

TABLE OF CONTENTS

<u>Division</u>	Section Number
00 Procurement and Contracting Requirements	
Environmental Subsurface Data	00 31 33
Figures	00 31 33.a
Tables	00 31 33.b
Boring Logs	00 31 33.c
Permits	00 31 43
01 General Requirements	
Control of Work and Materials	01 11 00
Scope and Sequence of Work	01 12 16
Special Provisions	01 14 00
Dust Control and Monitoring	01 14 19.16
Substitution Procedures	01 25 00
Construction Meetings	01 31 19.23
Construction Photographs	01 32 33
Documentation	01 33 19
Submittals	01 33 23
Health and Safety Plan	01 35 29
Quality Requirements	01 40 00
References	01 42 00
Structural Tests and Inspections	01 45 23
Signage (Traffic Control)	01 55 26.13
Uniformed Officer for Temporary Traffic Control	01 55 26.19
Road Flaggers	01 55 26.22
Construction Zone Safety Plan	01 56 00
Temporary Chain Link Fence	01 56 26
Tree Protection and Trimming	01 56 39
Rodent Control	01 57 16
Environmental Protection	01 57 19
Cutting, Coring & Patching	01 73 29
Cleaning up	01 74 13
Project As-Built Record Drawings	01 78 39
Operations and Maintenance Manuals	01 92 13
02 Existing Conditions	
Site Survey	02 21 13
Subsurface Explorations	02 32 13.13
Selective Site Demolition	02 41 13
Abandonment of Sewers and Drains	02 41 13.29
Minor Electrical Demolition	02 41 19.16
Handling, Transportation, Reuse and Off Site Disposal	

<u>Division</u>	<u>Section Number</u>
Of Surplus Excavation	02 61 00.16
03 Concrete	
Field Concrete	03 05 00
Concrete Formwork	03 11 00
Concrete Reinforcement	03 21 00
Cast-in-Place Concrete	03 30 00
10 Specialties	
Traffic and Site Signage	10 14 53
12 Furnishings	
Site Furnishings	12 93 00
26 Electrical	
Electrical	26 00 00
31 Earthwork	
Earthwork	31 00 00
Geotextile Fabrics	31 05 19.13
Rock Excavation and Disposal	31 23 16.26
Dewatering	31 23 19
Support of Excavation	31 50 00
32 Exterior Improvements	
Hot Mix Asphalt Pavement	32 12 16.13
Portland Cement Concrete Pavement	32 13 13
Precast Concrete Unit Pavers	32 14 00
Curbing	32 16 00
Loam and Planting Preparation	32 91 00
Turf and Grasses	32 92 00
Trees, Shrubs, Ground Cover and Landscaping	32 93 00
33 Utilities	
Television Inspection Pipes	33 01 30.16
Sewer Cleaning, Inspection, Testing, and Sealing	33 01 30.61
Service Connection Rehabilitation	33 01 30.65
Groundwater Monitoring	33 01 30.71
Raising and/or Setting of Sewer Manhole Frame & Cover	33 05 13.13
Tracer Tape	33 05 26.13
Service Connections (Water Services)	33 11 13.16
Connections to Existing Water Mains	33 11 13.34

Division**Section
Number**

PVC Gravity Pipe and Fittings	33 31 13.16
Precast Manholes & Catch Basins	33 39 13
Corrugated Polyethylene [HDPE] Drainage Pipe	33 41 13.22
Reinforced Concrete Pipe	33 41 13.28
Stormwater Treatment System	33 44 19.13
Modular Stormwater Storage Units	33 46 23

Appendices

Appendix A: Order of Conditions

END OF SECTION

SECTION 00 31 33
ENVIRONMENTAL SUBSURFACE DATA

PART I - GENERAL

1.01 SCOPE:

- A. The Project Area spans approximately 1,900 feet within the right of way of Endicott Street from Quinsigamond Avenue to Harding Street, and Bigelow Street from Endicott Street to Lafayette Street in Worcester, Massachusetts, as shown on Figure 1 attached. The area surrounding the Project Area is primarily residential in use, except for Crompton Park and a small portion of Endicott Street abutting Quinsigamond Avenue which was formerly used as an automotive repair facility, and is currently a distributor for car radio systems. Across Quinsigamond Avenue, the properties are primarily commercial and industrial in use and include the Worcester Regional Transport Authority (WRTA) Maintenance & Operations Facility, Eversource Energy, and the Former Castle Metals facility. Additionally, this area across Quinsigamond Avenue was formerly operated as a manufactured gas plant (MGP). The Project Area is also the location of one open release under the Massachusetts Contingency Plan (MCP) as listed under Release Tracking Number (RTN) 2-379. Additionally, several closed RTNs are located within 1,000 feet of the Project Area as shown on Table 1 – Proximate RTN Summary of the attachments included as part of this Section. The CONTRACTOR shall review the publicly available environmental reports to familiarize themselves with the Site and any abutting property conditions including but not limited to the RTNs listed above as available at the following MassDEP website:

<https://eeaonline.eea.state.ma.us/portal#!/search/wastesite>

- B. A subsurface exploration program consisting of soil borings with reasonable care in targeted portions of the proposed site work area. The results of the exploration program are included as attachments to this Section and are a part of the Contract Documents. CONTRACTOR shall review the attached analytical data.
- C. The attached soil analytical data is provided for informational purposes only. The CONTRACTOR shall not rely on the interpretations, opinions, conclusions or recommendations, only the factual data relative to the specific times, locations, and depths/elevations referenced. Specific project requirements are referenced only in the drawings and specifications. If CONTRACTORS deem the subsurface information insufficient, they may, after obtaining OWNER's permission, carry out additional subsurface explorations, at no expense to the OWNER. Laboratory analytical reports are available to the CONTRACTOR upon request.
- D. Subsurface information provided in the Contract Documents is limited by the methods used for obtaining and expressing such data, and is subject to various interpretations. The

terms used to describe soils, rock, groundwater and such other conditions are subject to local usage and individual interpretation.

- E. Borings have been drilled substantially at the locations indicated on the drawings and advanced to the depths shown on the logs. Soil information presented in the boring logs, as to classification, gradation, properties, density and consistency, is based on visual observation of recovered samples. Groundwater levels reported on the boring logs are those measured in the field at the particular location and at the time measurements were made, and do not necessarily represent permanent groundwater elevations. Groundwater elevations may be affected by temperature, rainfall, tidal fluctuation, and other factors that may not have been present at the time the measurements were made. The CONTRACTORS should be aware that groundwater level fluctuations may affect methods of construction.
- F. Subsurface exploration data is for the general information of the CONTRACTORS. The CONTRACTORS are obligated to examine the site, review boring logs, all available information and records of explorations, investigations and other pertinent data for the site, and then based upon their own interpretations and investigations decide the character of material to be encountered and excavated, the suitability of the materials to be used for backfilling and such other purposes, the requirement for additional soil characterization for off-Site disposal of surplus material, the groundwater conditions, difficulties or obstacles likely to be encountered, and other conditions affecting the work. The subsurface data is accurate only at the particular locations and times the subsurface explorations were made. No other warranty either expressed or implied by the OWNER, ENGINEER or their agents is made as to the accuracy of the subsurface information and data shown on the drawings or presented in the Contract Documents.

END OF SECTION



Legend

- RTN Locations
- Limit of Work
- 500 Foot Buffer
- 1000 Foot Buffer

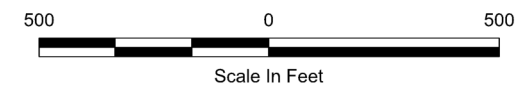


FIGURE 1

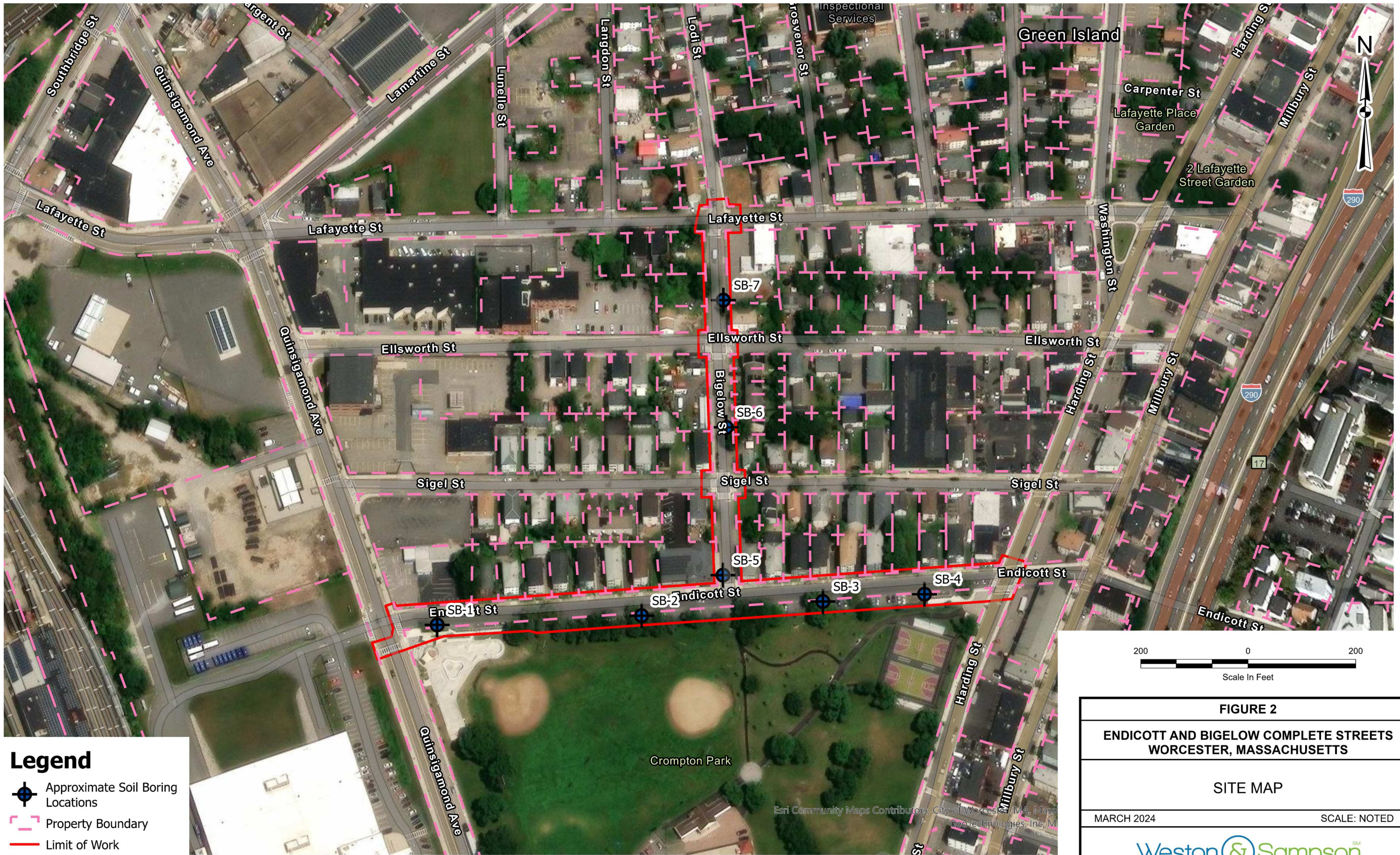
ENDICOTT AND BIGELOW COMPLETE STREETS
WORCESTER, MASSACHUSETTS

PROXIMATE RTN LOCATIONS

MARCH 2024

SCALE: NOTED

Weston & Sampson



Legend

- Approximate Soil Boring Locations
- Property Boundary
- Limit of Work

FIGURE 2	
ENDICOTT AND BIGELOW COMPLETE STREETS WORCESTER, MASSACHUSETTS	
SITE MAP	
MARCH 2024	SCALE: NOTED

Table 1
Proximate RTN Summary
Endicott and Bigelow Complete Streets
Worcester, Massachusetts

RTN	Site Name	Address	Compliance Status	Status Date	Contaminants of Concern (COCs)
2-0000171	40 Quinsigamond Ave Site	40 Quinsigamond Ave	REMOPS with AUL	4/22/2020	VOCs, SVOCs, Metals, TPH, DNAPL
2-0000365	Castle Metals	70 Quinsigamond Ave	RAO with AUL	12/30/2009	Petroleum (Gasoline and Diesel), VOCs, VPH, EPH, PAHs, Metals
2-0000379	Granite Realty Trust	1 Endicott St	Tier II	3/26/2008	Petroleum
2-0000623	Worcester Housing Authority	2 Lafayette St	DEPNFA	3/28/1996	Petroleum
2-0010426	Commonwealth Gas Co.	25 Quinsigamond Ave	RAO	8/21/1995	Petroleum (Gasoline)
2-0010473	Stanley Tool Bldg.	149 Washington St	DPS	7/7/1995	Petroleum (Gasoline)
2-0010516	Engine House	382 Southbridge St	RAO	12/13/1994	Lubricating Oil
2-0010760	Stanley Tools	149 Washington St	RAO with AUL	7/21/2009	Petroleum, Metals, CVOCs, and Mineral Oil
2-0011322	Worc DPW Combined Sewer Overflow Station	60 Quinsigamond Ave	RAO with AUL	6/19/2003	PAHs
2-0011180	Transformer Release	75 Quinsigamond Ave	RAO	5/29/1996	Mineral Oil
2-0011984	Intransit Truck Yard	448 Southbridge St	RAO	3/12/1998	Diesel Fuel
2-0012579	Noars Oil Co.	135 Millbury St	RAO	9/17/1999	No. 2 Fuel Oil
2-0012910	Railroad Yard	382 Southbridge St	RAO/TSS	12/3/2003	Petroleum, LNAPL
2-0013127	Tanker Threat	Carpenter St	RAO	2/11/2000	No. 2 Fuel Oil
2-0013307	Nissen Bakery	75 Quinsigamond Ave	RAO	7/28/2000	Diesel Fuel
2-0013251	St. Marys High School	50 Richland St	RAO	8/24/2000	No. 2 Fuel Oil
2-0014274	Intransit Container Inc.	448 Southbridge St	RAO	6/18/2002	Diesel Fuel
2-0014709	Nissen Bakery Loading Docks	Harding St	RAO	5/19/2003	Diesel Fuel
2-0016003	Castle Metals	70 Quinsigamond Ave	RTN Closed	8/1/2006	No. 2 Fuel Oil
2-0016502 and 2-0016732	JJ Nissen Bakery	75 Quinsigamond Ave	RAO	5/16/2007	EPH, PAHs, and Metals
2-0017492	Quinsigamond Ave Station	60 Quinsigamond Ave	RAO	6/10/2009	Coal Tar
2-0017877	Crompton Park Pool	50 Canton St	RAO	9/17/2010	PCBs
2-0019512	Former Manufacturing Gas Plant	42 Quinsigamond Ave	RTN Closed	5/10/2016	Coal Tar
2-0019594	Former MNG Plant	40 Quinsigamond Ave	RTN Closed	9/16/2016	Coal Tar
2-0019674	Former Commonwealth Gas Property	42 Quinsigamond Ave	PSC with AUL	6/11/2019	Coal Tar, ACM, Cyanide, PAHs, VOCs, Petroleum
2-0019990	Former Castle Metals	70 Quinsigamond Ave	URAM	9/29/2016	Petroleum (Gasoline and Diesel), VOCs, VPH, EPH, PAHs, Metals
2-0020335	Eversource	40 Quinsigamond Ave	URAM	10/19/2017	NAPL and Coal Tar
2-0020489	WRTA	42 Quinsigamond Ave	PSNC	5/10/2018	Diesel Fuel
2-0021969	Former St. Marys School	50 Richland St	PSNC	8/12/2022	No. 6 Fuel Oil
2-0022371	Providence and Worcester Railyard	382 Southbridge St	Unclassified	6/29/2023	NAPL

Notes:

1. RAO indicates the site was closed out under the MCP with the filing of a Response Action Outcome.
2. AUL = Activity and Use Limitation.
3. TPH = Total Petroleum Hydrocarbons.
4. PAHs = polycyclic aromatic hydrocarbons.
5. PCBs = polychlorinated biphenyls.
6. VOCs = volatile organic compounds.
7. RTN is the Release Tracking Number assigned by the MassDEP for the listed Site.

Compliance Status Abbreviations:

AUL = Activity and Use Limitation
DEPNFA = DEP - No Further Action
DPS = Downgradient Property Status
PSC = Permanent Solution with Conditions
PSNC = Permanent Solution with No Conditions
RAO = Release Action Outcome
REMOPS = Remedy Operation Status
TSS = Temporary Solution Statement

COC Abbreviations:

ACM = Asbestos-Containing Material
EPH = Extractable Petroleum Hydrocarbons
NAPL = Non-aqueous Phase Liquid
PAHs = Polycyclic Aromatic Hydrocarbons
SVOCs = Semi-volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
VPH = Volatile Petroleum Hydrocarbons

Table 2
Summary of Soil Analytical Results - Grab Soil Samples
Endicott and Bigelow Complete Streets Project
Worcester, Massachusetts

Parameter	Units	Reportable Concentrations (RCs) ¹	Sample ID, Date, and Depth (feet)													
			SB-1 (13-40)		SB-2 (8-6.7)		SB-3 (0-.2.5)		SB-04 (0-2.5)		SB-5 (0-2.5)		SB-6 (0-2.5)		SB-7 (0-2.5)	
			1/31/2024		1/31/2024		1/31/2024		1/31/2024		1/31/2024		1/31/2024		1/31/2024	
		RCS-1	1.083 - 3.33		0.67 - 6.7		0 - 2.5		0 - 2.5		0 - 2.5		0 - 2.5		0 - 2.5	
			Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
Total Metals																
Arsenic	mg/kg	20	16.3		13.1		21.9		21.3		19.4		13.2		14.2	
Barium	mg/kg	1000	15.5		24.4		38.7		49.8		40		27.4		29.2	
Chromium	mg/kg	100	11.7		14.8		17.8		18.3		18.5		13.6		12.3	
Lead	mg/kg	200	35.1		35.4		26		125		51.2		51.2		79.4	
Mercury	mg/kg	20	0.092		0.078	U	0.084	U	0.379		0.155		0.166		0.24	
Polycyclic Aromatic Hydrocarbons (PAHs)																
Acenaphthylene	mg/kg	2	0.70	U	0.14	U	0.15	U	0.15	U	1.7		0.14	U	0.14	U
Anthracene	mg/kg	1000	0.53	U	0.10	U	0.11	U	0.12		0.76		0.11	U	0.11	U
Benzo(a)anthracene	mg/kg	20	0.53	U	0.10	U	0.11	U	0.55		1.6		0.11	U	0.11	U
Benzo(a)pyrene	mg/kg	2	0.70	U	0.14	U	0.29		0.68		4.1		0.14	U	0.14	U
Benzo(b)fluoranthene	mg/kg	20	0.87		0.10	U	0.30		0.80		4.4		0.11	U	0.11	U
Benzo(g,h,i)perylene	mg/kg	1000	1.1		0.14	U	0.24		0.36		3.8		0.14	U	0.14	U
Benzo(k)fluoranthene	mg/kg	200	0.53	U	0.10	U	0.11	U	0.19		1.2		0.11	U	0.11	U
Chrysene	mg/kg	200	0.55		0.10	U	0.12		0.51		1.8		0.11	U	0.11	U
Dibenz(a,h)anthracene	mg/kg	2	0.37	U	0.074	U	0.078	U	0.088		0.90		0.075	U	0.076	U
Fluoranthene	mg/kg	1000	0.79		0.10	U	0.16		1.0		1.8		0.11	U	0.11	U
Indeno(1,2,3-cd)pyrene	mg/kg	20	0.86		0.14	U	0.21		0.33		2.9		0.14	U	0.14	U
2-Methylnaphthalene	mg/kg	0.70	0.37	U	0.074	U	0.078	U	0.078	U	0.095		0.075	U	0.076	U
Naphthalene	mg/kg	4	0.88	U	0.18	U	0.18	U	0.18	U	0.21		0.18	U	0.18	U
Phenanthrene	mg/kg	10	0.53	U	0.10	U	0.11	U	0.49		0.52		0.11	U	0.11	U
Pyrene	mg/kg	1000	0.70		0.10	U	0.16		1.0		2.2		0.11	U	0.11	U
Volatile Petroleum Hydrocarbons (VPH)																
Naphthalene	mg/kg	4	0.237	U	NT		NT		0.247		0.28	U	NT		NT	
Waste Characterization Parameters																
Cyanide	mg/kg	30	1	U	1	U	NT		NT		1.1	U	NT		NT	
% Solids	%	~	92.4		93		89.3		87.1		82.7		91.5		90.5	
Soil Categories			A-1		A-1		B-1		B-1		B-1		A-1		A-1	

QA/QC by MDM on March 27, 2024

Notes:

1. Reportable Concentrations are referenced from the Massachusetts Contingency Plan (310 CMR 40.0000, revised March 2024).

2. For full analytical results, please refer to the attached laboratory analytical report.

~ = No comparison criteria available.

VALUE = Parameter not detected above laboratory reporting limit shown.

VALUE = Parameter detected above laboratory reporting limit.

VALUE = Parameter detected above applicable comparison criteria.

