level of submergence over the impeller shall be measured and noted.

Q. Data shall be presented in a certified performance curve showing Total Dynamic Head, Input Power and Overall Efficiency plotted vs. Flow. Curve shall include pump motor data and serial number and shall present tabular values of duty points and acquired data points.

R. Based on the acquired data and published motor efficiencies, Brake Horsepower and Hydraulic Efficiency shall be calculated and plotted vs. flow.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Furnish an OEM approved field service engineer, for on-site inspection, approval, start up and training, for a minimum of three (3) days based on an 8 hour day, Monday through Friday during normal working hours. Coordinate with start-up service provided for wet weather pumps.

3.9 MANUFACTURER’S REPRESENTATIVE

A. The Contractor shall provide the services of the dry weather submersible sewage pump manufacturer’s authorized representative for technical assistance during installation, performing adjustments and correcting deficiencies in the installation, starting up and commissioning equipment, and inspecting and certifying the final installation.

B. Provide the services the manufacturer’s representative for a minimum of two (2) trips and three (3) 8-hour man days at the site for each unit of each component of the dry weather submersible sewage pump system with at least one additional 8-hour day for Owner’s training. Should additional time be required for correcting the installation, it shall be provided by the Contractor at no cost to the Owner.

C. Within twelve (12) months after start-up the manufacturer shall provide one (1) trip and one (1) day (up to 8 hours) of follow-up service and operator training. This shall be exclusive of the start-up service work.

D. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

E. The Contractor shall furnish copies of the manufacturer’s completed inspection checklist, startup report, and installation certification prior to Contract closeout.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain pumps.

END OF SECTION

SECTION 11540B

WET WEATHER SUBMERSIBLE SEWAGE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. As specified in this Section and as shown on the Drawings, the Contractor shall furnish, install, and place into satisfactory operating condition four (4) “wet weather submersible sewage pumps” and accessories, including but not limited to:

1. Four (4) suction elbows

2. Four (4) dedicated control pump monitoring system modules for connection of pump sensors to each module; include at a minimum:

a. 3 motor thermal sensors

b. One motor temperature sensor RTD

c. One main bearing sensor RTD

d. One moisture leakage sensor-motor

e. One vibration sensor in connection housing

f. One support bearing sensor RTD

g. One leakage sensor in oil chamber

B. Pumps shall be constructed under ISO 9001 Quality Control Standards

C. Pumps shall meet or exceed factory and field testing and certification requirements as specified in this Section

D. Pump OEM shall include a Computational Fluid Dynamics analysis based on three pumps running and insure against swirl angles entering the pump suction

1.2 RELATED SECTIONS

A. All of the Contract Documents, including the General Conditions, Special Conditions, General Specifications, Pollution Control and Environmental Protection, Division 1, Technical Specifications and the Exhibits apply to this Section.

B. Section 01650- Starting of Systems

C. Section 03100 Concrete Formwork

D. Section 03200 Concrete Reinforcement

E. Section 03300 Cast In Place Concrete

F. Section 06105 Miscellaneous Rough Carpentry

G. Section 09960 High Performance Coatings

H. Section 11060 Interior Piping and Appurtenances

I. Section 11070 Interior Valves and Appurtenances

J. Section 11540A Dry Weather Submersible Sewage Pumps

K. Section 13420 Instrumentation

L. Section 13460 PLCs

M. Section 13461 SCADA System

N. Section 13465 Sequence of Operation

O. Section 13965 Hydropneumatic Surge Control System

P. Section 16120 Conductors and Cables

Q. Section 16137 Control Cabinets and Enclosures

R. Section 16220 AC Motors

S. Section 16265 AC Adjustable Frequency Drives

T. Section 16420 Reduced Voltage Solid State Motor Starters

1.3 REFERENCES

A. At a minimum, the products and fabrication of the equipment specified herein shall meet the minimum requirements defined by the following agencies:

1. ANSI (American National Standards Institute)

2. ASTM (American Society of Testing and Materials)

3. ISO 9001 (International Organization for Standardization)

4. AFBMA (Antifriction Bearing Manufacturer's Association)

5. Hydraulic Institute (HI)

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Design Conditions

1.	Reference Pump Station System Head Conditions	
2.	365-day, 24 hour average flow, MGD	4.5
3.	Average Monthly Minimum Flow, MGD	1.3
4.	Average Monthly Maximum Flow, MGD	14.9
5.	Average Daily Minimum Flow (Low Instantaneous), MGD	2.6
6.	Average Daily Maximum Flow (High Instantaneous), MGD	7.5
7.	Historical Peak Hour Flow, MGD	26

B. Pump Rated Conditions

1.	Suction, maximum, inches	16
2.	Discharge, maximum, inches	12
3.	Minimum Efficiency at BEP, %	80.6
4.	Total Static Head, feet	28.5
5.	Maximum NPSH Required, feet	28
6.	Maximum Pump Speed, RPM	1,185
7.	Maximum Motor Horsepower, HP	335
8.	Maximum Motor Full Load Amps, A	415
9.	Motor Power Characteristics, Phase/Voltage	3/480
10.	Configuration	3 Duty, 1 Standby

C. Pumps shall operate fully within the Acceptable Operating Range at all times. At no time shall a pump operate less than 50% and greater than 125% of flow at Best Efficiency.

D. Pumps shall operate under two (2) system head conditions, depending on force main conditions. The first operating condition is with two (2) 24-inch Fusible PVC pipes open and available to accept flow. The second operating condition is with one (1) 24-inch FPVC pipe open and available to accept flow.

