Bank Street Drainage Project
Project Manual

City of New London
New London, Connecticut

March 2016

FUSS & O'NEILL

146 Hartford Road
Manchester, CT 06040

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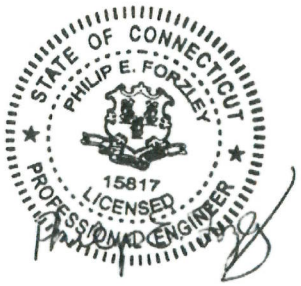
STORM DRAINAGE



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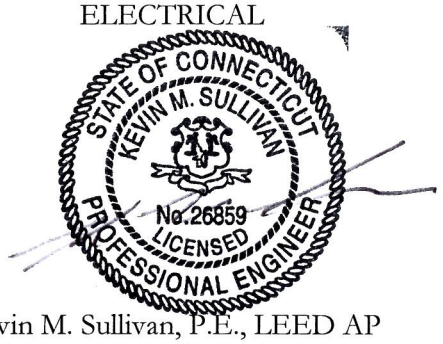

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BID FORM

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Office of the Finance Director

City of New London

181 State Street

New London, CT 06320

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

Addendum No.	Addendum, Date

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

K. The Bidder is required to complete within the bid pricing submitted all work depicted on the project plans and as described in the bid specifications. Compensation for any portion of the Work described within this contract not specifically identified as a pay item within the Bid Form, Bid Pricing Sheet, or Schedule of Values is understood to be included in the price for other items, unless specified in the Special Provisions as extra work. Work shown or described which does not have a specific pay items associated with it shall be included in the most applicable pay item provided in the bid. No additional compensation is allowed for additional shifts or premium pay necessary to ensure that the Work is completed within the time limits specified in the Contract.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the e execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

A. See attached Bid Schedule, Section 00411 for list of itemized Unit Prices

B. Unit Prices are subject to Paragraph 13.03 of the General Conditions.

C. Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. List of Project References;

E. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;

F. Contractor's License No.: _____

G. Required Bidder Qualification Statement with supporting data; and

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

_____

By:
[Signature] _____

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

_____

_____

_____

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

_____

Bidder's License No.: _____
(where applicable)

BID SCHEDULE

Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
01 55 05	**Maintenance and Protection of Traffic** at the Lump Sum Price of _____ Dollars and _____ Cents ($)	LS	1	$ _____
01 55 05.1	**City Road Traffic Control - Police Officer w/Car** at the per Hourly Price of _____ Dollars and _____ Cents ($)	HR	200	$ _____
01 55 05.2	**Town Road Traffic Control - Certified Flaggers** at the per Hourly Price of _____ Dollars and _____ Cents ($)	HR	620	$ _____
01 57 13	**Temporary Erosion and Sediment Control** at the Lump Sum Price of _____ Dollars and _____ Cents ($)	LS	1	$ _____
02 41 19.1	**Selective Demolition of Pumping Station Doors and Equipment** at the per Lump Sum price of _____ Dollars and _____ Cents ($)	LS	1	$ _____

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
02 41 19.2	**Selective Demolition of Storm Drainage Pipe** at the per Lump Sum price of	LS	1	
	_____ Dollars			$ _____
	and _____ Cents ($)			
09 01 91.1	**Repainting Structural Steel** at the per Lump Sum price of	LS	1	
	_____ Dollars			$ _____
	and _____ Cents ($)			
31 10 00	**Site Clearing** at the per Lump Sum price of	LS	1	
	_____ Dollars			$ _____
	and _____ Cents ($)			
31 20 00	**Earth Excavation** at the Square Yard Price of	SY	600	
	_____ Dollars			$ _____
	and _____ Cents ($)			
31 20 00.1	**Test Pits** at the per Each Price of	EA	50	
	_____ Dollars			$ _____
	and _____ Cents ($)			
32 12 16	**Asphalt Paving** at the Square Yard Price of	SY	1015	
	_____ Dollars			$ _____
	and _____ Cents ($)			

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
32 14 00	**Unit Paving** at the Square Yard Price of _____ Dollars and _____ Cents ($)	SY	30	$ _____
32 16 13	**Concrete Paving** at the Square Yard Price of _____ Dollars and _____ Cents ($)	SY	335	$ _____
32 16 14	**Reset Curbing** at the linear foot price of _____ Dollars and _____ Cents ($)	LF	315	$ _____
32 16 14.1	**Granite Curb** at the linear foot price of _____ Dollars and _____ Cents ($)	LF	100	$ _____
32 92 00	**Turfs And Grasses** at the Square Yard price of _____ Dollars and _____ Cents ($)	SY	50	11 $ _____
33 41 00.1	**Type 'C' Catch Basin Double Grate Type 1** at the each price of _____ Dollars and _____ Cents ($)	EA	11	$ _____

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
33 41 00.2	**Type 'C' Catch Basin Type 1** at the each price of _____Dollars and _____ Cents ($)	EA	1	$ _____
33 41 00.3	**Type II double catch basin with a conversion slab** at the each price of _____Dollars and _____ Cents ($)	EA	1	$ _____
33 41 00.4	**Type 'C-L' Catch Basin Double Grate Type 1** at the each price of _____Dollars and _____ Cents ($)	EA	6	$ _____
33 41 00.5	**Storm Manhole 6' Diameter** at the each price of _____Dollars and _____ Cents ($)	EA	1	$ _____
33 41 00.6	**Storm Manhole 7' Diameter** at the each price of _____Dollars and _____ Cents ($)	EA	5	$ _____
33 41 00.7	**12" R.C. Pipe** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	40	$ _____

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
33 41 00.8	**15" R.C. Pipe** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	40	$ _____
33 41 00.9	**18" R.C. Pipe** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	44	$ _____
33 41 00.10	**24" R.C. Pipe** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	125	$ _____
33 41 00.11	**42" R.C. Pipe** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	236	$ _____
33 41 00.12	**54" R.C. Pipe** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	48	$ _____
33 41 00.13	**34" x 53" Conc. Elliptical Piping** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	20	$ _____

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
33 41 0.14	**24" HDPE** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	27	$ _____
33 41 0.15	**30" HDPE** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	137	$ _____
33 41 00.16	**36" HDPE** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	24	$ _____
33 41 00.17	**42" HDPE** at the linear foot price of _____"Dollars and _____ Cents ($)	LF	250	$ _____
33 42 16.13.01	**Precast Box Culvert (4' x 5')** at the Linear Foot Price of _____Dollars and _____ Cents ($)	LF	50	$ _____
33 42 16.13.02	**Precast Storm Vault (8' x 8')** at the Each Price of _____Dollars and _____ Cents ($)	EA	2	$ _____

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
33 45 01.1	**Automatic Overhead Door and Hardware** at the each price of _____ Dollars and _____ Cents ($)	EA	3	$ _____
33 45 01.3	**66" x 66" Sluice Gate Electronic Valve Indicators** at the per Each Price of _____ Dollars and _____ Cents ($)	EA	2	$ _____
33 45 01.4	**78" x 78" Sluice Gate Electronic Valve Indicator** at the per Each Price of _____ Dollars and _____ Cents ($)	EA	1	$ _____
33 45 01.5	**36-inch Flanged-End Check Valve Assembly** at the per Each Price of _____ Dollars and _____ Cents ($)	EA	3	$ _____
33 45 01.6	**36-inch Restrained Flange Adapters** at the per Each Price of _____ Dollars and _____ Cents ($)	EA	3	$ _____
33 45 01.7	**S.S. C-Channel Shrouds, Fasteners and Support (Grease Line)** at the Linear Foot Price of _____ Dollars and _____ Cents ($)	LF	50	$ _____

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
33 45 01.8	**S.S. C-Channel Support, Fasteners (gear box oiler cooler)** at the Linear Foot Price of _____ Dollars and _____ Cents ($)	LF	70	$ _____
33 45 03.1	**Sump Pump and Appurtenances** at the per Lump Sum price of _____ Dollars and _____ Cents ($)	LS	1	$ _____
40 90 01.1	**Electrical & Controls** at the per Lump Sum price of _____ Dollars and _____ Cents ($)	LS	1	$ _____
Allowance No.1	**Unsatisfactory Soil Excavation** at the per Allowance Price of _____ Dollars and _____ Cents ($)	CY	2000	$ _____
Allowance No.2	**Rock Excavation** at the per Allowance Price of _____ Dollars and _____ Cents ($)	CY	1000	$ _____

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
Allowance No.3	**66" x 66" Sluice Gate Electric Actuator Evaluation, Repair/Replacement** at the per Allowance Price of	AL	1	
	Forty thousand Dollars			$ 40,000.00
	and _____ Cents ($)			
Allowance No.4	**Utility Location, Coordination and Relocation** at the per Allowance Price of	AL	1	
	One Hundred thousand Dollars			$ 100,000.00
	and zero Cents ($)			
Allowance No.5	**Testing & Inspection** at the per Allowance Price of	AL	1	
	One thousand Dollars			$ 1,000.00
	and zero Cents ($)			
Allowance No.6	**Electric Allowance** at the per Allowance Price of	AL	1	
	Fifteen thousand Dollars			$ 15,000.00
	and zero Cents ($)			
Allowance No.7	**Dewatering** at the per Allowance Price of	AL	1	
	Fifty thousand Dollars			$ 50,000.00
	and _____ Cents ($)			

BASE BID

Item No.	Item and Unit Price		Engineer's Estimate of Quantity	Computed Total
Allowance No.8	**Controlled Low Strength Material** at the Cubic Yard Price of	CY	30	
	_____ Dollars			$ _____
	and _____ Cents ($)			

TOTAL BASE BID $ _____

END OF BID SCHEDULE

SECTION 01 10 00 – SUMMARY

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Work Covered By Contract Documents

A. Project Identification: Project includes upgrades to the Shaw's Cove Pumping Station and controls system.

1. Project Locations:

a. Bank Street Drainage Improvements
(Bank Street, Blinman Street and Reed Street)

b. Shaw's Cove Pumping Station

1) Southward off Bank Street (see Contract Drawings - Sheet EI-101)

2. Owner: City of New London.

B. Engineer Identification: The Contract Documents, dated March 2016, were prepared for the Project by Fuss & O'Neill, Inc. 146 Hartford Road, Manchester, CT 06040.

C. Project Director:

1. The Owner's Representative is:

XXXXXX

2. The Engineer is:
Fuss & O'Neill, Inc.
146 Hartford Road
Manchester, CT 06040
(860) 646-2469, ext. 5219

D. Bank Street & Lower Blinman Street Drainage Improvements Phase 1: Work includes the following.

1. The design of the Bank Street Drainage Project has 3 separate components:.

a. Component 1: Gravity storm drainage system designed to intercept stormwater gutter flow in Reed Street and Blinman Street and route it directly to the 72-inch trunk line in Bank Street. The design includes providing approximately 560 LF of piping, 11 double catch basins, and 4 manholes within Reed Street, Blinman Street, and Bank Street and connecting the new drainage system into the existing 72-inch trunk in Bank Street.

b. Component 2: Improvements to a low-lying area on Blinman Street where stormwater ponds during storm events. While there is an existing storm drainage system in place, it is inadequate to effectively convey the runoff from most storm events. The improvements include replacing 2 single catch basins with double catch basins, replacing a catch basin/storm vault with a double catch basin, adding a new double catch basin, and upsizing storm piping.

c. Component 3: Improvements to Bank Street storm drainage system. Four single catch basins will be replaced with double catch basins and existing storm piping will be replaced with larger diameter pipes to better convey runoff to the existing 72-inch trunk line in Bank Street.

E. Level Control for the Blinman Street Catch Basin: Work includes the following.

1. Provide power, communications and a float system to be installed in a new storm drainage manhole at Blinman Street. This float system will be integrated into the sequence of operations for the Shaw's Cove Pumping Station located off Bank Street. Work under this portion of the project will include but not be limited to providing an electrical panel with power and telemetry, trenching and conduit installation and coordination with Eversource utility, and secure all permits necessary.

2. Sequence of Work: See Specification Section

F. Pumping Station Improvements Phase 1: Work includes the following

1. Repair or replace existing Limitorque electric actuator for 66" x 66" Sluice Gate #1

   a. Work consists of isolation, disassembly and removal and replacement of existing Limitorque indicators.

2. Replace existing Limitorque indicators for 66" x 66" Sluice Gate #2 and #3

   a. Work consists of isolation, disassembly and removal and replacement of existing Limitorque indicators.

3. Replace existing Limitorque indicator for 78" x 78" Sluice Gate

   a. Work consists of isolation, disassembly and removal and replacement of existing Limitorque electric actuator.

4. Replace sump pump

   a. Work consists of furnishing and installation of new sump pump and connection to existing 3-inch PVC discharge pipe, providing ball valve and appurtenances.

5. Furnish and install Roll-up overhead automatic doors in front of Louvers

   a. Work consists of removal of existing exterior steel doors and providing new interior overhead roll-up electric doors.

6. Selective Demolition

   a. Work consists of removal and disposal of existing exterior steel doors, as indicated on CD-503

7. Furnish and install three (3) 36-inch Tideflex Flanged Duckbill Check Valves with restrained flange adapters.

8. Furnish and install perforated S.S. "C" Channel shroud over existing brass lubrication lines

9. Furnish and install perforated S.S. "C" Channel shroud over gear box lubrication cooling lines

10. Paint entrance double steel door, door jamb, and all sluice gate valve control cabinets.

    a. Work consists of new sandblasting and painting the pumping station entrance door and sluice gate valve control cabinets.

    b. Refer to specific Sections 09 01 91 for Repainting Structural Steel

11. Cleanup and Documentation

    Contractor is responsible to remove debris from the pumping station and work sites. Accumulation of debris and construction waste shall be kept to a minimum during execution of work. Upon completion of Installation & Rehabilitation of the Pumping Station, work sites will be cleared of all debris and construction waste.

12. Electrical work shall be performed in conformance with the applicable sections of the NEC.

13. Furnishing and Installation of sump pump pursuant to Sections 33 45 03.

14. Refer to specific Section 33 041 01 for Pumping Station Improvements

1.3 Contract

A. Project will be constructed under a general construction contract.

1.4 Access To Site

A. Remove and restore to original condition walls, fences, structures, utility lines, poles, guy wires, anchors, and other improvements required to be relocated for completion of the Work. Costs for such activity shall be borne by the Contractor unless otherwise indicated.

1.5 Site Conditions

A. Interior views of Pumping Stations are from City Documents – O&M Manual Dated April 1990. The locations as depicted on the Drawings are considered approximate as to size, elevation and location. There may be additional utilities and structures that are not shown on the Drawings. Locate all existing utilities and structures and protect same from damage or harm. Restore utilities and equipment interfered with or damaged, at the expense of the Contractor, and to the satisfaction of its Owner.

B. Ensure that construction activities do not impact the activities or properties of the Owner and its agents without prior coordination and consent of these entities.

C. Contractor shall perform all subsurface exploration prior to ordering materials for or initiating construction.

1.6 Site Restrictions

A. Adhere to the provisions of the City of New London Noise Ordinance.

B. Contractor to provide a proposed schedule of construction for Pumping Station and drainage system improvements.

1.7 Work Hours

A. Schedule work activities between 7:00 AM and 5:00 PM, Monday through Friday. Requests to work extended hours will be considered by the City on a case-by-case basis. Further work hour restrictions will apply in high traffic areas, generally 9 am to 3 pm.

B. Make arrangements through Owner and Engineer for access at other times.

1.8 Laws, Ordinances, Permits And Fees

A. Give all necessary notices, obtain all permits, file all necessary plans, prepare all documents and obtain all required Certificates of Inspection for the work and deliver same to Owner's Representative before request for acceptance and final payment for work.

1. Fees for all permits, which are issued by the City and/or Licenses and Inspections, are waived.

B. General Contractor shall bear all costs associated with the acquisition of and compliance with all fees and permits required for the work, unless otherwise provided for herein.

C. Include in the cost of the Work, without extra cost to Owner, any labor, materials, services, apparatus, drawings, (in addition to contract drawings and documents) in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on Drawings and/or specified.

D. Materials furnished and work installed shall comply with all requirements of local utility companies, and with requirements of all governmental departments having jurisdiction.

1.9 Specification Formats And Conventions

A. Specification Format: The Specifications are organized into Divisions and Sections using the 49-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but

not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

1.10 Work Restrictions

A. Owner's Representative reserves the right to shut down work due to weather conditions which may necessitate maximum equipment readiness.

B. Overall Contract Duration is **180** calendar days from Notice to Proceed, inclusive of the above restrictions

1.11 Dewatering Submittal

A. Prospective Bidders to submit their proposed dewatering plan **with their bid** for the Owner's review. Bids received without a proposed dewatering plan may be rejected as non-responsive.

1.12 Control of Stormwater Submittal

A. Prospective Bidders to submit proposed control of water plan with their bid for the Owner's review. Plan to include plugging of pipes, bypass pumping, emergency removal from system as needed to keeps pipes free of water during construction operations.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section includes administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Lump-sum allowances.
   2. Unit-cost allowances.
   3. Quantity allowances.
   4. Contingency allowances.
   5. Testing and inspecting allowances.

C. Related Requirements:
   1. Section 012200 "Unit Prices" for procedures for using unit prices.
   2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3 Selection And Purchase

A. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Engineer from the designated supplier.

1.4 Action Submittals

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 Informational Submittals

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 Coordination

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 Lump-Sum Unit-Cost And Quantity Allowances

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include taxes,freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
   1. If requested by Engineer, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 Contingency Allowances

A. Use the contingency allowance only as directed by Engineer for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.9 Testing And Inspecting Allowances

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.10 Adjustment Of Allowances

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
   4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Examination

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 Preparation

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 Schedule Of Allowances

A. Allowance No. 1: Quantity Allowance: Include 2000 cu. yd. of unsatisfactory soil excavation and disposal off-site and replacement with satisfactory soil material from off-site, as specified in Section 312000 "Earth Moving."
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

B. Allowance No. 2: Quantity Allowance: Include 1000 cu. yd. of rock removal and replacement with satisfactory soil material, as specified in Section 312000 "Earth Moving."
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

C. Allowance No. 3: Contingency Allowance: 66" x 66" Sluice Gate Electric Actuator Include the sum of $40,000 for Limitorque SMB-1-25 with, multi-turn electric actuator as specified in Section 33 45 01 "Pumping Station."
   1. This allowance includes disassembling, removing, evaluating, , transporting, repairing or replacing as directed by the Owner (material cost), reinstalling and satisfactory testing, training, and inspection of the equipment prior to returning to an on-line status and Contractor overhead and profit.
      a. Coordination with Owner, as required for: temporary shutdown during replacement;
      b. Coordination with manufacturer for required repairs. Do not repair or replace equipment without written authorization from the Owner.
      c. Interior electrical systems including power, wiring, panel as indicated
      d. Incidental materials, equipment, tools and labor required to complete the Work.

D. Allowance No. 4: Contingency Allowance: Include a contingency allowance of $100,000.00 for utility location, utility coordination, and relocation necessary to conduct project.

E. Allowance No. 5: Testing and Inspection Allowance: Include the sum of $1,000.00 for testing concrete to be provided by Owner as specified in Section 321613 "Concrete Paving."

F. Allowance No.6: Contingency Allowance: Electrical. Include the sum of $15,000.00: Include Coordinate and provide electrical power to the electric panel from Eversource utility as specified in Section 26 and as shown on Drawing EI-101.
   1. This allowance includes material cost, receiving, handling, and installation and Contractor overhead and profit.

G. Allowance No. 7: Include a contingency allowance of $50,000 for Dewatering as specified in Section 312000 "Earth Excavation"
   1. This allowance includes all labor and materials necessary for the installation of the Dewatering System as submitted during the bid process.
      a. Necessary permitting
      b. Incidental materials, equipment, tools and labor required to complete the Work.
      c. Incidentals not covered by other payment items.

H. Allowance No. 8: Include a Quantity allowance of 30 cu. yd of controlled low strength material as specified in Section 312000 "Earth Moving."
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."
   2. This allowance includes material cost, receiving, handling, and installation and Contractor overhead and profit.

END OF SECTION

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SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section includes administrative and procedural requirements for unit prices.

1.3 Definitions

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 Procedures

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Schedule Of Unit Prices

A. Unit Price 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.
   1. Description: Unsatisfactory soil excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, according to Section 312000 "Earth Moving."
   2. Unit of Measurement: Cubic yard of soil excavated, based on survey of volume removed.
   3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. Unit Price No. 2: Rock excavation and replacement with satisfactory soil material.
   1. Description: Classified rock excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, according to Section 312000 "Earth Moving."
   2. Unit of Measurement: Cubic yard of rock excavated, based on survey of volume removed.
   3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

C. Unit Price No 3 – Controlled Low Strength Material:
   1. Description: Use of controlled low strength material for the installation storm drainage according to Section 312000 "Earth Moving."
   2. Unit of Measurement: Cubic yard of controlled low strength material as approved by the Engineer.
   3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION

SECTION 01 22 05 – PAYMENT ITEMS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes measurement and payment paragraphs for

1. Base Bid payment items.

B. Related Sections include the following:

1. Sections in Division 01 through 49 for detailed procedural, material, and installation requirements associated with the Work of each payment item.

1.3 Definitions

A. Base Bid: The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed

B. Payment Item: The Owner's distribution of the Contract Sum through listed work items.

1. Each item is specified to include a defined scope of services. However, not all materials, labor, equipment, or services of a payment item are guaranteed to be listed or specified.
2. Include costs associated with items of work required to complete the defined scope of services in its respective technical specification section and within the appropriately specified payment item.
3. Payment items include all necessary material, plus cost for delivery, installation, applicable taxes, overhead, and profit.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 List Of Payment Items

A. Item No. 01 55 05 – Maintenance and Protection of Traffic

1. Work associated with this item will be paid for at the Contract Lump Sum price including the following:

a. Labor, equipment, and services involved in the erection, maintenance, moving, adjusting, cleaning relocating and storing of signs, barricades, drums, traffic cones and delineators furnished by the contractor.

b. Labor and equipment involved in the maintenance of traffic lanes and detours.

c. Cost of signs, barricades, drums, traffic cones, and delineators

d. Incidentals not covered by other payment items.

B. Item No. 01 55 05.1 – City Road Traffic Control – Police Officer

1. Work associated with this item will be measured for payment by the actual number of hours for each person rendering services in accordance Item No 01 55 05.

a. Services of a Uniformed Traffic Person not approved by the Engineer and deemed not necessary will not be measured for payment.

b. The minimum hours of payment for each Uniformed Traffic Person in any one day shall be four hours.

c. No Uniformed Traffic Person shall work more than twelve hours in any one day.

d. Travel time for City Police officers, up to one hour per day, will be measured for payment. No travel time will be allowed or paid for Uniformed Municipal Police Officers.

e. Cost of police car is to be included in the measurement for payment.

2. Work associated with this item will be measured for payment by the actual number of hours for each person rendering services in accordance Item No 01 55 05.

a. Services of a Uniformed Traffic Person not approved by the Engineer and deemed not necessary will not be measured for payment.

b. The minimum hours of payment for each Uniformed Traffic Person in any one day shall be four hours.

c. No Uniformed Traffic Person shall work more than twelve hours in any one day.

d. No travel time will be allowed or paid for a Certified Flagger.

C. Item No. 01 57 13 - Temporary Erosion and Sediment Control

1. Work associated with this items will be paid for at the Contract Lump Sum price for the following:

a. Cost for labor and materials for installing and maintaining erosion and sediment control measures.

b. Incidentals not covered by other payment items.

D. Item No. 02 41 19.1 – Selective Demolition of Pumping Station Doors and Equipment

1. The Work of this item shall be measured by the lump sum of completed and accepted specified items.

2. Work associated with this item will be paid for at the Contract Lump Sum price including the following:

a. Removing, site cleaning, surface preparation and off-site disposal of three exterior steel doors, debris and waste materials

b. Removing, off-site disposal of demolition items:

1) One (1) 66" x 66" Sluice Gate Electric Actuator (As directed by the Owner)

2) Two (2) 66" x 66" Sluice Gate Electronic Valve Indicators two

3) One (1) 78" x 78" Sluice Gate Electronic Valve Indicator

c. All labor, tools, and equipment incidental to the Work.

d. Off-site disposal incidentals not covered by other payment items

E. Item No. 02 41 19.2 – Selective Demolition of Storm Drainage Pipe

1. The Work of this item shall be measured by the lump sum of completed and accepted specified items.
2. Work associated with this item will be paid for at the Contract Lump Sum price including the following:

a. Removal of drainage pipe within the limits shown on the plans.

b. All labor, tools, and equipment incidental to the Work.

c. Off-site disposal incidentals not covered by other payment items

d. Necessary work to control water within the storm drainage system to perform construction operations as needed to keep the system dewatered during construction.