Abbreviations:

mg/kg = milligrams per kilogram

ND = Not detected

NT = Not tested

Flags:

U = Not detected above laboratory reporting limit shown

Table 3
Summary of Soil Analytical Results - Composite Soil Samples
Endicott Street/Endicott and Bigelow Complete Streets Project
Worcester, Massachusetts

Parameter	Units	Reportable Concentrations (RCs) ¹	Bigelow Comp 1/31/2024		Endicott Comp 1/31/2024	
		RCS-1	Result	Flag	Result	Flag
Total Peotrlreum Hydrocarbons (TPH)						
TPH (C10-C36)	mg/kg	1000	114		51.5	
Total Metals						
Arsenic	mg/kg	20	17.1	U	16.1	U
Cadmium	mg/kg	80	0.422		0.434	
Chromium	mg/kg	100	14.7		13.6	
Lead	mg/kg	200	27.1		42.9	
Mercury	mg/kg	20	0.1		0.108	
Polychlorinated Biphenyls (PCBs)						
Total PCBs	mg/kg	1	0.0498	U, Y	0.0542	U, Y
Semi-Volatile Organic Compounds (SVOCs)						
Acenaphthylene	mg/kg	2	1.2	U	0.15	U
Benzo(a)anthracene	mg/kg	20	0.76		0.13	
Benzo(a)pyrene	mg/kg	2	1.5		0.25	
Benzo(b)fluoranthene	mg/kg	20	1.7		0.26	
Benzo(g,h,i)perylene	mg/kg	1000	1.6		0.23	
Benzo(k)fluoranthene	mg/kg	200	0.54		0.11	
Chrysene	mg/kg	200	0.79		0.17	
Fluoranthene	mg/kg	1000	0.94		0.24	
Indeno(1,2,3-cd)pyrene	mg/kg	20	1.4		0.22	
Phenanthrene	mg/kg	10	0.53		0.18	
Pyrene	mg/kg	1000	1.2	0.23		
Total SVOCs	mg/kg	~	11.63	Y	2.06	Y
Volatile Organic Compounds (VOCs)						
Benzene	mg/kg	2	0.0012	Y	0.00042	U
Total VOCs	mg/kg	~	0.0012		ND	
Waste Characterization Parameters						
Specific Conductivity	umhos/cm	~	96		68	
% Solids	%	~	91.8		91.4	
Soil Categories			A-1		A-1	

QA/QC by MDM on March 27, 2024

Notes:

1. Reportable Concentrations are referenced from the Massachusetts Contingency Plan (310 CMR 40.0000, revised March 2024).

2. For full analytical results, refer to the attached laboratory analytical report.

~ = No comparison criteria available.

VALUE = Parameter not detected above laboratory reporting limit shown.

VALUE = Parameter detected above laboratory reporting limit.

VALUE = Parameter detected above applicable comparison criteria.

Abbreviations:

mg/kg = milligrams per kilogram

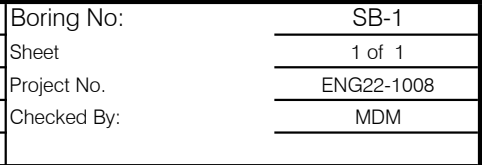
ND = Not detected


NT = Not tested


Flags:


U = Not detected above laboratory reporting limit shown


Y = Calculated value

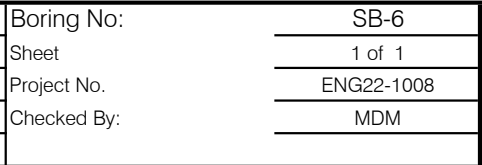


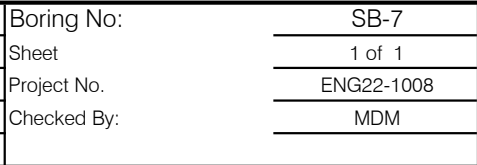
				GEOPROBE BORING LOG			Boring No: SB-2				
				Client City of Worcester			Sheet 1 of 1				
				Project Name: Endicott Complete Streets			Project No. ENG22-1008				
				Project Address: Worcester, MA			Checked By: MDM				
Driller Info.	BORING Co.		New England GeoTech		Project Info.	WSE Scientist Elizabeth Earley		Subsurface	Depth to Water (ft) N/A		
	FOREMAN		Hayes			Date 1/31/2024			Refusal N/A		
	DRILL RIG		Geoprobe 6620DT			Start Time 1030			Well Installed Y (N)		
	SAMPLER		5' Macrocore			End Time 1015			Screen Interval		
CORE STATS				SAMPLE DESCRIPTION							
Depth	Penetration (inches)	Recovery (inches)	Depth (FT)	PID (ppm)	Measure-ment	Moisture	Lithology (Modified Burmster)	Notes	Sample Details		
0	60	30	0-5	0.0		Dry	ASPHALT				
1							Brown F to C SAND, little cobbles, trace silt; black stain from 16-18"	(1)			
2							Tan F SAND, little silt, little gravel				
3							Orange C SAND with cobbles				
4							Grey to tan C SAND with cobbles				
5							Grey to tan F SAND with cobbles				
6							White to grey SAND with cobles, little gravels, trace debris (brick)				
7	End of Exploration at 5'										
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
NOTES:									Terms	Percentage	
1) TS, PAHS, RCRA-8 METALS, PACS 8-60"									trace	0-10%	
									little	10-20%	
									some	20-35%	
									and	35-50%	

				GEOPROBE BORING LOG			Boring No:		SB-3			
				Client			City of Worcester		Sheet		1 of 1	
				Project Name:			Endicott Complete Streets		Project No.		ENG22-1008	
				Project Address:			Worcester, MA		Checked By:		MDM	
Driller Info.	BORING Co.	New England GeoTech		Project Info.	WSE Scientist	Elizabeth Earley		Subsurface	Depth to Water (ft)	N/A		
	FOREMAN	Hayes			Date	1/31/2024			Refusal	N/A		
	DRILL RIG	Geoprobe 6620DT			Start Time	1045			Well Installed	Y (N)		
	SAMPLER	5' Macrocore			End Time	1030			Screen Interval			
CORE STATS				SAMPLE DESCRIPTION								
Depth	Penetration (inches)	Recovery (inches)	Depth (FT)	PID (ppm)	Measure-ment	Moisture	Lithology (Modified Burmster)			Notes	Sample Details	
0	60	30	0-5	0.1		Dry	ASPHALT					
1							Brown F to C SAND, some asphalt, trace gravel			(1)		
2												
3												
4												
5							End Exploration 5'					
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
NOTES:										Terms	Percentage	
1) TS, PAHS, RCRA-8 METALS taken 11"-32"										trace	0-10%	
										little	10-20%	
										some	20-35%	
										and	35-50%	

				GEOPROBE BORING LOG			Boring No: SB-4			
				Client City of Worcester		Sheet 1 of 1				
				Project Name: Endicott Complete Streets		Project No. ENG22-1008				
				Project Address: Worcester, MA		Checked By: MDM				
Driller Info.	BORING Co. New England GeoTech		Project Info.	WSE Scientist Elizabeth Earley		Subsurface	Depth to Water (ft) N/A			
	FOREMAN Hayes			Date 1/31/2024			Refusal N/A			
	DRILL RIG Geoprobe 6620DT			Start Time 1045			Well Installed Y (N)			
	SAMPLER 5' Macrocore			End Time 1100			Screen Interval			
CORE STATS				SAMPLE DESCRIPTION						
Depth	Penetration (inches)	Recovery (inches)	Depth (FT)	PID (ppm)	Measure-ment	Moisture	Lithology (Modified Burmster)	Notes	Sample Details	
0	60	35	0-5			Dry	ASPHALT			
1				0.1			Brown F to C SAND with little SILT petroleum odor	(1), (2)		
2							White F to C SAND some cobbles, trace gravel, black stain			
3				0.0				Dark brown F to C SAND, little SILT, trace gravel/brick fragments		
4										
5							End of Exploration at 5'			
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
NOTES: 1) TS, PAHS, RCRA-8 METALS taken 12"-32" 2) VPH, taken 19"-24"								Terms	Percentage	
								trace	0-10%	
								little	10-20%	
								some	20-35%	
								and	35-50%	

				GEOPROBE BORING LOG			Boring No:		SB-5								
				Client		City of Worcester		Sheet		1 of 1							
				Project Name:		Endicott Complete Streets		Project No.		ENG22-1008							
				Project Address:		Worcester, MA		Checked By:		MDM							
Driller Info.		BORING Co.		New England GeoTech		Project Info.		WSE Scientist		Elizabeth Earley		Subsurface		Depth to Water (ft)		N/A	
		FOREMAN		Hayes				Date		1/31/2024				Refusal		N/A	
		DRILL RIG		Geoprobe 6620DT				Start Time		900				Well Installed		Y (N)	
		SAMPLER		5' Macrocore				End Time		915				Screen Interval			
CORE STATS				SAMPLE DESCRIPTION													
Depth	Penetration (inches)	Recovery (inches)	Depth (FT)	PID (ppm)	Measure-ment	Moisture	Lithology (Modified Burmster)						Notes	Sample Details			
0	60	36	5	0.0		Dry	ASPHALT										
1							Brown F to C SAND, some cobbles, little silt, trace gravel						(1)				
2				0.1			Dark brown F to C SAND, little silt, trace debris (brick)						(2)				
3							CONCRETE										
4							Dark brown F to C SAND, little silt, trace gravel and concrete black stain										
5							End of Exploration at 5'										
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
NOTES:												Terms	Percentage				
1) TS, PAHS, RCRA-8 METALS taken 11"-32"												trace	0-10%				
2) VPH, PACS taken 32-36"												little	10-20%				
												some	20-35%				
												and	35-50%				





Depth	Penetration (inches)	Recovery (inches)	Depth (FT)	PID (ppm)	Measure- ment	Moisture	Lithology (Modified Burmster)	Notes	Sample Details
0	60	41	5	0.0		Dry	ASPHALT		
1							Brown C SAND, little silt, little fines, trace brick fragments, 1" black stain	(1)	
2									
3									
4									
5							Tan F to C SAND, little silt, trace gravel		
6	End of Exploration at 5'								
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									

Terms	Percentage
trace	0-10%
little	10-20%
some	20-35%
and	35-50%

SECTION 00 31 43

PERMITS

PART 1 – GENERAL

1.01 DESCRIPTION:

This Section provides specific information and defines specific requirements of the Contractor regarding the preparation and acquisition of permits required to perform the work of this project.

1.02 RELATED WORK:

- A. Section 01 11 00, CONTROL OF WORK AND MATERIALS
- B. Section 01 14 19.16, DUST CONTROL
- C. Section 01 55 26.13, SIGNAGE (TRAFFIC CONTROL)
- D. Section 01 57 19, ENVIRONMENTAL PROTECTION
- E. Section 02 41 13.29, ABANDONMENT OF SEWERS AND DRAINS
- F. Section 02 41 19.16, MINOR ELECTRICAL DEMOLITION
- G. Section 02 61 00.16, HANDLING, TRANSPORTATION, REUSE AND OFF SITE DISPOSAL OF SURPLUS EXCAVATION
- H. Section 31 00 00, EARTHWORK
- I. Section 31 23 19, DEWATERING

1.03 GENERAL REQUIREMENTS:

- A. The Owner has obtained or will obtain and pay for the permits listed below, which are required for this project. The Contractor shall assist in obtaining certain permits, as indicated. The Contractor shall obtain and pay for all other permits required.

<u>Permits by Owner</u>	<u>Status</u>
Conservation Commission Order of Conditions (Ch. 131, s. 40)	(Attached)
Trench Permit (520 CMR 14.00)(eff. date 3/1/09)	*
NPDES Construction General Permit	*

*Contractor shall prepare permit application and obtain the permit after contract is awarded, bearing all expenses. Owner will pay for and/or waive the permit application fee, if applicable.

1.04 CONSERVATION COMMISSION ORDERS:

The Conservation Commission has under the authority of Massachusetts General Laws Chapter 131, Section 40, issued an Order of Conditions on the work under this contract. This Order is to become a part of the Contract Documents and the Contractor shall perform all work in strict conformance with said Order. A copy of this Order is attached as Appendix A.

PART 2 - PRODUCTS

Not Used.

PART 3 – EXECUTION

3.01 PERFORM WORK IN ACCORDANCE WITH REQUIREMENTS:

- A. The Contractor shall perform the work in accordance with the Contract Documents, including the attached permits/order of conditions, and any applicable municipal requirements.
- B. Prior to commencing any construction activities, the Contractor shall demonstrate to the Owner and the Engineer, through on-site inspection and submitting copies of permits or approvals, that it is in full compliance with the terms and conditions of all permits specified herein. The Contractor shall maintain full compliance with all permits throughout the performance of the work, and upon request, grant access to permitting authorities to inspect the site for the purpose of verifying such compliance.

END OF SECTION

Document1

SECTION 01 11 00

CONTROL OF WORK AND MATERIALS

PART 1 – GENERAL

Not Used.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 HAULING, HANDLING AND STORAGE OF MATERIALS:

- A. The Contractor shall, at its own expense, handle and haul all materials furnished by it and shall remove any of its surplus materials at the completion of the work.
- B. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by it that are liable to injury and shall be responsible for any loss of or damage to any equipment or materials by theft, breakage, or otherwise.
- C. All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly stored in such location as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.
- D. The Contractor shall be responsible for all damages to the work under construction during its progress and until final completion and acceptance even though partial payments have been made under the Contract.

3.02 OPEN EXCAVATIONS:

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at its own expense, provide suitable and safe means for completely covering all open excavations and for accommodating travel when work is not in progress.
- B. Bridges provided for access to private property during construction shall be removed when no longer required.

CONTROL OF WORK AND MATERIALS

- C. The length of open trench will be controlled by the particular surrounding conditions but shall always be confined to the limits prescribed by the Engineer.
- D. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, then special construction procedures shall be taken, such as limiting the length of trench and prohibiting stocking excavated material in the street.
- E. All street excavations shall be completely closed at the end of each work day. Backfilling or use of steel plates of adequate strength to carry traffic shall be used.

3.03 MAINTENANCE OF TRAFFIC:

- A. Unless permission to close the street is received in writing from the proper authority, all excavated materials and equipment shall be placed so that vehicular and pedestrian traffic may be safely maintained at all times.
- B. Should the Chief of Police deem it necessary, uniformed officers will be assigned to direct traffic. The Contractor shall make all arrangements in obtaining uniformed officers required.
- C. The Contractor shall at its own expense, as directed by the Police Traffic Control/Safety Officer, provide and erect acceptable barricades, barrier fences, traffic signs, and all other traffic devices not specifically covered in a bid item, to protect the work from traffic, pedestrians, and animals. The Contractor shall provide sufficient temporary lighting such as lanterns/flashers (electric battery operated) or other approved illuminated traffic signs and devices to afford adequate protection to the traveling public, at no additional cost to the Owner.
- D. The Contractor shall furnish all construction signs that are deemed necessary by and in accordance with Part VI of the Manual on Uniform Traffic Control Devices as published by the U.S. Department of Transportation. In addition, the Contractor may be required to furnish up to 128 square feet of additional special construction warning signs. Size and exact wording of signs shall be determined by the Engineer during construction.
- E. The intent of policing is to ensure public safety by direction of traffic. Police officers are not to serve as watchmen to protect the Contractor's equipment and materials.
- F. Nothing contained herein shall be construed as relieving the Contractor of any of its responsibilities for protection of persons and property under the terms of the Contract.

3.04 CARE AND PROTECTION OF PROPERTY:

The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be promptly restored by the Contractor, at its expense, to a condition similar or equal to that existing before the damage was done, to the satisfaction of the Engineer.

3.05 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

- A. All existing buildings, utilities, pipes, poles, wires fences, curbing, property line markers and other structures which the Engineer decides must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the contractor. Should such property be damaged, it shall be restored by the Contractor, at no additional cost to the Owner.
- B. The Contractor shall determine the location of all underground structures and utilities (including existing water services, drain lines, electrical lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by Contractor.
- C. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are shaped so as to cut or otherwise damage such surfaces.
- D. All property damaged by the Contractor's operations shall be restored to a condition at least equal to that in which it was found immediately before work was begun. Suitable materials and methods shall be used for such restoration.
- E. Restoration of existing property and structures shall be carried out as promptly as practicable and shall not be left until the end of the construction period.

3.06 MAINTENANCE OF FLOW:

- A. The Contractor shall at its own cost, provide for the flow of sewers and drains interrupted during the progress of the work, and shall immediately cart away and dispose of all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Engineer well in advance of the interruption of any flow.

- B. All existing drainage facilities including, but not limited to; brooks, streams, canals, channels, ditches, culverts, catch basins and drainage piping shall be adequately safeguarded so as not to impede drainage or to cause siltation of downstream areas in any manner whatsoever. If the Contractor damages or impairs any of the aforesaid drainage facilities, it shall repair the same within the same day.
- C. At the conclusion of the work, the Contractor shall remove all silt in drainage structures caused by its operations.

3.07 REJECTED MATERIALS AND DEFECTIVE WORK:

- A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor, and shall not be made use of elsewhere in the work.
- B. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Engineer.
- C. The Contractor shall reimburse the Owner for any expense, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as determined by the Engineer, occurring previous to the final payment.

3.08 SANITARY REGULATIONS:

Sanitary conveniences for the use of all persons employed on the work, properly screened from public observation, shall be provided in sufficient numbers in such manner and at such locations as may be approved. The contents shall be removed and disposed of in a satisfactory manner as the occasion requires. The Contractor shall rigorously prohibit the committing of nuisances within, on or about the work. Any employees found violating these provisions shall be discharged and not again employed on the work without the written consent of the Engineer. The sanitary conveniences specified above shall be the obligation and responsibility of the Contractor.

3.09 SAFETY AND HEALTH REGULATIONS:

This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et. seq.)." The Contractor shall be familiar with the requirements of these regulations.

3.10 SITE INVESTIGATION:

The Contractor acknowledges that it has satisfied itself as to the conditions existing at the site of the work, the type of equipment required to perform this work, the quality and quantity of the materials furnished insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the drawings and specifications made a part of this contract. Any failure of the Contractor to acquaint itself with available information will not relieve it from the responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusion or interpretation made by the Contractor on the basis of the information made available by the Owner.

3.11 HANGERS, PADS, AND SUPPORTS:

- A. Unless otherwise indicated, hangers and supports shall be by the trade providing the supported item.
- B. Except where detailed or specified, design of hangers and supports shall be the responsibility of the Contractor. All parts of such hangers or supports shall be designed in accordance with accepted engineering practice, using a factor of safety of at least 2½.
- C. When proprietary hangers, etc., are supplied, satisfactory evidence of the strength of such items shall be furnished.
- D. Locations and sizes of openings, sleeves, concrete pads, steel frames, and other equipment supports are indicated on the drawings for bidding purposes only. Final sizes and locations of such items shall be obtained from the shop drawings.

3.12 SLEEVES, HOLES, HANGERS, INSERTS, ETC.:

- A. Except where holes and openings are dimensioned, and hangers, inserts, and supports are fully called for on the architectural and structural drawings (or reference is made thereon to drawings containing such information) to accommodate mechanical or electrical items, they shall be by the mechanical or electrical trade concerned.
- B. Sleeves, inserts, anchors, etc., supplied under the mechanical and electrical contracts in sufficient time to so permit, shall be set in concrete, masonry, etc., or fastened to steel deck, etc., by the respective architectural or structural trade. Where not supplied in sufficient time, installation of such items shall be the responsibility of the mechanical or electrical trade involved.
- C. Nothing shall be suspended from the ceiling joists and no fastenings made to the joists, except with the prior permission of the Architect. Request for permission shall be accompanied by full details of the hanger or fastener, including the weight of the item to be suspended.

- D. Nailers and other wood members attached to steel or masonry, for which fasteners are not indicated on the design drawings or in the specification, shall be fastened with the equivalent of ½-inch diameter bolts at 3 feet o.c.
- E. Openings for mechanical and electrical items in finished areas of the building shall be closed off with near escutcheon plates or similar closures. These closures shall be by the mechanical or electrical trade involved.
- F. HAZARDOUS WASTE:

Should the Contractor, while performing work under this contract, uncover hazardous materials, as defined in Massachusetts Hazardous Waste Regulations 310 CMR 30.00, he shall immediately notify the Engineer. The Contractor is not, and has no authority to act as, a handler, generator, operator or disposer of hazardous or toxic substances found or identified at the site, and the Owner shall undertake all such functions.

END OF SECTION

SECTION 01 12 16

SCOPE AND SEQUENCE OF WORK

PART 1 – GENERAL

1.01 WORK INCLUDED:

The City of Worcester DPW&P proposes several improvements to Endicott and Bigelow Street in Worcester. The extent of the corridors run from Quinsigamond Avenue to Milbury Street along Endicott Street, and from Endicott Street to Elsworth Street along Bigelow Street Rights of Way. Scope of work includes but is not limited to:

1. Drainage structures and drains for stormwater
2. Tree filter box with engineered soil media
3. Hot mix asphalt pavement
4. Poured in place concrete pavement
5. Streetscape lighting
6. Street signage
7. Granite curbing
8. Roadway and parking striping
9. ADA accessible walkways and ramps
10. Removeable bollards and other pedestrian amenities
11. Tree, shrub, perennial, groundcover plantings

PART 2 - PRODUCTS (NOT APPLICABLE)PART 3 - EXECUTION

3.01 GENERAL:

- A. The Contractor shall be responsible for scheduling its activities and the activities of any subcontractors involved, to meet the completion date, or milestones, established for the contract. Scheduling of the work shall be coordinated with the Owner and Engineer.
- B. The Construction Sequence Requirements shall be used by the Contractor to form a complete schedule for the project, which shall be coordinated with the Owner and Engineer. Prior to performing any work at the site, the Contractor shall submit a detailed plan to the Engineer for review. The plan shall describe the proposed sequence, methods, and timing of the work.

END OF SECTION

11/01/2024

SECTION 01 14 00

SPECIAL PROVISIONS

PART 1 - GENERAL

Not used

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.01 OCCUPYING PRIVATE PROPERTY:

The Contractor shall not enter upon nor occupy with men, equipment or materials any property outside of the public highways or Owner's easements, except with the written consent of the property owner or property owner's agent.

3.02 EXISTING UTILITY LOCATIONS – CONTRACTOR'S RESPONSIBILITY:

- A. The location of existing underground services and utilities shown on the drawings is based on available records. It is not warranted that all existing utilities and services are shown, or that shown locations are correct. The Contractor shall be responsible for having the utility companies locate their respective utilities on the ground prior to excavating.
- B. To satisfy the requirements of **Massachusetts law, Chapter 82, Section 40**, the Contractor shall, at least 72 hours, exclusive of Saturdays, Sundays and holidays, prior to excavation in the proximity of telephone, gas, cable television and electric utilities, notify the utilities concerned by calling "DIG SAFE" at telephone number: 1-888-344-7233.
- C. The Contractor shall coordinate all work involving utilities and shall satisfy itself as to the existing conditions of the areas in which it is to perform his work. It shall conduct and arrange its work so as not to impede or interfere with the work of other contractors working in the same or adjacent areas.