E. Depending upon system head conditions, with three pumps running, combined pump output would be expected to range between 15.0 MGD and 26.0 MGD.

F. Wet weather pumps must achieve peak hour design flow only under the first system head operating condition (two parallel 24 inch pipes opened)

G. Any deviations, exceptions or exclusions from conditions B-F above shall be clearly indicated in writing for Engineer's review

Francis T. Patnaude Inter-Municipal Pumping Station System Head Curve

Table 1: Flow vs. Head Condition Through Two (2) Parallel FPVC 24 inch Force Mains and One 30 inch Pressure Class 200 DIP Force Main

Flow, MGD	Total Dynamic Head Required, Feet	Pump Discharge Pressure, PSIG
0.0	28.0	12.1
1.0	28.2	12.2
1.5	28.5	12.3
2.0	28.8	12.5
3.0	29.7	12.9
4.0	31.0	13.4
4.5	31.7	13.7
5.0	32.5	14.1
6.0	34.3	14.9
7.0	36.5	15.8
7.5	37.7	16.3
8.0	38.9	16.9
9.0	41.6	18.0
10.0	44.6	19.3
10.5	46.3	20.0
12.0	51.5	22.3
13.5	57.4	24.9
14.0	59.5	25.8
15.0	63.8	27.7
16.0	68.5	29.7
18.0	78.6	34.1
20.0	89.7	38.9
21.0	95.7	41.5
24.0	115.2	49.9
27.0	137.0	59.3
30.0	161.0	69.8

Francis T. Patnaude inter-Municipal Pumping Station System Head Curve		
Table 2: Flow vs. Head Condition Through One (1) FPVC 24 inch Force Mains and One 30 inch Pressure Class 200 DIP Force Main		
Flow, MGD	**Total Dynamic Head Required, Feet**	**Pump Discharge Pressure, PSIG**
0.0	28.0	12.1
1.0	28.4	12.3
1.5	28.8	12.5
2.0	29.4	12.7
2.5	30.1	13.0
3.0	31.0	13.4
4.0	33.1	14.3
4.5	34.3	14.9
5.0	35.7	15.5
6.0	38.9	16.8
7.0	42.5	18.4
7.5	44.6	19.3
8.0	46.7	20.2
9.0	51.3	22.2
10.0	56.5	24.5
10.5	59.2	25.7
12.0	68.1	29.5
12.5	71.3	30.9
13.5	78.1	33.8
14.0	81.6	35.4
15.0	89.1	38.6
16.0	97.0	42.0
17.5	109.7	47.5
18.0	114.1	49.4
20.0	133.0	57.6
21.0	143.1	62.0
22.5	159.1	69.0
24.0	176.1	76.3
25.0	187.9	81.4
27.0	212.9	92.3
30.0	253.6	109.9

1.5 SUBMITTALS

A. Submit each item in this Section according to Division 1 and General Specifications, Section 7, Article 9 “Shop and Working Drawings.”

B. Eight (8) Sets of General Arrangement drawings that illustrate the layout of the equipment, equipment weight, principal dimensions with related verifications required for installation including anchorage locations.

C. Other related data including descriptive literature, Electrical Control Drawings including wiring diagrams, similar to those shown in Contract Drawings, Catalog Cut Sheets for individual components and Drive Motor Data.

D. Computational Fluid Dynamics (CFD) analysis and report with recommendations

E. A list of manufacturer’s recommended Spare Parts including any Special Tools required for routine maintenance of the equipment as specified in Part 2 of this Section.

F. Eight (8) Sets of O & M Manuals including As-Built Drawings of the Mechanically Cleaned Bar Screen Arrangement, Controls and Accessories shall be provided in digital format after equipment ship for inclusion in the Close-Out Submittal process.

G. Contents of Submittals

1. Product Data including rated capacities of selected models and certified performance curves, weights (shipping, installed, and operating), accessories, and controls. Include start-up instructions and factory test reports.

2. Certified shop and erection drawings showing all details of construction, dimensions and anchor bolt sizes and locations. Drawings showing layout and all connections of pumping units, specialty equipment, accessories, controls, and piping. Include Setting Drawings with templates, directions for installing foundation and anchor bolts, and other anchorages.

3. Descriptive literature, bulletins, catalogs and local supplier of the equipment

4. A complete bill of materials including buy out items for all equipment supplied by the manufacturer.

5. Shipping and receiving instructions and rigging instructions

6. Wiring diagrams detailing wiring for power, signal, and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

7. Product certificates signed by manufacturers of pumping units, certifying accuracies under specified operating conditions and that their products comply with specified requirements.

8. Factory witnessed Startup test report.

9. Operations and Maintenance data for pumping units, accessories, and controls specified, to be included in the Operation and Maintenance manual as specified in Division 1.

10. Complete description of surface preparation and shop prime painting for surfaces to be painted.

11. Startup and testing procedures including testing plan.

12. Commissioning Plan to demonstrate that all necessary mechanical, instrumentation and control, and electrical interfaces have been furnished and installed to ensure successful operation prior to commissioning

13. Manufacturer's Field Test Reports

    a. Description of all test procedures and equipment.

    b. Copies of all performance test results

14. Furnish eight (8) copies of a draft version of the O&M Manual. Respond to Owner and Engineer comments and furnish eight (8) final copies of final O&M Manual in 3-ring binders. The instructions shall be prepared specifically for this installation and shall include all required catalog cuts, drawings, equipment lists, and descriptions necessary to instruct operating and maintenance personnel unfamiliar with such equipment. Installation drawings, wiring diagrams, and maintenance requirements shall all be included.