F. Item No. 09 01 91.1 – Repainting Structural Steel

1. The Work of this item shall be measured by the lump sum of completed and accepted painting work.

2. Work associated with this item will be paid for at the Contract Lump Sum price including the following:

a. Field cleaning, surface preparation and repainting of existing steel entrance double door and door jamb to the Shaw's Cove pumping station.

b. Field cleaning, surface preparation and repainting of existing galvanized steel sluice gates cabinets as follow:

1) 66"x 66" Sluice gate cabinets: Three (3) cabinets attached to the pumping station building. Approximate size: 52" x 67" x 24"

2) 78" x 78" Sluice gate cabinet: one (1) Cabinet Approximate size: 52" x 67" x 24" (see CD-502 for location)

3) 96" x 96" Sluice gate cabinet: one (1) Cabinet Approximate size: 65" x 72" x 24" (see CD-502 for location)

c. Field paint galvanized steel cabinet plates, doors, hinges, nuts and bolts, building entrance door jambs.

d. Prepare existing steel surface for repainting, and paint the cleaned structural steel surfaces Protect during painting of steel elements.

e. Removing and proper off-site disposal of paint materials.

f. All materials, labor, tools, and equipment incidental to the Work.

g. Incidentals not covered by other payment items

G. Item No. 31 10 00 Site Clearing

1. Work associated with this items will be paid for at the Contract Lump Sum price for the following:

   a. Cost for labor and materials for protecting and/or removing trees as depicted on the plans.

   b. Incidentals not covered by other payment items.

H. Item No. 31 20 00 Earth Excavation

1. The Work of this item shall be measured per cubic yard of in-place material.

2. Work associated with this item will be paid for at the per Cubic Yard Contract price for excavating and disposing of material greater than one cubic yard in size, replacing excavated rock with compacted material, and all incidental materials, equipment, tools and labor required to complete the Work.

I. Item No. 31 20 00.1 Test Pits

1. The Work of this item shall be measured by the Contract Price per each.

2. Work associated with this item will be made at the Contract Unit Price per each Test Pit performed including the following:

   a. All materials, labor, tools, and equipment incidental to the Work.

   b. Incidentals not covered by other payment items

   c. Necessary work to control water within the storm drainage system to perform construction operations as needed to keep the system dewatered during construction.

J. Item No. 32 12 16 – Asphalt Paving

1. The work of this item will be measured for payment by the square yards of permanent pavement surface to the limits shown on the plan. Work to include the following:

   a. Incidental materials, equipment, tools and labor required to complete the Work.

   b. Cost of excavation and disposal of excavated material

   c. Cost of cleaning, saw cutting, tack coating and sealing of existing pavement.

   d. Incidentals not covered by other payment items.

K. Item No. 32 14 00 Unit Paving

1. The work of this item will be measured for payment by the square yards of unit paving to the limits shown on the plan. Work to include the following:

   a. Incidental materials, equipment, tools and labor required to complete the Work.

   b. Cost of excavation and disposal of excavated material

c. Cost of removing of existing unit pavers, cleaning, cutting and resetting unit paver.

d. Incidentals not covered by other payment items.

L. Item No. 32 16 13 – Concrete Paving

1. The work of this item will be measured for payment by the square yards of concrete placed to the limits shown on the plan. Work to include the following:

   a. Incidental materials, equipment, tools and labor required to complete the Work.

   b. Cost of excavation, backfilling, disposal of surplus material, gravel, or reclaimed miscellaneous base.

   c. Cost for detectable warning tiles.

   d. Incidentals not covered by other payment items.

M. Item No. 32 16 14 – Reset Curbing

1. The work of this item will be measured for payment by the actual number of linear feet of curbing reset or placed. Work to include the following:

   a. Incidental materials, equipment, tools and labor required to complete the Work.

   b. Cost of excavation, backfilling, and disposal of surplus material

   c. Cost for furnishing, placing and compacting granular base, beveling or rounding the ends of the curbing, sealing the joints with mortar,

   d. Removing the curbing and hauling it to any location on or adjacent to the project

   e. Incidentals not covered by other payment items

N. Item No. 32 16 14.1 – Granite Curbing

1. The work of this item will be measured for payment by the actual number of linear feet of granite curbing placed. Work to include the following:

   a. Incidental materials, equipment, tools and labor required to complete the Work.

   b. Cost of excavation, backfilling, and disposal of surplus material

   c. Cost for furnishing, placing and compacting granular base, beveling or rounding the ends of the curbing, sealing the joints with mortar,

   d. Incidentals not covered by other payment items.

O. Item No. 32 92 00 – Turfs And Grasses

1. The work of this item will be measured for payment by the square yards of turf established to the limits shown on the plan. Work to include the following:

   a. Incidental materials, equipment, tools and labor required to complete the Work.

   b. Incidentals not covered by other payment items.

P. Item No. 33 41 00 – Storm Utility Drainage

1. Drainage Structures under this item will be paid for by the Contract Price per each and includes the following:
    a. Drainage structures as depicted (Item 33 41 00.1 to 33 41 00.6 of Bid Schedule):
        1) Catch Basins
        2) Manholes
    b. Necessary work to control water within the storm drainage system to perform construction operations as needed to keep the system dewatered during construction.
    c. Incidental materials, equipment, tools and labor required to complete the Work.
2. Drainage pipe under this item will be measured for payment by the actual number of linear feet of piping placed (Item 33 41 00.7 to 33 41 00.17 of Bid Schedule). Work to include the following:
    a. Pipe materials as depicted on the plans:
        1) HDPE: High-density polyethylene plastic.
        2) PE: Polyethylene plastic.
        3) PVC: Polyvinyl chloride plastic.
        4) RCP: Reinforced concrete pipe
    b. Bedding Material for pipes
    c. Incidental materials, equipment, tools and labor required to complete the Work.
    d. Cost to include the removal and disposal of the pipe and concrete backfill, including excavation.
    e. Cost for plugging of existing pipes.
    f. Necessary work to control water within the storm drainage system to perform construction operations as needed to keep the system dewatered during construction.

Q. Item No. 33 42 16.13.01 – Precast Concrete Box Culvert

1. The work of this Section will be measured for payment by the actual number of linear feet of precast concrete box section installed.
2. Payment for this work will be made at the Contract Unit Price per linear foot for "Precast Concrete Culverts" of the size specified. Work to include the following:
    a. Incidental materials, equipment, tools and labor required to complete the Work.
    b. Control of water

R. Item No. 33 42 16.13.02 – Precast Concrete Storm Vault (8 x 8)

1. The Work of this item shall be measured by the Contract Price per each.
2. Payment for this work will be made at the Contract Unit Price per each Precast Concrete Storm Vault. Work to include the following:
    a. Incidental materials, equipment, tools and labor required to complete the Work.

b. Necessary work to control water within the storm drainage system to perform construction operations as needed to keep the system dewatered during construction.

S. Item No. 33 45 01.1: Automatic Overhead Door and Hardware

1. The Work of this item shall be measured by the Contract Price per each.

2. Work associated with this item will be paid for at the Contract Price per Each and includes the following.

   a. Roll up Service door and hardware,

   b. Coordination with Owner, as required for: temporary shutdown during replacement;

   c. Incidental materials, equipment and labor associated with mobilization of door to the sites and demobilization of materials and equipment and cleaning of the site after the work is complete.

   d. Interior electrical systems including power, wiring, panel as indicated

   e. Incidental materials, equipment, tools and labor required to complete the Work.

   f. Incidentals not covered by other payment items, including electrical and controls, etc.

T. Item No. 33 45 01.3: 66" x 66" Sluice Gate Electronic Valve Indicators

1. The Work of this item shall be measured by the Contract Price per each.

2. Work associated with this item will be paid for at the Contract Price per Each and includes the following.

   a. Providing indicator to the existing Limitorque electric operator, hardware, fittings, complete in place, and satisfactory testing, training, and inspection of the equipment prior to returning to an on-line status.

   b. Coordination with Owner, as required for: temporary shutdown during replacement;

   c. Interior electrical systems including power, wiring, panel as indicated

   d. Incidental materials, equipment, tools and labor required to complete the Work.

   e. Incidentals not covered by other payment items, including electrical and controls, etc.

U. Item No. 33 45 01.4: 78" x 78" Sluice Gate Electronic Valve Indicator

1. The Work of this item shall be measured by the Contract Price per each.

2. Work associated with this item will be paid for at the Contract Price per Each and includes the following.

   a. Providing indicator to the existing Limitorque electric operator, hardware, fittings, complete in place, and satisfactory testing, training, and inspection of the equipment prior to returning to an on-line status.

   b. Coordination with Owner, as required for: temporary shutdown during replacement;

   c. Interior electrical systems including power, wiring, panel as indicated

   d. Incidental materials, equipment, tools and labor required to complete the Work.

e. Incidentals not covered by other payment items, including electrical and controls, etc.

V. Item No. 33 45 01.5: 36-inch Flanged-End Check Valves

1. The Work of this item shall be measured by the Contract Price per each.

2. Work associated with this item will be paid for at the Contract Price per Each and includes the following.

   a. Providing Duckbill Flange-end check valve

   b. Coordination with Owner, as required for: temporary shutdown during installation of the check valves;

   c. Incidental materials, equipment and labor associated with mobilization of equipment to the sites and demobilization of materials and equipment and cleaning of the site after the work is complete.

   d. Removing and proper off-site disposal of abandoned materials.

   e. Incidentals not covered by other payment items.

W. Item No. 33 45 01.6: 36-inch Restrained Flange Adapters

1. The Work of this item shall be measured by the Contract Price per each.

2. Work associated with this item will be paid for at the Contract Price per Each and includes the following.

   a. Providing Series 2100 Megaflange restrained flange adapter for 36-inch check valves

   b. Coordination with Owner, as required for: temporary shutdown during installation of the restrained flange adapter and check valves.

   c. Incidental materials, equipment and labor associated with mobilization of equipment to the sites and demobilization of materials and equipment and cleaning of the site after the work is complete.

   d. Incidentals not covered by other payment items.

X. Item No. 33 45 01.7: S.S. C-Channel Shrouds, Fasteners and Support (Grease Line)

1. The Work of this item shall be measured by the linear foot of completed and accepted S.S. C-Channel shrouds and supports.

2. Work associated with this item will be paid for at the Contract linear foot price including the following:

   a. Coordination with Owner, as required for temporary shutdown during installation of S.S. perforated C-Channel shroud over existing brass grease line, and shall include all materials, equipment and labor associated with dewatering of the wet well before beginning work.

   b. Providing pipe hangers, fasteners and support

   c. Incidental materials, equipment, tools and labor required to complete the Work.

   d. Incidentals not covered by other payment items.

Y. Item No. 33 45 01.8: S.S. C-Channel Support, Fasteners (gear box oiler cooler)

1. The Work of this item shall be measured by the linear foot of completed and accepted S.S. C-Channel and supports.

2. Work associated with this item will be paid for at the Contract linear foot price including the following:

   a. Coordination with Owner, as required for temporary shutdown during installation of S.S. perforated C-Channel support over existing gear box oil cooler pipe, and shall include all materials, equipment and labor associated with dewatering of the wet well before beginning work.

   b. Providing pipe hangers, fasteners and support

   c. Incidental materials, equipment, tools and labor required to complete the Work.

   d. Incidentals not covered by other payment items.

Z. Item No. 33 45 03.1: Sump Pump and Appurtenances

1. The Work of this item shall be measured by the lump sum of completed and accepted sump pump and appurtenances.

2. Work associated with this item will be paid for at the Contract Lump Sum price including the following:

   a. Providing sump pump, fittings, ball valve, Series 2100 Megaflange restrained flange adaptor, threaded hose connection, complete in place, and satisfactory testing, training, and inspection of the equipment prior to returning to an on-line status.

   b. Coordination with Owner, as required for temporary shutdown during installation, and shall include all materials, equipment and labor associated with dewatering of the wet well before beginning work.

   c. Removing and proper off-site disposal of abandoned materials.

   d. All materials, labor, tools, and equipment incidental to the Work.

   e. Incidentals not covered by other payment items, including electrical and controls, etc.

AA. Item No. 40 90 01.1 – Electrical and Controls

1. The Work of this item shall be measured by the lump sum of completed and accepted electrical and control work.

2. Work associated with this item will be paid for at the Contract Lump Sum price including the following:

   a. Electrical service entrance and coordination with utility company

   b. Electrical conduits and wiring, including excavation and backfill

   c. Electrical service cabinet all-inclusive as shown in detail on drawings

   d. Concrete Pad for electrical service cabinet

   e. Coordination with Eversource utility and City

f. Controls System Integrator

g. Float switches and SS support bracket and wiring from Float MH to SCADA RTU

h. Installation of SCADA RTU in Pump Station building, and associated hardware.

i. Documentation and Modification of existing sluice gate and pump control panel to new SOO.

j. SCADA system Startup and Training for New London Flood Control personnel.

BB. Item No. 40 90 05.1 – SCADA System

1. The Work of this item shall be measured by the lump sum of completed and accepted electrical and control work.

2. Work associated with this item will be paid for at the Contract Lump Sum price including the following:

   a. SCADA system RTU's and associated appurtenances (ex. remote antennas and mounting masts)

   b. SCADA system Annual Cell/Connectivity and Website fee

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 Summary

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

1. The requirements of this Section are general in nature and apply to all Sections. Additional submissions and requirements are contained in each Section. In each individual Section, no attempt was made to cover or repeat the submissions contained in this Section and, therefore, the total number of submissions required are the combination of those described in this Section plus those specified in the various other Sections.

2. Additional submissions are required by the General and Supplementary Conditions including: Applications for Payment; requests for Change Orders; guarantees; permits; certifications; documents required by Federal, State and Local authorities; and submissions required by utility companies and other persons, firms or organizations.

B. Related Sections include the following:

1. Division 1 Section "Closeout Procedures" for submitting warranties and Project Record Documents.

1.2 Definitions

A. Action Submittals: Written and graphic information that requires Engineer's responsive action.

B. Informational Submittals: Written information that does not require Engineer's approval. Submittals may be rejected for not complying with requirements.

C. Certified Test Report: Reports written by a qualified testing agency or laboratory, on testing agency's standard form, indicating and interpreting results of tests of materials or products for compliance with requirements.

D. Material or Product Certificate: A document certifying that the materials, components, and equipment furnished conform to the requirements.

E. Product Data: Standard prepared data for manufactured products.

F. Shop Drawings: Custom prepared data applicable to the Work.

G. Samples: Physical examples of the Work.

H. Addresses: Include mailing address, telephone number, facsimile number, and e-mail address.

1.3 Submittal Procedures

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Engineer for Contractor's use in preparing submittals.

B. Method of Transmitting Submittals: Submit hard copy of submittals via mail or courier and electronic copy via email.

C. Clarity: Provide neat, clean, and legible printed materials that can be easily reproduced by normal photocopying or blueprinting. Illegible submittals will be returned unreviewed.

D. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

E. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal.

1. Initial Review: Allow 10 business days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

2. If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Allow 10 business days for processing each resubmittal.

4. No extension of the Contract Time or claims for delay will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

F. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.

3. Include the following information on label for processing and recording action taken:

    a. Project name.

b. Date.

c. Name and address of Engineer.

d. Name and address of Contractor.

e. Name and address of subcontractor.

f. Name and address of supplier including name and telephone number of contact.

g. Name of manufacturer including name and telephone number of contact.

h. Unique identifier, including revision number.

i. Number and title of appropriate Specification Section.

j. Drawing number and detail references, as appropriate.

k. Other necessary identification.

G. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals. Provide list or narrative of deviations on Submittal Transmittal form.

H. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review received from sources other than Contractor.

1. Transmittal Form: Use sample form at end of Section.

2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.

J. Destination: Send six copies of each submission to:

Mr. Kurt Mailman, P.E.
Fuss & O'Neill, Inc.
146 Hartford Road
Manchester, Connecticut 06040

K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

L. Use for Construction: Use only final submittals with mark indicating action taken by Engineer in connection with construction.

PART 2 - PRODUCTS

2.1 Action Submittals

A. Submittal Schedule:

1. Within 10 business days after the effective date of the Agreement, submit a schedule listing dates for submission and review of shop drawings, project data, and samples needed for each item of Work. Submit in conjunction with Construction Schedule.

B. Subcontractor List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

C. Construction Schedule:

1. Within 10 business days after the effective date of the Agreement, submit for Engineer's and Owner's information, a construction schedule showing in detail, the proposed sequence of the Work and the estimated start and end date for each stage of the Work. Prepare the schedule so that the actual progress of the Work can be recorded and compared with the expected progress. Coordinate the construction schedule with the proposed schedules of other contractors, if any, engaged in work at, or adjacent to, the Project site.
2. Prepare a bar chart construction schedule identifying major tasks and the associated time frame within which the task shall be completed. Tasks include:
    a. Project start date
    b. Pump/Valve isolation at each Pumping Station
    c. Inspection at each Pumping Station
    d. Repair & Refurbish at each Pumping Station
    e. Concrete rehabilitation
    f. Substantial and final completion dates

3. Coordinate the Work and make every effort to maintain the construction schedule. In the event actual progress begins to lag the schedule, promptly employ additional means or methods of construction to make up lost time.

4. Keep construction schedule current and revise or confirm the schedule to accurately reflect the conditions of the Work, past progress, and anticipated future progress.

D. Schedule of Values:

1. Within 10 business days after the effective date of the Agreement, submit a Schedule of Values of the various portions of the Work, including quantities aggregating the total Contract Price, and supported by such data to substantiate its correctness as Engineer may require. Use the Schedule of Values only as a basis for Contractor's Periodic Estimate. No payments will be made until such Schedule has been submitted and accepted by Engineer.

2. On "unit price" items, the schedule of values shall contain unit prices for various stages of work.

3. On "per each" or "lump sum" items, break prices down sufficiently to provide a convenient and realistic means for determining the amount of work done during various stages of progress.

4. Where prices are not broken down sufficiently to accurately determine the value of Work completed, Engineer will estimate the value of the Work completed and will deduct an amount so as to arrive at a conservative value which will allow Owner to easily complete the Work with the unpaid balance. When the required detail in the Schedule of Values is not provided, the Engineer will make the final determination.

E. Certified Test Reports:

1. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

2. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

F. Material or Product Certificates: Prepare written statements certifying that materials or products comply with the requirements.

1. Project to which material is consigned.

2. Name of contractor receiving material.

3. Item number and description of material.

4. Quantity of material represented by the certificate.

5. Means of identifying consignment including label, marking, or lot number.

6. Date and method of shipment.

7. Signature of Supplier's authorized agent.
8. Notarization of certificate.

G. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Manufacturer's catalog cuts.
    e. Wiring diagrams showing factory-installed wiring.
    f. Printed performance curves.
    g. Operational range diagrams.
    h. Compliance with recognized trade association standards.
    i. Compliance with recognized testing agency standards.
    j. Notation of coordination requirements.

H. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:
    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Shopwork manufacturing instructions.
    e. Templates and patterns.
    f. Schedules.
    g. Design calculations.
    h. Compliance with specified standards.
    i. Notation of coordination requirements.
    j. Notation of dimensions established by field measurement.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches.

I. Samples: Prepare physical units of materials or products, including the following:

1. Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit paired units that show approximate limits of the variations.

2. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

2.2 Informational Submittals

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Engineer will not return copies.

2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.

C. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

D. Material or Product Certificates: Prepare written statements on manufacturer's letterhead certifying that material or product complies with requirements. Use attached sample Material Certificate, or provide certificate that includes the following information.

1. Project to which material is consigned.

2. Name of contractor receiving material.
3. Item number and description of material.
4. Quantity of material represented by the certificate.
5. Means of identifying consignment including label, marking, or lot number.
6. Date and method of shipment.
7. Signature of Supplier's authorized agent.
8. Notarization of certificate.

E. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

F. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

G. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

H. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."

I. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

J. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

PART 3 - EXECUTION

3.1 Contractor's Review

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark each copy of each submittal with approval stamp before submitting to Engineer.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents. See attached Submittal Transmittal for sample of statement.

3.2 Engineer's Action

A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

1. Engineer may elect not to review partial or incomplete submittals and will return such submittals with no action taken.

B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Furnish as Submitted: Submittal appears to conform to Contract Documents and Contractor may proceed with ordering and installation.
2. Furnish as Noted: Same as "Furnish as Submitted" except that the Contractor must comply with modifications or notes added to the submittal by the Engineer.
3. Rejected: Submittal must be revised and resubmitted.

C. Informational Submittals: Engineer will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

SUBMITTAL TRANSMITTAL Date: _____

To: Fuss & O'Neill, Inc.
146 Hartford Road
Manchester, CT 06040
ATTN: Mrs. Fereshteh Doost, P.E.

From:

PROJECT: _____ SUBMITTAL NO.: _____
(List Section No., Article No., Paragraph)

_____
(Revision: 1st, 2nd, 3rd, etc.)

Transmitted herewith for review and comment are the following:

Copies	Dwg.	No.	Description

MANUFACTURER / SUPPLIER

Name: _____

Address: _____

Telephone No.: _____ Facsimile No.: _____

For Additional Information, Contact _____

E-mail Address: _____

I hereby certify that I have carefully examined the enclosed submittal and have determined and verified all field measurements, construction criteria, materials, catalog numbers and similar data, coordinated the submittal with other submissions and the work of other trades and contractors, and that to the best of my knowledge and belief, the enclosed submittal is in full compliance with the Contract Documents, except for the following deviations:

BY:
Signature: _____

Title: _____

FOR ENGINEER'S USE

SUBMITTAL TRANSMITTAL Date:

(Submit on Contractor's letterhead)

- - SAMPLE - - MATERIALS CERTIFICATE - - SAMPLE - -

(Submit on Manufacturer's letterhead)

Date: _____

WE HEREBY CERTIFY THAT _____

(Description, Kind of Material, Product Name, Model No.)

FURNISHED TO _____

(Name of Contractor) (Prime or Subcontractor)

FOR USE ON _____

(Project Name)

OWNER _____

(Project Owner)

IDENTIFIED BY: _____

(Label, Marking, Seal No., Consignment, or Waybill No.)

SHIPPED VIA: _____

(Method of Shipment, Car No., Truck No.)

SHIPPED ON: _____ DELIVERED ON: _____

MEETS THE REQUIREMENTS OF THE CONTRACT DOCUMENTS FOR THE SUBJECT PROJECT IN ALL RESPECTS. PROCESSING, PRODUCT TESTING AND INSPECTION CONTROL OF RAW MATERIALS ARE IN CONFORMANCE WITH APPLICABLE SPECIFICATIONS, DRAWINGS AND STANDARDS OF ARTICLES FURNISHED. ARTICLES FURNISHED COMPLY WITH THE FOLLOWING STANDARD SPECIFICATIONS:

_____

_____

_____

_____

All records and documents pertinent to this certificate and not submitted herewith will be maintained available by the undersigned for a period of not less than 3 years from the date of this certificate.

_____

(Name of Manufacturer)

_____

(Authorized Representative's Signature)

_____

(Title)

SECTION 01 57 13 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes furnishing, placing, and maintaining temporary sediment control measures as shown on the Drawings, as directed by the Engineer, and where necessary to reduce sediment content of runoff. Control measures are to remain in place until after completion of construction. Measures include the following:
   1. Silt fence.
   2. Erosion control bales.
   3. Catch basin inserts.
   4. Dewatering bags.
   5. Dust control.
      a. Conduct construction operations and activities to minimize the creation and dispersion of dust. If the Engineer determines that water and or calcium chloride is required for more effective dust control, provide such measures at no additional cost.

B. Related Sections include the following:
   1. Division 31 Section "Earth Moving."

1.3 Submittals

A. Certificates of Compliance:
   1. Filter fabric and geotextiles for each application.
   2. Catch basin inserts.
   3. Calcium chloride.

1.4 Quality Assurance

A. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and issued supplements excluding provisions for " Method of Measurement" and "Basis of Payment".

B. Connecticut Guidelines for Soil Erosion and Sediment Control by the Connecticut Council on Soil and Water Conservation.

PART 2 - PRODUCTS

2.1 Filter Fabric / Silt Fence

A. Synthetic Filter Fabric: Woven geotextile, 36 inches maximum height, conforming to the following:

Properties	Requirement	Unit
Grab Tensile Strength (ASTM D4632):	124	Lbs
Grab Tensile Elongation (ASTM D4632):	15	Percent
Puncture Strength (ASTM D4833):	65	Lbs
Flow Rate (ASTM D4491):	20	Gal/Min/Sq. Ft.
UV Resistance(at 500 hours) (Retained strength) (ASTM D4355):	80	Percent

B. Product and Manufacturer:
1. ProPex 2130 by Amoco Fabrics and Fibers Company, Austell, GA.
2. Mutual MISF 1855 by Mutual Industries, Inc., Philadelphia, PA.
3. Or equal.

C. Posts
1. Hardwood Stakes: 2-inch by 4-inch by 60-inch minimum.
2. Steel: 0.5 pounds per linear foot by 48 inches long minimum, with projections for fastening.

D. Silt Fence Fasteners: Staples, tie wires or hog rings, as recommended by manufacturer.
   a. Staples: Heavy-duty wire, 1-inch long minimum.