3.03 COORDINATION OF WORK:

11/01/2024

SPECIAL PROVISIONS

01 14 00-1

The General Contractor shall be responsible for coordinating its own work as well as that of any subcontractors. It shall be responsible for notification of the Engineer when each phase of work is expected to begin and the approximate completion date.

3.04 DESIGN OF EQUIPMENT:

Attention is directed to the fact that the layout of certain equipment is based on that of one manufacturer. If other equipment is submitted for approval, the Contractor shall prepare and submit for approval at its expense, detailed structural, mechanical and electrical drawings, equipment lists, maintenance requirements, and any other data required by the Engineer, showing all necessary changes and embodying all special features of the equipment he proposes to furnish. Such changes, if approved, shall be made at the expense of the Contractor.

3.05 FEDERAL REGULATORY COMPLIANCE:

- A. The Work will be partially funded by Community Development Block Grant funds and therefore the Contractor must comply with all applicable federal regulations.

3.06 PROJECT SIGN:

- A. Contractor will provide and temporarily install one monolithic 48" high x 96" wide x $\frac{3}{4}$ " thick Project sign and 2- 4"x 4" posts to identify the Project at a location to be determined in the field by the Owner. The signs shall be erected within ten (10) days after the construction contract is awarded. The signs shall be fabricated, erected, and maintained by the Contractor.
- B. The Project sign shall conform exactly to the City of Worcester's DPW and Parks' prototype Projects sign including but not limited to size, backer material, font style, size and relief, capitalization, color, weather proofing, fasteners and fastener locations.
- C. Final Graphic and language will be provided by the Owner (Background color is forest green, text is white). Sample below is for reference only.



- D. The Contractor shall provide adequate support for the two signs as determined by the Engineer. All supports, trim, and back of sign shall be painted with at least two coats of exterior paint.
- E. The project sign shall be maintained by the Contractor in good condition at all times for the duration of construction. The Contractor shall remove the sign upon completion of construction.

3.07 COMPLIANCE WITH PERMITS:

- A. The Contractor shall perform all work in conformance with requirements of the Permits, which appear in Section 00 31 43 – PERMITS.

3.08 CONTRACTOR'S REPRESENTATIVE:

The Contractor shall designate a representative who will be available to respond to emergency calls by the Owner at any time day and night and on weekends and holidays should such a situation arise.

3.09 HOURS OF CONSTRUCTION ACTIVITY:

- A. The Contractor shall conduct all construction activity between 7:00 a.m. and 5:00 p.m.,

11/01/2024

SPECIAL PROVISIONS

01 14 00-3

Monday through Friday. No construction work shall be allowed on Saturdays, Sundays or Holidays without written authorization from the Owner.

- B. The Owner will provide personnel for assistance in locating and operating valves at no cost to the Contractor during the Owner's normal working hours (**Monday through Friday 7:00 a.m. to 3:00 p.m.**). When this assistance is required by the Contractor outside of the Owner's normal working hours the cost will be incurred by the Contractor at the prevailing overtime rate of pay for the personnel providing the assistance. The Owner will bill the Contractor directly.

3.10 MASSACHUSETTS DATA SECURITY REGULATIONS:

The Contractor is required to comply with data security regulations contained in 201 CMR 17.00 that have been established to safeguard personal information of Massachusetts residents contained in paper or electronic records. The Contractor shall not submit to the Engineer or Owner documents in paper or electronic form that contain personal information (person's name combined with one or more of the following – Social Security Number, driver's license number or state-issued identification card number, financial institution account number, or credit or debit card number). Any document submitted to the Engineer that violates this provision shall be returned to the Contractor and the Contractor shall remove personal information from the document prior to resubmitting it to the Engineer. The Contractor shall require each Subcontractor to also comply with the MA data security regulations insofar as they involve submittal of personal information to the Engineer and Owner.

END OF SECTION

SECTION 01 14 19.16

DUST CONTROL AND MONITORING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section of the specification covers control and monitoring of dust generated during excavating, stockpiling, loading and removal of soils from the Site as well as backfilling and grading. Due to known contamination within the Project Area, dust generated during the course of the Work must be monitored, controlled and kept on-Site.
- B. The Contractor is responsible for control of dust at all times the project duration, 24 hours per day, 7 days per week, including non-working hours, weekends, and holidays.
- C. During progress of the Work, the Contractor shall conduct his operations and maintain the area of his activities, including street sweeping and implementing dust control measures, as necessary, to minimize creation and dispersion of dust. The Contractor shall conduct dust monitoring to ensure dust is being controlled within the Project Area. If dust emissions exceed the action level described in Paragraph 1.05 of this Section, or are determined to be a nuisance by the Engineer (e.g., dust clouds from work areas), the Contractor shall be responsible for implementing additional engineering controls (e.g., additional dust suppression agents, wind screens) to meet the established action level for the Site and described in this Section, at no additional cost to the Owner. The Engineer may perform dust monitoring for confirmation purposes.
- D. The Contractor is responsible for daily clean-up of public roadways, and portions of adjacent driveways/parking lots and walkways affected by the Work. A wet spray power vacuum street sweeper shall be used on pavement. Dry power sweeping is prohibited.

1.02 RELATED WORK:

- A. Section 00 31 33 – ENVIRONMENTAL SUBSURFACE DATA
- B. Section 01 35 29 – HEALTH AND SAFETY PLAN
- C. Section 01 57 19 – ENVIRONMENTAL PROTECTION
- D. Section 02 61 00.16 – HANDLING, TRANSPORTATION, REUSE AND OFF-SITE DISPOSAL OF SURPLUS EXCAVATED MATERIALS
- E. Section 31 00 00 – EARTHWORK

1.03 REGULATORY REQUIREMENTS

11/01/2024

DUST CONTROL
01 14 19.16-1

- A. The Contractor shall perform all work specified under this Section in accordance with the Massachusetts Department of Environmental Protection, Code of Massachusetts Regulations (CMR) 310 CMR 7.00, “Air Pollution Control Regulations”, specifically 310 CMR 7.09, “Dust, Odor, Construction, and Demolition” and in compliance with any requirements imposed by Region 1 of the Environmental Protection Agency.
- B. Work of this Contract shall be conducted in a manner that will not result in excessive particulate matter emissions, nuisance dust conditions, PM10 (particulate matter with an aerodynamic diameter less than or equal to 10 microns) emissions or PM10 concentrations exceeding the Site-specific dust action level of 150 µg/m³ on 24-hour average basis.

1.04 SUBMITTALS:

- A. Contractor shall submit a Dust Control and Monitoring Plan that outlines, in detail, the means and measures that will be implemented to comply with this Section, including dust suppression (e.g., calcium chloride, water, wind screens and barriers), prevention, cleanup, and other measures. The Dust Control and Monitoring Plan shall be submitted to the Engineer within 14 days after issuance of the Notice to Proceed.
- B. Contractor shall submit to the Engineer product literature and Material Safety Data Sheets for any dust suppression agents and/or stabilizers prior to use.
- C. The Dust Control and Monitoring Plan shall use the Site-specific risk-based dust action level of 150 micrograms per cubic meter (µg/m³).
- D. Contractor shall submit the data collected from the air monitor (Mini Ram monitor or approved equivalent) electronically to the Engineer on a daily basis, including data from all air monitors, daily averages and daily high readings. The Contractor shall note daily Site conditions contributing to elevated readings (e.g., high winds, etc.).

1.05 DUST MONITORING:

- A. The Contractor shall monitor for dust in ambient air using Mini Ram monitors, with continuous data loggers, or equivalent. At a minimum, dust monitoring shall be conducted during periods of active excavation or soil handling.
- B. Four (4) dust monitors shall be located generally north, south, east and west of active excavation areas. The exact locations shall be approved by the Engineer.

- C. If the Dust Action Level is exceeded due to the creation and dispersion of dust by Contractor's activities (as determined by the Engineer), the Contractor shall stop excavation activities and notify the Engineer of the exceedance. Following notification, additional dust suppression controls shall be implemented as specified herein, at no additional cost to the Owner. If the Dust Action Level is exceeded after the implementation of additional dust suppression controls, additional dust monitors shall be implemented by the Contractor to monitor dust adjacent to the excavation/stabilization areas at no additional cost to the Owner. The Contractor shall submit the data collected from the air monitor electronically to the Engineer on a daily basis, including data from all air monitors, daily averages and daily high readings.
- D. At all times during the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and wetting of streets as necessary, to minimize creation and dispersion of dust.

PART 2 - PRODUCTS

2.01 DUST SUPPRESSION AGENTS:

A. Calcium Chloride

1. Calcium chloride shall conform to the requirements of AASHTO-M 144, Type I or Type II and Specification for Calcium Chloride, ASTM D98. The calcium chloride shall be packaged in moisture proof bags or in airtight drums with the manufacturer, name of product, net weight, and percentage of calcium chloride guaranteed by the manufacturer legibly marked on each container.
2. Calcium chloride failing to meet the requirements of the aforementioned specifications or that which has become caked or sticky in shipment, may be rejected by the Engineer.

B. Water

3. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

2.02 BARRIERS, SCREENS, AND COVERS:

- A. Mesh Fabric/Wind screens shall be a durable fabric mesh of 50 percent porosity, attached to the temporary chain link fence and existing chain link fence.
- B. Wind barriers, if required, shall be solid wood fences or solid durable fabric, attached to Site's chain link fence, or other solid barriers intended to block the passage of wind.

11/01/2024

- C. Covers for stockpiles shall be 10-mil (minimum) nylon-reinforced polyethylene (NRPE) or 20-mil (minimum) polyethylene sheeting as described in Section 02 61 00.16 – HANDLING, TRANSPORTATION, REUSE AND OFF-SITE DISPOSAL OF SURPLUS EXCAVATED MATERIALS.

PART 3 - EXECUTION

3.01 CONSTRUCTION SITE DUST CONTROL – GENERAL:

- A. Wet suppression shall be used to provide temporary control of dust. Dust suppressants, as needed, should be applied to achieve the Dust Action Level depending upon meteorological conditions and work activity. The Contractor shall apply wet suppression on a routine basis to achieve dust levels below the Dust Action Level or required by the Engineer, to control dust.
 - 1. Wet suppression consists of the application of water or a wetting agent in solution with water. Ensure wetting agent is not used on plantable soils.
 - 2. Wet suppression equipment shall consist of nozzle-equipped spray bar, sprinkler pipelines, pressure gauge, tanks, tank trucks, or other devices capable of providing regulated flow, uniform spray, and positive shut-off.
- B. The Contractor shall provide the necessary means to retain on-Site all water runoff generated by dust control and dispose of such water in accordance with the requirements of the appropriate regulatory agencies. Runoff shall not be permitted to migrate from the Site. The Contractor shall be responsible for providing water, a means of disposal, necessary permits, and all appurtenances required to control dust.
- C. Calcium chloride shall be applied as required by the Engineer and only in areas which will not be adversely affected by the application. See Section 01 57 19 - ENVIRONMENTAL PROTECTION.
- D. Calcium chloride shall be used to control dust instead of wet suppression when freezing conditions exist. Calcium chloride shall be uniformly applied by a mechanical spreader at 1 ½ pounds per square yard, unless otherwise required by the Engineer. Ensure vegetation or soil to be used for vegetation is not treated.
- E. The use of petroleum products for dust suppression is prohibited.
- F. Provide wind screens and wind barriers, if required, in locations where they would be effective in minimizing wind erosion and spread of dust. The Contractor shall keep wind screens and barriers in good repair for the life of the Contract.

11/01/2024

3.02 PUBLIC ROADWAY DUST CONTROL:

- A. Vehicles leaving the Site shall have no mud and dirt on the vehicle body or wheels. Any foreign matter on the vehicle body or wheels shall be physically removed prior to vehicle's entering of a public roadway. Contractor shall not permit any truck to leave the Site with exterior mud or dirt that has the potential to be deposited on public roadways.
- B. Haul truck cargo areas shall be securely and completely covered during material transport on public roadways.
- C. Vehicle mud and dirt carryout, material spills, and soil wash-out onto public roadways and walkways and other paved areas shall be cleaned up immediately.
- D. The Contractor is responsible for daily clean-up of public roadways and walkways affected by work of this Contract. A wet spray power vacuum street sweeper shall be used on paved roadway. Dry power sweeping is prohibited.

3.03 CONTROL OF EARTHWORK DUST:

- A. During batch drop operations (i.e., earthwork with front-end loader, clamshell bucket, or backhoe) the free drop height of excavated or aggregate material shall be reduced as much as practical to minimize the generation of dust.
- B. To prevent spills during transport, freeboard space shall be maintained between the material load and the top of the truck cargo bed rail.

3.04 CONTROL OF STOCKPILE DUST:

- A. At a minimum the Contractor shall use the following methods to control dust and wind erosion of active and inactive stockpiles:
 - 1. Polyethylene tarps on stockpiles shall be placed both below and on top of stockpiles, and secured with sandbags or an equivalent method to prevent the cover from being dislodged by the wind. The Contractor shall repair or replace covers whenever damaged or dislodged, at no additional cost to the Owner.
 - 2. The tarps shall be bermed 12" high at all edges to prevent any infiltration of storm water or exfiltration of leachate.

- B. The methods to be used shall be submitted to the Engineer as part of the Dust Control Plan. Refer to the requirements of Section 02 61 00.16 – HANDLING, TRANSPORTATION, REUSE AND OFF-SITE DISPOSAL OF SURPLUS EXCAVATED MATERIALS for additional information related to stockpiling and stabilization of excavated materials.

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

1.03 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.04 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Engineer.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section.

SUBSTITUTION PROCEDURES

Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Engineer's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.05 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

SUBSTITUTION PROCEDURES

1.06 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.07 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

- B. Substitutions for Convenience: Not allowed

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 31 19.23

CONSTRUCTION MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This Section specifies requirements for project meetings including but not limited to Pre-Construction Conference and Progress Meetings.
- B. It shall be the responsibility of the Contractor to coordinate work between all subcontractors, sections, and trades required for the proper completion of the Work.

1.02 PRE-CONSTRUCTION CONFERENCE:

- A. After the bids have been opened but prior to the start of the construction there will be a pre-construction conference to discuss the phasing and scheduling of the Project. The specific time and place of the conference shall be arranged by the Engineer after the Contract has been awarded.
- B. This pre-construction conference is intended to establish lines of communication between the parties involved, review responsibilities and personnel assignments, establish project schedules, discuss proposed performance methods, and coordinate Work to be performed by subcontractors.
- C. Authorized representatives of the Owner, Engineer and their consultants, the Contractor, its Superintendent and Site Foreman, and all others invited by the Contractor, shall attend the pre-construction conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- D. Discuss items of significance at the pre-construction conference that could affect progress including at least the following:
 - 1. Tentative construction schedule
 - 2. Critical Work sequencing
 - 3. Federal compliance standards
 - 4. Designation of responsible personnel
 - 5. Procedures for processing field decisions and Change Orders
 - 6. Procedures for processing Applications for Payment
 - 7. Distribution of Contract Documents
 - 8. Submittal of Shop Drawings, Product Data and Samples
 - 9. Preparation of record documents

CONSTRUCTION MEETINGS

10. Use of the premises
11. Office, work and storage, and laydown areas
12. Equipment deliveries
13. Construction safety procedures
14. Environmental health and safety procedures
15. First aid
16. Security
17. Housekeeping
18. Working hours
19. Traffic Control
20. Emergency Vehicle Access to and around work site
21. Environmental protection measures for construction site

1.03 PROGRESS MEETINGS:

- A. During the course of the Project, the Contractor shall attend weekly progress meetings as scheduled by the Owner. The Owner, based on work progress and activities, may adjust the progress meetings to biweekly or other. The attendance of subcontractors may be required during the progress of the Work. The Contractor's delegate to the meeting shall be prepared and authorized to discuss the following items:
1. Progress of Work/Critical Work Sequencing in relation to Contract Schedule
 2. Proposed Work activities for forthcoming period
 3. Resources committed to Contract
 4. Coordination of Work with others
 5. Status of procurement of equipment and materials
 6. Status of Submittals
 7. Outstanding actions, decisions, or approvals that affect Work activities
 8. Site access and/or security issues
 9. Hazards and risks
 10. Housekeeping
 11. Quality issues
 12. Potential Claims
 13. Change Orders
 14. Costs, budget, and payment requests
- B. The Contractor shall revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized and the revised schedule shall be submitted to the Engineer and Owner.

PART 2 - PRODUCTS

Not used.

CONSTRUCTION MEETINGS

11/01/2024

01 31 19.23-2

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 01 32 33

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers construction progress photographs to be furnished by the Contractor on the project.
- B. Construction photographs shall be provided by a commercial photographer acceptable to the Engineer.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHS AND PRINTS:

- A. Digital photographs shall be in .gif, .jpeg, .bmp or .tif format.
- B. Prints shall be 8 x 10 full color on single weight, white base, and glossy paper, mounted with binder tabs.
- C. Photographs shall be taken using a digital camera before groundbreaking, monthly throughout the Work, and on final acceptance of the project.
- D. Twenty-four views shall taken **once per month**. The Engineer shall approve selection of views. The Engineer will select eight views to be made into prints, from each disc produced at the frequency specified above.
- E. Three prints of each of the eight views shall be furnished at the frequency specified above.

PART 3 - EXECUTION

3.01 COMPUTER DISC:

- A. The twenty-four views shall be delivered to the Engineer on a CD-ROM Disc within six days of exposure.
- B. Discs turned over to the Engineer shall be retained by the Engineer for future reference during the project.

3.02 PRINTS:

- A. Each print shall be identified on the back with name of project, phase, orientation of view, date and time of exposure, name and address of photographer, and photographer's numbered identification of exposure.

CONSTRUCTION PHOTOGRAPHS

- B. Prints shall be delivered within 15 days after Engineer selects the views to print.

END OF SECTION

SECTION 01 33 19

DOCUMENTATION

PART 1 – GENERAL

1.01 WORK INCLUDED:

- A. This section covers the requirements for documentation to be furnished by the Contractor on this project.

1.02 RELATED WORK:

- A. Section 33 01 30.51, SEWER LINE AND MANHOLE CHEMICAL ROOT TREATMENT
- B. Section 33 01 30.61, SEWER CLEANING, INSPECTION, TESTING AND SEALING
- C. Section 33 01 30.65, SERVICE CONNECTION REHABILITATION
- D. Section 33 41 13.28, REINFORCED CONCRETE PIPE

1.03 DOCUMENTATION:

- A. The Contractor shall maintain printed television inspection logs of sewer segments, for each sewer line segment undergoing repair/rehabilitation under this contract and provide one (1) copy of the logs within five (5) working days of the work being performed. Log sheet format shall be approved by Engineer prior to start of work.
- B. The log sheet(s) as a minimum shall clearly identify:
 - 1. Project Name
 - 2. Street Location, Name, Intersection, Station
 - 3. Date of inspection
 - 4. Total Length of Line Inspected
 - 5. Line Size(s)/Joint Spacing/Type
 - 6. Line and Manhole(s) Condition

11/01/2024

7. Significant observations such as service connections, offset joints, drop joints, broken/cracked pipe, protruding services, roots, collapsed sections, infiltration, presence of scale and corrosion and other discernible features.
 8. Filename.
- C. All logs shall be provided to the Engineer in PDF format (one log per PDF file) at the completion of the project.
 - D. All television inspection shall be recorded in MPEG format and shall include accompanying audio. Inspections shall be recorded one at a time, with each segment recorded as a separate file. The Contractor shall provide videos to the Owner, at no additional cost, as requested by the Engineer during the Project. Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. "AR-050 to AR-049 Downstream - CITS."
 - E. The Contractor shall additionally provide one (1) copy of all logs relative to work performed on sewer manholes within five (5) working days of the work being performed.
 - F. The Contractor shall take a digital photograph, in JPEG format, at each manhole before and after manhole rehabilitation. Filenames shall contain sub-area and manhole designations e.g. "AR-049." Digital photographs shall have a minimum resolution of ten (10) megapixels.
 - G. The Contractor shall provide Flow Isolation data in Microsoft Excel format.
 - H. The Contractor shall deliver to the Owner, at no additional cost, two (2) external hard drives each including the following information at the end of the project. The external hard drives shall be USB powered and capable of USB 3.0 connectivity and will become the property of the Owner upon delivery. The Contractor shall use file folders to organize individual types of data on the external hard drives. The Contractor shall include the following data on the external hard drives prior to delivery to the Engineer.
 - **Sewer Manhole Rehabilitation**
 - Pre and Post Rehabilitation Manhole Inspection Photos in JPEG format
 - Filenames shall contain sub-area and manhole designations e.g. "AR-059"
 - Each manhole rehabilitation log as a separate PDF file
 - Filenames shall contain sub-area and manhole designations e.g. "AR-049"
 - **Flow Isolation**
 - Microsoft Excel file with flow isolation data
 - Field logs as a PDF file

- **Sewer Line and Manhole Chemical Root Treatment**
 - Field logs as a PDF file
- **Clean, Inspect, Test, and Seal**
 - Television Inspection MPEG Files
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Mainline Test and Seal.”
 - Each television inspection log as a separate PDF file
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Mainline Test and Seal.”
- **Cured-in-Place Short Liner (and Cured-in-Place Structural Short Liner)**
 - Television Inspection MPEG Files
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Short Liner.”
 - Each television inspection log as a separate PDF file
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Short Liner.”
- **Cured-in-Place Pipe (and Structural Cured-in-Place Pipe) – Organized per Inversion**
 - Pre-inversion Television Inspection MPEG Files
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Pre-Cured-in-Place Pipe.”
 - Each pre-inversion television inspection log as a separate PDF file
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Pre-Cured-in-Place Pipe.”
 - Each liner order sheet (describing the material ordered) as a separate PDF file
 - Each service connection reinstatement sign-off sheet as a separate PDF file
 - Each thermo couple log kept during inversion process as a separate PDF file
 - Post-inversion Television Inspection MPEG Files
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Post-Cured-in-Place Pipe.”
 - Each post-inversion television inspection log as a separate PDF file
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Post-Cured-in-Place Pipe.”