15. Certificates of compliance with American Iron and Steel Act requirements.

16. Manufacturer shall furnish Pump Heat Gain running with three (3) wet weather pumps. The manufacturer shall provide data on the amount of heat generated by each wet weather pump motor that must be dissipated by the Pump Room ventilation system.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended location and application.

B. ISO 9001 factory certified.

C. To ensure unity of responsibility, all pumping units supplied under this Specification shall be of the same manufacturer, and shall be supplied, tested, and warranted by the pump original equipment manufacturer (OEM).

D. The pumping units specified under this section are to be standard sewage pumping equipment manufactured by a company with no less than fifteen (15) years of experience in the manufacture of sewage pumping equipment. Upon request by the engineer, the manufacturer shall provide proof of such experience by providing installation lists, brochures, catalog cuts, etc.

E. Comply with "Hydraulic Institute Standards for Centrifugal, Rotary & Reciprocating Pumps."

F. Comply with Hydraulic Institute Standards for Rotodynamic Pumps for Pump Intake Design, ANSI/HI 9.8-2012

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package spare parts in containers bearing labels clearly designating contents and pieces of equipment for which they are intended. Each box or package shall be properly marked to show its net weight in addition to its contents.

B. Store and safeguard equipment, material, and spare parts in accordance with the Manufacturer’s instructions.

C. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

E. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

F. Retain shipping flange protective covers and protective coatings during storage.

G. Protect bearings and couplings against damage.

H. Comply with pump manufacturer's written rigging instructions for handling.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete pedestals with actual equipment provided.

1.9 MANUFACTURER'S STANDARD WARRANTY

A. Original Equipment Manufacturer shall provide to the Owner a standard five (5) year prorated limited warranty from date of Substantial Completion of pump system against defects in materials and workmanship. Coverage shall include replacement parts, labor, travel expenses, and labor to remove/reinstall said equipment per the Manufacturer's limited warranty. Labor charges (i.e., removal or replacement of pumps, and motors) are excluded from this warranty except that manufacturer will be responsible, subject to standard rate limitations, for cost of partial removal, installation, and transportation for a failure occurring within ninety days of authorized, and registered start-up.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Subject to compliance with requirements, provide one of the following pump types:

1. Flygt/Xylem N-3312 ("N" Hydraulics Impeller)
   Representative Peter R. Pastore PE
   Vice President, Manager Municipal Group
   G.A. Fleet Associates, Inc.
   Fleet Pump and Service Group, Inc
   55 Calvert Street
   Harrison, NY 10528
   Direct: 914-381-7905
   Cell: 914-490-2280
   fax: 914-835-1331
   ppastore@gafleet.com
   www.gafleet.com
2. HOMA Pump Technology Inc. Model
   Representative Mr. Ray Bahr
   Blake Equipment
   East Windsor, CT
   Cell: 860-986-1072
   Ray.bahr@bghusa.com
3. Grundfos A/S Model S3.45.A120.3080.8.74M.D.628.G.N.D ("Smart Trim Impeller")
   Representative Mr. Tim Fortner
   Grundfos Water Utility, Inc
   District Sales Manager
   Water Utility-Northeast
   Mobile 610-297-5412
   E-mail: tfortner@grundfos.com
4. Or Equal

2.2 PUMP TYPE:

A. Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal non-clog effluent pump as defined in HI 1.1-1.2 and HI 1.3.

2.3 PUMP DESCRIPTION:

A. Pump shall be capable of operating in a continuous non-submerged condition in a vertical position in a dry pit pump room installation, permanently connected to inlet and outlet pipes. Pump shall be of submersible construction and will continue to operate satisfactorily should the dry pit be subjected to flooding. An inlet elbow as shown on the drawings with an inspection cover shall be provided.

2.4 PUMP REQUIREMENT:

A. Furnish and install four (4) submersible non-clog wastewater pump(s). Each pump shall be equipped with a submersible electric motor, connected for operation on 460 volts, 3 phase, 60 hertz, 4 wire service, with sufficient submersible cable suitable for submersible pump applications. Pump power cabling shall be interchangeable between pumps. The power cable shall be sized according to NEC and ICEA standards .Sufficient multi-conductor submersible cable will be furnished and used to convey pump monitoring device signals. Multi-conductor shall likewise be interchangeable between pumps.

2.5 PUMP CONSTRUCTION:

A. Major pump components shall be of AISI 80-55- 06 ductile iron or ASTM A-48, Class 35B, or Class 40B cast iron with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of 316 stainless steel. All exposed nuts or bolts shall be of 316 stainless steel construction. All metal surfaces coming into contact with the pumped media other than stainless steel shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump, or a two coat high build epoxy finish.

2.6 PUMP VOLUTE

A. The pump volute shall be a single piece construction, non-concentric design with smooth passages of sufficient size to pass five (5) inch minimum solids that may enter the impeller.

2.7 PUMP IMPELLER

A. The impeller shall be of gray cast iron, Class 35B or better, dynamically balanced, semi-open, multi-vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction.

B. The impeller vanes shall have screw-shaped leading edges that are hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater.

C. The screw shape of the impeller vanes shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. Impeller shall be locked to the shaft, held by an impeller bolt and treated with a corrosion inhibitor.

D. The impeller shall be locked to the shaft or held by a stainless steel impeller bolt and shall be coated with alkyd resin primer. The shaft shall be tapered and keyed to facilitate impeller removal.