2.2 Erosion Control Bales

A. Material: Hay or straw, bound by twine or wire, weighing 40 to 120 pounds per bale.

B. Stakes: Hardwood, 2-inch by 2-inch by 36-inch minimum.

C. Steel Posts: Minimum weight of 0.5 pounds per linear foot.

2.3 Dewatering Bag

A. Filter Bag (Silt Bag): Manufactured non-woven geotextile fabric bag, sewn with high-strength thread, with a spout to accommodate a 4-inch discharge hose (maximum), and attached straps.
1. Available Product and Manufacturer:
   a. Dirtbag® by ACF Environmental, Richmond, VA.
   b. Dandy Dewatering Bag by Dandy Products, Inc., Dublin, OH.
   c. Or equal.

B. Non-woven Geotextile Fabric:

Properties	Test Method	Units

Grab Tensile Strength	ASTM D4632	250 lbs
Puncture	ASTM D4833	165 lbs.
Flow Rate	ASTM D4491	70 Gal/Min/Sq. Ft.
Permitivity	ASTM D4491	1.3 sec-1
Mullen Burst	ASTM D3786	550 psi.
UV Resistance	ASTM D4355	70 percent
Apparent Opening Size Percent Retained	ASTM D4751	#40 US Sieve 100 percent

2.4 Catch Basin Inserts

A. Regular Flow Silt Sacks: Woven polypropylene that meets the following:

Properties	Test Method	Units
Grab Tensile Strength	ASTM D4632	300 Lbs
Grab Tensile Elongation	ASTM D4632	25 Percent
Puncture Strength	ASTM D4833	120 Lbs
Trapezoid Tear	ASTM D4533	120 Lbs
Flow Rate	ASTM D4491	40 Gal/Min/Sq. Ft.
Permittivity	ASTM D4491	0.55 Sec-1
Mullen Burst	ASTM D3786	800 psi
UV Resistance(at 500 hours) (Retained strength)	ASTM D4355	80 Percent
Apparent Opening Size	ASTM D4751	#40 US Sieve

1. Manufacturer: ACF Environmental, 1801-A Willis Road, Richmond, VA 23237 (800-844-9223),
2. Or equal.

2.5 Dust Control

A. Calcium Chloride: ASTM D98, Type 1 or Type 2.

B. Water: Potable.

PART 3 - EXECUTION

3.1 General

A. Minimize environmental damage during construction. Prevent discharge of fuel, oil, lubricants, and other fluids. Mitigate effects of discharge.

B. Install erosion and sediment control measures prior to clearing, demolition or construction.

C. Construct erosion and sediment control measures in accordance with standards and specifications of the Connecticut Guidelines for Soil Erosion and Sediment Control, Authorities Having Jurisdiction, indicated municipal regulations, and as follows:
   1. Provide additional sedimentation and erosion controls as required by municipality or Authorities Having Jurisdiction to address field conditions.
   2. Do not discharge turbid water from dewatering to inland wetlands or watercourses.
   3. Weekly, and prior to any anticipated rain event, inspect site. Ensure that erosion controls are properly maintained and functioning.
   4. Supply a 24-hour contact name and number as part of the erosion control plan.

D. Install additional control measures, if deemed necessary by the State, Municipality, Authority Having Jurisdiction, or Owner.

E. Implement and maintain the Erosion and Sediment Control Plan. Inform parties engaged on the construction site of the requirements and objectives of the plan. Notify the proper municipal agency of transfer of this responsibility.

F. Protect catch basins with erosion control bales or inserts throughout construction until disturbed areas are stabilized.
   1. Remove and dispose of sediment from control structures.

G. Control dust and wind erosion. Control dust to prevent a hazard to traffic on adjacent roadways. Dust control includes sprinkling of water and uniform application of calcium chloride on exposed soils.

H. Do not discharge directly into wetlands or watercourses where dewatering is necessary. Utilize methods and devices as permitted by authorities having jurisdiction and appropriate regulations to minimize and retain suspended solids including pumping water into a temporary sedimentation bowl, providing surge protection at inlet and outlet of pumps, floating pump intake.
   1. If pumping operation results in turbidity problems, stop pumping until means of controlling turbidity are determined and implemented.

I. Where control measures are required for longer than 60 days, use silt fence instead of erosion control bales.

J. Cut Areas
   1. Establish an erosion control line (haybale check or filter fabric) at toe of slope in cut areas and slope stabilization with mulch or grass within 30 days of start of cut operations.

K. Fill Areas
   1. Establish an erosion control line (woodchip berm or filter fabric) approximately 10 feet from toe of slope of proposed fill areas prior to beginning fill installation.
   2. Initiate slope stabilization with mulch or grass within 30 days of start of fill installation.

L. Within 7 days of completing slope construction, stabilize slopes with vegetation or matting to minimize exposure.

M. Stockpiles
1. Side Slopes: 2:1 maximum.
2. Surround stockpiles by a sediment barrier.
3. Stabilize stockpiles left bare for more than 15 days with temporary vegetation or mulch.

N. Final Grading
1. If final grading is delayed for more than 30 days after land disturbances cease, stabilize soils with temporary vegetation or mulch.

O. Planting Season for Temporary Vegetation
1. March 1 to June 15 and August 1 to October 1.
2. After September 15, stabilize areas with haybale check, filter fabric, or woodchip mulch.

P. Areas to Be Left Bare Prior to Finished Grading and Seeding
1. Within Planting Seasons
   a. Temporarily seed with Perennial Ryegrass
   b. Apply at a rate of 2 pounds per 1000 sq. ft. at a depth of 1/2 inch.
   c. Where grass predominates, fertilize according to a soil test at a minimum application rate of one pound per acre.
2. Outside of Planting Seasons
   a. Apply air-dried wood chip mulch, free of coarse matter.
   b. Apply at a rate of 185 to 275 pounds per 1000 sq. ft.

3.2 Control Systems

A. Silt Fence
1. Install fencing at location as shown on the Drawings or where directed by the Engineer. Maintain pitch of 2 to 20 degrees, with inclination toward potential silt source.
2. Install bottom 6 inches of fabric by trenching and burying the fabric into the notched ground.
3. Drive posts into ground a minimum of 12 inches.
4. Locate fabric splices at posts only. Provide 6-inch overlap and seal.

B. Sediment Control Bales
1. Install at locations as shown on the Drawings or where directed by the Engineer. Place bales lengthwise with ends tight abutting one another. Install bales with bindings located on the sides.
2. Entrench bales 4 inches and backfill. Place backfill toward potential silt source.
3. Secure in place with 2 stakes per bale and insert straw in voids between bales.

C. Catch Basin Inserts
1. Remove catch basin grate, insert silt sack, and secure in place by replacing grate.

3.3 Dust Control

A. Apply water and calcium chloride uniformly over the surface when dust becomes a nuisance or when directed by the Engineer.
   1. Provide shut-off valve in convenient location on water truck, to allow for regulating water flow.

3.4 Field Quality Control

A. Silt Fence and Erosion Control Bale Maintenance
   1. Inspect control system immediately after each rainfall and daily during prolonged rainfall. Make repairs immediately.
   2. Remove and dispose of accumulated sediments when sediment reaches approximately one-third the height of the control system, or when directed by the Engineer.
   3. Replace control system promptly if fabric decomposes or system becomes ineffective prior to the expected usable life.
   4. Maintain or replace system until no longer necessary for the intended purpose.

B. Dewatering Bag Maintenance
   1. Maintain in good condition throughout construction period.

C. Catch Basin Insert Maintenance
   1. Inspect after each major precipitation event. Inspect every two weeks if no major rain events have occurred.
   2. Remove, clean, and reinstall silt sack when sediment accumulates to half capacity of sack.

3.5 Removal

A. Remove and dispose of control systems after area stabilizes with new growth, or when directed by the Engineer.

END OF SECTION

SECTION 01 55 05 - TRAFFIC CONTROL

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes operations necessary to maintain vehicular and pedestrian traffic flow on public and private access ways and roads to the satisfaction of the DOT, applicable local Police Department and Engineer.

1. Maintain pedestrian and vehicular traffic and permit access to businesses, residences, and intersecting streets.

B. Traffic controls include, but are not limited to, the following:

1. Furnishing, erecting, moving, and dismantling barricades, signs, and temporary lighting to inform the general public of hazards during construction of the Work.
2. Constructing, maintaining, and removing temporary detours.
3. Relocating and maintaining traffic control items.
4. Uniformed officers.
    a. City or Town Police Officers.
    b. State Police Officers.

1.3 Definitions

A. Uniformed Officers

1. Certified Flaggers:
2. Local Police Officers: Uniformed, off-duty, local police officers.
3. State Police Officers: Uniformed, off-duty, sworn State Police Officers, including the usage of an official State Police vehicle and associated equipment.

1.4 Submittals

A. Detours: When required, submit to the Engineer and local police Department, proposed detour plan for all portions of the Work, at least seven days prior to commencing construction.

1. Pre-warn local regulatory agencies 72 hours in advance of changes in traffic patterns due to reduction of pavement widths or closing of streets.

1.5 Quality Assurance

A. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and issued supplements excluding provisions for "Method of Measurement" and "Basis of Payment".

PART 2 - PRODUCTS

2.1 Traffic Control Devices

A. Barricade Warning Lights: Form 816, Subsection 9.76.02.

1. Color: Yellow.
2. Burn: Steady burn or flashing mode.

B. Traffic Drums: Form 816, Subsection 9.78.02.

C. Traffic Cones: Form 816, Subsection 9.78.02.

D. Construction Barricades: Form 816, Subsection 9.79.02.

E. Construction Signs. Type II Reflective Sheeting and required portable supports or metal sign posts that conform with NCHRP Report 350 (TL-3).

1. Prior to using the construction signs and their portable supports, the Contractor shall submit to the Engineer a copy of the Letter of Acceptance issued by the FHWA to the manufacturer documenting that the devices (both sign and portable support tested together) conform to NCHRP Report 350 (TL-3).
2. Portable sign supports shall be designed and fabricated so that the signs do not blow over or become displaced by the wind from passing vehicles. Portable sign supports shall be approved by the Engineer before they are used.
3. Mounting height of signs on portable sign supports shall be a minimum of 1 foot and a maximum of 2 feet, measured from the pavement to the bottom of the sign.
4. All sign faces shall be rigid and reflectorized. Reflective sheeting shall conform to the requirements of Form 816 Article M.18.09.01 (Type III). Sheet aluminum sign blanks shall conform to the requirements of Form 816 Article M.18.13. Metal sign posts shall conform to the requirements of Form 816 Article M.18.14. Application of reflective sheeting, legends, symbols, and borders shall conform to the requirements specified by the reflective sheeting manufacturer. Attachments shall be provided so that the signs can be firmly attached to the portable sign supports or metal posts without causing damage to the signs.
5. The following types of construction signs shall not be used: mesh, non-rigid, roll-up.
6. The following portable sign support systems or equivalent systems that meet the above requirements may be used:

a. Korman Model #SS548 flexible sign stand with composite aluminum sign substrate (APOLIC)

b. Traffix "Little Buster" dual spring folding sign stand with corrugated polyethylene (0.4 in. thick) sign substrate (InteCel)

PART 3 - EXECUTION

3.1 Installation, General

A. Coordinate with local authorities for closing of sections of streets within the work area. Do not barricade streets or detour traffic without prior approval of local authorities. Keep closings to as brief a period as possible. Provide a minimum of 2 business days notice of street closings to local police, fire, school, and public works departments, and the Town Manager's office.

B. Provide traffic control personnel as required for the proper directing and control of traffic during the Work. At a minimum, provide the following:

1. Town Roads: One uniformed flagger.

2. State Roads: One uniformed Town or State police officer.

C. Keep warning lights lit.

3.2 Installation

A. Close traffic lane immediately adjacent to eastern building face whenever exterior demolition above the ground floor is occurring.

3.3 Traffic Control Devices

A. Furnish, erect, maintain, move and dismantle barricades, warning signs, lights, and traffic control items as necessary, to protect the Work, to provide for public safety, and as required by the Owner or Engineer.

B. Barricade Warning Lights: Place Type "A" low intensity, Type "B" high intensity, and Type "C" steady burn warning lights in conformance with Form 816, Article 9.76.03.

C. Traffic Drums: Place traffic drums in accordance with Form 816, Article 9.78.03.

D. Traffic Cones: Provide traffic cones in sufficient number to adequately control traffic on roadways during construction. Replace damaged traffic cones.

E. Construction Barricades: Form 816, Subsection 9.79.03.

F. Construction Signs: In conformance with Form 816 Article 9.71 "Maintenance and Protection of Traffic" and as directed by the Engineer.

1. Ineffective signs, as determined by the Engineer and in accordance with the ATSSA guidelines contained in "Quality Standards for Work Zone Traffic Control Devices", shall be replaced by the Contractor at no cost to the Owner.
2. Signs and their portable supports or metal posts that are no longer required shall be removed from the project and shall remain the property of the Contractor.

3.4 Traffic Control Personnel

A. Be aware of local authorities and State policies regarding the services of uniformed officers for construction projects including requirements for canceling scheduled traffic control personnel.

B. Provide services of uniformed officers during construction when traffic is sufficiently congested, public safety is endangered, traffic is detoured or bypassed, and when directed by the Engineer or authorities having jurisdiction.

C. Provide services of uniformed officers when required by authorities with jurisdiction or by Engineer.

D. Traffic Control During Construction Operation (English Version). See attached guidelines developed by the State of Connecticut Department of Transportation. Guidelines include the following text and plans.

1. Traffic Control Patterns
2. Placement of Signs
    a. Allowable Adjustment of Signs and Devices shown on the Traffic Control Plan
    b. Table 1 Minimum Taper Lengths
3. Section 1 Work Zone Safety Meetings
4. Section 2 Installing and Removing Traffic Control Patterns
5. Section 8 Use of Traffic Drums and Traffic Cones
6. Section 8 General
7. Plans (Attached to section).
    a. Notes
    b. Plan 10 - Work in Right Lane 4 Lane Undivided Highway.

TRAFFIC CONTROL DURING CONSTRUCTION OPERATIONS (English Version)

Rev. Date 1/2008

The following guidelines shall assist field personnel in determining when and what type of traffic control patterns to use for various situations. These guidelines shall provide for the safe and efficient movement of traffic through work zones and enhance the safety of work forces in the work area.

TRAFFIC CONTROL PATTERNS: Traffic control patterns shall be used when a work operation requires that all or part of any vehicle or work area protrudes onto any part of a travel lane or shoulder. For each situation, the installation of traffic control devices shall be based on the following:

Speed and volume of traffic
Duration of operation
Exposure to hazards

Traffic control patterns shall be uniform, neat and orderly so as to command respect from the motorist.

In the case of a horizontal or vertical sight restriction in advance of the work area, the traffic control pattern shall be extended to provide adequate sight distance for approaching traffic.

If a lane reduction taper is required to shift traffic, the entire length of the taper should be installed on a tangent section of roadway so that the entire taper area can be seen by the motorist.

Any existing signs that are in conflict with the traffic control patterns shall be removed, covered, or turned so that they are not readable by oncoming traffic.

When installing a traffic control pattern, a Buffer Area should be provided and this area shall be free of equipment, workers, materials and parked vehicles.

Typical traffic control plans 20 through 25 may be used for moving operations such as line striping, pot hole patching, mowing, or sweeping when it is necessary for equipment to occupy a travel lane.

Traffic control patterns will not be required when vehicles are on an emergency patrol type activity or when a short duration stop is made and the equipment can be contained within the shoulder. Flashing lights and appropriate trafficperson shall be used when required.

Although each situation must be dealt with individually, conformity with the typical traffic control plans contained herein is required. In a situation not adequately covered by the typical traffic control plans, the Contractor must contact the Engineer for assistance prior to setting up a traffic control pattern.

PLACEMENT OF SIGNS: Signs must be placed in such a position to allow motorists the opportunity to reduce their speed prior to the work area. Signs shall be installed on the same side of the roadway as the work area. On multi-lane divided highways, advance warning signs may be installed on both sides of the highway. On directional roadways (on-ramps, off-ramps, one-way roads), where the sight distance to signs is restricted, these signs should be installed on both sides of the roadway.

Allowable Adjustment of Signs and Devices
Shown on the Traffic Control Plans

The traffic control plans contained herein show the location and spacing of signs and devices under ideal conditions. Signs and devices should be installed as shown on these plans whenever possible.

The proper application of the traffic control plans and installation of traffic control devices depends on actual field conditions.

Adjustments to the traffic control plans shall be made only at the direction of the Engineer to improve the visibility of the signs and devices and to better control traffic operations. Adjustments to the traffic control plans shall be based on safety of work forces and motorists, abutting property requirements, driveways, side roads, and the vertical and horizontal curvature of the roadway.

The Engineer may require that the traffic control pattern be located significantly in advance of the work area to provide better sight line to the signing and safer traffic operations through the work zone.

Table I indicates the minimum taper length required for a lane closure based on the posted speed limit of the roadway. These taper lengths shall only be used when the recommended taper lengths shown on the traffic control plans cannot be achieved.

TABLE I – MINIMUM TAPER LENGTHS

POSTED SPEED LIMIT MILES PER HOUR	MINIMUM TAPER LENGTH IN FEET FOR A SINGLE LANE CLOSURE
30 OR LESS	180
35	250
40	320
45	540
50	600
55	660
65	780

SECTION 1. WORK ZONE SAFETY MEETINGS

1.a) Prior to the commencement of work, a work zone safety meeting will be conducted with representatives of DOT Construction, Connecticut State Police (Local Barracks), Municipal Police, the Contractor (Project Superintendent) and the Traffic Control Subcontractor (if different than the prime Contractor) to review the traffic operations, lines of responsibility, and operating guidelines which will be used on the project. Other work zone safety meetings during the course of the project should be scheduled as needed.

1.b) A Work Zone Safety Meeting Agenda, (see Section 9), shall be developed and used at the meeting to outline the anticipated traffic control issues during the construction of this project. Any issues that can't be resolved at these meetings will be brought to the attention of the District Engineer and the Office of Construction.

SECTION 2. INSTALLING AND REMOVING TRAFFIC CONTROL PATTERNS

2.a) Lane Closures shall be installed beginning with the advanced warning signs and proceeding forward toward the work area.

2.b) Lane Closures shall be removed in the reverse order, beginning at the work area, or end of the traffic control pattern, and proceeding back toward the advanced warning signs.

2.c) Stopping traffic may be allowed:

- As per the contract for such activities as blasting, steel erection, etc.
- To move slow moving equipment across live traffic lanes into the work area.

2.d) Under certain situations when the safety of the traveling public and/or that of the workers may be compromised due to conditions such as traffic volume, speed, roadside obstructions, or sight line deficiencies, as determined by the Engineer and/or State Police, traffic may be briefly impeded while installing and/or removing the advanced warning signs and the first ten traffic cones/drums only. Appropriate measures shall be taken to safely slow traffic. If required, State Police may use traffic slowing techniques, including the use of Truck Mounted Impact Attenuators (TMAs) as appropriate, for a minimum of one mile in advance of the pattern starting point. Once the advanced warning signs and the first ten traffic cones/drums are installed/removed, the two TMAs and sign crew should continue to install/remove the pattern as described in Section 4c and traffic shall be allowed to resume their normal travel.

2.e) The Contractor must adhere to using the proper signs, placing the signs correctly, and ensuring the proper spacing of signs.

2.g) Prior to installing a pattern, any conflicting existing signs shall be covered with an opaque material. Once the pattern is removed, the existing signs shall be uncovered.

SECTION 8. USE OF TRAFFIC DRUMS AND TRAFFIC CONES

8.a) Traffic drums shall be used for taper channelization on limited-access roadways, ramps, and turning roadways and to delineate raised catch basins and other hazards.

8.b) Traffic drums shall be used in place of traffic cones in traffic control patterns that are in effect for more than a 72-hour duration.

8.c) Traffic Cones less than 42 inches in height shall not be used on limited-access roadways or on non-limited access roadways with a posted speed limit of 45 mph and above.

8.d) Typical spacing of traffic drums and/or cones shown on the Traffic Control Plans in the Contract are maximum spacings and may be reduced to meet actual field conditions as required.

NOTES FOR TRAFFIC CONTROL PLANS

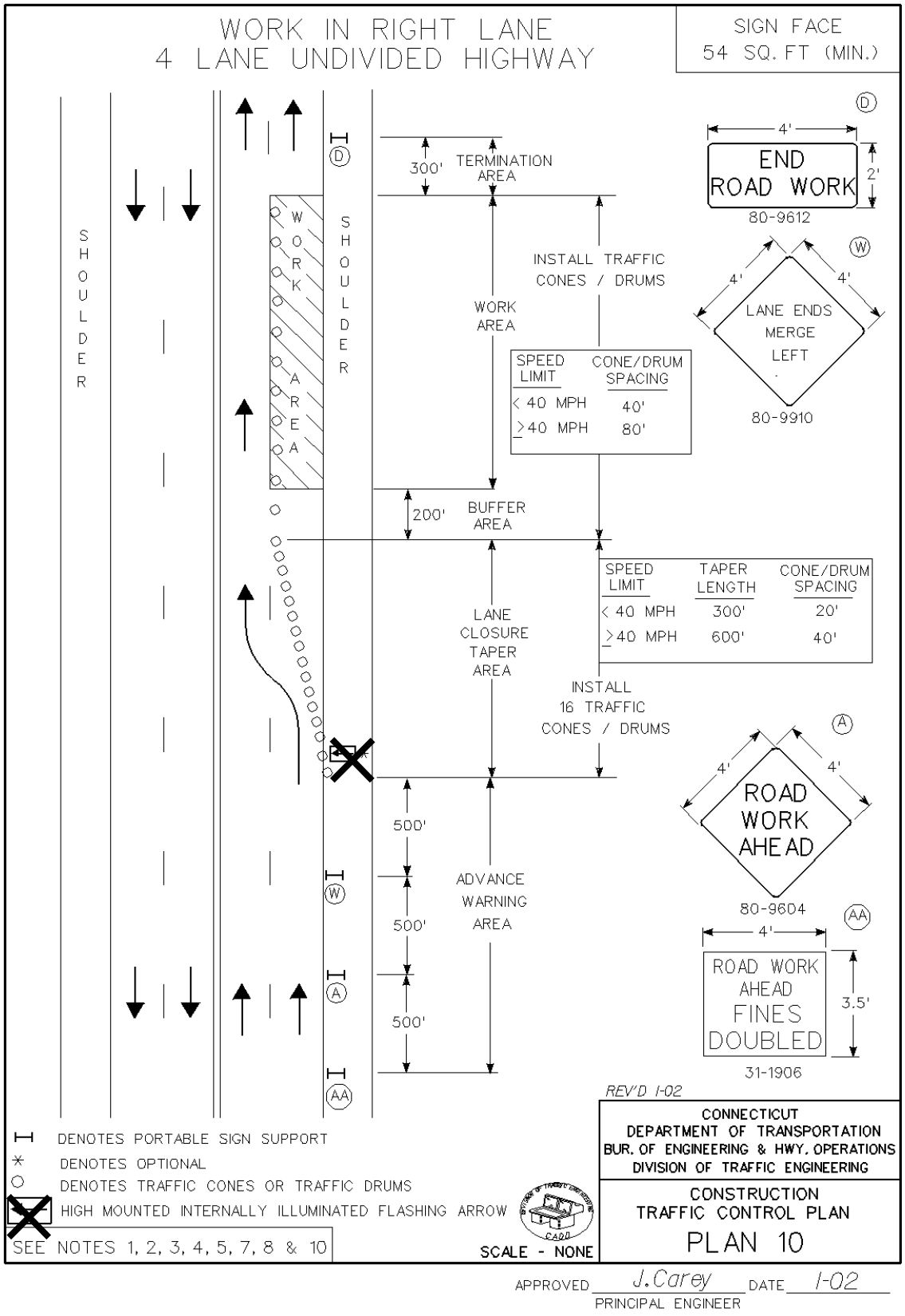
1. IF A TRAFFIC STOPPAGE OCCURS IN ADVANCE OF SIGN (A), THEN AN ADDITIONAL SIGN (A) SHALL BE INSTALLED IN ADVANCE OF THE STOPPAGE.
2. SIGNS (AA), (A) AND (D) SHOULD BE OMITTED WHEN THESE SIGNS HAVE ALREADY BEEN INSTALLED TO DESIGNATE A LARGER WORK ZONE THAN THE WORK ZONE THAT IS ENCOMPASSED ON THIS PLAN.
3. SEE TABLE #1 FOR ADJUSTMENT OF TAPERS IF NECESSARY.
4. A CHANGEABLE MESSAGE SIGN MAY BE UTILIZED ONE HALF TO ONE MILE IN ADVANCE OF THE LANE CLOSURE TAPER.
5. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 72 HOURS, THEN TRAFFIC DRUMS SHALL BE USED IN PLACE OF TRAFFIC CONES.
6. ANY LEGAL SPEED LIMIT SIGNS WITHIN THE LIMITS OF A ROADWAY / LANE CLOSURE AREA WILL BE COVERED WITH AN OPAQUE MATERIAL WHILE THE CLOSURE IS IN EFFECT AND UNCOVERED WHEN THE ROADWAY / LANE CLOSURE IS REOPENED TO ALL LANES OF TRAFFIC.
7. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN THE EXISTING CONFLICTING PAVEMENT MARKINGS SHALL BE ERADICATED OR COVERED AND TEMPORARY PAVEMENT MARKINGS THAT DEPICT THE PROPER TRAVELPATHS SHALL BE INSTALLED.
8. DISTANCES BETWEEN SIGNS IN THE ADVANCE WARNING AREA MAY BE REDUCED TO 200' ON LOW SPEED URBAN ROADS (SPEED LIMIT < 40 MPH).
9. FOR LANE CLOSURES ONE (1) MILE OR LONGER, A "REDUCE SPEED TO 45 MPH" SIGN SHALL BE PLACED AT THE ONE MILE POINT AND AT EACH MILE THEREAFTER.
10. IF THIS PLAN IS TO REMAIN IN OPERATION DURING THE HOURS OF DARKNESS, INSTALL BARRICADE WARNING LIGHTS - HIGH INTENSITY ON ALL POST-MOUNTED DIAMOND SIGNS IN THE ADVANCE WARNING AREA.
11. A CHANGEABLE MESSAGE SIGN SHALL BE INSTALLED ONE HALF TO ONE MILE IN ADVANCE OF THE LANE CLOSURE TAPER.