- Each material testing results report as a separate PDF file
- **Cured-in-Place Lateral Liner – Organized per Mainline Sewer Segment and Stationing**
 - Pre-inversion Television Inspection MPEG Files
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Pre-Cured-in-Place Lateral Liner.”
 - Each pre-inversion television inspection log as a separate PDF file
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. AR-050 to AR 049 Downstream – Pre-Cured-in-Place Lateral Liner.”
 - Each liner order sheet (describing the material ordered) as a separate PDF file
 - Each thermo couple log kept during inversion process as a separate PDF file
 - Post-inversion Television Inspection MPEG Files
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Post-Cured-in-Place Lateral Liner.”
 - Each post-inversion television inspection log as a separate PDF file
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Post-Cured-in-Place Lateral Liner.”
 - Each material testing results report as a separate PDF file
- **Service Connection Test and Grout**
 - Television Inspection MPEG Files
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Service Test and Grout.”
 - Each television inspection log as a separate PDF file
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “AR-050 to AR-049 Downstream – Service Test and Grout.”
- **Point Repair of Gravity Sewer (Open Cut)**
 - Television Inspection MPEG Files
 - Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “SI-057 to SI-056 Downstream – Open Cut.”
 - Each television inspection log as a separate PDF file

- Filenames shall contain upstream and downstream sub-area and manhole designations as well as camera direction and type of work e.g. “SI-057 to SI-056 Downstream – Open Cut.”
- **“Push Camera” Service Connection Television Inspection**
 - Television inspection MPEG Files
 - Filenames shall contain street address of service connection

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

SECTION 01 33 23

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall provide the Engineer with submittals as required by the contract documents.

1.02 RELATED WORK:

- A. Divisions 1 – 48 of these specifications that require submittals.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL:

- A. As required by the General Conditions, Contractor shall submit a schedule of shop and working drawing submittals.
- B. The Contractor shall submit the shop and working drawing submittals either electronically or hard copy.

3.02 ELECTRONIC SUBMITTALS:

- A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer by email (millonig.joshua@wseinc.com), one electronic copy in Portable Document Format (PDF) of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.
- B. Each electronic copy of the shop or working drawing shall be accompanied by the Engineer's standard shop drawing transmittal form, included as Exhibit 1 of this section (use only for electronic submittals), on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.
- C. The Contractor shall receive a shop drawing memorandum with the Engineer's approval or comments via email.

SUBMITTALS

3.03 HARD COPY SUBMITTALS:

- A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer, by mail (to Weston & Sampson Engineers, attention: Joshua Millonig, six (6) copies each of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.
- B. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

3.04 SHOP AND WORKING DRAWINGS:

- A. Shop and working drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish of shop coat, grease fittings, etc., depending on the subject of the drawings. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this Contract.
- B. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from its subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24-inch by 36-inch sheets, except those, which are made by changing existing standard shop or working drawings. All drawings shall be clearly marked with the names of the Owner, Project, Contractor and building, equipment or structure to which the drawing applies, and shall be suitably numbered. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names mentioned above.
- C. Only drawings that have been prepared, checked and corrected by the fabricator should be submitted to the Contractor by its subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Contract Documents in all respects. Shop drawings shall be reviewed and marked with the date, checker's name and indication of the Contractor's approval, and only then shall be submitted to the Engineer. Shop drawings unsatisfactory to the Contractor shall be returned directly to their source for correction, without submittal to the Engineer. Shop drawings submitted to the Engineer without the Contractor's approval stamp and signature will be rejected. Any deviation from the Contract Documents indicated on the shop drawings must be identified on the drawings and in a separate submittal to the Engineer, as required in this section of the specifications and General Conditions.

SUBMITTALS

- D. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all shop and working drawings so that there will be no delay in the work due to the absence of such drawings.
- E. The Engineer will review the shop and working drawings as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made on the drawings during the review do not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating its work with that of all other trades; and performing its work in a safe and satisfactory manner. The review of the shop drawings is general and shall not relieve the Contractor of the responsibility for details of design, dimensions, code compliance, etc., necessary for interfacing with other components, proper fitting and construction of the work required by the Contract and for achieving the specified performance. The Engineer will review submittals two times: once upon original submission and a second time if the Engineer requires a revision or corrections. The Contractor shall reimburse the Owner amounts charged to the Owner by the Engineer for performing any review of a submittal for the third time or greater.
- F. With few exceptions, shop drawings will be reviewed and returned to the Contractor within 30 days of submittal.
- G. No material or equipment shall be purchased or fabricated especially for this Contract nor shall the Contractor proceed with any portion of the work, the design and details of which are dependent upon the design and details of equipment or other features for which review is required, until the required shop and working drawings have been submitted and reviewed by the Engineer as to their general conformance and compliance with the project and its Contract Documents. All materials and work involved in the construction shall then be as represented by said drawings.
- H. Two copies of the shop and working drawings and/or catalog cuts will be returned to the Contractor. The Contractor shall furnish additional copies of such drawings or catalog cuts when it needs more than two copies or when so requested.

3.05 SAMPLES:

- A. Samples specified in individual Sections include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the work.

SUBMITTALS

- B. The number of samples submitted shall be as specified. Submittal and processing of samples shall follow the procedures outlined for shop and working drawings unless the specifications call for a field submittal or mock-up.
- C. Acceptance of samples will be acknowledged via a copy of the transmittal noting status. When samples are not acceptable, prompt resubmittal will be required.

3.06 OPERATING AND MAINTENANCE MANUALS AND SPARE PARTS LISTS:

- A. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Engineer for review in accordance with the instructions furnished under "Shop and Working Drawings." If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., two copies of the submittal will be returned with a copy of transmittal noting status. Four copies of the final operating and maintenance manuals and/or spare parts list shall be delivered to the Engineer prior to or with the equipment when it is delivered to the job site. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work, to be incorporated into the system manual.
- B. The information included in the manual shall be as described in the specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing identifying each part by number and a listing of all parts of the equipment, with part numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.
- C. Operating and maintenance manuals shall be in durable loose-leaf binders, on 8½-inch by 11-inch paper, with diagrams and illustrations either on 8½-inch by 11 inch or multiple foldouts. The instructions shall be annotated to indicate only the specific equipment furnished. Reference to other sizes or models of similar requirement shall be deleted or neatly lined out.

END OF SECTION

SUBMITTALS

SECTION 01 35 29

HEALTH AND SAFETY PLAN

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Prior to the start of work on the site, Contractor shall prepare and submit a site-specific health and safety plan in accordance with paragraph 1.04 below.

1.02 REFERENCES:

- A. OSHA 29 CFR 1910.120

1.03 RELATED WORK:

- A. Section 00 31 33 – ENVIRONMENTAL SUBSURFACE DATA
- B. Section 01 14 19.16 DUST CONTROL AND MONITORING
- C. Section 01 57 19 – ENVIRONMENTAL PROTECTION
- D. Section 02 61 00.16 HANDLING, TRANSPORTATION, REUSE AND OFF-SITE DISPOSAL OF EXCAVATED MATERIAL
- E. Section 31 00 00 EARTHWORK

1.04 PREPARATION OF A SITE-SPECIFIC HEALTH AND SAFETY PLAN:

- A. Prior to the start of work on the Site, and no later than seven (7) calendar days after the date of the Notice to Proceed, Contractor shall prepare and submit an initial Site-specific Health and Safety Plan which includes consideration of all known and potential hazards at the Site. Work may not proceed at the project Site until the Contractor's Health and Safety Plan has been received by Engineer.
- B. The Health and Safety Plan shall be submitted to the Engineer for review, before any work can be initiated. The Contractor is responsible for its workers' and Subcontractors' health and safety. Therefore, the Engineer will only review the Contractor's Health and Safety Plan for relevant content. The Contractor shall implement, maintain, and enforce these procedures during all phases of the Work associated with the description of work described in this Section.
- C. The Health and Safety Plan shall include Site access provisions that effectively limit access to work areas to only those persons in full compliance with the requirements of the Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120.

- D. The Contractor shall be cognizant of the minimum health and safety plan standards set forth in 29 CFR 1910.120 and 29 CFR 1926. The Health and Safety Plan shall include, but not be limited to, the minimum requirements specified in Part 2 of this Section.

PART 2 – PRODUCTS

2.01 HEALTH AND SAFETY PLAN:

- A. The health and safety plan shall include, but not necessarily be limited to the following:

1. Identification of Contractor's Site Safety Officer.
2. Identification of Hazards and Risks Associated with Project.
3. Contractor's Standard Operating Procedures, Including Personnel Training and Field Orientation.
4. Respiratory Protection Training Requirements.
5. Levels of Protection and Selection of Equipment Procedures.
6. Type of Medical Surveillance Program.
7. Personal Hygiene Requirements and Guidelines.
8. Zone Delineation of the Project Site.
9. Site Security and Entry Control Procedures.
10. Field Monitoring of Site Contaminants.
11. Contingency and Emergency Procedures.
12. Listing of Emergency Contacts.

PART 3 - EXECUTION

3.01 PERSONAL PROTECTIVE EQUIPMENT:

- A. The personal protective equipment required to provide the appropriate level of dermal and respiratory protection shall be determined based on the results of continuous air monitoring

performed by the Contractor and the standards set forth in the Contractor's health and safety plan.

- B. The Engineer may conduct duplicate air monitoring for quality control purposes. Modified Level D protection shall be the minimum requirement for all on-site personnel.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."
- G. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- H. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.04 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.05 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.06 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.07 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 - 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.08 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.

4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. **Manufacturer's Technical Representative's Field Reports:** Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. **Factory-Authorized Service Representative's Reports:** Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.09 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products

from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. 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 the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.010 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.

2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies & Owner at least 48 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Owner and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Owner and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's

services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
 2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.011 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect, Owner, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.

4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
 1. Submit log at Project closeout as part of Project Record Documents.

3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.01 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.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied

REFERENCES

directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 - 8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 - 9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 11. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 12. AGA - American Gas Association; www.aga.org.
 - 13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 15. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 16. AIA - American Institute of Architects (The); www.aia.org.
 - 17. AISC - American Institute of Steel Construction; www.aisc.org.
 - 18. AISI - American Iron and Steel Institute; www.steel.org.

REFERENCES

19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.
38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWWA - American Water Works Association; www.awwa.org.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.compositepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.

REFERENCES

63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Construction Specifications Institute (The); www.csiresources.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTA - Consumer Technology Association; www.cta.tech.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
72. DHI - Door and Hardware Institute; www.dhi.org.
73. ECA - Electronic Components Association; (See ECIA).
74. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
75. ECIA - Electronic Components Industry Association; www.eciaonline.org.
76. EIA - Electronic Industries Alliance; (See TIA).
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
80. ESTA - Entertainment Services and Technology Association; (See PLASA).
81. ETL - Intertek (See Intertek); www.intertek.com.
82. EVO - Efficiency Valuation Organization; www.evo-world.org.
83. FCI - Fluid Controls Institute; www.fluidcontrolsintstitute.org.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmglobal.com.
87. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
88. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridarroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GANA - Glass Association of North America; (See NGA).
93. GS - Green Seal; www.greenseal.org.
94. HI - Hydraulic Institute; www.pumps.org.
95. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
96. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
97. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
98. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
99. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
100. IAS - International Accreditation Service; www.iasonline.org.
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.

REFERENCES

109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
113. II - Infocomm International; (See AVIXA).
114. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
119. ISO - International Organization for Standardization; www.iso.org.
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
121. ITU - International Telecommunication Union; www.itu.int/home.
122. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; www.lightning.org.
125. MBMA - Metal Building Manufacturers Association; www.mbma.com.
126. MCA - Metal Construction Association; www.metalconstruction.org.
127. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
128. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
129. MHIA - Material Handling Industry of America; www.mhia.org.
130. MIA - Marble Institute of America; (See NSI).
131. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
132. MPI - Master Painters Institute; www.paintinfo.com.
133. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
134. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
135. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
136. NADCA - National Air Duct Cleaners Association; www.nadca.com.
137. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
138. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
139. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
140. NBI - New Buildings Institute; www.newbuildings.org.
141. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
142. NCMA - National Concrete Masonry Association; www.ncma.org.
143. NEBB - National Environmental Balancing Bureau; www.nebb.org.
144. NECA - National Electrical Contractors Association; www.necanet.org.
145. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
146. NEMA - National Electrical Manufacturers Association; www.nema.org.
147. NETA - InterNational Electrical Testing Association; www.netaworld.org.
148. NFHS - National Federation of State High School Associations; www.nfhs.org.
149. NFPA - National Fire Protection Association; www.nfpa.org.
150. NFPA - NFPA International; (See NFPA).
151. NFRC - National Fenestration Rating Council; www.nfrc.org.
152. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.

REFERENCES

153. NHLA - National Hardwood Lumber Association; www.nhla.com.
154. NLGA - National Lumber Grades Authority; www.nlga.org.
155. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
156. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
157. NRCA - National Roofing Contractors Association; www.nrca.net.
158. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
159. NSF - NSF International; www.nsf.org.
160. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
161. NSPE - National Society of Professional Engineers; www.nspe.org.
162. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
163. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
164. NWFA - National Wood Flooring Association; www.nwfa.org.
165. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
166. PDI - Plumbing & Drainage Institute; www.pdionline.org.
167. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
168. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
169. RFCI - Resilient Floor Covering Institute; www.rfci.com.
170. RIS - Redwood Inspection Service; www.redwoodinspection.com.
171. SAE - SAE International; www.sae.org.
172. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
173. SDI - Steel Deck Institute; www.sdi.org.
174. SDI - Steel Door Institute; www.steeldoor.org.
175. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
176. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
177. SIA - Security Industry Association; www.siaonline.org.
178. SJI - Steel Joist Institute; www.steeljoist.org.
179. SMA - Screen Manufacturers Association; www.smainfo.org.
180. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
181. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
182. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
183. SPIB - Southern Pine Inspection Bureau; www.spib.org.
184. SPRI - Single Ply Roofing Industry; www.spri.org.
185. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
186. SSINA - Specialty Steel Industry of North America; www.ssina.com.
187. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
188. STI - Steel Tank Institute; www.steeltank.com.
189. SWI - Steel Window Institute; www.steelwindows.com.
190. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
191. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
192. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
193. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
194. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
195. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
196. TMS - The Masonry Society; www.masonrysociety.org.

REFERENCES

197. TPI - Truss Plate Institute; www.tpinst.org.
198. TPI - Turfgrass Producers International; www.turfgrasssod.org.
199. TRI - Tile Roofing Institute; www.tilerroofing.org.
200. UL - Underwriters Laboratories Inc.; www.ul.com.
201. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
202. USAV - USA Volleyball; www.usavolleyball.org.
203. USGBC - U.S. Green Building Council; www.usgbc.org.
204. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
205. WA - Wallcoverings Association; www.wallcoverings.org.
206. WASTEC - Waste Equipment Technology Association; www.wastec.org.
207. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
208. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
209. WDMA - Window & Door Manufacturers Association; www.wdma.com.
210. WI - Woodwork Institute; www.wicnet.org.
211. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.

REFERENCES

17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

REFERENCES

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 45 23

STRUCTURAL TESTS AND INSPECTIONS

PART 1 -GENERAL

1.01 WORK INCLUDED:

- A. Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Obtaining, coordinating, and providing notifications to the Owner and Engineer.
 - 2. Provide safe access to the work of this Contract to accommodate the indicated tests and inspections.
 - 3. Implementing corrective action and providing additional tests and/or inspections for work identified as non-conforming by the Independent Testing Agency.

1.02 GENERAL REQUIREMENTS:

- A. The Massachusetts State Building Code, Latest Edition, 780 CMR, requires the Structural Engineer of Record (SER) to provide a program of structural tests and inspections for this project.
- B. Attachment A, Program of Structural Tests and Inspections, shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work; their other obligations for supervising the Work; for any design work which is included in their scope of services; for full compliance with the requirements of the Contract Documents; the detection of, or failure to detect, deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents.
- C. The Program of Structural Tests and Inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, procedures, and job site safety.

1.03 CONTRACTOR RESPONSIBILITIES:

11/01/2024

- A. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.
- B. The Contractor shall give reasonable notice to the Owner and the Engineer of when the various parts of the Work will be ready for testing and/or inspection. The Contractor shall notify the Owner and the Engineer a minimum of 48 hours before such tests and/or inspections are to take place.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

11/01/2024

STRUCTURAL TESTS AND INSPECTIONS
01 45 23-3

ATTACHMENT A**PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS**

The following is a summary of Work subject to Tests and Inspections under the Program.

1. In-situ Bearing Strata for Footings
2. Controlled Structural Fill
3. Cast-In-Place Concrete
4. Masonry
5. Structural Steel

Abbreviation**Agent**

SER

Structural Engineer of Record

ITA

Contractor – Independent Testing Agency

In-Situ Bearing Strata for Footings

Item	Agent	Scope
1. Bearing Strata QC Review	ITA	Review Contractor's field quality control procedures.
2. General Excavation	ITA	Inspect strata for conformance to the structural drawings, specifications, and/or geotechnical report.
3. General Excavation	ITA	Ensure that excavation is to proper depth or material.
4. General Excavation	ITA	Ensure that excavation is controlled and contains no unsuitable materials.
5. Bearing surfaces for footings	ITA	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.

11/01/2024

STRUCTURAL TESTS AND INSPECTIONS

01 45 23-4

Controlled Structural Fill

Item	Agent	Scope
1. Controlled Structural Fill QC Review	SER	Review Contractor's field quality control procedures
2. Fill Material	ITA	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
3. Installation of controlled structural fill	ITA	Provide full-time inspection of the installation, in accordance with the specifications.
4. Density of Fill	ITA	Perform field density tests of the in-place fill in accordance with the specifications.

Cast-In-Place Concrete Construction

Item	Agent	Scope
1. Cast-In-Place Concrete Construction QC Review	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Mix Design	SER	Review Mix Designs
3. Materials	SER	Review material certifications for conformance to Specifications

11/01/2024

4. Batching Plant	ITA	Review Plant quality control procedures and batching and mixing methods
5. Reinforcement Installation	ITA	Inspect reinforcing for size, quantity, condition and placement
6. Anchor Rods	ITA	Inspect anchor rods prior to and during placement of concrete.
6. Formwork	ITA	Inspect form sizes for proper sizes of concrete members.
7. Concrete Placement and Sampling fresh Concrete	ITA	Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot-weather placement procedures. Perform slump, density and air content tests at point of discharge.
8. Evaluation of Concrete	ITA	Test and evaluate in accordance with the specifications.
9. Curing and Protection	ITA	Observe procedures for conformance to the specifications.

Masonry Construction

Item	Agent	Scope
1. Masonry Construction QC Review	SER	Review Contractor's field quality control procedures
2. Materials	SER	Review material certifications for conformance to specifications.
3. Evaluation of Masonry Strength	SER	Verify strength in accordance with the specifications.
4. Proportioning, Mixing, and Consistency of Mortar and Grout	ITA	Inspect field mixing procedures for conformance to the specifications.

11/01/2024

5. Installation of Masonry	ITA	Inspect placement for conformance to the specifications. Verify cleanout hole locations (high lift grouting). Verify the installation of bond beams and special shapes.
6. Reinforcement Installation	ITA	Inspect reinforcing steel for size, quantity, condition and placement for conformance to approved submittals and Contract Documents.
7. Grouting Operations	ITA	Inspect grouting procedures for conformance with the specifications. Inspect cells prior to grouting. Assure observation holes have been installed prior to high lift grouting.
8. Weather Protection	ITA	Inspect protection for cold and hot weather for conformance with the specifications.
9. Anchorage	ITA	Inspect anchorage of masonry to other construction for conformance to the Contract Documents.

Structural Steel

Item	Agent	Scope
1. Fabricator Certification/Quality Control Procedures	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Fabricator Certification/Quality Control Procedures	SER	Review each Fabricator's quality control procedures.
3. Fabricator Inspection	SER	Inspect in-plant fabrication, or review Fabricator's approved Independent Inspection Agency's reports.
4. Materials	SER	Review materials certifications for conformance to the specifications.
5. Anchor Rods	SER	Review Contractor's as-built survey.
6. Anchor Rods	ITA	Verify that all anchor rods have been properly torqued and have adequate fit-up.

11/01/2024

7. Bolting	ITA	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade.
8. Welding	ITA	Check welder qualifications. Visually inspect fillet welds and test full penetration field welds in accordance with specifications
9. Shear Connectors	ITA	Inspect for size and placement. Test for proper weld attachment
10. Structural Framing, Details, and Assembly	ITA	Inspect for size, grade of steel, camber, installation and connection details. Check against Contract Documents and approved shop drawings.
11. Open Web Steel Joists	ITA	Inspect for size, placement, bridging, bearing and connection to structure. Visually inspect all welds of a minimum of 5% of the joists randomly selected.
12. Expansion and Adhesive Anchors	SER	Review installation procedures for both mechanical anchors and adhesive anchors. Verify that materials are suitable for job conditions.
13. Metal Decking	ITA	Verify gage, width, and type. Inspect placement, laps, welds, side laps attachment and screws or other mechanical fasteners. Check welder qualifications.
14. Field Correction of Fabricated Items	ITA	Review documentation of approved repairs and verify completion of repairs.

END OF SECTION

11/01/2024

STRUCTURAL TESTS AND INSPECTIONS
01 45 23-8

SECTION 01 55 26.22

ROAD FLAGGERS FOR TEMPORARY TRAFFIC CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers the provisions for complying with MassDOT requirements for construction zone safety plans on public works projects where roadway traffic flaggers are specified.

1.02 DESCRIPTION:

The Contractor shall utilize roadway traffic flaggers (flaggers) in the locations specified in Section 01 56 00 CONSTRUCTION ZONE SAFETY PLAN.

1.03 RELATED WORK:

- A. SECTION 01 56 00, CONSTRUCTION ZONE SAFETY PLAN

1.04 REFERENCES:

701 CMR 7.00 Use of Road Flaggers and Police Details on Public Works Projects

Massachusetts Department of Transportation Standard specifications for Highways and Bridges – latest edition

1.05 FLAGGER TRAINING AND CERTIFICATION REQUIREMENTS:

- A. Flaggers utilized during the performance of the work must possess a certificate of satisfactory completion from a MassDOT-approved flagger training program, such as, but not limited to, those offered by the Associated General Contractors, American Traffic Safety Services Association, American Flagging and Traffic Control, or the National Safety Council, within the previous three (3) years.
- B. Prior to the start of work, the Contractor shall provide to the Engineer a written list of certified flaggers to be used, including the most recent date of certification or recertification for each person listed.
- C. All flaggers shall carry their approved flagging training program certification card with them while performing flagging duties.