E. Acceptable: Flygt "N" Hydraulics impeller; Grundfos "S" impeller; HOMA Multi-Channel impeller, or equal.

2.8 PUMP AND MOTOR SHAFT:

A. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. The shaft shall be AISI 329 Stainless Steel. Shaft sleeves or shafts using mechanical couplings shall not be acceptable. The pump shaft shall be completely isolated from the pumped liquid.

2.9 MECHANICAL SEALS:

A. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Pump/Motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific bolt torque limit.

B. Rectangular cross sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be accepted. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

C. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two totally independent seal sets, each having an independent spring system. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant silicon carbide or tungsten carbide seal ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant silicon carbide or tungsten-carbide seal ring.

D. The following seal types shall not be accepted: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to affect sealing shall be used. The seal springs shall be isolated from the pumped media to prevent materials from packing

around them, limiting their performance. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal.

E. All seal rings shall be individual rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable.

F. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. Any intrusion of fluid shall not come into contact with the lower bearings.

G. The seals shall operate in a lubricant chamber that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication.

H. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

I. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

J. Acceptable Alternative: Seal leakage monitored by analog sensor impeded in the oil chamber that details the amount of water in the oil discerning 5% differences.

2.10 BEARINGS

A. The pump shaft shall rotate on a minimum of three grease-lubricated bearings. The upper bearing shall be insulated to insure against eddy current damage, provided for radial forces, shall be a single roller bearing. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust. The minimum L_{10} bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.

B. The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down.

2.11 PUMP MOTOR

A. The motor and the pump shall be produced by the same manufacturer.

B. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.

C. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber.

D. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%.

E. The motor shall be Premium Efficiency and inverter duty rated in accordance with NEMA MG1, Part 31. Motor efficiency at full load shall be 94% minimum.

F. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.

G. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40°C (104°F) with an 80°C temperature rise and capable of at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum.

H. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. One PT-100 type temperature sensor shall be installed in the stator winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel.

I. One PT-100 type temperature sensor shall be installed in the stator winding.

J. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable.

K. A mechanical float switch (FLS) or probe shall be mounted in the junction chamber to signal if there is water intrusion.

L. A pump memory module shall be provided to record pump run time, number of starts as well as contain the motor unit performance and manufacturing data and service history.

M. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request

showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on motor starting and no-load characteristics.

N. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off condition to full run-out.

2.12 SHIELDED PUMP POWER CABLE:

A. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

2.13 PUMP PILOT CABLE:

A. The pilot cable shall be designed specifically for use with submersible pumps. The cable shall be multi-conductor type with stainless steel braided shielding, a chlorinated polyethylene rubber outer jacket and tinned copper conductors insulated with ethylene-propylene rubber. The conductors shall be arranged in twisted pairs. The cable shall be rated for 600 Volts and 90°C (194°F) with a 40°C (104°F) ambient temperature. The cable length shall be adequate to reach the junction box without the need for splices.

2.14 PUMP COOLING SYSTEM

A. Each pump/motor unit shall be provided with an integral cooling system. The motor water jacket shall encircle the stator housing and shall be of cast iron, ASTM A-48, Class 35B, or Type 316 Stainless. The water jacket shall thus provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air. The cooling system shall provide for continuous submerged or completely non-submerged pump operation in liquid or in air having a temperature of up to 40°C (104°F), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures at levels less than 40°C are not acceptable.

2.15 PUMP PROTECTIVE DEVICES

A. The pump supplier shall provide a pump monitoring system that will protect the pump in case of failure, transmit warnings and alarms to operations personnel, and record pump operating data for historical recordkeeping. The monitoring system shall consist of a base unit, operator interface and pump memory module.

B. The pump monitor shall have provision to communicate to a higher level control system via MODBUS RS-485 network or Ethernet connection. All sensors located in the pump shall connect to the base unit and shall include:

1) Three (3) thermal switches embedded in the stator windings

2) One (1) RTD sensor in the stator windings

3) One (1) RTD sensor on the pump main bearing

4) One (1) moisture leakage sensor in pump stator housing

5) One (1) moisture leakage sensor in pump connection housing

6) One (1) vibration sensor in pump connection housing

7) One (1) RTD sensor on pump support bearing

8) Minimum One (1) RTD sensor in the stator windings

9) One (1) moisture leakage sensor in the pump seal oil chamber

C. The pump monitor shall include three (3) relay contacts to provide annunciation of warning (NO/NC), annunciation of alarm (NO/NC), and to shut down the pump (NC).

D. The pump monitor shall include a lit display, along with keypad, or touch screen. Pump sensor data shall be viewable on the display. The pump monitor shall indicate presence of warnings and/or alarms. A means of reset shall also be included on the pump monitor.

E. The pump monitoring system shall be capable of providing historical data of pump sensor information and present it in trend-char format. Upon alarm condition, sensor data shall be preserved as an alarm log.

2.16 ACCESSORIES

A. Pump OEM shall furnish standard base plate, leveling plate and suction nozzle.

PART 3 - EXECUTION

3.1 COMPUTATIONAL FLUID DYNAMICS ANALYSIS

A. The Pump OEM shall submit at time of shop drawing submittal a computational Fluid Dynamics (CFD) analysis of the wet well to ensure that swirl angles entering the pump suction do not exceed HI Standards.