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN
NOTES

NOTES.DGN


WORK IN RIGHT LANE
4 LANE UNDIVIDED HIGHWAY
SIGN FACE
54 SQ. FT (MIN.)
SHOULDER
WORK AREA
SHOULDER
300'
TERMINATION AREA
WORK AREA
INSTALL TRAFFIC CONES / DRUMS
SPEED LIMIT
CONE/DRUM SPACING
< 40 MPH
40'
≥ 40 MPH
80'
200'
BUFFER AREA
LANE CLOSURE TAPER AREA
SPEED LIMIT
TAPER LENGTH
CONE/DRUM SPACING
< 40 MPH
300'
20'
≥ 40 MPH
600'
40'
INSTALL 16 TRAFFIC CONES / DRUMS
500'
ADVANCE WARNING AREA
500'
500'
4'
END ROAD WORK
2'
80-9612
4'
4'
LANE ENDS MERGE LEFT
80-9910
4'
4'
ROAD WORK AHEAD
80-9604
4'
ROAD WORK AHEAD
FINES DOUBLED
3.5'
31-1906
REV'D 1-02
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BUR. OF ENGINEERING & HWY. OPERATIONS
DIVISION OF TRAFFIC ENGINEERING
CONSTRUCTION
TRAFFIC CONTROL PLAN
PLAN 10
DENOTES PORTABLE SIGN SUPPORT
DENOTES OPTIONAL
DENOTES TRAFFIC CONES OR TRAFFIC DRUMS
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW
SEE NOTES 1, 2, 3, 4, 5, 7, 8 & 10
SCALE - NONE
APPROVED J. Carey DATE 1-02
PRINCIPAL ENGINEER

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SECTION 02 41 19 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes the following:

1. Demolition and removal of items at the Pumping Station building as shown on drawings.
2. Remove and dispose of Sluice Gate Actuator and indicators:
    a. One (1) 66" x 66" Sluice Gate Electric Actuator (as directed by the Owner)
    b. Two (2) 66" x 66" Sluice Gate Electronic Valve Indicators two
    c. One (1) 78" x 78" Sluice Gate Electronic Valve Indicator
3. Remove and dispose of exterior steel doors total of three (3).
4. Removal of storm drainage pipe

1.3 Definitions

A. Demolish: Completely remove and legally dispose of off-site.

B. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.

1.4 Materials Ownership

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 Submittals

A. Schedule of Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

B. Landfill Records: Provide receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 Quality Assurance

A. Examination of Existing Conditions: The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.7 Project Conditions

A. Shaw's Cove Pumping Station shall be in service during the demolition.

1. Maintain access to existing walkways, pumping station building, and other facilities adjacent to the Pumping Station building.

    a. Do not close or obstruct walkways, exits, or other facilities without written permission from authorities having jurisdiction.

B. Owner assumes no responsibility for buildings and structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Hazardous Materials: If hazardous materials, such as chemicals, asbestos-containing materials, or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify Engineer and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Engineer. Continue to work in other areas.

D. On-site storage or sale of removed items or materials is not permitted.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 Examination

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

E. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

F. When unanticipated mechanical, electrical, or structural elements that conflict with intended function of design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

G. Survey of Existing Conditions: Record existing conditions by use of preconstruction videotapes.

1. Before selective demolition that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 Preparation

A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

3.3 Protection

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.

1. Protect existing site improvements, appurtenances, and landscaping to remain.

2. Protect walls, windows, roofs, and other equipment that are to remain and that are exposed to demolition operations.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 Selective Demolition, General

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, verify condition and contents of hidden spaces before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, and framing.
8. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

C. Items for Re-use and Preservation of Existing Surfaces to Remain:

1. The Contractor shall inspect closely each item specifically designated to be relocated, reused, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Engineer and Owner. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection, and shall bear responsibility for its repair or same replacement as directed by the Engineer, to the satisfaction of the Owner.
2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

3.5 Disposal Of Demolished Materials

A. Remove demolition waste materials from Project site.

B. Remove demolition waste materials from Project site and legally dispose of them in an approved landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. Do not burn demolished materials.

3.6 Cleaning

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

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SECTION 09 01 91 – REPAINTING STRUCTURAL STEEL

PART 1 - GENERAL

1.1 Section Includes

A. Field cleaning, surface preparation and repainting of existing galvanized steel sluice gates cabinets, and steel entrance door and door jamb to the Shaw's Cove pumping station.

1. Elements include cabinet plates, doors, hinges, nuts and bolts, building entrance steel door and door jambs, and other miscellaneous steel elements.

2. Galvanized steel cabinets are as follow:
   a. 66"x 66" Sluice gate cabinets: Three (3) cabinets attached to the pumping station building. Approximate size: 52" x 67" x 24"
   b. 78" x 78" Sluice gate cabinet: one (1) Cabinet Approximate size: 52" x 67" x 24" (see CD-502 for location)
   c. 96" x 96" Sluice gate cabinet: one (1) Cabinet Approximate size: 65" x 72" x 24" (see CD-502 for location)

B. Prepare existing steel surface for repainting, and paint the cleaned structural steel surfaces

1.2 References

A. ASTM: American Society of Testing and Materials

1. ASTM D 4285: Standard Test Method for Indicating Oil or Water in Compressed Air

2. ASTM D 4417: Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

3. ASTM E 11: Wire Cloth and Sieves For Testing Purposes

B. Federal Standards

C. NEPCOAT: Northeast Protective Coatings Committee

D. SSPC: The Society for Protective Coatings.

1. Technology Guide Number 6 – Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations

1.3 Submittals

A. Detailed plan for approval for protection methods that includes Environmental Protection.

B. Source and gradation of the blast abrasive.

C. Type and source of solvent if required.

D. Manufacturer's information regarding the specified coating materials, including:

1. Required wet and dry film thickness
2. Project safety data
3. Thinning recommendations
4. Temperature requirements
5. Profile recommendations
6. Mixing and application procedures
7. Required equipment

E. Test samples

F. Provide Engineer with a copy of Quality Control Plan. At a minimum it must contain procedures and verification of the following:

1. Compression air check. Refer to ASTM D 4285.
2. Dry film thickness. Refer to SSPC-PA2.
3. Air temperature
4. Humidity and Dew point
5. Surface temperature
6. Abrasive cleanliness check. Refer to SSPC AB 2.
7. Degree of cleanliness achieved
8. Surface profile. Refer to ASTM D 4417 Method C.
9. Batch number and amount of thinner used
10. Batch number of paint used

G. Provide daily reports to Engineer upon request.

1. Submit no later than 24 hours following the completion of work.

H. Submit a written site specific compliance program documenting the equipment, training, containment, and monitoring system to comply with OSHA's standard on lead exposure in construction as published in Federal Register, Section 29 CFR 1926.62, May 4, 1993.

1. Worker Health and Safety Program

2. Environmental Protection and Monitoring Program

3. Hazardous Waste Handling and Reporting of Release Program

4. Provide Engineer with Quality Control Plan and Procedures

I. Copy of SSPC Certifications

1.4 Quality Assurance

A. Responsible Parties:

1. Contractors and subcontractors performing surface preparation or coatings applications in the field:
   a. Obtain SSPC QP 2 Category A Certification.

1.5 Coating Application Requirements

A. Have the painter, the blasting operator, or both consult with the manufacturer's technical representative for answers to technical questions relating to the application of the specified coating materials.

B. Obtain surface preparation approval from the Engineer before beginning steel repairs and before field applying paint.

C. Use equipment capable of taking dry film thickness readings on all portions including nuts and bolts.

1.6 Project Conditions/Weather Limitations

A. Follow the manufacturer's recommendations if weather conditions require paint thinning.

B. Apply paint only when the following weather conditions exist:

1. The temperature of the air and the steel: above 40 degrees F, but not so hot as to cause the paint to blister.

2. The relative humidity:
   a. Less than 85 percent or such that the combination of temperature and humidity conditions inhibits surface condensation.
   b. Apply a thin film of water to a small area to test humidity. The surface may be painted if the film evaporates within 15 minutes.
   c. Steel temperature a minimum of 5 degrees F above Dew point.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Manufacturers' Names:

1. Benjamin Moore & Co. (Benjamin Moore).
2. PPG Industries, Inc. (Pittsburgh Paints).
3. Sherwin-Williams Co. (Sherwin-Williams).

2.2 Materials

A. Blasting abrasive: type and size as required.

B. Solvent: type and source as required.

C. Coating materials:

1. Mix properly following manufacturer's recommendations and project specifications.

2. Use necessary equipment for the proper application of the specified coating, observing safety practices found in SSPC Paint Application Guide No. 3, "A Guide to Safety in Paint Application."

2.3 Coating System

A. Select a complete 3-part coating system consisting of a zinc primer, epoxy or urethane intermediate coat, and aliphatic urethane top coat from the NEPCOAT Qualified Products List.

B. Use manufacturer's information regarding the specified coating materials, including required wet- and dry-film thickness, project safety data, thinning recommendations, temperature requirements, profile recommendations, mixing and application procedures, and required equipment.

C. Use coating materials properly mixed meeting the manufacturer's recommendations and project specifications. Check that the bottom of the container is free of any unmixed pigments prior to use.

D. Paint Color: Federal Standard No. 595.

1. Field coat: Color: Gray (Coordinate with Owner)

2. Top coat: Color: Gray (Coordinate with Owner)

E. Use necessary equipment for the proper application of the specified coating.

2.4 Exterior Galvanized Steel Cabinets

A. Surface Preparation: All galvanized items shall be lightly brush blasted or hand sanded equivalent to fine sand paper in appearance. (Not greater than 1 to 1.5 mil surface profile.)

B. Prime: Tnemec Series 27 Typoxy, Carboline Galoseal WB or equal at 2.5 to 3.5 mils DFT.

C. Finish: Tnemec Series 73 Endurashield, Carboline Carbothane 134 HG or equal at 1.5 to 3 mils DFT.

2.5 Mix

A. Mix the paint to a lump-free consistency with a high shear mixer such as a Jiffy mixer, according to the producer's directions.

1. Do not use paddle mixers or paint shakers.

2. Keep paint in the original containers and mix until all the metallic powder or pigment is suspended.

3. Continue mixing until all solids that may have settled to the bottom of the container are thoroughly dispersed.

B. Strain the paint through a screen having openings no larger than those specified for a No. 50 sieve. Refer to ASTM E 11.

C. Strain and continuously agitate the mixed material up to and during the time of application.

PART 3 - EXECUTION

3.1 Preparation

A. Clean surfaces including bearing units of all oil, grease, and dirt with clean petroleum solvents or steam cleaning prior to blasting operation. Refer to SSPC-SP10.

B. Surface Preparation: Clean steel surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. Corroded Steel:
   a. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning" requires that 95 percent of surface area be free of visible residue.

2. Painted Steel:
   a. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning" which allows tight residues of rust, mill scale, and coatings to remain.

3. Before painting, remove or adequately protect all prefinished items, protect adjacent surfaces as directed. Paint bottom edges of door. After painting, clean up all paint spots, droppings, etc. Touch up all damaged or defective work as directed.

C. Discoloration, light shadows, or slight streaks caused by stains of rust is not allowed on more than 5 percent of surface area.

D. Define acceptable surface preparation using SSPC-Vis 1.

E. Use SSPC-SP-11 "Power Tool Cleaning to Bare Metal" to clean areas such as backside of base plates, corners, etc., that cannot otherwise be cleaned.

F. Meet soluble salts requirements of SSPC and the coatings manufacturer.

G. Prime the surface within 8 hours from blasting.

H. Do not prime the surface if rust has started to form. Clean the surface again before applying the prime coat.

I. Protection:

1. Fully contain all material resulting from paint overspray.

2. Enclosure system must withstand extreme high winds.

3. Protect all portions of the structure that will not be painted including the underside of existing and new concrete deck.

3.2 PAINT STORAGE AND MIXING AREAS, AND WASTE DISPOSAL

A. Store paints and painter's materials only in area or areas designated solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris before authorized disposal to these areas.

B. Do not use plumbing fixtures, piping or mechanical equipment for mixing or disposal of paint materials.

1. Transport water to paint area by approved temporary hose or piping.

2. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in painter's area longer than 24 hours. Finally, dispose of waste in an approved disposal system outside of buildings.

3.3 Application

A. Field Inspection:

1. Do not apply paint until the Engineer approves the prepared surface.

2. Use rubber rollers or other approved protective devices on scaffold fastenings.

3. Do not use metal rollers, clamps, and other types of fastenings that mar or damage freshly coated surfaces.

B. Apply paint with spray nozzles at pressures recommended by the manufacturer of the coating system.

C. Prime Coat:

1. Maintain the dry film thickness of the prime coat between 2.5 and 6.0 mils. Refer to SSPC PA2.

2. Apply two or more coats without producing runs, bubbles, or sags if the required film thickness cannot be obtained by one coat.

3. Blast clean any coat that produces "mud-cracking" or adds more than 7.0 mils to a soundly bonded coating or bare steel. Refer to SSPC-SP 10. Re-coat the surface.

4. Thoroughly clean areas having deficient primer thickness with power washing equipment to remove all dirt. Wire-brush, vacuum, and re-coat the area.

D. Intermediate Coat: Apply paint to produce a uniform, even coating that bonds to the underlying surface. Refer to SSPC-PA 1.

1. Use the coating type and minimum dry film thickness specified.

2. Produce a dry-film thickness of the intermediate coat greater than 4 mils. Refer to SSPC PA2.

E. Finish coat: Keep the dry film thickness greater than 2 mils. Refer to SSPC-PA2.

F. Use wet and dry film thickness gauges for testing the coating thickness during and after application.

G. Painting Safety: Follow SSPC Paint Application Guide No. 3, "A Guide to Safety in Paint Application."

3.4 Suspension Of Work

A. Engineer may suspend work for questionable performance of the painter, blasting operator, or the equipment.

B. Suspension of work results from inadequate surface preparation, improper profile, runs, sags, overspray, thin film thickness, excessive film build-up, uneven coating, non-uniform color, improper curing, or any other defect in the coating system.

3.5 PROTECTION, CLEAN-UP

A. Protect materials and surfaces painted or coated under this section, both before and after application. Also protect adjacent work and materials by the use of sufficient drop cloths during the progress of this work. Upon completion of the work, clean up paint spots, oil, and stains from floors, glass, hardware, and similar finished items.

3.6 FINAL TOUCH-UP

A. Prior to final completion and acceptance, examine painted and finished surfaces and retouch or refinish as necessary and require to leave surfaces in perfect condition.

B. After each door has been fitted and hung, refinish edges, tops and bottom.

END OF SECTION

SECTION 26 05 05 – COMMON ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Provide basic electrical system components including raceway, wire and cable, pull and junction boxes, outlet boxes, wiring devices, motor starters, disconnect switches, overcurrent protective devices, electrical equipment not furnished as an integral part of manufactured equipment, and all incidental devices and accessories necessary for a complete and operational system as indicated on the Drawings and as specified.

B. Coordination of Electric Provider
   1. Coordinate electric utility company activities.
      a. Provide electric utility company a written schedule of electrical demolition activities and new work to ensure proper sequencing of each utility company's work.
         1) Keep the utility company apprised of any schedule changes.

C. Costs and Fees Associated with Electric Provider
   1. Work performed by utility company will be paid for with allowance provide in specifications.

1.3 Permits And Fees

A. Provide all necessary notices, obtain all permits, file all required plans, obtain all necessary approvals of governmental departments and utilities having jurisdiction over the electrical work and obtain all required certificates and inspections.

1.4 Codes, Regulations And Standards

A. All materials, equipment, apparatus and work shall be in accordance with the latest edition of the National Electrical Code, State and Local codes, and requirements of local utility companies.

B. Electrical equipment and materials shall be approved by the Underwriters' Laboratories, Inc. or other national, well known testing laboratory as evidenced by listing or labeling.
   1. All equipment items or parts thereof shall bear the manufacturer's nameplate, which shall give all pertinent information for the particular item.
      a. Distributor's or contractor's nameplates will not be acceptable.

C. Discrepancies. Provide the more stringent requirement in case of discrepancies among the Contract Documents, Code requirements and industry standards. Also, include item or arrangement of better quality, greater quantity or higher cost in Contract price.
   1. Notify Engineer in writing of identified discrepancies.

D. Design Drawings: Drawings are diagrammatic in nature. Locations of electrical equipment and accessories are not intended to show every offset and fitting, nor every structural difficulty that may be encountered during the installation of the Work.
   1. Where necessary and after approval from the Engineer, revise alignment of work and equipment from that shown on Drawings without additional cost to the Owner.
      a. Identify revised locations on Record Drawings.

1.5 Definitions

A. The following terms are used in this Division and are defined as follows:
   1. "Provide": To furnish and install, ready for safe and regular operation the item, material or service under discussion.
   2. "Furnish": To purchase, acquire and deliver to the site, complete with related accessories.
   3. "Install": To erect, mount and connect completely, by acceptable methods.
   4. "Concealed": Embedded in masonry or other construction; or installed in furred spaces, trenches or crawl spaces; or installed within double partitions or hung ceilings; or in enclosures.
   5. "Exposed": Visible to building occupants, excluding mechanical room and utility tunnel locations.
   6. "Equal": Of weight, size, design, capacity and efficiency to meet requirements specified and shown, and of acceptable manufacture, as determined in the opinion of the Engineer.
   7. "Acceptable": Acceptable, as determined in the opinion of the Engineer.
   8. "Named" Product: Manufacturer's name for product, as recorded in published documents of latest issue as of date of Contract Documents. Obtain Engineer's permission before using products of later or earlier model.

1.6 Submittals - General

A. Identify the following:
   1. Accessories and special/non-standard features and materials to be provided.
   2. List of accessories which are required for a proper installation but are NOT part of the submittal.
      a. In the latter case, identify the Section(s) under which the accessories are being provided.

B. Format: Include the following information on each submittal. Failure to comply will result in submittal rejection.
   1. Specification Section and Paragraph under which equipment is specified.)
   2. Equipment or fixture identification corresponding to that used in Contract Documents.
   3. Descriptive data necessary to verify compliance with Contract Documents.

C. Operation and Maintenance Manuals Format
   1. Arrange manuals in the following format:
      a. Tab A - Description of Electrical System and Component Parts, including function, normal operating characteristics and limiting conditions, performance curves, engineering data and tests, and complete nomenclature and manufacturer's number for replaceable parts.
      b. Tab B - Operating Procedures, including start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shutdown and emergency instructions; summer and winter operating instructions; and any special operating instructions.
      c. Tab C - Sequence of Operation and Control Diagrams, corrected to show as-built conditions.
      d. Tab D - Copies of approved shop drawings, charts and diagrams.
      e. Tab E - Maintenance Procedures, including routine operations, guide to trouble-shooting; disassembly, repair and reassembly; alignment, adjusting and checking; servicing and lubrication schedule, and list of lubricants; manufacturer's installation and maintenance bulletins and related information.
      f. Tab F - Parts List, including illustrations, assembly drawings and diagrams required for maintenance, predicted life of parts subject to wear, and recommendations for stocking spare parts.
      g. Tab G - Names, addresses and telephone numbers of manufacturer's representative and Service Company.
      h. Tab H - Other data, if required under pertinent Sections of these Specifications.

D. Review Process: Upon completion of submittal review, Action Submittals will be returned, marked with one of following notations: Furnish as Submitted, Furnish as Corrected, Revise and Resubmit, Rejected, or Submit Specified Item.
   1. Provide only materials and products noted as "Furnish as Submitted" or "Furnish as Corrected".

1.7 INFORMATIONAL SUBMITTALS

A. List of Proposed Manufacturers: Submit prior to product and shop drawing submittals.

B. Copies of notification letters, permits, certificates, and inspection reports.

C. Manufacturers Guarantee: Furnish standard manufacturers' guarantees for work. Such guarantees shall be in addition to, and not in lieu of, other liabilities under the law or by other provisions of the Contract Documents.

1.8 Action Submittals

A. Product Data:
   1. Manufacturer's specifications including materials of construction, metal gage, thickness and finish.

2. Performance data, ratings, operating characteristics and operating limits.
3. Electrical ratings and characteristics.
4. Certifications requested, including UL label or listing.

B. Certification: Certify that system elements are of sufficient capacity to meet the specified performance requirements as set forth in Contract Documents.

C. Shop Drawings
1. Certified dimensional drawings including clearances required for maintenance or access.
2. Wiring and control diagrams, where applicable.

D. The selection and intention to use a product specified by name shall NOT excuse the need for timely submission of shop drawings for that product.

E. Submission of shop drawings of unnamed manufacture or shop drawings at variance with the Contract Documents is NOT a proper request for substitution.

F. Samples
1. Submit samples as requested by Engineer/Owner.
2. Clearly identify samples that are submitted in lieu of shop drawings. Submit a minimum of two samples.
   a. Only one sample will be returned. Keep the accepted sample at the job site office.

1.9 Closeout Submittals

A. Record Drawings
1. Maintain and keep on site at all times, one complete set of blackline prints for Electrical and Communication work. Promptly and accurately record changes, revisions and additions in a clear and neat format.
2. Indicate daily progress on Record Drawings by coloring in the various lines, fixtures, apparatus and associated appurtenances as they are erected.
3. Approval of requisition for payment of work installed will NOT be given unless supported by the Record Drawings.
4. At the conclusion of work, deliver Record Drawings to Owner.

B. Operation and Maintenance Manuals
1. Submit Operation and Maintenance manuals for each system or piece of equipment, at least 4 weeks prior to request for acceptance of same. Upon acceptance, furnish four copies of each manual to Engineer for transmittal to Owner.

C. Video of Equipment Instruction Procedures. Pertaining to the operation or programming of equipment. Submit to Owner.

D. Letter of Guarantee.

E. Extended equipment warranty.

1.10 Quality Assurance

A. Only the best of workmanship in accordance with present standards and generally accepted construction practices will be acceptable. Any work which the workmanship is judged by the Engineer to be below the present standards or generally accepted construction practices shall be replaced with properly done work at the Contractor's expense.

1.11 Warranty

A. Warranty materials, equipment and labor against defects for a period of one year from date of Substantial Completion. Repair or replace areas, materials and other systems damaged as a result of defects.
   1. Replace defective items (requiring excessive servicing) during warranty period at no additional cost to the Owner.
   2. Provide maintenance and emergency service including labor and materials during the warranty period at no additional cost to Owner. Perform service and replace affected components within reasonable time period.

PART 2 - PRODUCTS

2.1 General

A. Materials for the Work are specified in the appropriate Specification Sections and may also be specified on the Drawings.

2.2 Product Selection

A. Contractor's options for selecting products are limited by Contract Document requirements and governing regulations and are NOT controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but are NOT necessarily limited to, following various methods of specifying:
   1. "Or Equal": Where named products are accompanied by the term "or equal" or words of similar effect, provide one of named products or propose substitute product according to "SUBSTITUTIONS" Article.
   2. Standards, Codes and Regulations: Where specification requires only compliance with a standard, code or regulation, Contractor may select any product which complies with requirements of that standard, code or regulation.
   3. Performance Requirements: Provide products which comply with specific performances indicated and which are recommended by manufacturer (in published product literature or by individual certification) for application intended. Overall performance of product is implied where product is specified with only certain specific performance requirements.

B. Inclusion by name, of more than one manufacturer or fabricator, does NOT necessarily imply acceptability of standard products of those named. All manufacturers, named or proposed, shall conform, with modification as necessary, to criteria established by Contract Documents for performance, efficiency, materials and special accessories.

2.3 Substitutions

A. Substitution request from Contractors may be submitted only after the award of Contract. Requests shall be in writing on Contractor's letterhead and shall include:
   1. Contractor's statement to the effect that proposed substitution will result in overall work equal to or better than, work originally intended.
   2. Contractor's detailed comparison of significant qualities between specified item and proposed substitution.
   3. Statement of effect on construction time, coordination with other affected work, and cost information or proposal.