11/01/2024

ROAD FLAGGERS FOR TEMPORARY TRAFFIC CONTROL

01 55 26.22-1

- D. All flaggers shall have completed CPR and First Aid training according to the standards and guidelines of the American Heart Association or the American Red Cross. All flaggers shall carry their CPR/First Aid certification cards with them while performing flagging duties.
- E. All certifications shall remain valid for the duration of the project or the flagger shall be removed from the project.

PART 2 - PRODUCTS

- A. Each flagger shall be equipped with the following high visibility clothing, signaling, and safety devices:
 - (1) A white protective hard hat with a minimum level of reflectivity per the requirements of ANSI, Type I, Class E&G.
 - (2) A clean, unfaded, untorn lime/yellow reflective safety vest and safety pants meeting the requirements of ANSI 107 Class 3 with the words "Traffic Control" on the front and rear panels in minimum two (2) inch (50 millimeter) high letters.
 - (3) A "STOP/SLOW" traffic paddle conforming to the requirements of Part 6E.03 of the Manual on Uniform Traffic Control Devices, a reflectorized red flag, flagger station advance warning signage, and two-way radios capable of providing clear communication within the work zone between flaggers, the Contractor, and the Engineer. The traffic paddle shall be mounted on a pole of sufficient length to be seven (7) feet above the ground as measured from the bottom of the paddle.
 - (4) A working flashlight with a minimum of 15,000 candlepower and a six (6) inch red attachable wand, a whistle with an attached lanyard, and a First Aid kit that complies with the requirements of ANSI Z308.1.

PART 3 - EXECUTION

3.01 OPERATION:

- A. Flaggers shall be utilized in accordance with the appropriate traffic management plan or that the Owner's Authorized Representative deems necessary for the direction and control of traffic.
- B. Any flagger determined by the Authorized Representative or Engineer to be ineffective in controlling traffic may be removed at the discretion of the Engineer. If a flagger is directed to be removed, the Contractor shall immediately comply with the directive from the Engineer and shall suspend operations as necessary until a qualified replacement can be provided. Such a suspension of operations shall not be considered as a basis for a claim or an extension of time.

11/01/2024

END OF SECTION

11/01/2024

ROAD FLAGGERS FOR TEMPORARY TRAFFIC CONTROL
01 55 26.22-3

SECTION 01 55 26.13

SIGNAGE (TRAFFIC CONTROL)

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers furnishing and installing traffic control signs and other devices.

1.02 SYSTEM DESCRIPTION:

The Contractor shall furnish and install all construction signs deemed necessary by and in accordance with the latest edition of Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) as published by the U.S. Department of Transportation.

PART 2 - PRODUCTS

2.01 TRAFFIC WARNING AND REGULATING DEVICES:

Contractor shall provide warning signs, barricades and other devices in accordance with the specifications provided in the MUTCD. Size of signs, lettering, colors, method of support and other factors prescribed in the MUTCD shall be adhered to.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Contractor shall erect barricades, barrier fences, traffic signs, and other traffic control devices as required by the MUTCD, or as required by the Engineer, to protect the work area from traffic, pedestrians, and animals.
- B. Contractor shall relocate barricades, signs and other devices as necessary as the work progresses.
- C. Unless extended protection is required for specific areas, when the work has been completed, all temporary warning and regulatory devices used by the Contractor shall be removed so that traffic can move unimpeded through the area.

END OF SECTION

SECTION 01 55 26.19

UNIFORMED OFFICERS FOR TEMPORARY TRAFFIC CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers the provisions for furnishing Uniformed Officers for Traffic Control and Maintenance of Traffic as described in Section 01 11 00 CONTROL OF WORK AND MATERIALS.

1.02 DESCRIPTION:

- A. The Contractor shall coordinate with the local jurisdiction's Traffic Control Officer to determine the number of Officers deemed necessary to provide for public safety and to maintain a smooth flow of traffic through the construction area(s) affected.

1.03 RELATED WORK:

- A. SECTION 01 11 00, CONTROL OF WORK AND MATERIALS (MAINTENANCE OF TRAFFIC)
- B. SECTION 01 55 26.13, SIGNAGE (TRAFFIC CONTROL)

PART 2 - PRODUCTS

2.01 UNIFORMED OFFICERS:

- A. Contractor shall provide the Traffic Control Officer with a minimum of 24 hours notice indicating the time of day, street location and confirm number of officers required for traffic control.
- B. Contractor shall give the Traffic Control Officer a minimum of 2 hours prior cancellation notice should Contractor determine that due to weather or conditions beyond his control he would not need the scheduled officers.
- C. Contractor shall pay for officer(s) at the prevailing rate established by the local police department should officers not be needed and the Contractor fails to cancel the officers as noted in 2.01.B above.
- D. Where the Owner is paying directly for Traffic Officers and the Contractor cancels scheduled officers, the Contractor shall be responsible for payment of the wages for cancellations if not cancelled in accordance with 2.01.B and 2.01.C above.

UNIFORMED OFFICERS FOR TEMPORARY
TRAFFIC CONTROL

PART 3 - EXECUTION

3.01 OPERATION:

- A. Contractor shall provide barricades, barrier fences, traffic signs, and other traffic control devices as required by the Owners Traffic Control Officer, or as required by the Engineer, to protect the work area from traffic, pedestrians, and animals.
- B. Contractor shall relocate barricades, signs and other devices as necessary as the work progresses as required by the Owners Traffic Control Officer or the Engineer.

END OF SECTION

SECTION 01 56 00

CONSTRUCTION ZONE SAFETY PLAN

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers the provisions for complying with Commonwealth of Massachusetts requirements for construction zone safety plans on public works projects.

1.02 DESCRIPTION:

- A. The Contractor shall implement traffic safety and control measures through the construction zone through road closures and detours and mitigate impacts on traffic outside of the construction zone in accordance with these contract documents.

1.03 RELATED WORK:

- A. SECTION 01 11 00, CONTROL OF WORK AND MATERIALS
- B. SECTION 01 55 26.13, SIGNAGE (TRAFFIC CONTROL)

1.04 REFERENCES:

Massachusetts Department of Transportation Standard Specifications for Highways and Bridges – latest edition

PART 2 - PRODUCTS

- 2.01 Traffic control devices utilized by the Contractor shall meet the requirements of these contract documents and the latest Massachusetts Department of Transportation (MassDOT) Standard Specifications and Manual on Uniform Traffic Control Devices (MUTCD).

PART 3 - EXECUTION

3.01 OPERATION:

- A. Contractor shall be responsible for providing all temporary traffic control devices including barricades, barrier fences, signs, drums, cones, impact attenuators and other traffic control devices in accordance with typical traffic management plans and details shown on the drawings or as required by the Owner's Representative.

CONSTRUCTION ZONE SAFETY PLAN

01 56 00-1

- B. The Contractor shall prepare temporary traffic management plans and details that deviate significantly from the typical plans shown on the drawings and submit to the Owner's Representative for review and approval prior to start of the work.
- C. Contractor shall relocate barricades, signs and other devices as necessary as the work progresses as required by the Owner's Traffic Control Officer or the Owner's Representative.

END OF SECTION

SECTION 01 56 26

TEMPORARY CHAIN LINK FENCE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall provide all labor, materials and appurtenances necessary for the installation, maintenance and dismantling of 6-foot temporary fencing.
- B. The Contractor shall be responsible for securing the site from trespassers. Existing fencing exists on portions of the site as shown on the Contract Drawings; it will be at the discretion of the Contractor to determine whether the existing fence is suitable for site safety and security. The Contractor shall install temporary fencing across lengths of damaged/unsuitable fencing to secure the site and prevent trespassers.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Manufacturer's literature of the materials specified herein.
- B. Shop drawings of the temporary chain link fence and gates.
 - 1. Shop drawings shall indicate layout of temporary fencing, location and size of gates, existing pavement and roads, and other site-specific conditions. Prepare drawing after site observation and verification of existing conditions.

PART 2 - PRODUCTS

2.01 TEMPORARY CHAIN LINK FENCING

- A. Unless otherwise indicated, type of 6-foot temporary chain link fencing shall be Contractor's option. Following types are acceptable:
 - 1. New materials or previously used salvaged chain link fencing in good condition.
 - 2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with base plates, or inserting in precast concrete blocks.
 - 3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.
- B. Gates: Provide gates of the quantity and size indicated on the Contract Drawings or

11/01/2024

required for functional access to Site.

1. Fabricate of same material as used for fencing.
2. Vehicle gates:
 - a. Minimum width: 20 feet to allow access for emergency vehicles.
 - b. Capable of manual operation by one person.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The fence and gates shall be erected by skilled mechanics in accordance with the recommendations of the manufacturer and these specifications. These specifications shall take precedence over the recommendations of the manufacturer if any discrepancy exists between them.
- B. Posts
 1. Maximum post spacing shall be 10-feet. Post spacing shall be uniform and posts shall be plumb.
 2. Drive posts, set in holes and backfill, or anchor in precast concrete blocks.
 3. For soft and unstable ground conditions, cast concrete plug around post.
 4. Posts over pavement: Use steel post plates or precast concrete blocks.
 5. Gate posts: Use bracing or concrete footings to provide rigidity for accommodating size of gate.
 6. Temporary terminal posts shall be securely connected to existing fence posts to prevent site access/trespassing.
- C. Securely attach wire fabric to posts. Maximum area of unbraced fence fabric shall not exceed 1,500 square feet.
- D. Install with required hardware.
- E. Fabric shall be stretched taut, with the bottom edge following the existing grade, and shall be a continuous mesh between terminal posts. Each span of fabric shall be attached independently at terminal posts. Where terminal posts do not have provisions for weaving fabric to posts, stretcher bars shall be placed through the end weave of the fabric and secured to the post with bar bands spaced not more than 15-inches apart on the post.

11/01/2024

Temporary terminal posts shall be secured to existing fence posts to prevent Site access/trespassing.

- F. Fabric shall be attached with ties to line posts at intervals of not more than 14-inches (and to the top railing and braces at intervals not exceeding 24-inches).
- G. The bottom tension wire shall be interlaced in the weave of the fabric, pulled taut and fastened to terminal posts.

3.02 MAINTENANCE AND REMOVAL

- A. Maintain fencing in good condition. If damaged, immediately repair.
- B. Remove temporary fencing upon completion of Work or when no longer required for security or control. Backfill holes and compact. Holes in pavement shall be surfaced to match existing paving. Repair damage caused by installation of temporary fencing.

END OF SECTION

SECTION 01 56 39

TREE PROTECTION AND TRIMMING

PART 1 – GENERAL

1.01 WORK INCLUDED:

- A. This section includes the protection and trimming of trees that are to remain but interfere with, or are affected by, execution of the Work, whether temporary or new construction.

1.02 RELATED WORK:

- A. SECTION 01 57 19 ENVIRONMENTAL PROTECTION
- B. SECTION 31 00 00 EARTHWORK
- C. SECTION 31 11 00 CLEARING AND GRUBBING
- D. SECTION 31 23 16.26 ROCK EXCAVATION AND DISPOSAL
- E. SECTION 32 91 19 LOAMING AND SEEDING

1.03 QUALITY ASSURANCE:

- A. Tree Pruning Standards: Comply with the National Arborist Association's "Pruning Standards for Shade Trees" except where more stringent requirements are indicated.
- B. All tree trimming work shall be conducted by qualified and trained personnel under the direct supervision of a Massachusetts Certified Arborist (MCA) in the Contractor's employ.

1.04 SPECIAL REQUIREMENTS:

- A. Dutch Elm diseased wood shall be disposed of in accordance with provisions of General Laws, Chapter 87, Section 5, and Chapter 132, Sections 8 and 11 as amended; and in accordance with any additional local regulations. All wood shall be removed from the site and be properly disposed of in accordance with state and local regulations.
- B. No burning shall be permitted on the project site.

11/01/2024

- C. Prior to commencing work, the Contractor shall submit a plan to the Engineer for legal disposal of removed materials, in conformance with State and Federal regulations.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D448, size 24, with 90 to 100 percent passing a 2-½-inch (63-mm) sieve and not more than 10 percent passing a ¾-inch (19-mm) sieve.
- B. Topsoil: As per Specification Section 32 91 13: Soil Preparation and Soil Mixes.
- C. Filter Fabric: Manufacturer's standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Temporary Protection: Provide temporary fencing, barricades, or other suitable guards located outside the drip line (outer perimeter of branches) to protect remaining trees and other plants from damage.
- B. Protect tree root systems from damage due to noxious materials caused by run-off or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- C. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line and prevent soil compaction over root systems.
- D. Do not allow fires.

3.02 EXCAVATION:

- A. Install shoring or other protecting support systems to minimize sloping or benching of excavations.

11/01/2024

- B. Do not excavate within tree drip line, unless otherwise indicated.
- C. Where excavation for new construction is required within tree drip lines, hand excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
 - 1. Relocate roots in backfill areas wherever possible. If encountering large, main lateral roots, expose beyond excavation limits as required to bend and relocate without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3-inches (75 mm) back from new construction.
 - 2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition and temporarily support and protect roots from damage until they are permanently relocated and covered with earth.
- D. Where utilities trenches are required within tree drip lines, tunnel under or around the roots by drilling, auger boring, pipe jacking, or digging by hand.
 - 1. Root Pruning: Do not cut main lateral roots to tap roots; cut only smaller roots that interfere with installation of new work. Cut roots with sharp pruning instruments; do not break or chop.

3.03 REGRADING:

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree drip line. Maintain existing grades within tree drip lines.
 - 1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots to tap roots; cut only smaller roots. Cut roots cleanly with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 6-inches (150 mm) or less below elevation of finish grade shown, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- C. Moderate Fill: Where existing grade is more than 6-inches (150 mm) but less than 12-inches (300 mm) below finish grade elevation, place a layer of drainage fill, filter fabric, and a final layer of topsoil on existing grade.

11/01/2024

1. Carefully place drainage fill against tree trunk approximately 2-inches (50 mm) above finish grade elevation and extend not less than 18-inches (450 mm) from tree trunk on all sides. For balance of area within drip line perimeter, place drainage fill to an elevation 6-inches (150 mm) below grade.
2. Place filter fabric with overlapping edges of 6-inches (150 mm) minimum.
3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.04 TREE PRUNING:

- A. If required, prune remaining trees to compensate for root loss caused by damaging or cutting root system as required by the Engineer in accordance with accepted horticultural practices.
- B. Cut branches with sharp pruning instruments; do not break or chop.

3.05 TREE REPAIR AND REPLACEMENT:

- A. Promptly repair trees damaged by construction operations to prevent progressive deterioration.
 1. Provide new trees of size and species selected by the Engineer when trees over 6-inches (150 mm) in caliper, measured 12-inches (300 mm) above grade, are required to be replaced, due to abuse/damage/neglect of contractor.

3.06 DISPOSAL OF WASTE MATERIALS:

- A. Burning on Owner's Property: Burning is not permitted on Owner's property.
- B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION

11/01/2024

TREE PROTECTION AND TRIMMING
01 56 39-4

SECTION 01 57 16

RODENT CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section specifies requirements for rodent control activities by the Contractor at all work and laydown (or staging) areas in connection with this Contract.
- B. The Contractor shall retain the services of a licensed rodent exterminator to conduct an inspection of the work and laydown areas and report on the presence of rodents and take any necessary measures to eliminate existing rodent populations prior to start of work.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Within ten days after Notice to Proceed, submit to the Engineer a written description of rodent control measures to be used and the areas to be included in the program.
- B. Provide the name and background of the licensed rodent exterminator retained to provide any necessary rodent eradication measures prior to start of work.

PART 2 - PRODUCTS

2.01 CONTAINERS:

Use metal or heavy-duty plastic refuse containers with tight-fitting lids for disposal of all garbage, or trash associated with food. These containers shall not have openings that allow access by rodents.

PART 3 - EXECUTION

3.01 WORK AND LAYDOWN AREAS WITHIN THE CONTRACT AREA:

- A. Before mobilization begins, obtain written verification from the rodent exterminator that rodent populations have been effectively controlled in areas to be occupied.
- B. Following site clearing and before demolition, excavation, or construction, inspect work and laydown areas and remove all remaining trash, debris, and weeds.

10/30/2024

- C. Maintain work and laydown areas free of trash, garbage, weeds, and debris. Provide and enforce proper use of refuse containers to ensure that rodents and other pests are not harbored or attracted.
- D. Designate specific locations as lunch and coffee break areas to prevent random disposal of garbage and trash. Keep those areas free of litter and garbage, and provide refuse containers as described in 2.01 of this section. Keep refuse containers upright with their lids shut tight.
- E. Have all refuse containers emptied daily to maintain site sanitation.
- F. Notify the Engineer within 24 hours whenever rodents (rats or mice) or signs of rodent activity (burrows or droppings) are observed in work or laydown areas. Take appropriate action to locate and control the rodents.

3.02 LAYDOWN AREAS OUTSIDE THE CONTRACT AREA:

- A. Implement pest control at all laydown areas that are not areas of this Contract, but that are used by the Contractor in connection with this Contract. Undertake rodent control at least two weeks prior to use of the area and with time to ensure that the site is free of rodent populations (rats and mice) prior to site occupancy. Maintain the site free of rodents throughout the duration of its use.
- B. Clear laydown areas of trash, debris, and weeds prior to occupancy. Initiate those actions only after rodent populations have been effectively controlled.
- C. Maintain laydown areas free of trash, garbage, weeds, and debris. Provide and enforce proper use of refuse containers to ensure that rodents and other pests are not harbored or attracted.
- D. Dispose of all garbage or trash associated with food in refuse containers with tight-fitting lids as described in 2.01 of this Section. Have refuse containers emptied daily to maintain site sanitation.

END OF SECTION

SECTION 01 57 19

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools, and equipment and performing all work required for the prevention of environmental pollution during and because of construction operations under this contract.
- B. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as any conditional requirements applied, all of which are attached to Section 00 31 43, PERMITS.
- C. Prior to commencement of work, the Contractor shall meet with the Owner and the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

- A. Section 00 31 43, PERMITS
- B. Section 01 14 19.16, DUST CONTROL
- C. Section 01 33 00, SUBMITTALS
- D. Section 31 00 00, EARTHWORK
- E. Section 31 11 00, CLEARING AND GRUBBING

1.03 SUBMITTALS:

- A. The Contractor shall submit details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of resource areas protected under the Wetlands Protection Act.

PART 2 – PRODUCTS

2.01 CATCH BASIN PROTECTION:

- A. To trap sediment and to prevent sediment from clogging drainage systems, catch basin protection in the form of a siltation sack (Siltsack as manufactured by ACF Environmental, Inc. or approved equal) shall be provided as approved by the Engineer.

ENVIRONMENTAL PROTECTION

PART 3- EXECUTION**3.01 NOTIFICATION AND STOPPAGE OF WORK:**

- A. The Engineer will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

- A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

- A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.
- B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 CONSTRUCTION IN RESOURCE AREAS PROTECTED UNDER THE WETLANDS PROTECTION ACT;

- A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within 100-feet of resource areas protected under the Wetlands Protection Act.
- B. The Contractor shall perform his work in such a way that these areas outside the limits of work are left in the condition existing prior to construction.
- C. The elevations of resource areas protected under the Wetlands Protection Act shall not be unduly disturbed by the Contractor's operations.

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:**ENVIRONMENTAL PROTECTION**

- A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.
- B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to ensure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

3.06 LOCATION OF STORAGE AREAS:

- A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project and shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.
- B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of compost filter tubes or silt fences around the perimeter of stockpiles shall be employed to protect any downstream areas from siltation.
- C. There shall be no storage of equipment or materials in resource areas protected under the Wetlands Protection Act.
- D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

3.07 PROTECTION OF LANDSCAPE:

- A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.
- B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.
- C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured,

or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Engineer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of under the provisions of Section 31 11 00, CLEARING AND GRUBBING.

- D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.08 CLEARING AND GRUBBING:

- A. The Contractor shall clear and grub only on the area designated on the contract drawings and only the area required for construction operations, as approved by the Engineer.

3.09 DUST CONTROL:

- A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust.

3.10 CATCH BASIN PROTECTION:

- A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems. Siltation sacks shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation sacks from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The contractor shall properly dispose of all debris at no additional cost to the Owner.

END OF SECTION

SECTION 01 73 29

CUTTING, CORING AND PATCHING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the cutting, coring, rough and finish patching of holes and openings in existing structures.

1.02 RELATED WORK:

A. SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 2 - PRODUCTS

2.01 SEALING MATERIALS:

- A. Mechanical seals shall be modular, adjustable, bolted, mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve. The seal shall be rated by the manufacturer for 40 feet of head or 20 psig. Mechanical seals shall be Link-Seal, manufactured by Thunderline Corp., Wayne, MI., or approved equal.
- B. Sealant shall be a two part foamed silicone elastomer as manufactured by Dow Corning Co., product No. 3-6548 silicone R.T.V.; 3M brand fire barrier products caulk C.P. 25 and 3M brand putty 303; Flame-Safe fire stop systems Fig. No. FS-500 by Thomas & Betts Corporation, or approved equal. Packing shall be a fire retardant pliable material, Fig. 310 by Sealtite Co.; White Oakum W.S.-600 by American Manufacturing Co., or approved equal. Sealant bead configuration, depth and width shall be in accordance with manufacturer's recommendations.

2.02 MISCELLANEOUS MATERIALS:

- A. Bonding compound shall be Sikadur Hi-Mod epoxy by Sika Corporation, or equivalent by Euclid Chemical Corporation, Master Builders Company, or approved equal.
- B. Non-shrink grout shall be Masterflow 713 by Master Builders Company; Euco N-S by Euclid Chemical Co.; Five Star Grout by U.S. Grout Corp. or approved equal.
- C. Materials for finish patching shall be equal to those of adjacent construction.