B. As part of the analysis, the OEM shall employ industry acceptable computer modeling methods for modeling the general approach flow in the wet well, as configured and shown on Drawings EP-1.2, EP-3.2 and EP-3.3, at three (3) design flows; including 4.5 MGD, 14.9 MGD and 26 MGD

C. The analysis shall include a set of .pdf slides demonstrating flow and velocity vectors, as-well-as; a written report certifying and summarizing the analysis raw data. If swirl angles greater than 5 Degrees (as required by HI) are shown to potentially exist, the OEM shall offer recommendations to alter flow patterns to acceptable levels and re-model the wet well to demonstrate acceptable swirl angle levels. These recommendations shall take the form of modifications to internal baffles, benching and anti-vortex prisms. The length, width and depth of the wet well will not be changed.

D. The manufacturer’s analysis and report shall thoroughly describe any conditions (e.g., potential formation of swirl, vortices or uneven velocity distributions at the intake) which could lead to undesirable conditions that may potentially overload their motors, reduce their pump efficiencies, cause an unbalanced load on the their impellers or bearings, cause premature wear on rotational parts, or result in cavitation across their impeller.

3.2 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of pumps.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Pump Installation Standards:

1. Comply with HI 1.4 for installation of centrifugal pumps.

B. Offloading is the responsibility of the Owner. Supervision of installation will be provided by the OEM or representative of the sewage pumping system. Installation shall be done after the foundation is completed, and the level floor of the pump room has been poured, and properly cured. The pumping system will be installed over the foundation and concrete base topping slab and shall be leveled as necessary as per the Structural Drawings or per the Engineer’s Direction.

C. Equipment Mounting: Install submersible sewage pumps on concrete base in accordance with the Structural drawings. Install suction elbow and base plate provided by Pump Manufacturer in accordance with Manufacturer’s directions. Comply with requirements for concrete base specified in Division 3 Section "Cast-in-Place Concrete."

D. Wiring Method: Comply with requirements in Division 16

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

F. Install equipment tag numbers and/or operating instruction signs permanently attached to equipment or mount on wall adjacent to equipment.

G. Power cable(s) shall be supported with new 316 stainless steel cable grips, detachable from new stainless steel anchorage. Make electrical connections for power to motor and associated electrical devices specified in this Section, and/or shown on the drawings. Refer to Division 16 Sections for electrical power, wiring, and controls.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Sections 11060 Interior Piping and Appurtenances and Section 11070 Interior Valves and Appurtenances

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Make final connection of pumps to their Adjustable Frequency Drives.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for submersible sewage pump marking

B. A permanently-marked, legible, stainless steel nameplate shall be securely attached to the pump or bedplate where it shall be easily visible. The nameplate shall include the following information:

1. Manufacturer’s name and address and telephone number;

2. Model or type designation;

3. Serial number

4. Rated capacity;

5. Rated total head;

6. Rated speed;

7. Motor HP, rpm and frame size

8. Maximum power required;

9. Impeller diameter(s);

C. Pumps that are produced at more than one location shall be identified as the product of a particular location.

D. A corrosion resistant metal nameplate bearing the arrow shall be considered acceptable if permanently fastened to the pump body.

E. The model or type identification shall correspond with the manufacturer’s catalog designation. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.

F. All markings shall be legible and durable.

3.6 FACTORY ACCEPTANCE TESTING

A. Each pump shall be factory acceptance tested. All tests shall be performed in accordance with the Hydraulic Institute Test Standards for Centrifugal Pumps - 1.6 (Latest Revision). Test data shall be taken as described below. Owner and/or Owner's representative(s) shall witness the test and shall be given sufficient notice of the testing dates. Pump Manufacturer shall pay all costs associated with Owner-witnessed pump testing including costs for mid-week, most-direct-air transportation for 2 people, and 2 motel rooms for 2 mid-week nights for the Owner's representatives. Pump manufacturer will not be responsible for automobile rental or for meals.

B. Manufacturer shall include travel expenses for two persons for 2 days in accordance with this Section.

C. Each pump case shall undergo a certified hydrostatic test at 150% of the pressure developed at shut-off head.

D. As part of the pre-test preparations prior to witness testing:

1. Pump type, size and configuration shall be checked for compliance with customer specifications.

2. Pump motor and power cable insulation shall be tested for moisture content or insulation defects with a mega-ohm meter.

3. Stator winding resistance phase to phase shall be recorded

E. The pump shall be connected to an AFD controller similar to the unit which will operate the pump at the job site

F. The pump shall be run dry briefly (bumped) to establish correct impeller rotation and to record "No Load Amps".

G. The pump shall be submerged in clear water at ambient temperature and lowered onto a discharge connection in a wet pit

H. The flow shall be measured with a flow meter and transmitter that is annually calibrated in-house in accordance with Hydraulic Institute Standards

I. The discharge pressure shall be measured with a differential pressure transducer calibrated quarterly in house and in accordance with Hydraulic Institute Standards

J. Power input to the pump motor shall be measured using a power meter equipped with potential taps and current transformers. The meter shall be annually calibrated in accordance with Hydraulic Institute Standards by an outside agency.

K. All measuring or monitoring equipment shall be calibrated in accordance with Hydraulic Institute standard ANSI/HI Para 11.6.9.1.2.

L. Each pump shall be started and run at full speed for ten (10) minutes prior to recording any test data.

M. Pump sensors shall be monitored during pump testing

N. Data readings of pump performance (flow, head, and voltage, current and input KW) shall be taken at not less than seven (7) points. These shall include shutoff, specified duty points and run out.

O. At the duty points, the tolerance criteria shall be in accordance with Acceptance Level 1B of the American National Standard for Submersible Pump Tests ANSI/HI 11.6-2001.