B. Substitution requests from contractors will only be considered if:
   1. Extensive revisions to Contract Documents are NOT required;
   2. Changes are in keeping with general intent of Contract Documents;
   3. Requests are submitted in a timely and proper manner, fully documented; and
   4. One or more of following conditions is satisfied; all as judged by Engineer:
      a. Where request is directly related to the "or equal" clause or words of similar effect in Contract Documents.
      b. Where specified product, material or method can NOT be provided within Contract Time; but NOT as a result of Contractor's failure to pursue the work promptly to coordinate various activities properly.
      c. Where specified product, material or method can NOT be provided in manner which is compatible with other materials of the work and where Contractor certifies that proposed substitution is compatible.
      d. Where specified product, material or method can NOT be properly coordinated with other materials of the work and where Contractor certifies that proposed substitution can be properly coordinated.
      e. Where specified product, material or method can NOT be warranted as required and where Contractor certifies that proposed substitution can be so warranted.
      f. Where specified product, material or method can NOT be used without adversely affecting Owner's insurance coverage on completed work and where Contractor certifies that proposed substitution can be so used.
      g. Where specified product, material or method will encounter other substantial non-compliances which are NOT possible to otherwise overcome except by using proposed substitution.
      h. Where specified product, material or method can NOT receive required approval by governing authority and proposed substitution can be so approved.
      i. Where a substantial advantage is offered to the Owner; in terms of cost, time, energy conservation or other valuable considerations; after deducting offsetting

responsibilities that this Contractor may be required to bear, including additional compensation to Engineer for any redesign or evaluation services, increased cost of other work by other contractors, and similar considerations.

C. The burden is upon the Contractor, supplier and manufacturer to satisfy to the Engineer that:
   1. The proposed substitute is equal to, or superior to, the item specified.
   2. The intent of the Contract Documents, including required performance, capacity, efficiency, quality, durability, safety, function, appearance, space clearances and delivery date, will be equaled or bettered.

D. Changes in work of other trades, such as structural supports, which are required as a result of substitution and the associated costs for such changes, shall be the complete responsibility of the Contractor proposing the substitution. There shall be NO additional expense to the Owner.

PART 3 - EXECUTION

3.1 Installation

A. Install work as close as possible to layouts shown on Contract Drawings. Modify work as necessary to:
   1. Provide maximum possible headroom and space clearances.
   2. Provide ready access to all parts of the work, for inspection, operation, safe maintenance and repair, and code conformance.
   3. Coordinate and arrange work to avoid conflicts with work of other trades. Satisfactory space conditions shall be shown on coordination drawing submittals.

B. Where space appears inadequate, consult Engineer before proceeding with installation.

C. Finished work shall present a neat coordinated appearance.

3.2 inspection Of work

A. Do not cover or enclose work until it has been inspected, tested, and approved by the Owner's Representative and by authorities having jurisdiction.

B. When requested, uncover and expose work that has not been completely inspected, tested and approved. Repair and restore surfaces and enclosures at no additional cost to Owner.

3.3 Field Quality Control

A. Instruct the Owner or the Owner's Representative in the operation, adjustment, and maintenance of electrical equipment. The procedures of any instructions pertaining to the operation and/or programming of equipment shall be video taped and two copies turned over to the Owner.

B. Obtain services of manufacturer's representatives of major equipment during erection or construction of their respective equipment to insure proper installation of same. Failure to have such checks made by manufacturers shall place full responsibility for proper installation on contractor who shall make any corrections or remedy all defects at no additional cost to Owner. If required by the Engineer, a letter shall be provided from each manufacturer certifying that manufacturer's requirements are met.

C. Test and adjust each system and equipment for which he is responsible during the progress of the work, as required by the Engineer, and shall thoroughly test the same under working conditions at the completion of the work.

D. Coordinate activities related to the electrical work.

3.4 Cleaning

A. Remove debris at the close of each workday from work areas and adjacent occupied areas. Maintain adjacent areas in a safe and useable condition.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes the following:
   1. Wiring and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.3 Definitions

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 Submittals

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 Quality Assurance

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 Coordination

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 Conductors and Cables

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Insulated Wire Corp.; a Leviton Company.
   2. General Cable Corporation.
   3. Senator Wire & Cable Company.
   4. Southwire Company.
   5. Approved Manufacturer

B. Copper Conductors: Comply with NEMA WC 70. Minimum size for power and lighting shall be No. 12. Minimum size for low voltage control shall be No. 16.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.

2.2 Connectors and Splices

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AFC Cable Systems, Inc.
   2. Hubbell Power Systems, Inc.
   3. O-Z/Gedney; EGS Electrical Group LLC.
   4. 3M; Electrical Products Division.
   5. Tyco Electronics Corp.
   6. Approved Manufacturer

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 Conductor Material Applications

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 Conductor Insulation and Multiconductor Cable Applications and Wiring Methods

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: [**Type THHN-THWN, single conductors in raceway**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**] [**Nonmetallic-sheathed cable, Type NM**].

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

G. Class 1 Control Circuits: Type THHN-THWN, in raceway.

H. Class 2 Control Circuits: Type THHN-THWN, in raceway.

I. Branch circuit conductors within lighting fixtures shall have minimum 90 degrees C. rating approved for fixture wiring.

J. Final connections to equipment shall be made with copper insulated conductors installed in liquid tight flexible raceway. Minimum size ¾".

3.3 Installation Of Conductors and Cables

A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

C. There shall be no splices in any conductors except where circuits are branched and located in accessible junction or outlet box.

D. Unless otherwise noted, each conduit raceway shall contain only those conductors constituting a single feeder circuit.

E. Branch circuit home runs shall not share a common neutral. Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.

F. All feeder and branch circuits shall have a full size separate grounding conductor installed in the conduit.

G. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 Connections

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. All connections and pigtail splices for wires #14-#10 shall be made with insulated type "Y", "R", or "B" spring connectors or compression splices. Conductor sizes #8 and larger shall be made with compression connectors.

D. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

E. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

F. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 Field Quality Control

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 Definitions

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 Submittals

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.
   2. For handholes and boxes for underground wiring, including the following:
      a. Duct entry provisions, including locations and duct sizes.
      b. Frame and cover design.
      c. Grounding details.

d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Qualification Data: For professional engineer and testing agency.

D. Source quality-control test reports.

1.5 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 Metal Conduit And Tubing

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.
10. Approved Equal

B. EMT: ANSI C80.3.

C. LFMC: Flexible steel conduit with PVC jacket.

D. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel set-screw type.

E. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 Nonmetallic Conduit And Tubing

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.
13. Approved Equal

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 Boxes, Enclosures, And Cabinets

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.

7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
13. Approved Equal

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 Raceway Application

A. See wiring methods indicated on drawings for raceway applications.

B. Minimum Raceway Size**3/4-inch (21-mm)** trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

3.2 Installation Of Raceways

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 12 inches (300 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Arrange conduit to maintain headroom and present a neat appearance.

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Conceal raceway within finished walls, ceilings, and floors, unless otherwise indicated.

G. All metal conduit, enclosures and raceways for conductors shall be mechanically joined together to form a continuous electrical continuity and bond. Provide grounding bushings on all conduits 1-1/4 inches and larger.

H. Conduits shall be in full lengths wherever possible and all ends shall be cut square, reamed and burred.

I. Bring conduit to the shoulder of fittings and couplings and fasten securely.

J. Use conduit bodies to make sharp changes in direction.

K. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inches in size.

L. The use of wooden plugs inserted in concrete or masonry units as base for fastenings conduits, tubing, boxes, cabinets, or other equipment shall be prohibited.

M. The installation of conduit or tubing which has been crushed or deformed shall be prohibited.

N. All conduits shall be plugged with approved discs during construction and be dry and clean before pulling wires.

O. Install conduit to prevent low spots which might accumulate water during or after installation. Where unavoidable, provide junction box with drain fitting at conduit low point.

P. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

Q. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

S. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

T. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

3.3 Installation Of Underground Conduit

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench and install backfill as shown on drawings.
   2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
   3. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
   4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
      a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
      b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
   5. Install underground warning tape as specified in Division 26 "Identification for Electrical Systems".

3.4 Protection

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:
1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 Submittals

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 Quality Assurance

A. Comply with ANSI A13.1[**and IEEE C2**].

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 Coordination

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 Power Raceway Identification Materials

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 Armored And Metal-Clad Cable Identification Materials

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 Power And Control Cable Identification Materials

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.4 Conductor Identification Materials

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

2.5 Underground-Line Warning Tape

A. Tape:
1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical [**and communications**]utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE, <**Insert inscription**>.

C. Description: 6 inch wide plastic tape, magnetic detectable type, with suitable warning legend described above equal to Seton Name Plate Co. style 57360.

2.6 Warning Labels And Signs

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

2.7 Instruction Signs

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 Equipment Identification Labels

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.9 Cable Ties

A. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
   3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
   4. Color: Black.

2.10 Miscellaneous Identification Products

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 Installation

A. Verify identity of each item before installing identification products.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches (300 mm) below finished grade. Use multiple

tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

3.2 Identification Schedule

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 20 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at **10-foot (3-m)** maximum intervals.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      b. Colors for 208/120-V Circuits:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
      c. Colors for 480/277-V Circuits:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
      d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

E. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   1. Comply with 29 CFR 1910.145.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.

F. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
    a. Equipment: Engraved, laminated acrylic or melamine label.
    b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment to Be Labeled:
    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:
   1. Lighting and appliance branch-circuit panelboards.

1.3 Definitions

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 Submittals

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.
   8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 Quality Assurance

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.6 Delivery, Storage, And Handling

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1.

1.7 Project Conditions

A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
   b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.8 Coordination

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 General Requirements For Panelboards

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- or surface-mounted cabinets as indicated on drawings.
1. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
2. Finishes:
   a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Galvanized steel.
3. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
   6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
   7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 Lighting And Appliance Branch-Circuit Panelboards

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.
   5. Approved equal.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only as indicated on drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

PART 3 - EXECUTION

3.1 Examination

A. Receive, inspect, handle, and store panelboards according to NECA 407 and NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 Installation

A. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

B. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

C. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.

D. Install filler plates in unused spaces.

E. Comply with NECA 1.

3.3 Identification

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 Field Quality Control

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

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

C. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

E. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 Adjusting

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

3.6 Protection

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:
1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities
7. Protect existing site improvements and utilities to remain

B. Related Sections:
1. Section 01 57 13 "Temporary Erosion and Sediment Control" for temporary control systems including silt fence, hay bales, and construction entrance requirements.

1.3 Definitions

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 Material Ownership

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 Informational Submittals

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 Project Conditions

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Remove and Reset Existing Site Improvements. Remove, store, and protect items required to be reset upon completion of proposed construction. Clean and Restore items to existing condition or better prior to resetting.
   1. Restore items promptly during construction; do not leave until end of construction.

D. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 Materials

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Site Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 Preparation

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 Tree And Plant Protection

A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer.

3.3 Existing Utilities

A. Locate, identify, and disconnect utilities indicated to be abandoned in place.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Engineer not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Engineer's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.4 Site Improvements

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along lines of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
      a. Do not mix excavated pavement with other excavated materials.

3.5 Restoration

A. Repair of restore existing site improvements and vegetation to remain, which is damaged by construction operations, to existing condition or better as determined by the Engineer, at no additional cost to owner.

3.6 Disposal Of Surplus And Waste Materials

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:
1. Preparing subgrades for walks, pavements, and turf and grasses.
2. Subbase course and base course for concrete walks and pavements.
3. Subbase course and base course for asphalt paving.
4. Subsurface drainage backfill for walls and trenches.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.
6. Dewatering
7. Disposal of unsuitable material
8. Disposal of surplus material, if required
9. Controlled Low Strength Material (CLSM)

B. Related Sections:
1. Section 334100 "Storm Drainage Piping" for excavating for excavating and backfilling buried utility structures.

1.3 Definitions

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
   2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted; and that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase or base if subbase is not used, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

M. Controlled Low Strength Material (CLSM): Self-compacted, low-cementitious backfill mix used in place of compacted backfill, with a compressive strength less than or equal to 1200 psi after 28 days. CLSM is also known as flowable fill, controlled-density fill, lean-mix backfill, and flowable mortar.

1.4 Action Submittals

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Controlled low-strength material, including design mixture.
   3. Warning tapes.

1.5 Informational Submittals

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.

C. Material Certificates: Signed by manufacturers certifying the Control Low Strength Material complies with each of the following requirements:
   1. Cementitious materials and aggregates.
   2. Admixtures.
   3. Certified test results by testing agency for each CLSM design mix proposed for use on the project, indicating conformance with performance criteria.

D. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

E. Dewatering Plan: Identify location and duration of system, and process for removing particulate matter from pumped or drained water, including copies of all required permits. The Contractor shall engage an independent Registered Professional Engineer (in the state where the project is located) with experience in the design of temporary dewatering systems to evaluate his methods for control of water and to design dewatering systems or provide guidance during construction. The design and sequencing of the dewatering systems shall be consistent with the requirements of the temporary earth support system. The Contractor shall submit a notarized letter to the Engineer certifying conformance to the above requirements, before the start of any construction.

1.6 Quality Assurance

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and issued supplements excluding provisions for "Method of Measurement" and "Basis of Payment".

1.7 Project Conditions

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 015713 "Temporary Erosion and Sediment Control" are in place.

PART 2 - PRODUCTS

2.1 Soil Materials

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. Granular Fill: Broken or crushed stone gravel or a mixture thereof; Form 816, Section M.02.01, and M.02.06, Grading A.

F. Processed Aggregate Base: Form 816, Section M.05.01.

G. Stone:
1. 2" Stone: Form 816, Section M.01.01, No. 3
2. 1 1/4" Stone: Form 816, Section M.01.01, No. 4
3. 3/4" Stone: Form 816, Section M.01.01, No. 6
4. 1/2" Stone: Form 816, Section M.01.01, No. 67
5. 3/8" Stone: Form 816, Section M.01.01, No. 8

H. Pipe Bedding Material
1. Stone: Form 816, Section M.01.01, No. 6
2. Sand: Form 816, Section M.03.01-2

2.2 Geotextiles

A. Separation Fabric: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Minimum Grab Tensile Strength: 200 lbf; ASTM D 4632.
   2. Minimum Tear Strength: 75 lbf; ASTM D 4533.
   3. Minimum Puncture Resistance: 80 lbf; ASTM D 4833.
   4. Minimum Water Flow Rate: 4 gpm per sq. ft.; ASTM D 4491.
   5. Maximum Apparent Opening Size: No. 40; ASTM D 4751.

B. Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Minimum Grab Tensile Strength: 150 lbf; ASTM D 4632.
   2. Minimum Tear Strength: 50 lbf; ASTM D 4533.
   3. Minimum Puncture Resistance: 100 lbf; ASTM D 4833.
   4. Minimum Water Flow Rate: 75 gpm per sq. ft.; ASTM D 4491.
   5. Maximum Apparent Opening Size: No. 80; ASTM D 4751.

C. Stabilization Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Minimum Grab Tensile Strength: 250 lbf; ASTM D 4632.
   2. Minimum Tear Strength: 100 lbf; ASTM D 4533.
   3. Minimum Puncture Resistance: 100 lbf; ASTM D 4833.
   4. Minimum Water Flow Rate: 75 gpm per sq. ft.; ASTM D 4491.
   5. Maximum Apparent Opening Size: No. 100; ASTM D 4751.

2.3 Accessories

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

2.4 Controlled Low Strength Material

A. Material
   1. Portland Cement: ASTM C 150, Type I.
   2. Fine Aggregate: ASTM C 33, uniformly graded.
   3. Fly Ash: ASTM C618.
   4. Water: Potable and complying with ASTM C 94.

B. Admixtures
   1. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Do not use admixtures containing calcium chloride.
   2. Air-Entraining Admixture: ASTM C 260.
   3. Water-Reducing Admixture: ASTM C 494.
   4. Coloring Admixture: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis.

C. Mixes
   1. Prepare design mixes, determined by either laboratory trial mix or field test data bases, that results in a flowable product at time of placement which does not require manual means to move into place, and the following:
      a. Provide mix designed to be hand excavatable at any time after placement.
      b. Provide mix that meets the following strength, when tested in accordance with ASTM D4382.
         1) Minimum Compressive Strength (28 Days): 30 psi.
         2) Maximum Compressive Strength (56 Days): 125 psi.
      c. Flowability: ASTM D6103.
   2. Provide flow and set time characteristics to meet project conditions.
   3. Yield and Dry Unit Weight: ASTM D6023.

D. Performance Requirements
   1. Excavatable CLSM:
      a. 28 Day Compressive Strength: 125 psi maximum.
   2. Non-Excavatable CLSM:
      a. 28 Day Compressive Strength: 150 psi minimum.
   3. Minimum Load Bearing Strength. 20 psi minimum within 2 hours of placement, for early paving requirements.

PART 3 - EXECUTION

3.1 Preparation

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

D. Test Pits:

1. Excavate test pits to determine location of existing utilities and structures.
2. Backfill test pits immediately after locating and identifying utility or structure.
3. Excavate and backfill pits with hand tools when existing conditions prevent the use of machinery.

3.2 DEWATERING

A. The Contractor shall evaluate the impact of the anticipated subsurface soil and groundwater conditions on his proposed method of excavation and dewatering and other operations. The Contractor shall provide pumps and other facilities to control groundwater and surface water in order to permit work to be performed under dry and stable conditions. The Contractor shall provide any facilities required to remove subsurface water from the construction area in advance of excavation. Dewatering shall continue until all work below groundwater level has been completed or otherwise stabilized against uplift or other disturbance. Pumping shall be continuous where required to protect the work and to maintain satisfactory progress.

C. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding or damaging Project site and surrounding area.

D. Protect excavations, backfills, fills and subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. Provide positive drainage of backfill and fill.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain dewatering until structures, pipes and appurtenances will not be damaged by surface or ground water. Maintain until dewatering is no longer required.
3. The Contractor shall dewater in a manner which does not cause loss of ground or disturbance to the bearing soil or soil supporting adjacent structures.

E. Obtain discharge permit for water discharging into storm drainage system or waterway. Remove particulate matter from pumped or drained water which discharges or flows into storm drainage system or waterway.

3.3 Explosives

A. Explosives: Do not use explosives.

3.4 Excavation, General

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches outside of concrete forms other than at footings.
      b. 12 inches outside of concrete forms at footings.
      c. 6 inches outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches beneath bottom of concrete slabs-on-grade.
      f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 Excavation For Walks And Pavements

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 Excavation For Utility Trenches

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Sawcut bituminous and concrete pavement along neat straight lines.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches, or as indicated on the drawings, deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches, or as indicated on the drawings, deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 Subgrade Inspection

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.8 Storage Of Soil Materials

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 Backfill

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 Utility Trench Backfill

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs, or as indicated on the Drawings.

3.11 Soil Fill

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, up to top of subgrade, use granular fill.
   3. Under steps and ramps, up to top of subgrade, use granular fill.
   4. Under building slabs, up to top of subgrade, use granular fill.
   5. Under footings and foundations, up to top of subgrade, use granular fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 Soil Moisture Control

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 Compaction Of Soil Backfills And Fills

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.14 Grading

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

3.15 Subsurface Drainage

A. Subdrainage Pipe: Specified in Section 334100 "Storm Utility Drainage Piping."

3.16 Subbase And Base Courses Under Pavements And Walks

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Place base course material over subbase course under hot-mix asphalt pavement.
   2. Shape subbase course and base course to required crown elevations and cross-slope grades.
   3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
   4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.17 Contaminated Soil

A. Immediately stop work in the vicinity of suspected contaminated soil, groundwater, or other media.
   1. Immediately notify the owner so that appropriate testing and subsequent action can be taken.
   2. Resume work in the immediate vicinity only upon direction of the owner.

3.18 Field Quality Control

A. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections in accordance with section 014000 "Quality Requirements".

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 Protection

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 Disposal Of Surplus And Waste Materials

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

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SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 Summary

A. This Section includes the following:

1. Bituminous concrete paving.
2. Bituminous concrete patching.
3. Bituminous concrete curbing.
4. Pavement-marking paint.

B. Related Sections include the following:

1. Section 312000 "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.3 Unit Prices

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

1.4 Definitions

A. Bituminous Concrete Base Course: Asphalt-aggregate layer placed over subgrade, aggregate subbase course, or aggregate base course; and beneath bituminous concrete surface course.

B. Bituminous Concrete Surface Course: The asphalt-aggregate top course of a bituminous concrete pavement, sometimes called a wearing course.

C. DOT: Department of Transportation.

1.5 System Description

A. Provide bituminous concrete paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.

B. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and issued supplements excluding provisions for "Method of Measurement" and "Basis of Payment".

1.6 Action Submittals

A. Job-Mix Design Certification: For each job mix proposed for the Work, signed by the supplier.

1.7 Informational Submittals

A. Qualification Data: For bituminous concrete supplier.

B. Material Certificates: For each paving material, signed by manufacturers.

1.8 Quality Assurance

A. Supplier Qualifications: A qualified supplier, registered with and approved by CT DOT.

B. Regulatory Requirements: Comply with CT DOT Form 816 for bituminous concrete paving work.

C. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.9 Delivery, Storage, and Handling

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

C. Transport bituminous concrete mixture in tight body trucks that have been previously cleaned of foreign material.

1. Tightly cover trucks with waterproof canvas or other suitable covers.

D. Deliver mixture within 25 deg F of approved job mix formula temperature.

1.10 Project Conditions

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
2. Bituminous Concrete Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Bituminous Concrete Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 deg F and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 Bituminous Concrete

A. Materials: Section M.04 and M.05.02 of Form 816.

B. Tack Coat: AASHTO M 140 Grade SS-1 or SS-1H, emulsified asphalt or AASHTO M 208 Grade CSS-1 or CSS-1H, cationic emulsified asphalt, slow setting, diluted in half with water.

C. Bituminous Concrete Curbs: Section 8.15, M.04, and M.05.02 of Form 816

2.2 Auxiliary Materials

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Waterborne Pavement-Marking Paint:

1. Hot-Applied: Article M.07.21 of Form 816, with a 2 minute drying time.
2. Non-Heat-Applied: Article M.07.20 of Form 816, with a 15 minute drying time.
    a. Color: As indicated.
3. Epoxy Resin: Article M.07.22 of Form 816
    a. Color As indicated

2.3 Mixes

A. Bituminous Concrete: Dense, hot-laid, bituminous concrete plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Course Depth and Class: As indicated.

PART 3 - EXECUTION

3.1 Examination

A. Verify that surface to receive paving is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase or aggregate base course using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

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

3.2 Repairs

A. Sawcutting: Where new pavement abuts existing pavement, sawcut existing pavement to provide a straight and clean transition.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, bituminous concrete paving at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying bituminous concrete paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Temporary Repair: Fill excavated pavement area with bituminous concrete base mix to indicated thickness and, while still hot, compact flush with adjacent surface.

D. Permanent Repair: Partially fill excavated pavement area with bituminous concrete base mix and, while still hot, compact. Cover bituminous concrete base course with compacted, bituminous concrete surface layer finished flush with adjacent surfaces.

3.3 Surface Preparation

A. General: Immediately before placing bituminous concrete, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying bituminous concrete paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 Bituminous Concrete Placing

A. Machine place hot bituminous concrete on prepared surface, spread uniformly, and strike off. Place by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place bituminous concrete base course in number of lifts and thicknesses indicated.

2. Place bituminous concrete surface course in single lift.

3. Spread mix at minimum temperature of 250 deg F.

4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in bituminous concrete paving mat.
6. In areas inaccessible to pavers, use staked forms to maintain indicated line and grade. Prevent segregation of mix when placing mix by hand.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of bituminous concrete base course before placing bituminous concrete surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot bituminous concrete to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 Joints

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of bituminous concrete course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
5. Compact joints as soon as bituminous concrete will bear roller weight without excessive displacement.
6. Compact material at joints to a density within 2 percent of specified course density.

3.6 Compaction

A. General: Begin compaction as soon as placed paving material will bear roller weight without excessive displacement. Compact material with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while bituminous concrete is still hot enough to achieve specified density. Continue rolling until course has been uniformly compacted to the following density:

1. Average Density: 95 percent of reference maximum theoretical density according to AASHTO T 209, but not less than 92 percent nor greater than 97 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while bituminous concrete is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while material is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh material. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 Installation Tolerances

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course:
   a. Roadways and Parking Lots: 3/8 inch..
   b. Sidewalks and Driveways: 1/4 inch.
2. Surface Course: 1/4 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Variation from Design Elevation: 1/4 inch.

D. Curb Alignment: Place curbing to produce an alignment within 1/4 inch tolerance as determined by using a 10-foot straight edge along front face of curb.

3.8 Bituminous Concrete Curbs

A. Construct bituminous concrete curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F.

B. Place bituminous concrete to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after bituminous concrete has cooled.