PART 3 - EXECUTION

11/01/2024

CUTTING CORING AND PATCHING

01 73 29-1

3.01 GENERAL:

- A. The Contractor shall leave all chases or openings for the installation of its own or any other contractor's or subcontractor's work, or shall cut the same in existing work, and shall see that all sleeves or forms are at the work and properly set in ample time to prevent delays. It shall see that all such chases, openings, and sleeves are located accurately and are of proper size and shape and shall consult with the Engineer and the contractors and subcontractors concerned in reference to this work.
- B. In case of its failure to leave or cut all such openings or have all such sleeves provided and set in proper time, Contractor shall cut them or set them afterwards at its own expense, but in so doing he shall confine the cutting to the smallest extent possible consistent with the work to be done. In no case shall piers or structural members be cut without the written consent of the Engineer.
- C. The Contractor shall not cut or alter the work of any subcontractor or any other contractor, nor permit any of its subcontractors to cut or alter the work of any other contractor or subcontractor, except with the written consent of the contractor or subcontractor whose work is to be cut or altered or with the written consent of the Engineer. All cutting and patching or repairing made necessary by the negligence, carelessness, or incompetence of the Contractor or any of its subcontractors shall be done by or at the expense of the Contractor and shall be the responsibility of the Contractor.
- D. All cutting and coring shall be performed in such a manner as to limit the extent of patching.
- E. All holes cut through concrete and masonry walls, slabs or arches shall be core drilled unless otherwise approved. No structural members shall be cut without the approval of the Engineer and all such cutting shall be done in a manner required by them. No holes may be drilled in beams or other structural members without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.

3.02 CORING:

- A. Coring shall be performed with an approved non-impact rotary tool with diamond core drills. Size of holes shall be suitable for pipe, conduit, sleeves, equipment or mechanical seals to be installed.
- B. If holes are cored through floor slabs they shall be drilled from below.
- C. All equipment shall conform to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring and maintenance.
- D. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.

11/01/2024

CUTTING CORING AND PATCHING

01 73 29-2

- E. Slurry or tailings resulting from coring operations shall be vacuumed or otherwise removed from the area following drilling.

3.03 CUTTING:

- A. Cutting shall be performed with a concrete saw and diamond saw blades of proper size and application.
- B. Provide for control of slurry generated by sawing operation on both sides of wall or slab.
- C. When cutting a reinforced concrete wall, the cutting shall be done so as not to damage bond between the concrete and reinforcing steel left in the structure. Cut shall be made so that steel neither protrudes nor is recessed from the face of the cut.
- D. Adequate bracing of area to be cut shall be installed prior to start of cutting. Check area during sawing operations for partial cracking and provide additional bracing as required to prevent a partial release of cut area during sawing operations.
- E. Provide equipment of adequate size to remove cut panel.
- F. For cutting a trench in a floor slab, a full-depth cut shall be made using a concrete saw for the desired width of the trench. A partial-depth cut shall be made to expose the reinforcing bars. The width of the partial cut shall be to the required lap length of the reinforcing bars. Care shall be taken not to cut exposed reinforcing bars but if any are cut, dowel holes shall be drilled and dowels epoxied in. Reinforcing of the same size, as the existing shall be tied to the existing exposed reinforcing and/or dowels with the proper lap length.

3.04 PATCHING:

Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as approved.

Trenches in floor slabs shall be repaired as described in 3.03F above and concrete meeting the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE shall be poured and cured.

END OF SECTION

SECTION 01 74 13

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of its work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon request by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

1.02 RELATED WORK:

- A. Section 00 72 00 GENERAL CONDITIONS
- B. Section 01 11 00 CONTROL OF WORK AND MATERIALS
- C. Section 01 14 00 SPECIAL PROVISIONS
- D. Section 01 57 19 ENVIRONMENTAL PROTECTION

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

3.01 DAILY CLEANUP:

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and

sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

- B. Upon written notification by the Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.
- C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

3.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

- A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

3.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

- A. On or before completion of the work, the Contractor shall, unless otherwise specifically required or permitted in writing, tear down and remove all temporary buildings and structures it built; shall remove all temporary works, tools and machinery or other construction equipment it furnished; shall remove all rubbish from any grounds which it has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by its operations in a neat and satisfactory condition.

3.04 RESTORATION OF DAMAGED PROPERTY:

- A. The Contractor shall restore or replace, when and as required, any property damaged by its work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

3.05 FINAL CLEANUP:

- A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Engineer shall approve the condition of the site.
- B. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the building to a "like new" condition. This cleanup shall include removing all trash and debris from the premises; sweeping and mopping of all floors; washing of all walls, windows and

doors; cleaning and polishing of all finish metal surfaces; cleaning of all equipment, utilizing proper solvents for removal of oil and grease; cleaning of dirt and debris out of all mechanical and electrical cabinets; and all other related work required to render the building suitable for use. Before acceptance, the Engineer shall approve the condition of the building.

END OF SECTION

SECTION 01 78 39

PROJECT AS-BUILT RECORD DRAWINGS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the Contractor's As-Built Record drawings for the project. The As-Built Record drawings for the project shall include, but are not limited to:

- A. The Contractor's construction coordination drawings for all the project disciplines. The Contractor's construction coordination drawings for the project disciplines shall be submitted to the Engineer prior to Construction of the said discipline. The Contractor's construction coordination drawings for the project disciplines shall include but are not limited to the following:

1. Architectural
2. Civil
3. Structural
4. Electrical
5. Process
6. Instrumentation

B. Draft Record Documents Review

Upon completion of the project construction the Contractor shall submit a complete copy of 24- by 36-inch Record Drawings to the Owner and the Engineer for review. The Owner and the Engineer shall jointly review the Record Drawings and provide comments to the Contractor. The Contractor shall modify the Record Drawings as necessary based on the comments provided by the Owner and the Engineer.

C. Final Record Documents

Upon incorporation and acceptance of the Draft Record Drawings comments from the Owner and the Engineer, the Contractor shall submit the Final Record Drawings and documentation. The Contractor shall submit two sets of 24- by 36-inch Record Drawings to the Owner and an additional two sets of 24- by 36-inch Record Drawings to the Engineer for their records. The Contractor shall also submit to the Engineer a minimum 20 gigabyte flash drive with the electronic Record Drawing

11/01/2024

PROJECT AS BUILT RECORD DRAWINGS

01 78 39-1

files. The electronic Record Drawing files shall be obtained from the Owner (the Engineer shall provide on behalf of the Owner if the Engineer was the project designer) and developed in AutoCAD 2010/Revit 2017 (or later) and the submittal shall include the Final AutoCAD DWG/Revit RVT file documents, drawing line types, blocks, etc. The actual version of AutoCAD/Revit shall be coordinated with the Engineer.

D. Pre- and Post-Construction Survey

The Contractor shall perform a pre- and post-construction survey of the entire project area. The topographic survey shall be performed by or under the supervision of and certified by a Registered Land Surveyor in the State of **Massachusetts**. The Contractor shall also submit to the Engineer a minimum 20 gigabyte flash drive with the electronic pre- and post-construction survey files. The Contractor shall send the electronic pre- and post-construction survey files to the Engineer which shall be developed in AutoCAD 2010/ Revit 2017 (or later) and the submittal shall include the Final AutoCAD DWG / Revit RVT file documents, drawing line types, blocks, etc. The actual version of AutoCAD / Revit shall be coordinated with the Engineer. The Contractor shall notify the Owner and Engineer at least 48-hours in advance of each survey.

1.02 RELATED WORK:

- A. General Requirements in their entirety.
- B. Division 02 through Division 33.

1.03 AS-BUILT DOCUMENTS:

- A. Contractor shall maintain on site, separate from the documents used for construction, one complete set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Written interpretations and clarifications.
 - 7. Field Orders.
 - 8. Field test reports properly verified.
- B. The completed set of documents shall include but are not limited to:

11/01/2024

1. Significant deviations of any nature made during construction.
- C. The completed set of as-built documents shall be submitted to the Engineer with the final Application for Payment.

PART 2 - MATERIALS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 92 13

OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. This section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.02 RELATED WORK:

- A. General Requirements in their entirety (Section 00700 through Section 01780)
- B. Individual Technical Specification Sections Specific for Operation and Maintenance Data.
- C. Section 01329, SUBMITTALS FOR OPERATION AND MAINTENANCE MANUALS
- D. Section 01330, SUBMITTALS

1.03 FORMAT:

- A. Prepare data in form of an instructional manual.
- B. Binders: Commercial quality, 8 ½- x 11-inch three-ring binders with hardback, washable, plastic covers; two inch maximum ring size. When multiple binders are used, correlate data into related, consistent groupings. Provide a table of contents in each binder.
- C. Cover: Identify each binder cover and spine with typed or printed title OPERATION AND MAINTENANCE INSTRUCTION; list title of Project facility; identify subject matter of contents.
- D. Arrange contents by systems under section numbers and sequence of Table of Contents.
- E. Provide tabbed flyleaf for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: Manufacturer's printed data, or typewritten data - on 20-pound paper.
- G. Drawings: Provide with reinforced punched, binder tab. Bind in with text; fold larger drawings to size of text pages.
- H. Submit certification that the data and drawings provided pertain exactly to the model, size, and series product and equipment installed in the work.

11/01/2024

- I. All documents will be electronically scannable.
- J. All products, systems, and drawings must be cross-referenced with tag ID numbers.
- K. The manual for each piece of equipment shall be a separate document with the following specific requirement:

- 1. Contents:

- Table of Contents and Index

- Brief description of each system and components

- Starting and stopping procedures

- Special operating instructions

- Routine maintenance procedures

- Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams

- One copy of each wiring diagram

- One copy of each approved shop drawing and each Contractor's coordination and layout drawing

- List of spare parts, manufacturer's price, and recommended quantity

- Name, address and telephone number of local service representatives.

- 2. Material

- Loose leaf on 60 pound, punched paper

- Holes reinforced with plastic cloth or metal

- Page size, 8 ½- x 11-inches

- Diagrams, illustrations and attached foldouts as required, of original quality, reproduced by dry copy method

- Covers: oil, moisture and wear resistant 9 x 12 size

11/01/2024

1.04 QUALITY ASSURANCE:

- A. Prepare instructions and data by personnel experienced in maintenance and operations of described products.

1.05 CONTENTS, EACH VOLUME (BINDER):

- A. Table of Contents: Provide title of Contract, schedule of products and systems, indexed to content of the volume. A listing of all relevant tag ID numbers for each volume shall be placed immediately after the Table of Contents.
- B. For each product or systems: List names, addresses, and telephone numbers of subcontractors and suppliers, including local source of suppliers and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- E. Text: As required to supplement product data, provide logical sequence of instructions for each procedure incorporating manufacturer's instructions.
- F. Warranties, Guarantees, and Bonds: Bind copy of each
- G. See O&M Manual Review Checklist at end of this specification section.

1.06 MANUAL FOR MATERIALS AND FINISHES:

- A. Building Products, Applied Materials, and Finishes: Include product data with catalog number, size composition, and color and texture designations. Provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: As specified in individual product specification sections.

11/01/2024

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS:

- A. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- B. Data submitted on all equipment shall include complete maintenance instructions (including preventive and corrective maintenance) and parts lists in sufficient detail to facilitate ordering replacements.
- C. All products, systems, equipment, electrical wiring, instrumentation wiring, personnel protection systems wiring, presented in this manual will have tag numbers corresponding to contract drawings and specifications. In the event, numbers do not exist; the Engineer will specify a series of numbers.
- D. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications.
- E. Include color-coded wiring diagrams as installed.
- F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequence. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter and any special operating instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required. Cross-reference lubricants to products offered by at least three major lubricant suppliers.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color-coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

11/01/2024

- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports, calibration data, alignment records, and other information.
- P. Additional Requirements: as specified in individual product specification sections.
- Q. Provide a listing in table of Contents for design data with tabbed flysheet and space for insertion of data.
- R. Incorporation of all Physical Checkout information obtained through the field-testing and correction phases of the Work. Input must be specific to the actions and information obtained during those phases.

1.08 SUBMITTALS:

- A. Submit draft and final copies of operation and maintenance manuals as described in Section 01 33 23.13 SUBMITTAL OF OPERATION AND MAINTENANCE MANUALS.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

Note to Specifier: Review the attached Checklist and add items that are required or delete items not relative to this project.

**OPERATION AND MAINTENANCE MANUAL
REVIEW CHECKLIST**

- | | |
|--|--------------------------|
| 1. Name, address, telephone/fax number of the manufacturer | <input type="checkbox"/> |
| 2. Name, address, contact name, telephone/fax of local representative | <input type="checkbox"/> |
| 3. Name, address, telephone/fax number of the contractor | <input type="checkbox"/> |
| 4. Exploded view/general arrangement of materials of construction | <input type="checkbox"/> |
| 5. Description of operation/operating principal | <input type="checkbox"/> |
| 6. Project specific Operating parameters | <input type="checkbox"/> |
| 7. Wiring Diagrams (If Applicable) | <input type="checkbox"/> |
| 8. Troubleshooting checklist | <input type="checkbox"/> |
| 9. Recommended spare parts list with prices, and ordering instructions | <input type="checkbox"/> |
| 10. Model number and the serial number of the model provided | <input type="checkbox"/> |
| 11. Performance curves or tabulated data | <input type="checkbox"/> |
| 12. Routine Maintenance instructions/service instructions with recommended Intervals | <input type="checkbox"/> |
| 13. Assembly and disassembly instructions | <input type="checkbox"/> |
| 14. Recommended lubricates and lubrication schedule. | <input type="checkbox"/> |
| 15. Approved copies of Shop Drawings are to be included in the manual | <input type="checkbox"/> |
| 16. Startup/break-in and adjustment instructions | <input type="checkbox"/> |
| 17. Warranty information | <input type="checkbox"/> |

Reviewed By: _____
Weston & Sampson Engineers

Date: _____

END OF SECTION

11/01/2024

OPERATIONS AND MAINTENANCE MANUALS
01 92 13-6

SECTION 02 21 13

SITE SURVEY

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section includes the following:
 - 1. Layout for all site work performed by a licensed surveyor.
 - 2. Maintaining site control.
 - 3. Preparing record drawings showing all new utilities and building additions.
 - 4. Locate property and/or easement lines, building or other facilities that could affect construction.

1.02 DEFINITIONS:

- A. Licensed Surveyor: Registered in state where project is located and acceptable to the Owner.

1.03 QUALITY ASSURANCE:

- A. All survey calculations of field work, where the accuracy could affect construction or the original design intent, shall be performed under the supervision of the Licensed Surveyor. If requested by the Engineer, the Contractor shall have the portion of survey in question certified that the work was done under the supervision of the Licensed Surveyor.
- B. Perform survey work in accordance with recognized professional surveying practices, complying with local and state laws, rules and regulations. Ensure work performed by qualified personnel acceptable to Engineer.
- C. Maintain Project Survey field work in a condition such that it can be checked by the Engineer and provide assistance in carrying out these checks. Checking by the Engineer does not relieve the Contractor of its responsibilities under this item.

1.04 SUBMITTALS: IN ACCORDANCE WITH SECTION 01 33 00 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Legible, comprehensive and complete survey notes, computations, sketches, drawings and similar records kept in a conventional format acceptable to the Engineer.
- B. Record Plans or As-Built of all site improvements performed under this Project.

Green Island Phase II

- C. Calculations and field notes required to reestablish or modify the original control.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

- A. Surveying instruments and equipment used in performing the Project Survey shall be of the type(s) appropriate for the application at hand and shall be kept in acceptable calibration and good working order.

2.02 MATERIALS:

- A. All temporary materials used in field shall be weather resistant and of standard quality.
- B. All permanent materials incorporated into the project shall be a type that prevents movement from freeze-thaw, minor contact or other expected occurrences and is found to be acceptable by the Owner and local or state authority. When possible, use material specified on the Drawings.

PART 3 - EXECUTION

3.01 FIELD SURVEY AND OBTAINING RIGHT OF ENTRY:

- A. All survey layout work shall be tied or referenced to the control survey data shown on the plans or supplied by the Engineer. The existing control shall be maintained in its original condition throughout the term of the Contract. If alteration of the original baseline condition is unavoidable, notify the Engineer of this situation and present a plan and procedure to the Engineer for review to remedy this alteration. Bring any error, apparent discrepancy in or absence of control survey data provided, to the Engineer's attention for resolution.
- B. At the direction of the Owner, establish, stake and reference all rights-of-way, easement limits, and building corners, and where required, stake under the direction of the Licensed Surveyor. The Licensed Surveyor shall, through the Contractor, present to the Engineer a certificate with the professional's seal in an acceptable format that such information has been accomplished under his or her direction.
- C. At all times maintain the project survey field work in a condition such that it can be reviewed by the Engineer and render reasonable assistance to the Engineer in carrying out such checks. However, reviewing by the Engineer does not relieve the Contractor of its responsibilities under this Item.
- D. Assume sole responsibility for obtaining right of entry to properties, other than

Green Island Phase II easements with surface rights, for the purpose of conducting layout and survey work.

3.02 RECORD DRAWINGS/AS BUILT DRAWINGS:

- A. Upon completion of the work under this Item, present a certificate to the Engineer attached to the As-built drawings, stating that all the facilities shown on the Drawings have been located in accordance with such Drawings or approved modifications thereof.

END OF SECTION

SECTION 02 32 13.13

SUBSURFACE EXPLORATIONS

PART 1 GENERAL

1.01 WORK INCLUDED:

A. Geotechnical Borings

1. The work to be done under this Contract includes the furnishing of all materials, labor, equipment, water supply and all else necessary for making and completing borings as described herein within 5 feet of the two sports light tower foundations adjacent to the basketball court (total of 2 borings).
2. The borings shall be advanced to 20 feet below finished grade to determine the character, thickness, and stratification of the subsurface materials.
3. If bedrock is encountered within 15 feet of finished grade, a 5 foot rock core shall be retrieved.

B. Test Pits

1. The work to be done under this Contract includes the furnishing of all materials, labor, and equipment for completing test pits as described herein.
2. Contractor shall excavate six test pits to 5 feet below finished grade at locations of proposed retaining walls with heights exceeding 4 feet. Test pit locations shall be selected by the Engineer.

C. Borings and test pits shall be advanced in the presence of the Engineer who will log the borings and test pits. Contractor shall provide a minimum of 48 hours notice of the work to the Engineer.

D. All work shall be performed to avoid damage to existing utilities and structures. Contractor shall be responsible for damage and repairs resulting from their work.

1.02 APPLICABLE STANDARDS:

- A. ASTM D1586 - Standard Penetration Test and Split-Barrel Sampling of Soils.
- B. ASTM D1587 - Thin-Walled Tube Sampling of Soils.

11/01/2024

- C. ASTM D2113 - Practice for Diamond Core Drilling for Site Investigation.

1.03 RELATED WORK

- A. Section 00 31 32, SUBSURFACE DATA

1.04 REGULATORY REQUIREMENTS:

- A. Apply for, pay for, and obtain all necessary permits and licenses for lawful execution of this work. These include, but not limited to, permits and fees for water, sidewalk crossing, shed erection, pavement cuts, and repairing streets and sidewalks and all other buildings, electrical, plumbing, gas, and sewer permits from authorities having jurisdictions. At the written approval of the Engineer, some or all regulatory requirements could be waived.

1.05 CONTRACTOR'S PLANT AND EQUIPMENT:

- A. All equipment, and methods to be used by the Contractor shall be subject to approval by the Engineer before starting, and during the course of the work. Approval of the equipment and methods shall not be construed as approval of the performance of the work. Provide additional equipment, where ordered by the Engineer, to perform work according to the specifications.

1.07 PROJECT RECORD DOCUMENTS:

- A. Assist the Engineer in collecting data as required to complete logs for each boring and test pit. Each log shall include:
 - 1. General
 - a. Name of Contractor and foreman.
 - b. Location and identification number of exploration, ground surface elevation and datum used for elevations.
 - c. Results of all exploration details arranged in tabular form giving full information on vertical arrangement, thickness, and classification of the materials penetrated.
 - 2. Soil Boring
 - a. Height and weight of drop hammer used to drive sampler and to drive split-barrel samples and casing.

- b. Type, number, and depth of each sample.
 - c. Number of blows required to drive split-barrel sampler for six-inch penetration of split-barrel sampler and each twelve-inch penetration of the casing.
 - d. Size, length, and depth to bottom of casing.
 - e. Depth to groundwater measurement and time and date of each measurement. Take measurement on each day if boring takes longer than one day to complete. If no water is encountered, the log shall read "No Water".
 - f. Amount of recovery in inches for each sample attempted.
 - g. Description of each soil sample in accordance with the applicable soil classification system selected by the Engineer.
 - h. Depth at which rock was encountered and depth of bottom of borehole or depth to refusal (where encountered).
3. Rock Coring
- a. Type and size of barrel and bit.
 - b. Depth of each core run and length of core recovery.
 - c. Time required to core each foot of sample.
 - d. Description of rock.
4. Test pits
- a. Excavation equipment used to advance test pits.
 - b. Description of each soil sample in accordance with the applicable soil classification system selected by the Engineer.
 - c. Presence and estimated quantity of cobbles, boulders, debris, organics, etc.
 - d. Depth to groundwater measurement and time and date of each measurement. Take measurement on each day if boring takes longer than one day to complete. If no water is encountered, the log shall read "No Water".

- e. Depth of bottom of test pit excavation or depth to refusal (where encountered).
- B. Deliver all samples to Engineer at the end of the work.