P. While testing, the level of submergence over the impeller shall be measured and noted.

Q. Data shall be presented in a certified performance curve showing Total Dynamic Head, Input Power and Overall Efficiency plotted vs. Flow. Curve shall include pump motor data and serial number and shall present tabular values of duty points and acquired data points.

R. Based on the acquired data and published motor efficiencies, Brake Horsepower and Hydraulic Efficiency shall be calculated and plotted vs. flow.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Furnish an OEM approved field service engineer, for on-site inspection, approval, start up and training, for a minimum of three (3) days based on an 8 hour day, Monday through Friday during normal working hours. Coordinate with start-up service provided for wet weather pumps.

3.9 MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of the wet weather submersible sewage pump manufacturer's authorized representative for technical assistance during installation, performing adjustments and correcting deficiencies in the installation, starting up and commissioning equipment, and inspecting and certifying the final installation.

B. Provide the services the manufacturer's representative for a minimum of two (2) trips and three (3) 8-hour man days at the site for each unit of each component of the wet weather submersible sewage pump system with at least one additional 8-hour day for Owner's training. Should additional time be required for correcting the installation, it shall be provided by the Contractor at no cost to the Owner.

A. Within twelve (12) months after start-up the manufacturer shall provide one (1) trip and one (1) day (up to 8 hours) of follow-up service and operator training. This shall be exclusive of the start-up service work.

C. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

D. The Contractor shall furnish copies of the manufacturer's completed inspection checklist, startup report, and installation certification prior to Contract closeout.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain pumps.

END OF SECTION

SECTION 14600

HOISTS AND CRANES

PART 1 - GENERAL

1.01 REFERENCES

A. AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. ANSI MH 27.1, Specifications for Underhung Cranes and Monorail Systems.

C. ANSI B30.16 Safety Standard for Overhead Hoists (Underhung).

D. ANSI B30.11 Safety Standards for Monorails and Underhung Cranes.

E. ASME HST-1M, Performance Standard for Overhead Electric Chain Hoists.

F. ASME HST-4M, Performance Standard for Overhead Electric Wire Rope Hoists.

G. ASME NOG-1, Rules for Construction of Overhead and Gantry Cranes.

H. AWS D1.1, Code for Welding in Building Construction.

I. AWS D14.1, Specifications for Welding Industrial and Mill Cranes

J. Hoist Manufacturer’s Institute Standard Specification for Electric Wire Rope Hoists.

K. ANSI/NFPA 70 National Electric Code, Article 610, Cranes and Hoists.

L. OSHA 29 CFR 1910.179, Overhead and Gantry Cranes.

1.02 SYSTEM DESCRIPTION

A. Hoist and Crane System: Furnish all necessary engineering, design, supervision, labor, materials and equipment required to provide underhung monorail crane system with 2-part, double reeved, 3/8” diameter rope, single-speed motorized hoist. Provide track capable of spanning between building girder support points noted on the drawings, connections to building steel girder supports, fittings, track suspension, track

electrification, motorized trolley with wire rope and lifting hook, and motorized trolley controls as necessary for a complete installation.

1.03 DESIGN REQUIREMENTS

A. System Capacity: (5) Tons.

B. Crane, carrier, and hoist equipment shall be designed for Class C – moderate service. Operation shall be in normal ambient temperatures (0° to 40° C) and normal indoor conditions, free from excessive dust and moisture.

C. Crane shall be motor propelled, single girder with a minimum span of 31 feet.

E. Hoist shall be suspended from a motor driven trolley and have a minimum lifting speed of 15 feet per minute.

F. Hoist, trolley, and crane shall be controlled by a pushbutton control pendant suspended 4’-0” above floor.

G. Runway track shall be supported by and bolted directly to steel girders where indicated on the drawings. Connections to the girders shall be provided by the Crane manufacturer.

1.04 SUBMITTALS

A. Submittals Package: Refer to Section 01300 for project requirements. Submit shop drawings, product data, and quality control submittals specified below at the same time as a single submittal package.

B. Shop Drawings:
1. Show the construction details of the hoist and crane system and the crane support structure.
2. Show the electric wiring and control system.
3. Show installation details & connections to building superstructure.

C. Product Data:
1. Catalog sheets, specifications, and installation instructions.
2. Bill of materials.
3. Name, address, and telephone number of nearest fully equipped service organization.

D. Quality Control Submittals:
1. Design data, including safety factor of materials.
2. Test report of hoist and crane system.

3. Certificate required under Quality Assurance.

E. Contract Closeout Submittals:
1. Operation and maintenance data.
2. Warranty.
3. Test reports of the completed hoist and crane system.

1.05 QUALITY ASSURANCE

A. Required: A written warranty in approved form, submitted in compliance with related requirements of General Conditions, as a condition precedent to final acceptance, warranting the work of this Section against defective materials and workmanship for a period of one year after date of acceptance.

B. The manufacturer and erector shall demonstrate a minimum of five (5) years of experience with hoist and crane systems.

C. The Contractor shall employ currently qualified welding process and welding operators in accordance with AWS Structural Welding Code and shall provide certification that welders to be employed in the Work have satisfactorily passed AWS qualification tests.

D. Company Field Advisor: A company field advisor from the manufacturer/erector shall provide the following:
1. Render advice regarding installation of the hoist and crane system.
2. Clearly label crane with rated load capacity with label visible from floor level and loading position.
2. Witness final system test (OSHA Load Test Certification) and then provide with an affidavit that the hoist and crane system is installed in accordance with the contract requirements and is operating properly.