C. Protect curbing for a minimum of 24 hours and until mixture has cooled so as not to become marked.

3.9 Pavement Marking

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Allow paving to age for 5 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 Field Quality Control

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports in accordance with section 014000 "Quality Requirements".

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of bituminous concrete courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each bituminous concrete course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of bituminous concrete mixture delivered daily to site, prepared according to AASHTO T 209, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

    a. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional bituminous concrete where test results or measurements indicate that it does not comply with specified requirements.

3.11 Disposal

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:
   1. Curbs and gutters including integral curbing.
   2. Walkways.
   3. Concrete pads.

B. Related Sections:
   1. Section 312000 "Earthwork" for subgrade preparation, grading, and subbase course.
   2. Section 321726 "Tactile Warning Surfacing" for detectible warning tiles.

1.3 Definitions

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 Action Submittals

A. Product Data: For each type of product indicated.

B. Other Action Submittals:
   1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 Informational Submittals

A. Qualification Data: For qualified Installer of detectable warning, ready-mix concrete manufacturer, and testing agency.

B. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Admixtures.
   4. Curing compounds.

5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

C. Field quality-control reports.

1.6 Quality Assurance

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

E. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and issued supplements excluding provisions for "Method of Measurement" and "Basis of Payment".

1.7 Project Conditions

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 Forms

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
   1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 Steel Reinforcement

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

C. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

D. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

E. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

F. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

G. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

H. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

I. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

2.3 Concrete Materials

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, portland cement Type I/II. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class C or Class F.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
   3. Do not use fine or coarse aggregates containing substances that cause spalling.

C. Water: Potable and complying with ASTM C 94/C 94M.

2.4 Admixtures

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2.5 Curing Materials

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.6 Related Materials

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade suitable for intended use.

2.7 Concrete Mixtures

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): as indicated on the Drawings (3000 psi minimum).
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Pozzolan: 25 percent.

2.8 Concrete Mixing

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 Examination

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

1. Proof-roll prepared subbase surface below concrete walkways that cross through driveways or parking lots to identify soft pockets and areas of excess yielding according to requirements in Section 312000 "Earth Moving."

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

3.2 Preparation

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 Edge Forms And Screed Construction

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 Steel Reinforcement

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

3.5 Joints

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation, Expansion and Asphalt Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 30 feet unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction and tooled Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes.

3.6 Concrete Placement

A. Before placing concrete, inspect and complete formwork installation**,** steel reinforcement**,** and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms**,** steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 Float Finishing

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 Concrete Protection And Curing

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3.9 Paving Tolerances

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 1/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/2 inch.
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   5. Lateral Alignment and Spacing of Dowels: 1 inch.
   6. Vertical Alignment of Dowels: 1/4 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
   8. Joint Spacing: 3 inches
   9. Contraction Joint Depth: Plus 1/4, no minus.
   10. Joint Width: Plus 1/8, no minus.

3.10 Field Quality Control

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections in accordance with section 014000 "Quality Requirements".

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 1000 sq. ft. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31/C 31M; cast and field cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.11 Repairs And Protection

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.

B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

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SECTION 32 14 00 - UNIT PAVING

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. Section includes the following applications of stone masonry:

1. Recycled unit pavers on flexible base

1.3 Submittals

A. Product Data: For each type of product indicated.

1. For stone varieties proposed for use on Project include quarry location.

B. Samples for Verification:

1. For each stone type indicated. Include at least two samples in each set for each type of stone, exhibiting extremes of the full range of color and other visual characteristics expected in completed Work. Samples will establish the standard by which stone provided will be judged.

C. Qualification Data: For qualified Installer.

1.4 Quality Assurance

A. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction and supplements.

B. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

C. Source Limitations for Stone: Obtain each variety of stone, from one quarry with resources to provide materials of consistent quality in appearance and physical properties.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 Delivery, Storage, And Handling

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.6 Project Conditions

A. with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 Recycled Pavers

A. Recycled unit pavers on flexible base: Pavers shall be recycled from existing pavers in the disturbed areas depicted on the plans. Pavers selected for reuse shall match size, style and wear pattern as those to remain. Pavers shall be clean, free of mortar, asphalt, etc.

2.2 Granite Block

A. Granite: Blocks shall be new and shall be cut from fine to medium grained sound and durable granite, white in color. The granite shall be reasonably uniform in quality and texture throughout and shall be free from an excess of mica and feldspar and from seams, scales, or evidence of disintegration. If used blocks are used they shall be clean, free of mortar, asphalt, etc.

1. Blocks: Blocks shall be fairly rectangular in shape and shall be not less than three (4") nor more than five inches (5") in lengths; not less than three (4") nor more than five inches (5") in width; and twelve inches (12") in length. Blocks for curbing shall be installed with joints not to exceed one half inch (1/2"). All blocks shall have one reasonably smooth split head.

2.3 Flexible Base & Jointing

A. Bedding sand: clean, non-plastic sand manufactured from crushed rock. Do not use limestone screenings, stone dust or other materials with particles that pass the No. 200 sieve. Bedding sand shall conform to the following gradation when tested in accordance with ASTM C 136.

Sieve Size		Percent Passing
3/8 in.	(9.5 mm)	100
No. 4	(4.75 mm)	95 - 100
No. 8	(2.36 mm)	85 - 100
No. 16	(1.18 mm)	50 - 85
No. 30	(0.600 mm)	25 - 60
No. 50	(0.300 mm)	10 - 30
No. 100	(0.150 mm)	2 – 10

B. Joint sand: clean, non-plastic sand manufactured from crushed rock. Joint sand shall conform to the following gradation when tested in accordance with ASTM C 136.

Sieve Size		Percent Passing
No. 4	(4.75 mm)	100
No. 8	(2.36 mm)	95 - 100
No. 16	(1.18 mm)	70 - 100
No. 30	(0.600 mm)	40 - 100
No. 50	(0.300 mm)	20 - 40
No. 100	(0.150 mm)	10 - 25
No. 200	(0.075 mm)	0 – 10

C. Concrete slab and reinforcing: shall conform to requirements for concrete walk pavement

D. Base course: processed aggregate conforming to the requirements of CDOT Form 816 Section M.05, Article M.05.01.

E. Edge restraint: shall be a high-strength PVC edge restraint specifically manufactured as edging for modular pavers. Edge restraint shall be L-shaped in section with an additional truss-shaped flange section along the outside edge to provide additional support and a place through which to anchor stakes. Provide connector pipes, anchor pins and other accessories necessary for a complete installation. The edge restraint shall be similar to Pave Edge Rigid, Pave Edge Flexible and Pave Edge Industrial as manufactured by Pave Tech, Inc., Bloomington, MN. (612-881-5773)

2.4 Mortar Materials

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207.

D. Mortar Cement: ASTM C 1329.

E. Masonry Cement: ASTM C 91.

F. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.

G. Water: Potable.

2.5 Stone Trim Anchors & Dowels

A. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone units and holes for fastening to substrates as indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Halfen Anchoring Systems; Meadow Burke.

b. Heckmann Building Products Inc.

c. Hohmann & Barnard, Inc.

B. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.

2.6 Masonry Cleaners

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Diedrich Technologies, Inc.

b. Dominion Restoration Products.

c. EaCo Chem, Inc.

d. Hydrochemical Techniques, Inc.

e. Prosoco, Inc.

2.7 Mortar Mixes

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.

2. Limit cementitious materials in mortar to portland cement and lime.

B. Mortar for Stone Masonry: Comply with ASTM C 270, Specification.

1. Mortar for Setting Stone: Type S.

2.8 Fabrication

A. Fabricate stone to comply with sizes, shapes, and tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.

B. Cut and Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.

C. Cut and drill sinkages and holes in stone for anchors and supports.

D. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

1. Clean sawed backs of stone to remove rust stains and iron particles.

PART 3 - EXECUTION

3.1 Examination

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine substrate to verify that dovetail slots, inserts, reinforcement, and other items installed in substrates and required for or extending into stone masonry are correctly installed.

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

3.2 Preparation

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 Setting Of Stone Masonry, General

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Retain one of first five paragraphs below or revise to suit Project. Show detail of typical jointing pattern on Drawings because terminology may not be clear.

D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

E. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

F. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any.

3.4 Construction Tolerances

A. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.

B. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

3.5 Adjusting And Cleaning

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Engineer.
2. Defective joints.
3. Stone masonry not matching approved samples and mockups.
4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.
6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

3.6 Excess Materials And Waste

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 32 16 14 - CURBING

GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes the following:
   1. Stone curbing and edging.
   2. Reset Stone Curbing

B. Related Sections
   1. Section 32 12 16 "Asphalt Paving" for bituminous concrete curbing.
   2. Section 32 13 13 "Concrete Paving" for expansion and isolation-joint materials, and monolithic cast-in-place concrete curbing and walks.

1.3 Submittals

A. Material Certification. For each product, certifying material meets the Specification requirements.

1.4 Quality Assurance

A. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and issued supplements excluding provisions for "Method of Measurement" and "Basis of Payment".

PART 2 - PRODUCTS

2.1 Materials

A. Mortar: Form 816, Section M.11.04.

B. Granite Curb: Form 816, Section M.12.06-1.

C. Existing Curbing as noted.

D. Dowels: Galvanized steel.

E. Expansion- and Isolation-Joint Filler Strips: Section "Concrete Pavement."

PART 3 - EXECUTION

3.1 Installation

A. Excavate, prepare foundation, set curb, and point joints in accordance with Form 816 Section 8.13
   1. Install curbing as indicated and as recommended by manufacturer.
   2. Reset stone curbing as indicated. The curbing to be reset is to be removed with care to avoid damage. Any curb not reset shall remain the property of the City of New London unless otherwise ordered by the Engineer.

B. Transition Curbing. Provide transition curbing for handicap ramps where indicated.

3.2 Installation Tolerances

A. Curb Alignment: 1/4-inch maximum, as determined by using a 10-foot straight edge along front face of curb.

END OF SECTION

SECTION 32 17 26 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:
   1. Cast-in-place detectable warning tiles.

B. Related Requirements:
   1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.3 Action Submittals

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.4 Closeout Submittals

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 Project Conditions

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:
   1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.
    a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.6 Warranty

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    a. Deterioration of finishes beyond normal weathering and wear.
    b. Separation or delamination of materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Tactile Warning Surfacing, General

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for tactile warning surfaces.
1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 Detectable Warning Tiles

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
1. Material: Polymer composite or cast-fiber-reinforced polymer concrete tile or Molded glass- and carbon-fiber-reinforced polyester.
2. Color: Red brick.
3. Shapes and Sizes:
    a. Rectangular panel 24 by 60 inches or as required.

4. Dome Spacing and Configuration: Manufacturer's standard compliant spacing in manufacturer's standard pattern.
5. Mounting:
   a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.
   b. Detectable warning tile set into formed recess in concrete and adhered with mortar or adhesive according to manufacturer's recommendations.

2.3 Accessories

A. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.

B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 Examination

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

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

3.2 Installation Of Tactile Warning Surfacing

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 Installation Of Detectable Warning Tiles

A. Cast-in-Place Detectable Warning Tiles:
1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.

4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

3.4 Cleaning And Protection

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 Summary

A. This Section includes the following:

1. Providing and grading topsoil.
2. Seeding, or hydroseeding.
3. Mulching.
4. Lawn and grass renovation.

B. Related Sections include the following:

1. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.

1.2 Definitions

A. Finish Grade: Elevation of finished surface of topsoil.

B. Lawn: Newly graded areas to be seeded, or established turf or grass areas to be reseeded.

C. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath topsoil.

D. Topsoil Mix: Native or imported topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

1.3 Submittals

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass and sod, identifying source, including name and telephone number of supplier.

B. Product Certificates: For soil amendments, fertilizers, and mulch signed by product manufacturer.

C. Qualification Data: For landscape Installer.

D. Material Test Reports: For existing surface soil and imported topsoil.

E. Planting Schedule: Indicating anticipated planting dates for each type of planting.

F. Topsoil/Amendments Chemical Analysis

1. Obtain one composite sample for every 500 cu. yds. of soil/material with at least three samples for each soil/material type from each borrow source location. Analyze each for pesticides (EPA Method 8081), Chlorinated Herbicides (EPA Method 8151), Polyaromatic Hydrocarbons (EPA Method 8270), Total Petroleum Hydrocarbons (CTETPH method), Total RCRA 8 Metals (EPA Method 6010 / 7421 / 7470), Volatile Organic Compounds (EPA Method 8260), and Polychlorinated Biphenyls (EPA Method 8082). Based on the results of this testing, additional Synthetic Precipitation Leaching Procedure (SPLP) or Toxicity Characteristic Leaching Procedure (TCLP) testing may be required at the discretion of the Engineer. The Owner reserves the right to reject material based on the results of this testing.

   a. Satisfactory soil/material shall not exceed laboratory detection limits for concentrations of Pesticides, Chlorinated Herbicides, Polyaromatic Hydrocarbons, Total Petroleum Hydrocarbons, Volatile Organic Compounds, and Polychlorinated Biphenyls.

   b. Satisfactory soil/material shall not exceed naturally occurring background levels for concentrations of RCRA-8 Metals in native soils on site.

   c. In no case shall soil/material exceed any GB pollutant mobility criteria (GB PMC) or residential direct exposure criteria (RES DEC) established in Sections 22a-133k-1 through 22a-133k-3 of the regulations of Connecticut state agencies.

2. Soil/Material Origin: Provide a description for each originating off-site location or project from which imported soil/material is obtained, including known historical activities occurring on the site, and any possible releases that have occurred.

   a. The following are not acceptable :

      1) Soils/materials originating from sites subject to any Federal or State remediation program.

      2) Soils/materials that have undergone any treatment process for one or more chemical constituents listed within the CT RSRs.

1.4 Quality Assurance

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

1.5 Delivery, Storage, And Handling

A. Seed, Lime, and Fertilizer: Deliver in original sealed, labeled, and undamaged containers.

1.6 Scheduling

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 1 to June 1.

2. Fall Planting: August 15 to October 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.7 Lawn Maintenance

A. Begin maintenance immediately after each area is planted and continue until satisfactory lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

C. Watering: Keep lawn uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Prevent walking over muddy or newly planted areas.

2. Water lawn at a minimum rate of 1 inch per week.

D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain grass height of 2 to 3 inches.

E. Lawn Post fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.

PART 2 - PRODUCTS

2.1 Seed

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows:

	Proportion by Weight (Percent)	Minimum Purity (Percent)	Minimum Germination (Percent)
Kentucky Bluegrass	30	95	75
Creeping Red Fescue	20	98	85
K.31 Tall Fescue	40	98	85
Perennial Ryegrass	10	98	90

2.2 Inorganic Soil Amendments

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Provide lime in form of dolomitic limestone, Class S, with a minimum of 95 percent passing a No. 100 sieve.

B. Perlite: Horticultural perlite, soil amendment grade.

C. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.3 Planting Accessories

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.4 Fertilizer

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 18 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.5 Mulches

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.6 Topsoil Mix

A. Topsoil Mix: Mix topsoil with soil amendments and fertilizers in quantities required by the topsoil test report.

1. Thoroughly blend stockpiled soil with soil amendments before spreading.

PART 3 - EXECUTION

3.1 Examination

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 Lawn Preparation

A. Limit lawn subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread topsoil mix to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if topsoil or subgrade is frozen, muddy, or excessively wet.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 Seeding

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at the rate of 5lb/1000 sq. ft..

C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:2.5 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:3 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acreto form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Bond straw mulch by spraying with non-asphaltic tackifier at manufacturer's recommended rate. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

3.5 Hydroseeding

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.

2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acredry weight but not less than the rate required to obtain specified seed-sowing rate.

3.6 Lawn Renovation

A. Renovate existing lawn.

B. Renovate existing lawn damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.

C. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.

D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

E. Mow, dethatch, core aerate, and rake existing lawn.

F. Remove weeds before seeding.

G. Remove stones larger than 1 inch in any dimension. Remove waste and foreign materials, including sticks, roots, trash, and other extraneous matter, and legally dispose of them off Owner's property..

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches of existing soil. Provide new topsoil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new lawns.

K. Water newly planted areas and keep moist until new lawn is established.

3.7 Satisfactory Lawns

A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 3 by 3 inches .

B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.8 Cleanup, Protection, And Repair

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from construction, and vehicular and pedestrian traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

1. Where seeded areas have been compacted or young plants damaged, rework soil to a suitable seedbed, reseed and reblanket with full amounts of the specified materials.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION

SECTION 33 41 00 - STORM UTILITY DRAINAGE

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:
1. Pipe and fittings.
2. Cleanouts.
3. Drains.
4. Manholes.
5. Catch basins.
6. Stormwater inlets.
7. Stormwater detention structures.
8. Pipe outlets.
9. Stormwater disposal systems.
10. Stormwater infiltration systems.

B. Related Sections:
1. Section 32 13 13 – Concrete Paving for concrete products

1.3 Definitions

A. HDPE: High-density polyethylene plastic.

B. PE: Polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

D. RCP: Reinforced concrete pipe.

1.4 Action Submittals

A. Product Data and Material Certificates of Compliance:
1. For each type of product indicated.

B. Shop Drawings:
1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins. Include plans, elevations, sections, details, frames, covers, and grates.

1.5 Informational Submittals

A. Field quality-control reports.

1.6 Quality Assurance

A. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and issued supplements excluding provisions for "Method of Measurement" and "Basis of Payment".

1.7 Delivery, Storage, And Handling

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.8 Project Conditions

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Engineer no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Engineer's written permission.

PART 2 - PRODUCTS

2.1 HDPE Pipes and Fittings

A. Corrugated-HDPE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints
   1. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.2 Concrete Pipe And Fittings

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class IV, Wall B for gasketed joints.
   1. Gaskets: ASTM C 443, Rubber

2.3 Catch Basins

A. Normal-Traffic, Precast Concrete Catch Basins: Form 816, Section M.08.02-4, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.

1. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: Form 816, Section M.08.02-5, Type C or C-L.

2.4 Manholes

A. Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 8-inch minimum thickness for floor slab and 8-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 8-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that accommodates frame and cover.
6. Gaskets: ASTM C 443, rubber.
7. Steps: ASTM C 478, individual steps or ladder.

PART 3 - EXECUTION

3.1 Earthwork

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 Piping Installation

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.

3.3 Pipe Joint Construction

A. General: Join and install pipe and fittings according to installations indicated.

B. HDPE Pipe and Fittings: As follows:

1. Join pipe with soiltight joints according to manufacturer's written instructions.
2. Install according to ASTM D 2321 and manufacturer's written instructions.
3. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

C. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

3.4 Manhole Installation

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 1 inches above finished surface elsewhere unless otherwise indicated.

3.5 Catch Basin Installation

A. Install precast concrete catch basin sections according to ASTM C 891.

B. Construct catch basins to sizes and shapes indicated.

C. Set frames and grates to elevations indicated.

3.6 Concrete Placement

A. Place cast-in-place concrete according to ACI 318.

3.7 Identification

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 Field Quality Control

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plug in end of incomplete piping at end of day and when work stops.
3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

END OF SECTION

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SECTION 33 42 16.13 - PRECAST CONCRETE DRAINAGE STRUCTURES

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes plant-precast concrete units, including the following:

1. Box culvert.
2. Storm Vault

B. Related Sections include the following:

1. Section 334100 – Storm Utility Drainage

1.3 Performance Requirements

A. Structural Performance: Provide precast concrete units and connections capable of withstanding design loads within limits and under conditions indicated.

1.4 Submittals

A. Product Data: For precast concrete box section.

B. Shop Drawings: Detail fabrication and installation of precast concrete units. Indicate locations, plans and profiles, dimensions, shapes, cross sections, openings, joint details, inverts, and types of reinforcement, including size, spacing and concrete cover.

1. Detail special sections, as needed.
2. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
3. Indicate handling devices, and lifting and supporting points.
4. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.

C. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of engineers/architects and owners, and other information specified.

D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Concrete materials.
2. Reinforcing materials.
3. Admixtures.

4. Concrete mixes.
5. Gaskets.
6. Grout

1.5 Quality Assurance

A. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.

1. Assumes responsibility for engineering precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast concrete that are similar to those indicated for this Project in material, design, and extent.
3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Groups B and C.
4. Has sufficient production capacity to produce required units without delaying the Work.

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. Design Standards: Comply with ACI 318 and the design recommendations of ASTM C1443 and PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."

D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered.

1.6 Delivery, Storage, And Handling

A. Deliver precast structural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

PART 2 - PRODUCTS

2.1 Reinforcing Materials

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M, as follows:

1. Steel Reinforcement: ASTM A 615, Grade 60, deformed.

C. Epoxy-Coated-Steel Wire: ASTM A 884, Class A coated, plain.

D. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 116, and as follows:

1. For uncoated reinforcement, use all-plastic or CRSI Class 1 plastic-protected bar supports.
2. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.2 Concrete Materials

A. Portland Cement: ASTM C 150, Type I, Type II, or Type III, of same type, brand, and source.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33.

1. Fine Aggregate: Natural sand.
2. Coarse Aggregate: Well-graded crushed stone, 3/4 inch maximum.

C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

D. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

E. Water-Reducing Admixture: ASTM C 494, Type A.

F. Retarding Admixture: ASTM C 494, Type B.

G. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

H. High-Range, Water-Reducing Admixture: ASTM C 494, Type F or Type G.

I. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.

J. Plasticizing Admixture: ASTM C 1017.

2.3 Grout Materials

A. Cementitious Non-Shrink Grout: ASTM C1107, premixed, non-metallic, and non-staining, conforming to the following:

1. Minimum Compressive Strength: 4,000 psi
2. Maximum Water/Cement Ratio: 0.45 by weight
3. Expansion: 4 percent maximum when tested in accordance with ASTM C827

2.4 Concrete Mixes

A. Prepare design mixes for each type of concrete required.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast concrete fabricator's option.

C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.

D. Normal-Weight Concrete: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi.
2. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content of 4 to 7 percent.

E. Other Admixtures: Use water-reducing, high-range water-reducing, water-reducing and accelerating, or water-reducing and retarding admixtures according to manufacturer's written instructions.

F. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.5 Joints

A. Butyl Rubber Gaskets: ASTM D 2000 – M1AA 507, 607, 710.

2.6 Fabrication

A. Units: Monolithically precast units. ASTM C1443.

1. Dimensions: As indicated.
2. Joints: Watertight.
3. Ends of Units: Male and female ends for each unit.
    a. Joint Overlap: 6 inches minimum.
    b. Gasket: Factory-installed 1-inch gasket at male end.

B. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances.

1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's written instructions.

C. Cast-in openings larger than 10 inches in diameter or 10 inches square according to Shop Drawings. Smaller holes may be field cut by trades requiring them, as approved by Engineer.

D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.

2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete-placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.

3. Place reinforcement to obtain at least the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.

F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.

1. Slump: Between 5- and 8-inches.

G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 116.

H. Comply with ACI 306.1 procedures for cold-weather concrete placement.

I. Comply with ACI 305R recommendations for hot-weather concrete placement.

J. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint casting date on each precast concrete unit on a surface that will not show in finished structure.

K. Cure concrete, according to requirements in PCI MNL 116, by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

L. Product Tolerances: Fabricate precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product tolerances and the following:

1. Internal and External Unit Dimensions: Plus or minus 1/2-inch.
2. Slab and Wall thickness: Minus 1/4-inch.
3. Length of Unit: Plus or minus 1/2-inch.

M. Finish formed surfaces of precast concrete as indicated for each type of unit, and as follows:

1. Standard Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.

N. Screed finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections.

2.7 Source Quality Control

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.

B. Strength of precast concrete units will be considered deficient if units fail to comply with PCI MNL 116 requirements, including the following:

1. Units fail to comply with compressive-strength test requirements.
2. Reinforcement of units do not comply with fabrication requirements.
3. Concrete curing and protection of units against extremes in temperature fail to comply with requirements.
4. Units are damaged during handling and erecting.

C. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with PCI MNL 116 requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.

1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Engineer.
2. Cores will be tested, after immersion in water, in a wet condition per ACI 301 if units will be wet under service conditions.
3. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.
4. Test results will be made in writing on the same day that tests are performed, with copies to Engineer, Contractor, and precast concrete fabricator. Test reports will include the following:

a. Project identification name and number.

b. Date when tests were performed.

c. Name of precast concrete fabricator.

d. Name of concrete testing agency.

e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

E. Hydrostatic Test: Connect a minimum of two sections per the designated field orientation. Attach end slabs, fill interior with water to a minimum of one third of volume, and apply 10 psi for 30 minutes without leakage or drop in pressure.

1. After successful completion of initial test, open one-side of joint 3/4-inch, without leakage or drop in pressure.

2. Do not ship units until achieving successful test results.

F. Dimensional Tolerances: Units with dimensions smaller or larger than required and not complying with tolerance limits may be subject to additional testing.

1. Precast concrete units with dimensions larger than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to comply with construction conditions.

G. Defective Work: Precast concrete units that do not comply with requirements, including strength, pressure test, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 Examination

A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Install precast concrete units in accordance with manufacturer's written instructions.