PART 2 MATERIALS

2.01 EQUIPMENT FOR GEOTECHNICAL BORINGS:

- A. Casing: Flush jointed, extra heavy, machine threaded, steel pipe with driving shoe at bottom end. Minimum inside diameter:

Type B - 2-3/8 inch
Type N - 3 inch
Type H - 4 inch
- B. Hollow stem Augers: Minimum inside diameter two and two tenths (2.2) inches. Maximum inside diameter six and a half (6.5) inches. Auger lengths five (5) feet maximum. Equipped with center rod plug and pilot bit.
- C. Drill Rods: Cold drawn steel tubes with flush joints and square threads. Stiffness (moment of inertia) equal or greater than that of a parallel wall A-rod (1 5/8-inch OD and 1 1/8-inch ID).
- D. Split Barrel Sampler: ASTM D1586. Effective length of split tube between 22 inches and 30 inches. Equipped with top check valves and core catchers for use as directed by the Engineer. Each drill rig shall be equipped with a minimum of two complete split barrel samplers acceptable to the Engineer.
- E. Thin-Walled Tubes: ASTM D1587. Three (3) inch outside diameter bright, clean and free from dents, rust, and scars, coated with lacquer on other rust inhibitors.
- F. Rock Core Barrel and Bits: ASTM D2113 Double Tube, Swivel Type, N-size for Type N boring, A or B size for Type B borings. All coring shall be completed in lengths of 5 feet.
- H. Sample Containers
 - 1. Split Barrel Samples
 - a. Preserve all samples in wide mouth, round, screw-top, airtight, clean glass jars, eight ounces or larger.

Place representative samples in jars at same time they were obtained to preserve original moisture in the material. Tightly cap all jars, identify each jar with legible labels. On each label show the date, boring number, sample number, depth of sample, number of blows for each six inches of penetration. Jars should be placed in suitable boxes labeled and identified on the outside.

- b. Store and protect all samples from freezing at or near the site during the course of the work.
- c. Deliver fully identified samples to the Engineer at the completion of work.

2. Rock Cores

- a. Supply new wooden core boxes 5 feet in length with a capacity for 20 feet of core in each box. Equip all boxes with necessary partitions, hinges, and latches for securing the cover. Label each box with project name, boring number, and core run numbers and representative depths.
- b. Place rock core in suitable wooden boxes so partitioned that the cores will be kept separate.
- c. Arrange and label rock cores neatly in the boxes in the sequence in which the material was removed from the hole with the depth of the top and bottom of each run clearly marked.

3. Thin-Wall Tube Samples

- a. Prepare tubes for shipment in accordance with ASTM D1587 "Preparation for Shipment"

2.02 DRILL WATER:

- A. Drill water shall be clean and free of any hazardous materials, oil or any deleterious materials that might negatively affect strata or the environment.
- B. It is the SUBCONTRACTOR responsibility to secure water for the drilling operation. The Engineer will notify the SUBCONTRACTOR if water is available at the project site. In such a case, the Engineer will obtain the OWNER'S permission to use such water.

PART 3 EXECUTION

3.01 PREPARATION:

- A. Before performing drilling or excavation at any location, the Contractor shall contact DIGSAFE and the OWNER of property and any other local utilities (e.g., water, sanitary sewer, etc.) to avoid damage to any existing utilities.
- B. Provide, place and erect all necessary barricades, warning signs, and lighting required to protect work from traffic and pedestrians.
- C. Verify that site conditions will support equipment for performing the subsurface exploration program.
- D. Notify Engineer a minimum of forty-eight (48) hours in advance of proposed starting date and time as required.

3.02 DRILLING AND SAMPLING:

- A. Depth of Boring:
 - 1. Carry borings to the depths indicated herein. Do not carry borings below the depth indicated unless directed by the Engineer.
 - 2. If refusal is encountered above the specified depth, core drill a minimum of 5 feet as directed by the Engineer. As used in these specifications, refusal is defined as the resistance to penetration of the split spoon sampler of not less than 100 blows per one inch when driven with a 140-pound weight free-falling 30 inches. In each case, the Engineer shall determine that refusal actually has been encountered and will determine the need to core drill.
- B. Advancing Casing:
 - 1. Drive casing vertically with a weight of at least 300 pounds free-falling 24 inches through earth and other materials to such depth below the ground surface as required to maintain an open borehole or as directed by the Engineer. Record the blows per foot, hammer weight and free-fall distances and include on drill records. Simultaneous washing and driving of casing will not be permitted except with the specific approval of the Engineer. Where so permitted, indicate on drill records the depths between which water was used while driving the casing.

2. Measure groundwater level before removing casing at completion of boring if no instrumentation installation or testing will be performed in borehole.

C. Advancing Hollow Stem Augers:

1. Maintain a center rod plug and pilot bit in place while advancing the hole by rotation. When sampling below the groundwater table, completely fill the hollow stem with water or drilling fluid prior to and during withdrawal of the plug and during sampling.

D. Advancing Uncased Boreholes:

1. Uncased boreholes may be employed for Type B borings only. In such boreholes, drive casing to such depth as required to maintain an open borehole. Utilize water or commercial drilling fluid as required to maintain a fully open hole. Maintain the level of drilling fluid as near as practicable to the ground surface at all times.

E. Split Spoon Sampling:

1. Perform split spoon sampling in accordance with ASTM D1586. For each sample, drive sampler twenty-four (24) inches or to refusal whichever occurs first. Obtain split spoon samples at intervals determined by the Engineer and at each change in stratum. A recovery of less than 6 inches of soil in the split barrel portion of the sampler shall be an unacceptable sample. Attempt another sample immediately below the recovery until acceptable recovery is obtained.
2. When sampling in sandy or loose silt deposits below the ground water table, maintain the water level in the borehole at ground surface at all times. If this is insufficient to prevent the formation material from rising into casing or augers, use commercial drilling mud to maintain bottom stability when approved by the Engineer.

F. Rock Core Drilling

1. Prior to coring, firmly seat casing in rock and wash out before inserting diamond core bit.
2. Core in runs of five (5) feet or less until depth is sufficient to satisfy Engineer of the character of the rock penetrated.

3. For each core run withdraw core, label, and store in approved core box before drilling is continued. Handle carefully to ensure proper identification and placement in the core box in the order they are removed from the hole.
4. Take care to recover as large a percentage of core as possible. Regulate the speed of drill and remove core as often as necessary to assure maximum percentage of recovery.
5. If unable to obtain satisfactory core recovery, take whatever measures the Engineer may authorize to improve core recovery. Measures to improve core recovery may include changes in:

- Type of drill bit
- Rate of feed
- Speed of rotation
- Volume of cooling water
- Style of core barrel
- Length of coring interval
- Type of machine

No additional payment will be made for such changes unless authorized by the Engineer.

3.03 SEALING BOREHOLE:

- A. Immediately after removing casing or augers, backfill hole with the native soils and thoroughly tamp the surface.
- B. For boreholes made through paved surfaces, patch the surface with equivalent material of a thickness equal to or greater than the adjacent existing pavement.
- C. The Contractor is responsible for settlement of all boreholes for a period of one month after completion of the contracted work. The Contractor will be required to bring sunken borehole to grade as directed by the Engineer.

3.04 TEST PITS

- A. Advancing Test Pit:
 1. Extend test pits to the depths indicated herein. Do not extend the test pit below the depth indicated unless directed by the Engineer.

2. Test pits shall be at least 3 feet wide to enable the Engineer to observe soil stratigraphy on the side wall.
3. Facilitate collection of soils samples by the Engineer from the excavator bucket.
4. Engineer will not enter the test pits.

B. Backfilling

1. Test pits shall be backfilled with the excavated material placed into the excavation in 12-inch-thick loose lifts and compacted with several tamps with the excavator bucket.

3.05 ABANDONED HOLES:

A. An abandoned hole is defined as any one of the following:

1. A boring is started and for any reason not carried to the depth required by the Engineer.
2. The casing is removed from a borehole or the hole is abandoned without the permission of the Engineer.
3. If Contractor fails to keep complete records of materials encountered.
4. The Contractor fails to furnish the Engineer with the required samples and cores.

B. Make an additional borehole at a location selected by the Engineer to replace each abandoned hole.

C. No payment will be made for abandoned holes nor for any samples or cores obtained in abandoned holes.

END OF SECTION

SECTION 02 41 13

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

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

1.02 DESCRIPTION OF WORK:

- A. Work under this Section shall consist of the careful removal, storage for reuse, transportation off-site, or demolition, of all structures and site features encountered or noted to be removed or abandoned to a minimum of three feet below finished grade, and the removal and disposal of all materials not called for to be reused or salvaged, in accordance with the contract drawings, these specifications, and Owner's Representative's requirements. Provide all labor, equipment, materials and transportation necessary to complete the work.
- B. Items plan referenced to be removed and stored shall be carefully removed and stored on site in a manner and location designated by the Owner's Representative for reinstallation later as shown on the plans or as indicated by the Owner's Representative.
- C. Items plan referenced, or as indicated by the Owner's Representative to be removed and disposed of shall be removed from the site and properly and legally disposed of by the Contractor.
- D. Items indicated on the contract drawings or in the specifications to be removed and salvaged, or other items required to be removed by the Owner's Representative, shall be transported to a municipal storage facility, located within the City confines, and unloaded and stacked as required by the Owner's Representative.
- E. Items indicated on the contract drawings or in the specification to be removed and reset shall be carefully removed and reset in the same location as existing according to the specification and details.
- F. General work/demolition requirements of this Section include, but are not limited to:
 - 1. Cement concrete and bituminous concrete pavements
 - 2. Unit paving/ setting bed

11/01/2024

- 3. Curbing
- 3. Trees
- 4. Other features as indicated on the drawings

1.03 PROTECTION:

- A. The Contractor shall assume complete responsibility and liability for the safety and structural integrity of all work and utilities to remain during demolition.
- B. Provide safeguards including, but not limited to, warning signs, barricades, temporary fences, warning lights and other items required for protection of personnel and the general public during performance of all work.
- C. All features related to protection shall be maintained until that work has been completed to the point when such safeguards are no longer required.

1.04 SPECIAL REQUIREMENTS:

- A. The Contractor shall salvage items label to be demolished and transport these to the Owner's City Yard unless these are called for to be reused or required by the Owner's Representative to be disposed of.
- B. Install erosion controls to protect adjacent areas from eroded materials likely to enter wetlands, resource areas, or drainage ways/systems, downstream of areas disturbed by work activities.
- C. Where items to be demolished are located within or adjacent to pavements to remain, the Contractor shall make provisions to protect that pavement to remain. Cut concrete pavement back to score line and cut bituminous concrete pavement back far enough so as not to allow disturbance to base course materials. Pavements damaged as a result of Contractor activities shall be replaced to the extent determined by the Owner's Representative at no additional cost to the Owner.

1.04 REFERENCES:

- A. Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges – latest edition.

PART 2 - PRODUCTS

2.01 BACKFILL:

- A. The Contractor shall provide suitable backfill as specified under Section 31 23 00 of these

11/01/2024

Specifications, to fill voids left by removal or abandonment of site features, and shall provide all pipe cap ends, mortar, brick and other material needed to cap off or plug pipes of various sizes and kinds.

- B. Suitable materials shall be used as base course fill and topsoil to the depth as specified herein. Restore disturbed areas with similar materials blended to match the line and grades of adjacent surfaces.

2.02 TEMPORARY FENCE:

- A. The work under these Items shall conform to the relevant provisions of section 644 of the MassDOT Standard Specifications.
- B. The work shall include temporary installation of chain link fence around the perimeter of the work limits shown on the plans, and as required by the Owner's Representative, and as Contractor sees fit to protect work.
- C. Temporary fence shall consist of 6 foot high chain link fence anchored into a base that is both stable and movable to allow access and adjustment as needed. Reclaimed existing fence fabric and materials may be used with the approval of the Owner's Representative. The Contractor shall submit a shop drawing to the Owner's Representative for approval prior to installation.

PART 3 - EXECUTION

3.01 SALVAGEABLE MATERIAL:

- A. Frames, grates and other salvageable material shall be carefully removed to minimize damage and stored for later reuse, transport, or removal from site.

3.02 ABANDONED STRUCTURES:

- A. All inlets and outlets shall be plugged with at least eight (8) inches of brick and mortar masonry. Upper portions of masonry structures shall be removed to a depth of three feet. The bottoms of all structures shall be broken to allow drainage, and the structure shall be filled with suitable backfill material placed in six (6) inch layers and thoroughly compacted at each level.
- B. The Owner's Representative shall review work related to abandoned structures before backfilling. Those items not reviewed before backfilling shall be uncovered and backfill procedures observed, at no expense to the Owner.

3.03 ABANDONED PIPES OR CONDUITS:

- A. Plug previously abandoned drainpipes encountered with masonry brick at least eight (8)

11/01/2024

inches in thickness.

- B. Abandon discontinued water supplies that are encountered during the execution of this contract in accordance with Owner requirements.
- C. Electrical conduits encountered and previously abandoned shall be capped or plugged.

END OF SECTION

SECTION 02 41 13.29

ABANDONMENT OF SEWERS AND DRAINS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers the abandonment of sewers and drains through various means including furnishing, handling and installation of all concrete and masonry plugs; removal and disposal of manholes, and filling existing pipes with controlled density fill, as shown on the Drawings and specified herein.
- B. The Contractor shall furnish all materials, tools, labor, and equipment to abandon existing sewers, combined sewers, and drains.

1.02 RELATED WORK:

- A. Section 03 30 00 CAST-IN-PLACE CONCRETE

1.03 REFERENCES:

The following standards form a part of this specification, as referenced:

American Society for Testing and Materials (ASTM)

ASTM C32 Specifications for Sewer and Manhole Brick (Made from Clay or shale).

Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00 SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

Plan for abandoning existing pipe, showing equipment, methods and materials. The plan shall be submitted to and reviewed by the Engineer before construction.

PART 2 - PRODUCTS

2.01 PLUGS:

11/01/2024

- A. Plugs installed at the open ends of the pipe to be abandoned shall be 12-inch thick 3,000-psi cement concrete, or 8-inch thick brick masonry as directed. The pipes to be abandoned include all sewer, combined sewer, and drains as specified herein and as shown on the Drawings.
- B. Precast cement concrete plugs that are used shall meet the requirements for 3,000 psi concrete and shall be free of cracks and spalls. Brick masonry plugs shall be made of brick meeting the requirements of ASTM C32, for grade SS, hard brick.
- C. Mortar shall be composed of portland cement, hydrated lime, and sand, and the volume of sand shall not exceed three times the sum of the volumes of cement and lime. The proportions of cement and lime shall be as directed and may vary from 1:1/4 for dense hard-burned brick to 1:3/4 for softer brick. In general, mortar for grade SS brick shall be mixed in the volume proportions of 1:1/2:4-1/2; portland cement to hydrated lime to sand. The cement concrete plug shall be covered with non-shrink grout to prevent leakage at the plug.

2.02 PIPE FILL:

- A. Fill used for the abandonment of sewers, combined sewers, and drains as shown on the drawings shall consist of clean fill, or controlled density fill meeting the requirements included in MassDOT Standard Specifications for Highways and Bridges Division III, M4.08.0: Controlled Density Fill.
- B. Any variance from the specified material shown on the plans or as specified herein for the abandonment of the pipeline shall be subject to the written approval of the Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. PLUGS:
 - 1. Existing sewers or drains shall be plugged with 3,000 psi concrete or with brick masonry, as directed by the Engineer. For non-circular pipes, the largest interior cross sectional dimension shall govern in determining size of abandonment.
 - 2. Plugs shall be of adequate strength to withstand the full soil and groundwater pressure but not less than 5 psi.
 - 3. Open ends of sewer and drain services less than 12-inches in diameter shall be plugged with the appropriate VC plugs or concrete plug as directed by the

11/01/2024

Engineer. Such plug shall be made watertight with an application around the plug of an approved watertight compound.

4. Masonry plugs shall be at least 8-inches thick and concrete plugs shall be at least 12-inches thick. Pipes entering a manhole or catch basin that are to be abandoned shall have a plug installed that is flush with the interior wall of the structure.

B. PIPE FILL:

1. Existing sewers or drains 12-inches and larger shall be abandoned and filled with clean fill, or controlled density fill, and plugged, as shown on the Drawings.
2. Existing sewers or drains smaller than 12-inches shall be plugged and abandoned but need not be filled with clean fill or any other material unless otherwise specified by the Engineer.
3. The method of filling the abandoned pipeline shall fill a minimum of 95 percent of the total annular volume of the pipe.

3.02 REMOVAL AND DISPOSAL OF MANHOLES

A. REMOVAL OF MANHOLES

1. Frames and covers will be removed and delivered to the place designated by the Owner.
2. After filling the pipes to be abandoned that are entering the manhole as specified above, the Contractor shall remove the cone section of a precast manhole or the top four feet of brick in a brick manhole.
3. The Contractor shall place and compact clean fill in the void left by the removal of the manhole.
4. The ground or paved surface shall be restored in accordance with the drawings.

B. DISPOSAL OF MANHOLES

1. The Contractor shall dispose of all manhole materials that are to be removed. Unless the Owner designates a site for receiving the removed materials, the Contractor shall dispose of the materials at a site of his own choosing.

END OF SECTION

11/01/2024

SECTION 02 41 19.16

MINOR ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes:
 - 1. Removal of existing electrical service wiring.
 - 2. Disposal of materials.
 - 3. Storage of removed materials.
 - 4. Identification of utilities.
- B. Related Sections:
 - 1. Section 02 41 13 – SELECTIVE SITE DEMOLITION.

1.2 CLOSEOUT SUBMITTALS:

- A. Section 01 77 00 – CLOSEOUT PROCEDURES: Requirements for submittals.
- B. Project Record Documents: Record actual locations of capped utilities conduits and equipment abandoned in place.

1.3 PRE-INSTALLATION MEETINGS:

- A. Convene minimum one week prior to commencing work of this section.

1.4 SCHEDULING:

- A. Schedule work to coincide with new construction.
- B. Cease operations immediately when structure appears to be in danger and notify Engineer. Do not resume operations until directed.

1.5 COORDINATION:

- A. Conduct demolition to minimize interference with adjacent building areas.
- B. Coordinate and sequence demolition so as not to cause shutdown of operation of existing processes or surrounding areas.
- C. Identify salvage items in cooperation with Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.
- B. Verify termination points for demolished services.

3.2 PREPARATION:

- A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

3.3 DEMOLITION:

- A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.
- B. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring, which are not part of final project.
- C. Perform work on energized equipment or circuits with experienced and trained personnel.
- D. Cap abandoned empty conduit at both ends.

3.4 CLEANING:

- A. Remove demolished materials as work progresses. Legally dispose.
- B. Keep workplace neat.

END OF SECTION

SECTION 02 61 00.16
HANDLING, TRANSPORTATION, REUSE AND OFF-SITE DISPOSAL OF EXCAVATED
MATERIAL

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK:

- A. In general, the Contractor shall maximize the reuse of excavated materials to minimize the generation of surplus material requiring off-site disposal as required by the Engineer and specified herein.
- B. The Work of this Section consists of all labor, equipment, materials, and services for excavating, temporary stockpiling at the Site, handling, segregating, tracking, and management of excavated material, including transporting, and off-Site recycling and/or disposal of surplus/unusable material as directed by the Engineer, generated during the course of the Work.
- C. The Contractor is responsible for sample collection and laboratory analysis of representative disposal characterization samples to obtain acceptance of any excavated materials to be transported off-site to recycling/disposal facilities as specified herein.
- D. The Contractor shall note that the work adjoins one open release under the Massachusetts Contingency Plan (MCP) and is listed under Release Tracking Number (RTN) 2-379. Additionally, several closed RTNs are located within 1,000 feet of the Project Area. Refer to Sections 00 31 32 – GEOTECHNICAL SUBSURFACE DATA and 00 31 33 – ENVIRONMENTAL SUBSURFACE DATA for additional information.
- E. For the purpose of this contract, the Contractor shall assume the following:
 - a. Quantity of Group A-2 Material to be handled, stockpiled, segregated, sampled, loaded and legally hauled for offsite reuse shall be 2,000 tons.
 - b. Quantity of Group B-1 Material to be handled, stockpiled, sampled, loaded and legally hauled for offsite reuse or disposal shall be 1,500 tons.
 - c. Quantity of Group B-2 Material to be handled, stockpiled, sampled, loaded and legally hauled for offsite reuse or disposal shall be 1,000 tons.
 - d. Remainder of excavated material to be handled, stockpiled, segregated, sampled, loaded and legally hauled for on-site reuse or offsite reuse or offsite disposal shall be assumed to be Group A-1.

- F. See the Contract Drawings and Section 31 00 00 EARTHWORK for backfilling details.

1.02 RELATED WORK:

- A. Section 00 31 32 – GEOTECHNICAL SUBSURFACE DATA
- B. Section 00 31 33 – ENVIRONMENTAL SUBSURFACE DATA
- C. Section 01 14 19.16 – DUST CONTROL
- D. Section 01 35 29 – HEALTH AND SAFETY PLAN
- E. Section 01 57 19 – ENVIRONMENTAL PROTECTION
- F. Section 31 00 00 – EARTHWORK

1.03 SUBMITTALS:

- A. Submit to the Engineer, for review, and in accordance with the requirements of the general specifications, the information required by Paragraph 1.03.B of this Section, no more than 14 days after issuance of the Notice to Proceed.
- B. Excavated Materials Management Plan (EMMP) for Construction in the Work Area.

The EMMP shall include the following:

1. Plans and procedures for the excavation of soil as shown on the Contract Drawings.
2. Plans and procedures for the segregation, stockpiling, characterization sampling (where required) and on-site management of surplus excavated materials. The EMMP shall include a plan showing proposed locations of soil stockpiling areas. Provide a schedule detailing the proposed sequence of excavation, stockpiling, and sampling. Refer to Paragraph 3.03 and 3.04 of this Section.
3. All pertinent information relating to the transport of surplus excavated material. The information, at a minimum, shall include:
 - a. Name and address of all transporters.
 - b. Transporter identification number (USEPA or Massachusetts Department of Transportation Transporter) and expiration date.