PART 2 - PRODUCTS

2.01 HOIST AND CRANE SYSTEMS

A. Hoist: Electric wire rope hoist as manufactured by American Monorail, Spanmaster, or Wright with all parts and accessories necessary to install on bridge crane and meeting the following requirements:
1. Maximum lifting capacity of 5 tons.
2. Vertical Impact: the impact allowance shall be 1/2% of the rated load for each “foot per minute” of the hoisting speed with a minimum allowance of 15% and a maximum of 50%.
3. Minimum lifting speed 15 feet per minute.

4. Trolleys: Trolley assemblies shall be articulating type such that the articulated connection shall permit rotational movement in all three axes. Attach load bars to yokes in such manner as to assume that all wheels are in contact with the operating flange at all times.
    a. Yokes shall be ductile castings, forgings or steel fabrications and shall be fixture machined.
    b. Trolley wheels shall be made from high-strength forged or machined steel, 5" minimum thread diameter. The wheel thread shall be accurately machined to assure concentricity of axle and thread, and hardened to 425 Brinell. Wheels are to be furnished with electro-plate finish, black oxide, or equal treatment, in lieu of paint.
    c. Wheel bearing shall be double row precision ball or taper roller bearings, lubricated and permanently sealed at assembly. Bearings must have a minimum B-10 life of 5,000 hours.
    d. Drop Lugs: Included on both sides of trolley to limit trolley in the event of wheel, axle, or load bar failure.
5. Motor driven trolley with travel speed of 35 feet per minute.
6. Festoon system for control cable.
7. Friction clutch assembly on hoist to prevent overloading.
8. Dual braking system.
9. Upper and lower limit switches.
10. Hook with safety latch. Hook shall be mounted to swivel on thrust bearing.

B. Crane: Underhung, motor driven, single girder crane as manufactured by American Monorail, Spanmaster, or Wright with track, suspension system and all parts necessary to meet the following requirements:
1. Rating of Service “Class C” as specified in ANSI MH 27.1.
2. Vertical impact: the impact allowance shall be 1/2% of the rated load for each “foot per minute” of the hoisting speed with a minimum allowance of 15% and a maximum of 50%.
3. Track and Fittings:
    a. Track size based on the load positioned on the track system to produce the most severe conditions of stress and deflection.
    b. The total track deflection shall not exceed 1/450 of the span or 1-3/4 inch, whichever is the least.
    c. Track sections shall be installed with bolted type splice plates to provide flush and level connections at the operating tread of the track. The maximum gap between the adjacent ends of the load carrying flange not to exceed 1/16 inch.

d. Rigid track support shall be accomplished by bolting the runway track to the supporting structure. Provide connection details as part of shop drawing submittal.

e. Track Suspension: All necessary clamps, hanger rods, bolts, and other fittings from which the track system is suspended shall be provided as a part of the overhead track system. Track hanger supports shall be spaced as shown on the Drawings.

4. Electrification:

a. Track electrification shall be accomplished by UL approved conductor bar rated 90A continuous. Insulation cover shall be rigid orange PVC, self-extinguishing, with an operating temperature of 150° F.

b. Conductors shall be complete with mounting clips, end caps, splices with covers, and power feeds.

c. Current collectors shall be sliding shoe type, spring loaded, and designed so that sparking and loss of contact shall be minimized.

d. Separate conductors shall be provided for each phase. More than one conductor in a single enclosure will not be permitted.

e. All controls shall be housed in a single NEMA 12 panel.

f. A fused, manual disconnect switch with a lockable handle mounted through the panel door shall be provided and wired into the incoming power circuit.

g. All motors equipped with magnetic contactors operated with ON-OFF push button station pendant suspended 4'-0" above the floor, from the hoist trolley unit.

h. All electrical equipment shall meet NEMA 1 requirements.

i. Crane operation: 480 volt, 3 phase, 60 hertz.

j. Control circuits: Maximum 120 volts.

5. Interlocks (if applicable):

a. The interlock mechanism shall be manually operated, cross-connected, double locking pin type so designed that they will not operate until the crane is in proper alignment with the connecting crossover or spur rail.

b. Equip crane with a crane travel lockout limit switch to prevent bridge travel motion while in the latched position with the crossover or spur rail.

6. Single Girder Cranes: Single girder motor driven cranes with single spans of 40 feet or more, must have rigid outrigger beam mounted parallel to the crane girder running the entire span of the crane.

7. End Stops: Track end stops shall be of the bolted type and shall be capable of withstanding the impact of a fully loaded crane or carrier traveling at 50% of the full load speed.