B. Keep excavations dry during installation of units.

C. Lay sections to proper grade and alignment to provide continuous inverts and to insure a watertight joint.

D. Remove and reinstall misaligned units, or units with improperly closed joints.

E. Replace units damaged by improper storing, transportation or handling at no additional cost.

F. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints as follows:

1. Provide forms or other approved method to retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

END OF SECTION

SECTION 33 45 01 – PUMPING STATION IMPROVEMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes equipment and accessories as well as necessary appurtenances required for the pumping station improvements.

B. Pumping Station improvements include:

1. Provide roll-up overhead doors
2. Replace sluice gate Limitorque Indicators
3. Repair or Replace sluice gate Limitorque electric actuator (Allowance #3)
4. Provide duckbill check valves
5. Replace pump grease piping shrouds
6. Replace pump gear box oiler piping shrouds

C. Related Sections include the following:

1. Division 26 sections for Electrical power requirements
2. Division 40 sections for Instrumentation and Control System

1.3 DESIGN REQUIREMENTS

A. Major elements and features of the pumping station are indicated to provide overall intent of system requirements. Coordinate and provide system complete in detail and ready for operation.

1.4 SUBMITTALS

A. General: Submit pumping station drawings and literature (for equipment, controls and accessories) together as one system submittal. Individual submittals will not be accepted.

B. Product Data: Include rated capacities; furnished specialties; and accessories. Include the following and appurtenances associated with these systems.

1. Doors, including hardware and accessories
2. Limitorque Indicator and Electric Actuator

3. Flanged- End Check Valve
4. Shrouds, supports and fasteners

C. Shop Drawings: Show fabrication and installation details for each door, equipment, appurtenances, and valve. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of assembly, components, and location and size of each field connection.

D. Operation and Maintenance Manuals:

1. Quantity: Four bound copies.
2. Include information required for the proper operation, maintenance, repair and adjustment of equipment, and the following:
    a. Wiring diagrams.
    b. Lubrication schedules.
    c. Troubleshooting recommendations.
    d. Local or nearest supplier of service and spare parts for each piece of equipment.
    e. Parts list clearly numbered or identified to facilitate ordering of replacements.

E. Warranties: Special warranties specified in this Section.

F. Material Certificates: Submit manufacturer's materials certificate for compliance with specifications for:

1. Doors, including hardware and accessories.

G. Samples: Submit color and samples for the following:

1. Roll-up doors

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

B. An authorized representative of sum pump, door manufacturer, Limitorque operator and Tideflex check valve representative for installation and maintenance of units required for this Project.

C. Manufacturer Qualifications: A qualified manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of pumping stations and are based on the specific system indicated.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. System Integrator: The identification and designation of an electrical-mechanical system integrator is a requirement of this Project.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of pumping stations improvements that fail in design, materials or workmanship 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturer: Subject to compliance with requirements, provide products by the manufacturer specified.

2.2 OVERHEAD DOOR AND HARDWARE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. C.H.I Overhead Doors, Arthur, Illinois.
2. Model No.: Service Door 6182

B. Rolling Service Door Dimensions

1. Width: 7'-0"
2. Height: 10'-0"

C. Rolling Service Door Installation

1. Interior Masonry Mounting Option

D. Curtain: Interlocking curtain slats roll-formed from 18 gauge galvanized steel.

E. Finish: Curtain slats and hood are hot-dipped galvanized, per ASTM A653 A, with baked on epoxy primer and polyester

1. Finish Coat Colors: Galvanized.
2. Guides and headplates: shop painted black.
3. Bottom bars: Galvanized.

F. Wind Load: Standard door construction will withstand 20 p.s.f. in accordance with ASTM E330 using 1.0 factor of safety.

G. Bottom Bar: Fabricated from two galvanized steel angles 11 gauge

H. Guides: Fabricated from three (minimum 3/16") structural steel angles bolted together to form guide channel. Guide angles include curtain stops and flared guides.

I. Headplates: Headplates for mounting curtain, hood and barrel assemblies fabricated from minimum 1/4" steel plate. Drive side of barrel to be provided with precision sealed ball bearing in cast iron housing.

J. Barrel: Fabricated from minimum 4-1/2" O.D. pipe. Deflection under full load not to exceed 0.03" per ft. of span. Barrel provided with lugs welded to the barrel assembly for curtain attachment.

K. Springs: Helical wound torsion spring assemblies are grease packed and designed for a minimum 20,000 cycles of operation as standard. Other spring cycle options include ha reduction to 20 cycles per day or high cycle options of 50,000 and 100,000 cycles.

L. Hood: Fabricated from minimum 24 gauge galvanized steel sheet shaped to fit within the headplates. Intermediate hood support(s) furnished as required.

M. Operation: Motor operation with electric interlock switches

1. Manual push-up, chain hoist (for emergency).

N. Installation: Rolling Steel Doors shall be installed and adjusted according to C.H.I. assembly instructions by trained door service technicians.

1. Insulator of laid in place urethane insulation
2. Minimum R-Value: 6.7
3. Insulated slats (IS) cover: 2-1/2" by 13/16"

O. Hardware:

1. Provide heavy-duty, corrosion-resistant hardware, with stainless-steel fasteners to suit door type.

P. Warranty: Manufacture's standard 5-year from date of plant shipment against defects in materials or workmanship. (Spring wire one year.)

2.3 66" x 66" SLUICE GATE ELECTRIC ACTUATOR (Allowance)

A. Limitorque actuators: Disassemble, evaluate, remove, transport, repair or replace, reinstall and inspect existing Limitorque SMB-1-25, multi-turn electric actuator with weatherproof rugged cast iron housings:

B. Existing Limitorque Actuator:

1. Model: SMB-1-25
2. Order No.: 3D5958B
3. Serial No.: 309133
4. HP: 1.6
5. Phase: 3
6. Hz: 60
7. Volts: 208
8. Duty: 30 Min.

C. Available Manufacturers:

1. Flowserve Corporation – Flowserve Limitorque, Lynchburg, VA
   - Local New England Engineering, Sales and Service for Flowserve Limitorque provided by: Chalmers & Kubeck North, 24-34 Elise Street, Westfield, MA at (413- 568-2461 ext. 106)

D. Provide SMB-1-25 actuators with hand wheel. The actuator shall be safely operated manually in the event of power interruption.

E. Gear housing

1. Housing material –Ductile iron
2. Lubrication – MOV long-life EP, NLGI grade 0 grease
3. Gear reduction – Double reduction type: worm and helical gearing
4. Worm gear – alloy bronze
5. Worm – alloy steel
6. Helical gears – heat-treated steel

F. Motor

1. Type – Squirrel-cage induction

2. Power supply – 3phase, 60 Hz, 208 volts
3. Speed:1800 rpm, 4 pole motor
4. Duty – 30 minutes
5. Dynamic torque – nominal 20% of start torque
6. Insulation – Class B standard,
7. Heater – 120 VAC

G. Seals: Viton

H. Control Station: Includes three-position selector switch (open, stop, close), two indicating lights (open, intermediate, close indication), and a three-position selector switch (local, off, remote)

I. Controls

1. INT (Integral Controls) – Includes transformer and reversing contactor

J. Paint: LPS-129. Color blue standard. Valspar epoxy/polyurethane.

K. Temperature rating: -20°F to 150°F (-29°C to 66°C)

L. Local/remote indication?

Local Continuous Position Indicator.

2.4 66" x 66" SLUICE GATE ELECTRONIC VALVE INDICATORS

Limitorque Indicators: Replace existing top-mounted mechanical dial position indicator (MDPI) units for existing Limitorque as indicated below:

1. Number: Two (2)
2. Model: SMB-1-25
3. Order No.: 3D5958B
4. Serial No.: 309133

2.5 78" x 78" SLUICE GATE ELECTRONIC VALVE INDICATOR

Limitorque Indicator: Replace existing top-mounted mechanical dial position indicator (MDPI) unit for existing Limitorque as indicated below:

1. Number: One (1)
2. Model: SMB-2-60
3. Order No.: 3D5958A

4. Serial No.: 3090653

2.6 FLANGED-END CHECK VALVES

A. Available Manufacturer and Model: Tideflex Technologies, Carnegie, PA. All valves shall be of the Series TT-35-1.

1. Number: Three (3)
2. Series: TT 35-1
3. Maximum Working Pressure: 17 +/- psi
4. Maximum Back Pressure: 4 +/- psi

B. Check Valves shall be all rubber and of the flow operated check type with a flanged end connection. The port area shall contour down to a duckbill which shall allow passage of flow in one direction while preventing reverse flow. The flange and flexible duckbill sleeve shall be one piece rubber construction with nylon reinforcement. The bill portion shall be thinner and more flexible than the valve body, and formed into a curve of 180°.

C. The check valve shall be furnished complete with 3/8" thick steel back-up rings for installation.

D. The flange drilling shall conform to ANSI B16.1 Class 125/ANSI B16.5, Class 150 standards. The valve shall be furnished with stainless steel back-up rings for installation.

1. Pipe ANSI Flange Size: 36-inches
2. The bill slit of the duckbill valve must be at least 1.57 times the nominal pipe diameter

E. Check Valve: Manufacturer shall have conducted independent hydraulic testing to determine head loss and jet velocity characteristics.

F. Manufacturer must have available flow test data from an accredited hydraulics laboratory to confirm pressure drop data. Company name, plant location, valve size and serial number shall be bonded to the check valve.

2.7 RESTRAINED FLANGE ADAPTER

A. The flange adapter shall be the SERIES 2100 MEGAFLANGE adapter, as produced by EBAA Iron, Inc.,

B. Flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10.

C. Restraint for the flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.

D. The flange adapter shall be capable of deflection during assembly, or permit lengths of pipe to be field cut, to allow a minimum of 0.6" gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

E. For ductile iron pipe, the flange adapter shall have a safety factor of 2:1 minimum.

F. Traceability

a. An identification number consisting of year, day, plant and shift (YYDDD), (plant designation)(Shift number), shall be cast into each gland body.

b. All physical and chemical test results shall be recorded such that they can be accessed via the identification number on the casting. These Material Traceability Records (MTR's) are to be made available, in hard copy, to the purchaser that requests such documentation and submits his gland body identification number.

c. Production pieces that are too small to accommodate individual numbering, such as fasteners and wedges, shall be controlled in segregate inventory until such time as all quality control tests are passed. These component parts may then be released to a general inventory for final assembly and packaging.

d. All components shall be manufactured and assembled in the United States. The purchaser shall, with reasonable notice, have the right to plant visitation at his/her expense.

G. Coating for restraint devices shall consist of the following:

a. All wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.

b. All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.

c. The coating system shall be MEGA-BOND by EBAA Iron, Inc. or approved equal. Requests for approved equal must submit coating material and process details for review prior to bid.

d. For more information regarding MEGA-BOND, refer to the MEGA-BOND brochure or visit www.ebaa.com.

2.8 HANGERS AND SUPPORTS FOR GREASE AND OILER LINE SHROUDS

A. Provide a sufficient quantity of S.S. C-Channel shroud over existing brass grease line, fasten to ceiling with S.S. fasteners and ties around pump tube with cable as shown on the Drawings.

B. Provide a sufficient quantity of S.S. C-Channel support and fasteners over existing gear box oil cooler as shown on the Drawings.

C. Provide hangers and supports of standard design where possible and that are best suited for the service required.

D. All submerged piping supports, guides, and fasteners in the wet well wall and ceiling shall be Type 316 stainless steel or as shown on the Drawings.

E. Attach hangers and supports within buildings to walls, floors, or ceilings, as appropriate.

F. Minimize the injury hazard in all protruding supporting devices. Provide end caps on exposed ends of framing members.

G. All hangers supplied for insulated lines shall be sized for the outside diameter of the applied insulation

H. The design of all hangers and supports shall be subject to the acceptance of the Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine sluice gate piping systems to verify actual locations of piping connections before Limitorque indicator and electric actuator installation.

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

3.2 OVERHEAD DOOR

A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.

1. Advise procedures and corrections necessary to accommodate installation.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. General: Install door, track, and operating hoist complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

C. Rolling steel door shall be installed and adjusted according to manufacturer's assembly instructions by trained door system technicians.

3.3 FLANGED-END CHECK VALVES

A. Valve shall be installed in accordance with manufacturer's written Installation and Operation Manual and approved submittals.

B. Manufacturer's authorized representative shall be available for customer service during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.

C. Manufacturer shall also make customer service available directly from the factory in addition to authorized representatives for assistance during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.

3.4 COORDINATION

A. Coordinate demolition of existing doors and pumping station equipment improvements.

3.5 PUMPING STATION COMPONENTS

A. Install pumping station components where indicated, according to specific equipment and piping arrangement indicated.

1. Install equipment under the supervision of manufacturer's service representative.

3.6 IDENTIFICATION

A. Install identifying labels permanently attached to equipment.

B. Install operating instruction signs permanently attached to equipment or on pumping station wall near equipment.

3.7 ELECTRICAL WORK

A. Perform instrumentation and controls work and electrical work in accordance with the requirements of the appropriate Division 26 sections. Install systems to provide a complete and operational power and control system for the pumping station improvements.

3.8 FIELD QUALITY CONTROL

A. Perform field testing to verify proper installation and operation of roll-up electric doors, sluice gate Limitorque indicator, and sluice gate Limitorque electric actuator (Allowance No. 3), accessories and electrical as a completely integrated, automatic, unattended system. Repeat field testing

1. Perform testing in presence of Owner, Engineer, and manufacturer's service representative.

2. Provide Owner with two days written notice of scheduled testing.

B. Perform quality-control tests and inspections of each equipment and prepare test reports.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

D. Remove and replace at no additional cost units rejected by Engineer. Engineer will reject units that do not operate free from vibration and heating, and that do not perform required service satisfactorily. Retest as specified above.

3.9 STARTUP SERVICE

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

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

1. Adjust Equipment, accessory, and control settings, and safety and alarm devices.

3.10 CLEANING

A. Clean dirt and debris from wet wells, pumps, and piping.

B. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finishes to match original finishes.

C. Remove all packaging and debris from installation area at the completion of installation.

D. Present operation and maintenance instructions to owner after demonstrating proper care and operation of door, Limitorque actuator, indicator and valve.

3.11 DEMONSTRATION

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

1. Provide seven days written notice to Owner.

2. Provide a minimum of four hours (exclusive of travel time) training sessions for the following equipment:

a. Roll-up overhead doors
b. Sluice gate Limitorque electric actuator
c. Sluice gate Limitorque Indicator
d. Duckbill check valve

END OF SECTION

SECTION 33 45 03 – SUMP PUMP

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Contractor shall furnish all labor, material, equipment and incidentals required to submersible centrifugal dewatering pump for the Shaw's Cove Pumping Station.

B. Section Includes:

1. Submersible sump pump, controls and appurtenances.

1.3 Action Submittals

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Piping, valve, check valve, pipe supports and piping appurtenances.

1.4 Closeout Submittals

A. Operation and Maintenance Data: For pump and control, to include in operation and maintenance manuals.

1.5 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. UL Compliance: Comply with UL 778 for motor-operated water pump.

1.6 Delivery, Storage, And Handling

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

B. Protect bearings and couplings against damage.

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

PART 2 - PRODUCTS

2.1 Sump Pump

A. Manufacturer and Model: Zoeller Engineered Products of Louisville, Ky. (800-928-7867), close coupled U.L. and/or CSA listed Model 293.

B. Operating Conditions:

1. Submersible sump pump shall be rated at 1 H.P., 208 volts, 3 phase, 60 HZ., 3450 R.P.M. The unit shall produce 96 G.P.M. at 25 feet of TDH.

2. Pump motor shall be hermetically sealed, submersible type, operating in a high quality dielectric oil for cooling the windings and for lubrication of the motor bearings and ceramic- carbon shaft seal. Pump motor shall have external magnetic conlactor and overload protection. All fasteners and external metal parts shall be of stainless steel. Impeller shall be of vortex non-clog design.

3. The submersible pump shall be non-overloading throughout the length of the curve and be capable of operating un-submerged without damaging the pump. The reserve service factor shall be a minimum of 1.15. The submersible pump shall pass a 2-inch spherical solid. The submitted performance curve shall show the flow and head capacity of the pump.

4. The pump housing configuration shall have a 3-inch flanged vertical discharge.

C. Electrical Power Cord:

1. The pump shall be supplied with 50 feet of multi-conductor power cord. It shall be SO type cord capable of continued exposure to the pumped liquid. Power cord shall be sized for the rated full load amp loading of the pump in accordance with the National Electric Code. Power cable shall enter into the junction box through a compression type sealing gland. Water sealing and strain relief are separated. The entire junction chamber shall be sealed off from the motor housing by thru wall terminals to protect the motor from moisture.

D. Motor:

1. 293 (1 HP) Series shall have a 2-pole squirrel cage induction motor. Impeller shall be of cast bronze. The motor housing shall be finned for extra cooling capability.

E. Bearings And Shaft:

1. The upper and lower ball bearings are continuously lubricated by the oil which fills the motor housing. The motor shaft shall be made of 1117 carbon steel.

F. Seals: Pump shall have a mechanical single seal configuration with the carbon/ceramic

G. Impeller: The impeller shall be of a fully balanced bronze non-clogging vortex design.

H. Serviceability:

1. Components required for the repair of the pump shall be readily available within 24 hours. Components such as mechanical seals and bearings shall not be of a proprietary design and be available from local industrial supply houses. Special tools shall not be required to service the pump. A network of service stations shall be available nationwide in those cases where service requirements are beyond the scope of in-house service mechanics.

I. Support:

1. The pump shall have cast iron support legs enabling it to be a free standing unit.

J. Testing:

1. Each pump shall run in liquid before being shipped. It shall be checked at its maximum running point for performance, amps, grounding, winding insulation, and water tightness.

a. An optional certified performance test based on the Hydraulic Institute or SWPA (Submersible Wastewater Pump Association) Test Standard for submersible pump.

b. Provide start up services at the job site by an authorized representative of Zoeller Engineered Products. Complete start-up report form ZM1074 in the presence of the Installers, and return to the Project Engineer or Zoeller Engineered Products.

K. Warranty:

1. Standard warranty shall be 24 months from date of installation. Warranty repairs shall be provided by an authorized service station.

2.2 Control

A. General

1. Submersible pump shall be controlled by a manual switch rated for inductive load of 208 v, 3 ph, 1 HP motor.

2.3 Ball Valve

1. PVC construction ball valve; solvent connections at each end, 150 psi.

a. Manufacturers and Models:

1) Matco Norca, Model 770N PVC ball valves

2) Or approved equal.

2.4 Flange Adapter

A. PVC Pipe

1. Flange adapters for existing 3-Inch PVC pipe:

a. Restrained flange adapters may be used in lieu of flanged spool pieces. Flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10.

b. Restraint for the flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.

c. The flange adapter shall be capable of deflection during assembly, or permit lengths of pipe to be field cut, to allow a minimum of 0.6" gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

d. For ductile iron pipe, the flange adapter shall have a safety factor of 2:1 minimum.

e. The flange adapter shall be the SERIES 2100 MEGAFLANGE adapter, as produced by EBAA Iron, Inc., or approved equal.

f. Traceability

   1) An identification number consisting of year, day, plant and shift (YYDDD)(plant designation)(Shift number), shall be cast into each gland body.

   2) All physical and chemical test results shall be recorded such that they can be accessed via the identification number on the casting. These Material Traceability Records (MTR's) are to be made available, in hard copy, to the purchaser that requests such documentation and submits his gland body identification number.

   3) Production pieces that are too small to accommodate individual numbering, such as fasteners and wedges, shall be controlled in segregate inventory until such time as all quality control tests are passed. These component parts may then be released to a general inventory for final assembly and packaging.

   4) All components shall be manufactured and assembled in the United States. The purchaser shall, with reasonable notice, have the right to plant visitation at his/her expense.

g. Coating for restraint devices shall consist of the following:

   1) All wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.

   2) All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.

3) The coating system shall be MEGA-BOND by EBAA Iron, Inc. or approved equal. Requests for approved equal must submit coating material and process details for review prior to bid.

4) For more information regarding MEGA-BOND, refer to the MEGA-BOND brochure or visit www.ebaa.com.

2.5 Electrical

A. Source of electrical for sump pump: Use 3 pole breaker compatible with the existing panel located on the top level of the pump station. Former sump pump has also 1 HP motor.

PART 3 - EXECUTION

3.1 Examination

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.2 Installation

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pump.

B. Use existing temporary sump pump during construction.

3.3 Connections

A. Install sump pump and connect the 3-inch flanged vertical discharge to the existing 3-inch PVC pipe.

3.4 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. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform 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:

D. Pump and manual control will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection report.

3.5 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.

3.6 Adjusting

A. Adjust pump to function smoothly, and lubricate as recommended by manufacturer.

3.7 Demonstration

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

END OF SECTION

SECTION 40 90 01 – INSTRUMENTATION & PROCESS CONTROL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. The Shaw's Cove Stormwater Pumping Station has a relay based control panel that integrates both manual and automatic operating elements. The control improvements are centered about adding float switches in a stormwater manhole on Blinman Street and the related cellular communications components that will report the float positions to the pump station and corresponding controls changes to remotely operate equipment. The cellular communications module also provides a website that serves to report and also logs the data of the time history of float positions and is used to initiate communication notices (via phone, text and email) to Flood Control Staff. The position of one of the reported float switches will be selected to initiate automatic operation of the pump station per the revised sequence of operations. The existing control panel within the pumping station will be modified. A System Integrator is required for this work.

1.3 Definitions

A. SCADA – Supervisory Control and Data Acquisition

B. E/C SI: Electrical/Controls System Integrator

1.4 Submittals

A. Refer to sections:
   1. 01 11 22 - Summary of General Requirements
   2. 40 90 05 – SCADA System
   3. Division 26 - Electrical

B. Submit detailed information for each instrument or control device, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:
   1. Product (item) name used herein and on the Contract Drawings.
   2. Manufacturers complete model number.
   3. Location of the device.
   4. Input/Output characteristics.
   5. Range, size, and graduations.
   6. Physical size with dimensions, enclosure NEMA classification and mounting details.
   7. Materials of construction of all components.
   8. Instrument or control device sizing calculations where applicable.

C. Submit detailed drawings concerning control panels and/or enclosures including:
   1. Ladder diagram of the existing control panel.

2. Ladder diagram modified for meeting revised Sequence of Operations (in this section)
3. Cabinet assembly and layout drawings to scale.
4. Fabrication and painting specifications.
5. Point to point wiring diagrams depicting wiring within the panel as well as connections to external devices.
6. Where message display, operator interface, and push-button panels are required, submit detailed layout to scale, including details of fabrication. Half-scale layout will be acceptable. Submit preliminary operator interface and message screens for approval.

D. Product Data: Provide catalog sheets and technical data sheets to indicate all aspects of the software package and its capabilities.

E. Provide a printed tag database listing indicating each database point and their properties.

F. Provide a printout of the communications driver configuration.

G. Submit project specific SCADA screens, associated pop-up screens and windows, and alarm screens for review and approval. The submittal shall include the actual screens that will be developed for use at the facility.

H. Project Plan - The Contractor shall require the Vendor to submit a project plan prior to any other submittals. This submittal shall be submitted within 60 days of the Notice to Proceed and include (at a minimum) the following:
1. A schedule of installation that shall include beginning and completion dates of each phase of this project. It shall also include any required shutdowns of the existing system, the times/approximate dates and the durations of the shutdowns.
2. A plan of the proposed method of installation of the PLCs and the necessary coordination with any existing systems.
3. A proposed plan for the supervision and start-up of each system.

1.5 Coordination

A. Coordinate arrangement, mounting, and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

1.6 Quality assurance

A. Installer Qualifications: An experienced installer who is the electrical/controls system integrator or an authorized representative of the E/C SI or of equipment manufacturer for both installation and startup of equipment required for this Project.

B. Manufacturer Qualifications: A firm experienced in manufacturing items similar to that specified for this Project and with a record of successful in-service performance, acceptable to the Engineer.

1.7 Coordination

A. The E/C SI will coordinate features of distribution equipment, MCC, overcurrent protection devices, controls and instrumentation components including the radio based SCADA communications system to form an integrated electrical power and control system

B. The E/C SI (Electrical/Control System Integrator) will accept single source responsibility and provide all labor, materials, services, equipment and transportation necessary for the complete and operational control system (including controls and associated hardware, all enclosures and panels, and instrumentation) and integration with the power distribution, control system/panel and mechanical/electrical components of the project.