8. Brakes:
    a. Hoisting Brakes: In accordance with Hoist Manufacturers Institute specifications and ANSI B30.16 Safety Standards for Overhead Hoists (Underhung).
    b. Brakes supplied for carrier and crane travel shall conform with ANSI B30.11 Safety Standards.
9. Miscellaneous:
    a. Paint: Crane manufacturer's standard paint system. Color shall be selected by the Owner from the manufacturer's standard color selection.
    b. Letter the crane rated capacity on the bridge rail and on the control box.
    c. Electrical Equipment: Comply with the provisions of ANSI/NFPA 70 National Electrical Code, Article 610, for wiring and equipment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the Work in this Section in accordance with the manufacturer's printed instructions, shop drawings, and directions of the Company Field Advisor.
B. Ceiling mounted workstation design varies from system to system. Positioning of support brackets or hangers may vary with building structural arrangement as well as with track profile.
C. Units and accessories should be installed in accordance with manufacturer's instructions and shop drawings.
D. Do not modify crane components without manufacturer's approval.
E. Clearances for moving crane components:
    a. Minimum vertical clearance: Three inches (76 mm) from any overhead obstruction.
    b. Minimum horizontal clearance: Two inches (51 mm) from any lateral obstruction.
    c. Prior to applying proper torque to the bolts, ensure monorail track is:
    d. Level to within (plus or minus) 1/8 inch in 20 feet (3 mm in 6.1 m).
F. Monorail Installation
    a. Establish where system is to be installed. Bolt proper mounting support brackets or hangers to the ceiling beams. Raise the track section and attach it to the brackets or hangers with appropriate fasteners. Monorail should extend between 4.5 inches and 12 inches beyond last support at either end for plain track or up to 48 inches for trussed track. Festoon storage may extend beyond last support.

G. Splice Installation
    a. For systems with more than one section of track, additional section is installed in the same manner—with the addition of splice joint assembly.
    b. Plain Track: Splice joints should be within 12 inches of a support bracket or hanger.
    c. Reinforced Track: Splice joints should be within 48 inches of a support bracket or hanger.
    d. Adjust side setscrews so that track slots are aligned and there is a smooth transition from section to section. Tighten top setscrews then side setscrews for correct track alignment.
    e. Trussed track splice joints also include two splice plates and four 1/2-inch bolts with nuts and lock washers. Install splice plates to connect ends of truss tubes with the four through-bolts provided. Torque bolts to 50 foot-pounds.
    f. When end stop hole in track aligns with sleeve setscrew, move sleeve approximately 1/4 an inch to either side of end stop hole.

H. Monorail End Stop Installation
    a. Secure end stop assemblies, end stop bolts, and lock nuts at both ends of monorail, except for end of festoon storage area, where applicable.

I. Festoon Track Extension Installation
    a. Install festoon trolleys and cable in monorail. Use the following trolley spacing:
    b. Bridges……18-inch loops, approximately
    c. Monorails……36-inch loops, approximately
    d. Place festoon track extension on end of Monorail as close as possible to power junction box. Align festoon track extension prior to tightening bolts. Adjust bolts in side of festoon track extension to ensure alignment of bottom flanges of track. Clamp festoon track extension firmly into a straight level position prior to tightening top of extension. Check to ensure all surfaces of track ends and festoon track extension are in contact.
    e. Use end stop supplied with system, and install according to installation instructions in end of festoon track extension.
    f. All end stop bolts must have rubber bumper to ensure festoon trolleys remain in track.
    g. Ensure all end stop warning labels are in place.
    h. Install festoon end clamp to secure festoon cable at end of festoon track extension.
    i. Ensure trolleys slide across Monorail and festoon track extension joint smoothly.
    j. Ensure all trolleys stack properly in festoon track extension area, clear through bolts, and contact end stop.

J. Monorail Festoon Installation

a. Install festoon trolleys into storage area of monorail track if system includes festooning.
b. Secure end stop bolts and rubber bumpers. Locate and secure festoon end clamps. Install festoon cable on festoon trolleys at equal spacing, approximately six feet, seven inches apart for 36-inch loops.

K. Hoist Trolley and Monorail Festoon Installation
a. Install hoist trolley and festoon trolleys on track. Secure end stop bolts and rubber bumpers.
b. To prevent personal injury or death DO NOT operate crane without end stop through bolts securely in place.
c. Once installation is completed, the track should be leveled. Install lateral and longitudinal sway bracing. The total system should be checked for tightness of all nuts and bolts.

L. Hoist Installation
a. Attach hoist to the hoist trolley. Use washers on hoist mounting pin to center hoist inside hoist trolley. Reinstall washers on outside of hoist trolley (both sides) before installing or reinstalling cotter pins to secure hoist-mounting pin. Replace cotter pin(s) if worn or broken. Bend cotter pin around mounting pin.
b. Do not operate hoist or crane if cotter pins are not in place and properly bent over on both sides of hoist trolley. Check regularly that cotter pins are in place and securing hoist on hoist trolley.

3.02 FIELD QUALITY CONTROL

A. Inspection
a. Verify all bolts are tight and lock washers fully compressed.

B. Field Test
a. Ensure crane operates properly (movement is smooth and consistent).
b. Verify motorized operation and controls function properly.
c. Make adjustments as needed, and correct inadequacies.

C. Acceptance Test
a. After the enclosed track crane system has been installed, OSHA requires an acceptance test before operating and after any modifications. An authorized dealer or installer should perform the test.

D. Maintenance
a. A system inspection should be performed 30 days after installation. All nuts, bolts, and screws should be checked for tightness. All end stops, cotter pins, and hoist trolleys should be checked for abnormal wear or breakage. Check track splices for alignment, and verify that end trucks and festoon trolleys travel smoothly through joints. Check that festoon cables and/ or hoses are securely clamped to festoon trolleys and end clamps.

b. A complete inspection of all fasteners and connections should be performed annually or every two thousand (2,000) hours. Heavy conditions of use may require more frequent inspections.
c. Operators should visually inspect the system before each use to note any unusual or abnormal system operations.

E. Clean Surfaces
   a. Touch up scratches and blemishes with matching paint from manufacturer.
   b. Keep surfaces clean and clear of build-up and residue.

F. Protect Crane
   a. Protect installed products until completion of project.
   b. Touch up, repair, or replace damaged products before substantial completion.

END OF SECTION