1.8 Instrumentation General

A. Type
   1. Instruments shall be provided with stainless steel mounting hardware, wall brackets, or instrument racks as appropriate for each location.
   2. Electronic equipment shall be of the manufacturer's latest design, using printed circuitry and suitably coated to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field-mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.
   3. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

1.9 Sequence of Operations

Station Stopped/Resting

78-inch gate – Open
96-inch gate – Open
3 wet well/sump sluices gates – Closed
Pumps – Off in Auto Mode
Air Intake "Louvers" – Open
Interior Overhead Doors - Closed

Automatic Operation

Gate Operation:

- 78 inch Gate Operation:
    - Currently this gate is operated manually by the Flood Control Staff, and will continue o=to operate manually.
    - The gate has the option to be operated automatically as follows:
        - When Tide Water level sensor (located on the Shaw's Cove side of the 78-inch gate) rises above 2.0 ft elevation NAVD88 (~4.4 ft existing gage elevation reading) the 78 inch gate is Closed.
        - When Tide Water level sensor (located on the Shaw's Cove side of the 78-inch gate) falls below 0.6 ft elevation NAVD88 (~3.0 ft existing gage elevation reading) the 78 inch gate is closed.
        - Option of automatic operation of 78 inch gate shall be tested and retained.
- Sluice Gates to the Wet Well/Sump (3 gates on north side of wet well)
    - When the Street Level/Fore Bay level sensor (located above the conduit into the station below the station concrete floor in the NW corner) rises above 2.0 ft elevation NAVD88 (~4.4 ft existing gage elevation reading) the three sluice gates to the pumping station wet well/sump are Opened (Currently only Sluice Gate #1 opens automatically. This is a modification of the existing sequence of operations).
    - when Blinman Manhole float level switch (located in the manhole north of the pumping station on Blinman Street) rises above 2.5 ft elevation NAVD88 the three sluice gates to the pumping station wet well/sump are Opened (Currently only Sluice Gate #1 opens automatically. Opening all three sluice gates automatically is a modification of the existing sequence of operations). Adding the Blinman Manhole Float to open the 3 sluice gates is a modification of the existing sequence of operations.
        - when Blinman Manhole float level switch tips at high level, the monitoring website will A-Telephone Flood Control Personnel on phone list, B-Text Flood Control Personnel on phone list, and C-Email to names on the email contact list.
    - The three sluice gates to the pumping station wet well/sump shall be Closed manually by Flood Control Staff when the pumping station is shut down.
- Pump Operation: Monitor water level in Sump/Wet Well with the Sump/Wet Well Level Sensor - the following initiates operation of the pumping station in Auto mode:
    - Pumps On & Off – in Auto:
        - When Wet Well level sensor rises to 5.5 ft (-1.17 ft NAVD88) above wet well floor level (-6.67 ft NAVD88) [the current set point is 8.3 ft (1.63 ft NAVD88) above wet well floor level (-6.67 ft NAVD88)] Pump #2 starts automatically. Then if the water level continues to rise to 7.0 ft (0.33 ft NAVD88)) [the current set point is 8.8 ft (2.13 ft NAVD88) above wet well floor level (-6.67 ft NAVD88)] above the wet well level floor then Pump #1 then also starts automatically. Pump #2 turns off at 3.4 ft (-3.27 ft NAVD88) and will restart automatically. Pump #1 turns off at 4.0 ft (-2.67 ft NAVD88) and will restart automatically. Currently the pumps turn off after the first cycle and are restarted when Flood Control Personnel arrives at the station and resets the panel (pushes reset button).

  - When the first pump starts at 5.5 feet above wet well bottom (currently Pump #2) (currently 8.3 feet is setpoint) a call to Flood Control personnel is initiated from the existing alarm monitoring company – Flood Control personnel then immediately report to the pumping station. This alarm call will be retained. The work performed through this contract shall eliminate resetting the panel and maintain automated pump cycling.
- Overhead Door Operation (combustion and cooling air source for diesel pump engines)
  - When the call to start the pump engine is initiated, all three Overhead Doors that cover the louvers will be called to open. Provide a time delay of 0.5 minutes for overhead doors to open before automatically starting the pumps. (Mechanical louvers remain in open position at all times)
  - The Interior Overhead Doors will be Closed manually by Flood Control personnel after pumping operations are completed.

Manned Operation

Upon Arrival at the Shaw's Cove Pumping Station, Flood control personnel will be able to continue operating the station on automatic or take control of the station manually: HOA switches shall be provided for each of the three pumps and the three individual overhead doors.

Shut Down Pump Station

After storm is over the operators return the station to Auto mode.

PART 2 - PRODUCTS

2.1 Remote Terminal Units and Cloud Based SCADA System

A. Refer to Section 40 90 10 – SCADA System

2.2 Float Switches

A. Dry contact switch mechanism. 120 VAC, 13 amps non-inductive rated.

B. 16 gauge 2 conductor SJOW oil resistant CPE chord

C. Non-mercury design

D. UL recognized, CSA certified

E. Tie-wrap nylon, weight: 2.5 lbs.

F. Provide adequate length chord with 5' extra length for each float switch

G. Available Manufacturer:

1. Gems Warrick Series M, or equal.

2.3 ENCLOSURE HEATER

A. Supplements the smaller heater condensation prevention.

1. 1300W, 120V, 1Ph, 11.5A
2. Thermostatically controlled, fan-driven heater
3. Aluminum housing
4. Thermostat range adjustable from 0 F to 100 F (-18 C to 38 C) (set point approximately 15F)
5. Four 10-32 x self-tapping screws are included with each heater
6. Ball bearing fan
7. Terminal strip with clamp connector that accepts both solid and stranded wire

B. Available Manufacturer:

1. Hoffman/Pentair DAH13001C

2.4 Others

A. All others parts and equipment must be accepted as part of the submittal review.

PART 3 - EXECUTION

3.1 General Installation

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

B. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances, and regulations, the E/C SI shall bear full responsibility for such violations and assume all costs arising there from.

3.2 Temporary Configuration Of Control System

A. Throughout the control system upgrade the E/C SI shall maintain the Shaw's Cove Pumping Station as functional to pump stormwater by Flood Control Staff using manual controls.

B. Upgrades and changes to the system shall not be scheduled during storm events that potentially need to be staffed by Flood Control personnel.

3.3 Systems Integration

A. The E/C SI shall complete documentation of the existing control system prior to modifying the existing control system. Submit an existing electrical ladder logic diagram.

B. The E/C SI shall document modifications to the existing control system prior to execution of the proposed changes. Submit revised electrical ladder logic diagram showing proposed modifications.

C. Review proposed changes in the sequence of operations and interface with the Flood Control Staff and Engineer before proceeding with execution.

D. The E/C SI shall commission the system by testing the system witnessed by New London Staff and Engineer.

E. Provide two days of testing and training with City of New London Flood Control staff for pump station on-site operations and interfacing with the website. Teach assigned staff to log into website to review and download/print data and change lists for alarm and notification phone calls, texts and emails.

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SECTION 40 90 05 – SCADA SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, start-up and place in satisfactory operation a complete Cloud based Supervisory Control and Data Acquisition (SCADA) System at the Shaw's Cove Stormwater Pumping Station.

B. The SCADA system shall consist of three sub-systems: a Central Server, a web-based user interface and the Remote Terminal Units (RTU's) of various sizes.

C. The SCADA system shall be manufactured by High Tide Technologies, LLC, or pre-approved equal.

1.2 GENERAL

A. The Central server shall consist of a cluster of servers providing various data processing, web server and database functions. The system shall be scalable to add more servers as the demands on the system increase.

B. The web-based user interface software shall provide all the functions necessary for the Owner to interact with the data from the remote units as well as execute configuration and control commands.

C. RTU's shall be furnished and installed at each of the monitored sites. The Manufacturer shall have available several models of RTU's which will accommodate a wide variety of Input and Output requirements.

1.3 QUALIFICATIONS

A. The SCADA System shall be furnished by a single Supplier who shall assume responsibility for providing a complete and integrated system.

B. Manufacturers Qualifications: Only manufacturers who have been regularly engaged in the supply of SCADA equipment for at least 10 years and capable of meeting the following criteria need respond.

1. Have completed a minimum of three (3) satellite telemetry systems and three (3) cellular telemetry systems.
2. Provide the Owner with reference names and phone numbers for a minimum of two Satellite Telemetry System customers and two Cellular Telemetry system customers.

3. Acknowledge that shipment of the SCADA RTU units and related equipment shall be authorized only by the Owner.
4. Utilize only UL listed and rated components in enclosure manufacture.
5. Provide 100 percent of all hardware and software technical manuals to the Owner in digital format (Adobe PDF).
6. Provide a complete bill-of-materials (BOM) and enclosure layouts that are numerically cross-referenced together for each SCADA unit. The BOM shall contain the standard factory supplied part numbers instead of proprietary numbers.
7. Provide a warranty and customer support for a period of not less than one (1) year after the Owner accepts each SCADA unit.
8. Provide primary technical support to the Owner by full-time qualified staff members only.

C. Installers Qualifications:

1. Only Installers who have been regularly engaged in the installation of SCADA equipment and have completed the Manufacturer's installer certification course need respond.

PART 2 - PRODUCTS

2.1 CENTRAL SERVER

A. The Central Server core shall be configured as a cluster of servers, each performing different tasks. Key functions shall be running on multiple servers thus providing redundancy in the event of hardware failures. The entire cluster shall be hosted in a server-hosting center with power, network and hardware redundancy built in.

2.2 WEB-BASED USER INTERFACE SOFTWARE

A. Compatibility: The system shall be compatible with modern web browsers on various operating systems including computers, tablets and smartphones.

B. Access and Security: Access to the customer's user interface shall begin with a username and password screen. The web interface shall utilize fully encrypted data and passwords via standard HTTPS technology – the same level of security used by online banking applications. The person designated by the Owner as the "administrator" shall have authority to manage usernames and passwords as well as control and change certain parameters related to their system.

C. Levels of Access: Four levels of access shall be provided. VIEWERS shall only have permission to view the system data. OPERATORS shall be able to view and acknowledge alarms. SUPERVISORS shall be able to perform all the functions of the operators as well as change parameters in the system and manually turn pumps on and off. ADMINISTRATORS shall be able to perform all the functions of the supervisors as well as create and delete users from the system. Administrators shall also be able to assign which contacts will receive alarms.

D. User Limits: The Owner shall be able to create as many users as needed and all users shall be able to be logged in simultaneously. No additional charge shall be assessed on the number of users or viewers.

E. User Interface Types:

1. The system shall provide options to the Owner for either tabular or graphical status representations of the installations.
2. Larger systems shall be able to be broken down into segments or zones for easy navigation and display. Size, location and layout of objects on the screen shall be customizable by the software provider upon Owner request.
3. The software shall be capable of showing location and status of each RTU installation on maps, given Owner supplied addresses or coordinates.

F. The system shall have robust Alarming Capabilities, including the following features:

1. The ability to send alarms via voice calls, text messages or emails.
2. The ability to configure a preferred alarm delivery order with delays between each level and each operator.
3. The ability to accept acknowledgments via voice or text at the time the alarm is delivered or via the web interface at any time.
4. The ability for users to view a list of alarm histories for each installation including which user acknowledged the alarm.
5. The ability to set any alarm recipient to be "Nagged" by calling them every 10 minutes until someone acknowledges the alarm.
6. The ability to set shifts and days off for each alarm recipient and set day and night shift alarm notifications.
7. The ability to have audible and visual alarms pop up on the computer that is logged in to the system.
8. The ability to alarm the user if the RTU has stopped communicating with the host servers.

G. Auto Refresh: The web interface shall automatically refresh when new data or alarms are reported.

H. Data Analytics and Graphing: The system shall provide various menus to allow users to view historical data on pop-up graphs. Users shall have the ability to set the time range of the graphs and zoom in to view events of the past. When a user's mouse is held over a data point, the details of that data point shall appear on the screen.

I. Raw Data Downloads: The user shall be able to dump raw data in tabular format for offline analysis that can be imported into a spreadsheet for further analysis.

J. Report Generation: The user shall have the ability to download formatted spreadsheet reports of various functions. The software shall also provide the ability to automatically fill in the owner's report forms in standard Excel formatted files.

K. Screen Configuration: The Manufacturer shall provide a service to configure graphic and tabular screen layouts, particular locations and sizes of graphical objects to match the customer's requirements.

L. Service History: The system shall provide a mechanism for the user to enter freeform service history information for all RTU sites.

M. The system shall be capable of providing Automatic and Manual Controls as listed below:

1. Ability for one Tank to control one or more remotely located pump stations and valves based on tank level or system pressures. This should be performed in either round robin or lead/lag configurations.
2. Ability to automatically cause the digital input from one RTU to be replicated on the digital output of another RTU (when digital outputs are available).
3. Ability to automatically cause the analog input level at one RTU to be replicated on the analog output of another RTU (when analog outputs are available).
4. Ability for the user to set analog threshold alarms and controls and have them downloaded to the RTU. These include levels, pressures, flow rates and any physical sensor that outputs an analog signal. This feature shall apply to RTU's with analog input capability.
5. Ability for supervisors or administrators to manually control digital outputs that are connected to valves or pumps on RTU's that are equipped with outputs.

2.3 REMOTE TERMINAL UNITS (RTU)

A. RTU's for Shaw's Cove Pumping Stations:
   1. Blinman Street Manhole location (location with floats being monitored) – to be installed in a curbside electrical enclosure.
      a. Provide HTT1100, w/ 4X enclosure
      b. Power with 120 VAC
      c. Configure for Cellular Communications
      d. Provide externally mounted Omni Directional antenna w/ 25 ft cable
      e. Provide standard I/O configuration (8 Discrete Inputs and 4 AI) for expansion, adding transmitter in future.
      f. Operating temperature range minus (-) 5 F to140 F
      g. DO's contacts rated for 120V, 10 amp minimum
      h. Provide LED indicator lights on all relays
   2. Shaw's Cove Pump Station location (location being provided with float status for operational permissive) – to be installed in the Shaw's Cove PS pump room.
      a. Provide HTT4100, w/ 4X enclosure
      b. Power with 120 VAC
      c. Configure for Cellular Communications
      d. Provide externally mounted Omni Directional antenna w/ 50 ft cable
      e. Provide standard I/O configuration (28 DI, 6 AI, 4 DO & 2AO) for expansion, adding transmitter in future.
      f. Operating temperature range minus (-) 5 F to140 F
      g. DO's contacts rated for 120V, 10 amp minimum
      h. Provide LED indicator lights on all relays

B. General: RTU's shall be A/C or Solar powered depending on the model, as designated by the Owner. The RTU's shall be available as either a kit that can be mounted in existing cabinets or supplied in a NEMA 4X enclosure with a raised door supported by stainless steel hinges on the left and a stainless steel latch configured for a padlock (supplied by Owner). The electronic components provided shall be din-rail mounted for easy replacement without removal of the enclosure. AC power supplies and solar regulators shall be modular and easily replaceable in the field.

C. The Manufacturer shall have the following types of RTU's available or equivalent:

Option	DIs	AIs	DOs	AOs	Networks	Applications
HTT201	2				Cellular	Manholes, Lift Stations, Alarms
HTT900	12				Sat, Cell, IP	Lift Stations, Meters
HTT1100	8	4 inc. + 4 opt.	4 opt.		Sat, Cell, IP	Lift Stations, Tanks, Meters, Valves, Pressure, Boosters etc.
HTT3100	28	6 inc + 4 opt.	4	2	Sat, Cell, IP	Larger Lift Stations, Boosters, Small Plants
HTT4100	28+	12+	8	opt.	Cell, IP	Plant Monitoring
GPG	2				Mesh Radio	Grinder Pump Alarming

1. Solar power shall be available as requested for HTT201 and HTT1100.
2. Back-up battery power shall be available for all but HTT4100 and GPG in the event that AC power is lost. When in battery backup mode the unit will at a minimum have enough power to send out a power fail alarm and on some options actually maintain full functionality for a small number of days.

D. The Manufacturer shall have the following types of Inputs and Outputs available:

1. Digital inputs compatible with either open collector or dry contact sources. Optional 115V or 230V instrumentation relays to mount in the enclosures when required.
2. Counter inputs. Four of the digital inputs configurable as pulse counters for flow monitoring equipment or rain gauges.
3. Analog inputs configurable to accept either 0-5V or 4-20ma and 0-20ma inputs. For 4-20ma and 0-20ma inputs, the sense resistor shall be 250ohms and removable for voltage sensors. 4-20ma inputs configurable to accept 2-wire, 3-wire or 4-wire sensors. Battery backed up 24V loop power shall also be available as well as analog inputs with optional integrated surge protection available.
4. Digital Outputs. RTU's with digital outputs configured with din-rail mounted Form-C relays capable of switching up to 5A at 250V.
5. Analog Outputs. RTU's with analog outputs capable of syncing 4-20ma outputs under RTU control.
6. Modbus Master. At least one type RTU shall have an RS-232 port that can be configured as a Modbus Master for reading data from third-party PLC or sensor equipment.

E. Two-way Communications: The RTU shall have capability to both send alarms and scheduled reports up to the server as well as receive commands from the server at any time. All functional configurations and alarm thresholds shall be able to be sent from the server without visiting the RTU.

F. Digital Alarm Functions: The RTU shall be able to report status changes or alarms on any digital input. All analog inputs may be configurable as digital or alarm inputs.

1. Pseudo alarms shall be available to report when two or more selected digital inputs are in the alarm state at the same time.
2. Whenever a digital alarm occurs the status shall be reported to the server after a programmable validation delay.

G. The RTU shall have the following Analog Input Monitoring Functions:

1. Reports analog input levels on programmable schedules ranging from 1 min to several hours.
2. Ability of the user to configure up to four separate alarm thresholds for each analog input. The RTU shall send an extra report to the server whenever the analog level passes through any of the alarm thresholds. Alarm thresholds shall be continuously monitored regardless of the reporting interval.
3. Ability to configure the RTU to sample the analog input only when one or more digital inputs are active. This may be used to monitor pump amps or flow rate only when a pump is running.
4. Ability to report an alarm when an analog reading falls too rapidly such as tank level falling due to system leak.

H. Local Pump Alternator/Controller. The RTU shall include a software pump controller with the following functions built in and configurable over the communications channel:

1. Local control for up to three pumps.
2. Local alternation, lead lag or round robin control behavior.
3. A maximum number of pumps running setting that actively turns off pumps to stay below the maximum.
4. Back up timers that can be set for maximum ON time or maximum OFF time or both. The maximum on setting can be configured to turn all pumps off or to force alternation.
5. Ability to set a time of day where the RTU turns pumps ON for a fixed duration of time.
6. Alarm the server if a pump is called for but does not start.
7. Ability to turn a pump ON or OFF based on local analog input alarm thresholds. This can be used for functions like low suction cut-off, local altitude valve control or local alarm light activation.

I. Flow Meter Functions. The RTU shall support the following features associated with flow meters:

1. Four internal 32-bit pulse counters stored in non-volatile memory.
2. Ability to report the counter totals on intervals ranging from 1 minute to daily.
3. Ability to convert two of the counter inputs pulse rates to a flow rate and report to the server in the form of an instantaneous flow rate reading.
4. Ability to take two of the Analog inputs connected to flow rate outputs of meters and integrate the signal to create a pseudo totalizer simulating a pulse counter. This will be used when pulse outputs are not available from the flow meters.

J. Rain Gauge Monitoring. The RTU counter inputs shall be able to support tipping bucket rain gauge instruments with the following reporting features:

1. Ability to report rainfall in 15 min resolutions.
2. Graph rain on the web interface in hourly, daily and monthly increments.

K. Wastewater Pump Station Functions. The RTU shall support the following pump station monitoring functions:

1. Ability to accumulate and report start and runtime statistics for up to five pumps. The statistics may be scheduled to report to the server on intervals between hourly and daily.
2. Ability to report an alarm if a single pump run cycle exceeds a threshold set by the user.
3. Optional flow estimation based on wet well geometries and pump on/off levels.
    a. Works for either float or level based installations
    b. Pump Capacity calculation
    c. Station output flow rate and totalization
    d. Station inflow rate estimation

L. Power Monitoring. The RTU shall support the following power related functions:
1. All units shall have battery backup that keeps the core functions active for at least two days. Depending on what option is installed, some I/O's will continue to function normally.
2. Alarms shall be sent to the server when power loss is detected.
3. For solar RTU's or A/C powered RTU's running on battery, alarms shall be sent to the server when the battery reaches a critical low level. Solar units shall also report if no charging voltage is received for 4 days as an indication that the panel may be stolen or defective.

M. Ease of Replacement. Main electronics' modules shall have the following features:

1. Main electronic modules shall be din-rail mounted for easy removal and replacement.
2. All power and I/O connectors shall be two-part pluggable terminals so that when a module is replaced no wires have to be removed from the terminals.
3. The same basic RTU shall be used for all communications options with no I/O configuration changes.

N. Antenna Options:

1. Cellular options shall include an antenna that is internal to the enclosure, an omnidirectional antenna external to the enclosure or a directional (higher gain) antenna external to the enclosure.
2. Satellite RTU's shall require an external 3-inch stub antenna with a bracket and either a 15, 30 or 50-foot external cable.
3. IP units shall only require standard 10baseT RG6 Internet patch cable connection.

O. Expansion and Accessories. The RTU's shall have the following optional factory-installed accessories available:

1. Din-rail mounted main power surge arrestor.
2. Din-rail mounted Analog or Digital signal surge arrestors.
3. RTU's with four Analog inputs shall have an optional expansion module to add four additional 4-20ma analog inputs.
4. Enclosure heaters and thermostats.
5. Local digital displays for analog inputs.
6. RTU's with a programming port through which qualified installers may upgrade internal software without returning the equipment to the factory.

P. Communication Platforms:

1. RTU's may be configured with either low earth orbit satellite (Iridium), GSM cellular (ATT or International), CDMA cellular (Verizon) or IP (Internet) as designated by the Owner to communicate bi-directionally from the RTU to the Central Server.

Q. Customer Service:

1. The Manufacturer shall provide 24-hour, seven days a week phone support access to the Owner by the Manufacturer's customer support personnel. Customer support personnel shall provide assistance with software, communications and hardware as required by the Owner. The Manufacturer shall provide the Owner with a toll-free number to contact their customer support personnel. No additional fees shall be charged by the Manufacturer for configuring the Owner's software for his applications.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install all equipment in accordance with ANSI C2, ANSI/NFPA 70 and the requirements specified herein.

B. Install all field instruments in accordance with the Manufacturer's recommendations.

3.2 WIRING

A. Install conductors and cables in conduit, unless indicated otherwise.

B. Complete raceway systems and remove obstructions before pulling conductors into place. Avoid damaging insulation during conductor installation. Use an approved lubricating compound as required to facilitate pulling wires.

3.3 SPLICES AND TERMINATIONS

A. Make up both mechanically and electrically tight.

B. Provide with a flashover or insulation value at least 100 percent in excess of wire insulation.

C. Make splices and terminations in junction boxes.

D. Make connections in No. 10 AWG and smaller conductors with insulated pressure connectors or wire nut connections.

E. Use terminal blocks of the proper voltage for interconnecting or splicing control cables, communication cables, and other conductors. Mount terminal blocks in a cabinet and label terminals properly.

3.4 CELLULAR ANTENNA MOUNTING

A. All antennas shall be mounted with galvanized clamps or other non-corroding attachment devices.

B. The mounting of the antennas shall be in such a manner to prevent welding, drilling or other corrosion and stress inducing modifications, or damage to paint systems.

C. All antennas shall utilize existing non-load bearing structures such as safety rails for mounting points.

D. Antennas shall be mounted in a manner so that cables and antennas do not interfere with safety equipment or harnesses while climbing up or on the structures.

E. Cutting into a structural member is not acceptable.

F. All antennas shall be mounted to insure the most direct view of the cell towers at the remote sites.

G. Antenna masts shall be provided where necessary to elevate the antenna high enough to insure direct view of cell towers, and shall include the mast and all attachment hardware.

3.5 ANTENNA CONNECTION SEALING

A. All antenna connections shall be coated with silicon grease and then covered with a protective rubber boot.

3.6 TESTING

A. Performance Verification Test: Conduct performance verification tests to demonstrate that control system maintains set-points, and that system is programmed for the correct sequence of operation. Conduct performance verification test one day after work is installed of continuous RTU systems operation and before final acceptance of work. Performance verification test shall demonstrate the following:

1. Field Testing: Calibrate field equipment and verify equipment and system operation before placing the system on-line.
2. Calibration Accuracy and Operation of Inputs Test: Check for proper calibration and operation of each input instrument. Document each reading for the test report.
3. RTU Startup and Memory Test: Demonstrate that programming is not lost after a power failure, and RTU controllers automatically resume proper control after a power failure.
4. Surge Protection: Show that surge protection, meeting the requirements of this specification, has been installed on incoming power to the digital controllers and on communications lines.

3.7 FIELD TESTS

A. Demonstrate compliance of the control system with the contract documents. Furnish personnel, equipment, instrumentation, and supplies necessary to perform calibration and site testing. Ensure

that tests are performed by competent employees regularly employed in the testing and calibration of instrumentation systems.

B. Notify the Owner of any defective products and workmanship disclosed by the tests.

C. Testing will include the field and the performance verification tests. Field tests shall demonstrate proper calibration of input devices, and the operation of specific equipment. Performance verification test shall ensure proper execution of the sequence of operation and proper tuning of control loops.

D. Test each device such that each item will function not less than five times.

E. Tests are subject to oversight and approval by the Owner.

END OF SECTION