- c. Proof of permit, license, or authorization to transport surplus excavated material, when applicable, in all affected states.
 - d. Dust control measures.
- 4. Identify each waste stream and propose appropriate disposal/recycling facilities that will accept the surplus material. The Contractor shall submit to the Engineer, approvals or letters of intent and facility information for each facility proposed, within 7 days of issuance of the Notice to Proceed. The Contractor shall submit names of two (2) facilities for each category of surplus excavated material, as identified in Paragraph 3.04 of this Section. Disposal/recycling facilities listed in the EPA Superfund Program will not be accepted as disposal/recycling facilities for this Work. For each facility, the Contractor shall submit the following information:
 - a. General Information
 - i. Facility Name
 - ii. Facility Address
 - iii. Name of Contact Person
 - iv. Title of Contact Person
 - v. Telephone Number of Contact Person
 - vi. Permit Number
 - b. The facility shall specify the volume of material that can be accepted from the Site on a weekly and a total basis.
 - c. The facility shall provide written confirmation that they are permitted to accept and will accept the surplus excavated material of the general quality and quantity described by these Specifications.
 - d. The facility shall provide a listing of all current and valid permits, licenses, letters of approval, and other authorizations to operate that they hold, pertaining to the receipt and management of the soils or materials specified in this Contract.
 - e. The Contractor shall submit a complete list of the disposal facility's permitted allowable contaminant levels and physical characteristic requirements for contaminated material, and list any required regulatory approvals for individual waste streams
- 5. Documentation of an emergency service agreement between the Contractor and a certified emergency response contractor.

6. Procedures for decontamination of vehicles and equipment.
- C. Laboratory results for all samples collected and/or analyzed by the Contractor shall be submitted to the Engineer within 2 days of receipt in tabulated spreadsheet form summarizing detections and exceedances of applicable criteria along with the raw laboratory data package. The results shall include all Chain-of-Custody forms and all documentation provided by the laboratory, including MCP data enhancement requirements. Analytical data shall be kept confidential, distributed only to the Engineer.
- D. As part of the EMMP, the Contractor shall develop a Sampling and Analysis Plan (SAP) outlining the procedures for the characterization of all excavated materials to obtain off-site disposal/recycling facility acceptance. The SAP shall include, but is not limited to, the following:
 1. The name and copies of all applicable certifications of the Contractor's proposed analytical laboratory to perform disposal characterization laboratory analysis.
 2. Proposed off-site disposal/recycling facility sampling and material acceptance requirements.
 3. Disposal characterization sampling procedures.
 4. Laboratory analytical methods used to analyze disposal characterization samples.
 5. Quality assurance and quality control procedures to be implemented during sampling collection and laboratory analysis.

1.04 REFERENCES:

- A. Massachusetts Department of Environmental Protection (DEP) Policy Number:
 1. WSC-94-400, Interim Remediation Waste Management Policy for Petroleum Contaminated Soils.
 2. WSC-94-320, Construction Activities in Contaminated Areas.
 3. COMM-97-001, Reuse and Disposal of Contaminated Soils at Massachusetts Landfills.
- B. Massachusetts Contingency Plan, 310 CMR 40.0000.
- C. Toxic Substances Control Act (TSCA), 40 CFR 761.00.

- D. Massachusetts Hazardous Waste Regulations, 310 CMR 30.000, Massachusetts Solid Waste Regulations, 310 CMR 19.000 and the Resource Conservation Recovery Act (RCRA), 40 CFR 148 and 268.
- E. All other applicable Federal, State, and local regulations. It is the Contractor's responsibility to know, understand, and abide by all such regulations and common practices. In the event of a conflict, the most stringent regulations shall govern.

1.05 DEFINITIONS:

- A. Excavated Material: All soil, sediment, sewer grit, and miscellaneous materials and/or debris excavated from within the limit of work.
- B. Contaminated Material: Soil containing Oil or Hazardous Material (OHM) at concentrations equal to or greater than MCP Reportable Concentrations, category S-1 (RCS-1) or containing concentrations in excess of MassDEP <RCS-1 Soil Reclamation Facility acceptance criteria regulated under MassDEP Policy COMM-15-01.
- C. LSP: Licensed Site Professional, a hazardous waste site cleanup professional, as defined in M.G.L. c. 21A § 19, holding a valid license issued by the Board of Registration of Hazardous Waste Site Cleanup Professionals, pursuant to M.G.L. c. 21A, §§ 19 through 19J.
- D. Suspected Contaminated Material: Excavated material with any of the following characteristics: significant petroleum and/or chemical odor; an oily sheen; and/or material with staining or significant change of color.
- E. URAM: Utility Related Abatement Measure
- F. Refer to Paragraph 3.05 of this Section for the definitions of the excavated material categories (Group A, Group B and Group C).

1.06 PERMIT REQUIREMENTS:

- A. The Contractor shall obtain all Federal, State, and local permits required for the transport and disposal of surplus excavated material. The Contractor shall adhere to all permit requirements.
- B. The Contractor shall document that the disposal facilities proposed have all current certifications and permits as required by Federal, State, and local regulatory agencies to receive and dispose of the surplus excavated material.

1.07 EXISTING CONDITIONS:

11/01/2024

HANDLING, TRANSPORTATION, REUSE AND
OFF-SITE DISPOSAL OF EXCAVATED MATERIAL
02 61 00.16-5

- A. Work under this Project will occur within the Limits of Work shown on the Contract Drawings. The Contractor shall note that the work adjoins one open release under the MCP and is listed under RTN 2-379. Additionally, several closed RTNs are located within 1,000 feet of the Project Area. Refer to Sections 00 31 32 and 00 31 33 for additional information.
- B. Contractor shall note that there are areas of impacted soil located within the work zone with contamination that exceeds the Massachusetts Contingency Plan (MCP) reportable concentrations for Category S-1 soils (RCS-1). Soil sampling conducted within the Project area identified arsenic and benzo(a)pyrene above the MCP RCS-1 standard. Based on the results, soil management in the area of these impacts and within the disposal site boundary of RTN 2-379 will be performed under a Utility Related Abatement Measure (URAM) according to the MCP (310 CMR 40.0460). The URAM will be prepared and filed by the Owner prior to initiating work in this area.

1.08 QUALITY CONTROL:

A. The Contractor shall perform the following:

1. Completed the 40-hour OSHA health and safety training course, with current 8-hour OSHA refresher training.
2. Performance of characterization sampling required for the disposal of surplus excavated materials to meet all State and Federal regulations and disposal requirements. **Characterization sampling may only occur with the observation of the Engineer.**
3. Preparation of draft Material Shipping Records (MSRs), Bills of Lading (BOLs), and/or Hazardous Waste Manifests for transportation of surplus excavated materials. Such documents shall be submitted to the Engineer for review and comment. The Owner's LSP (the Engineer) shall sign all BOLs prepared by the Contractor upon final approval. The Contractor shall be responsible for submitting completed Massachusetts BOLs, hazardous waste manifests, MSRs, and other shipping documents to the Engineer within two weeks of shipment to a disposal/recycling facility.
4. Prepare the necessary documents to transport and dispose/recycle of stockpiled material and submit the executed transportation and disposal/recycle documents to the appropriate Federal, State and Local agencies with copies of all documents submitted to the Engineer in the required time frame for submittal.

5. Preparation, signing, and stamping of all final LSP Opinions submitted to DEP for any response actions taken during the project for releases of oil and/or hazardous materials caused by the Contractor.
6. Ensuring compliance with all references listed in Paragraph 1.04 of this Section.
7. Ensuring that the work shall conform to local, State and Federal regulatory agencies governing the handling of contaminated and hazardous materials.
8. Ensuring that Best Management Practices shall take place while performing the work described in this Section.
9. Develop and implement Site-specific emergency response and health and safety protocols and procedures.
10. Advise the Engineer at least three working days in advance of the schedule for off-Site disposal/recycling.
11. Keep records, including daily logs and photographs, of all waste streams, weights, stockpiles, and surplus excavated materials for the purposes of tracking points of origin.
12. Develop and implement dust control measures, which will adequately protect workers and residents in the nearby community and prevent off-Site migration of dust. Refer to Section 01 14 19.16 – DUST CONTROL.

PART 2 – PRODUCTS

2.01 GENERAL:

- A. All Contractor personnel shall wear personal protective equipment and protective clothing consistent with the levels of protection for this Work as indicated in Section 01 35 29 – HEALTH AND SAFETY PLAN.
- B. If containers are used by the Contractor for storing and/or hauling the surplus excavated material, the containers shall be constructed of steel, in good condition and designed for the intended purpose of safe, secure storage of contaminated and hazardous materials during loading and transport. The containers shall have a secure cover that will prevent a release of material from truck during transportation. The containers and covers shall be at no additional cost to the Owner and shall be approved by the Engineer prior to mobilization of trucks/containers. The containers must be approved by and labeled in accordance with the U.S Department of Transportation (USDOT). The containers shall be

sift-proof and water resistant in accordance with the USDOT.

- C. The Contractor shall decontaminate vehicles, construction equipment, tools and appliances used during the Work as required in Section 01 35 29 – HEALTH AND SAFETY PLAN and Section 01 14 19.16 – DUST CONTROL.

2.02 FILL MATERIALS:

- A. Backfill material shall be in accordance with Section 31 23 00 – EARTHWORK.

2.03 STOCKPILE SHEETING

- A. 10-mil (minimum) nylon-reinforced polyethylene (NRPE) or 20-mil (minimum) polyethylene sheeting shall be used for all stockpile sheeting.
- B. NRPE sheeting conform to the following specifications:
 - 1. Membrane shall be manufactured of new, first quality product designed and manufactured specifically for its intended use.
 - 2. The material shall be 10-mil polyethylene reinforced with a non-woven grid of high strength nylon cord.
 - 3. The material shall be ultra-violet resistant and cold crack resistant to -40 degrees Fahrenheit.
 - 4. The materials shall be manufactured in a minimum 12-foot seamless width. Labels on the rolls shall identify the thickness, width and manufacturer's mark number.

PART 3 – EXECUTION

3.01 GENERAL:

- A. For all soils requiring disposal, the Contractor shall perform supplemental disposal characterization sampling and analytical testing of the surplus excavated material as required by the permitted disposal/recycling facility for facility acceptance.
- B. Based upon all analytical results, the Contractor shall transport and dispose/recycle the surplus excavated material as specified in Paragraphs 3.07 and 3.08 of this Section.
- C. The Owner will be the generator of all surplus excavated materials removed from the Site

and will sign all MSRs, BOLs, and manifests. The Contractor shall be the generator of material contaminated as a result of the Contractor or Sub-Contractors release of oil/hazardous materials on the Site caused by them. The Contractor shall prepare all MSRs, BOLs, and Hazardous Waste Manifests and shall submit all transportation paperwork to the Engineer for approval prior to shipment. The Owner's LSP (the Engineer) shall sign all BOLs upon final review and approval (with the exception of spills caused by the Contractor, which will be the Contractor's responsibility).

- D. The Owner shall have final approval over all disposal/recycling options based on the analytical data.
- E. Immediately notify the Engineer of visible stains or unnatural odor of any surplus excavated material, or if suspected contaminated and/or hazardous material is encountered. Excavate and stockpile areas of suspected contaminated and/or hazardous material as required by the Engineer and the procedures described in this Section.
- F. The Contractor shall coordinate with the Engineer to establish and maintain soil stockpile(s) volume using appropriate survey instrument layout techniques, as well as establish vertical control points in the vicinity of the soil stockpile areas such that volume of the stockpile(s) can be readily determined from instrument survey and approved by the Engineer.
- G. A LSP Opinion from the Owner's LSP shall be required for all material shipped using a Massachusetts BOL.
- H. The Contractor shall remove rubble, metal, wood, plastic, and other debris materials in soils as necessary, via screening or other suitable means and methods, to meet acceptance criteria for the selected disposal/re-use facility.

3.02 DISPOSAL CHARACTERIZATION SAMPLING:

A. Disposal Characterization Sampling

- 1. All disposal characterization sampling and analysis performed by the Contractor shall be at no additional cost to the Owner.
- 2. The Contractor shall be responsible for sampling and characterizing surplus excavated material for the purpose of obtaining approvals from the disposal/recycling facility(ies). The Contractor shall provide the Engineer with a minimum of 2 days' notice prior to sampling and shall not sample unless Engineer's approval is received and the Engineer is present to witness the collection of the samples.

- a. The Contractor shall perform all sampling and analysis of stockpiled surplus excavated material as required by potential receiving facilities and this Section.
 - b. The Contractor shall collect additional samples to perform additional testing of the surplus excavated material as required by the disposal/recycling facility(ies) at no additional cost to the Owner.
3. The collected samples shall be submitted, at a minimum, for the chemical analyses in the following Table.

Chemical Analysis	EPA Method
Total Petroleum Hydrocarbons (TPH)	8100 – Modified
Semi-Volatile Organic Compounds (SVOCs)	8270
Volatile Organic Compounds (VOCs)	8260
Polychlorinated Biphenyls (PCBs)	8082
MCP 14 Metals ¹	6010 and 7471
Reactive Cyanide and Sulfide	SW-846
Ignitability	1010
Corrosivity	9045
Conductivity	120.1

Notes:

1. MCP 14 Metals include antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc.

4. Any samples found to contain contaminant concentrations equal to or greater than “20 times” their hazardous waste toxicity threshold (i.e., the 20-times rule) shall be analyzed for toxicity characteristic leaching procedure (TCLP).
5. Submit a copy of all chemical analyses and a tabulated summary of the data in Microsoft Excel format to the Engineer within 2 days of receipt of the laboratory report, per Paragraph 1.03.C of this Section.
6. Take samples in such a manner as not to cause any cross-contamination. All sampling equipment shall be decontaminated between usage.
7. All analyses shall be performed by a laboratory certified for such analyses by the Commonwealth of Massachusetts.
8. The Engineer may stop the Contractor’s work in a particular location at any time in order to have samples taken and analyzed. If necessary, the Contractor shall assist the Engineer in collecting samples. The work shall not resume in that area until authorized by the Engineer. Stoppage of work for this reason, or until laboratory

results are delivered to the Engineer, shall not be a cause for the Contractor to request additional compensation or an extension of time to the Contract or to other intermediate Contract deadlines.

3.03 TEMPORARY STOCKPILING OF SURPLUS EXCAVATED MATERIALS:

- A. The Contractor shall be allowed to stockpile surplus excavated material on-site pending approval/manifests for transport and disposal or reuse if the following conditions are met:
 - 1. The stockpiled impacted material must be removed off-site as soon as possible and in all cases within 90 days from the day of its initial excavation for hazardous waste and 120 days for non-hazardous waste (hazardous waste as defined in 310 CMR 30.0000 and RCRA).
 - 2. The stockpiled impacted material shall be placed on 10-mil (minimum) polyethylene sheeting and covered with 10-mil (minimum) polyethylene sheeting or 10-mil nylon sheeting. The cover shall be secured such that it is not blown off by wind. The Contractor shall immediately cover any stockpile where the cover has been blown off by wind or is uncovered for any reason at no additional cost to the Owner.
 - 3. The polyethylene sheeting shall be bermed around the edges to prevent any infiltration of stormwater or exfiltration of leachate.
 - 4. The base of the temporary stockpile shall be sloped to create leachate collection points. Collect and appropriately dispose of leachate generated from the stockpiles.
- B. If any one of these conditions cannot be met, then the Contractor shall store impacted material in water-tight containers at no additional cost to the Owner pending transportation and disposal. The containers must be removed off site within 90 days from the first day of excavation/generation for hazardous waste and 120 days for non-hazardous waste.
- C. All surplus excavated material shall be stored in a secure manner to prevent exposure to humans and the environment.
- D. The stockpiling or consolidating of surplus excavated material near sensitive human health receptors such as public and private water supply wells or sensitive environmental receptors such as wetlands, surface water bodies, or marine environments shall be prohibited.
- E. Disposal of material that is contaminated as a result of careless handling or use of unauthorized procedures shall be disposed of off-Site at the Contractors expense. Delays of Work resulting from temporary storage of surplus excavated material, regardless of the

classification, shall be at no additional cost to the Owner.

- F. Surplus excavated material shall be disposed/recycled off-Site per this Section within 90-days of initial excavation.
- G. The Contractor shall segregate surplus excavated material into stockpiles no greater than 200-cubic yards. The Contractor shall collect the necessary samples of stockpile material at that time for classification and after giving Engineer at least two (2) days' notice of sampling. After the initial classification of the stockpile, the Engineer may require the Contractor to segregate stockpiled surplus excavated material into smaller, separate stockpiles for additional sampling to further classify the surplus excavated material.
- H. The stockpiles shall be clearly labeled and securely barricaded from contact by workers and the general public.

3.04 EXCAVATED MATERIAL CATEGORIES:

Material shall be categorized and managed as described in Paragraphs 3.01 through 3.09. Based on the analytical results from the disposal characterization sampling, the excavated material will be categorized as follows:

- A. Group A-1 – excavated soil with contaminant concentrations less than MCP Reportable Concentrations (RCs) S-1 (RCS-1) Standard that meet the typical acceptance criteria for reuse at an in-state RCS-1 soil reclamation or similar soils reuse facility.
 - 1. Group A-1 material may be reused on-site where applicable and in accordance with Section 31 00 00 – EARTHWORK or otherwise appropriately disposed of off-site in accordance with all local, state, and federal regulations and the requirements of this Section. The transportation and disposal of surplus Group A-1 material shall be at no additional cost to the Owner.
 - 2. The Contractor shall handle and transport soil classified as Group A-1 materials using a Material Shipping Record (MSR).
 - 3. Group A-1 surplus excavated materials identified/approved by the Engineer for reuse off-site must be done so in accordance with Massachusetts DEP's Similar Soils Provision Guidance (WSC-13-500) and all relevant Federal, State and local regulations and approvals.
 - 4. Contractor shall note only reuse facilities with a written Soil Management Plan and operating in compliance with an approved Administrative Consent Order (ACO) issued from DEP will be permitted for use during the work of this Contract.

5. Remove rubble, metal, wood, plastic, and other debris materials in soils as necessary, via screening or other suitable means and methods for on-site reuse purposes as Common Borrow (per Section 31 00 00), or to meet acceptance criteria for the selected re-use facility. Dispose of screened/removed solid waste debris material including, but not limited to, rubble, metal, lumber, and plastic, be in accordance with these Specifications and all applicable local, State, and Federal regulations.
- B. Group A-2 – excavated soil with contaminant concentrations less than MCP Reportable Concentrations (RCs) S-2 (RCS-2) Standard that meet the typical acceptance criteria for reuse at an in-state RCS-2 soil reclamation or similar soils reuse facility.
1. Group A-2 material may be reused on-site where applicable and in accordance with Section 31 00 00 – EARTHWORK or otherwise appropriately disposed of off-site in accordance with all local, state, and federal regulations and the requirements of this Section. The transportation and disposal of surplus Group A-2 material shall be at no additional cost to the Owner.
 2. The Contractor shall handle and transport soil classified as Group A-1 materials using a Material Shipping Record (MSR).
 3. Group A-2 surplus excavated materials identified/approved by the Engineer for reuse off-site must be done so in accordance with Massachusetts DEP's Similar Soils Provision Guidance (WSC-13-500) and all relevant Federal, State and local regulations and approvals.
 4. Contractor shall note only reuse facilities with a written Soil Management Plan and operating in compliance with an approved Administrative Consent Order (ACO) issued from DEP will be permitted for use during the work of this Contract.
 5. Remove rubble, metal, wood, plastic, and other debris materials in soils as necessary, via screening or other suitable means and methods for on-site reuse purposes as Common Borrow (per Section 31 00 00), or to meet acceptance criteria for the selected re-use facility. Dispose of screened/removed solid waste debris material including, but not limited to, rubble, metal, lumber, and plastic, be in accordance with these Specifications and all applicable local, State, and Federal regulations.

- C. Group B-1 - surplus excavated material with contaminant concentrations greater than or equal to RCS-1 and/or typical soil reclamation facility reuse criteria that meets the acceptance criteria for reuse at in-state unlined/lined landfill:
1. The Contractor shall handle and transport Group B-1 material using Bills of Lading. The Contractor shall submit the names and addresses of the proposed landfills or facilities, as required by the EMMP, to the Engineer and Owner for review and approval prior to transportation of Group B material.
 2. Group B-1 material shipped to a disposal/recycling facility must meet the selected facility's chemical and physical acceptance criteria. Selected facilities must be established, fully operational, appropriately insured, and be operating in compliance with all applicable local, State, and Federal regulations.
 3. Group B-1 surplus excavated material that meets the Massachusetts solid and hazardous waste regulations and the receiving facility's operating permit(s) may be used for daily cover, intermediate cover, and pre-cap contouring material.
 4. Group B-1 surplus excavated material that meets the Massachusetts criteria for recycling or thermal desorption and the receiving facility's operating permit(s) may be transported to the selected facility given the selected facility must be established, fully operational, appropriately insured, and be operating in compliance with all applicable local, State, and Federal regulations.
 5. Group B-1 surplus excavated material that meets the criteria for out-of-state landfilling, recycling or thermal desorption, and meets the receiving facility's operating permit(s) may be transported to the selected facility given the selected facility must be established, fully operational, appropriately insured, and be operating in compliance with all applicable local, State, and Federal regulations.
 6. Remove rubble, metal, wood, plastic, and other debris materials as necessary, via screening or other suitable means and methods, to meet acceptance criteria for the selected facility. Dispose of screened/removed solid waste debris material including, but not limited to, rubble, metal, lumber, and plastic, be in accordance with these Specifications and all applicable local, State, and Federal regulations.
- D. Group B-3 - surplus excavated material with contaminant concentrations greater than or equal to RCS-1 and/or typical soil reclamation facility reuse criteria that meets the acceptance criteria for disposal/recycling at an asphalt batching, thermal treatment, or out-of-state landfill:

1. The Contractor shall handle and transport Group B-3 material using Bills of Lading. The Contractor shall submit the names and addresses of the proposed landfills or facilities, as required by the EMMP, to the Engineer and Owner for review and approval prior to transportation of Group B material.
2. Group B-3 material shipped to a disposal/recycling facility must meet the selected facility's chemical and physical acceptance criteria. Selected facilities must be established, fully operational, appropriately insured, and be operating in compliance with all applicable local, State, and Federal regulations.
3. Group B-3 surplus excavated material that meets the Massachusetts solid and hazardous waste regulations and the receiving facility's operating permit(s) may be used for daily cover, intermediate cover, and pre-cap contouring material.
4. Group B-3 surplus excavated material that meets the Massachusetts criteria for recycling or thermal desorption and the receiving facility's operating permit(s) may be transported to the selected facility given the selected facility must be established, fully operational, appropriately insured, and be operating in compliance with all applicable local, State, and Federal regulations.
5. Group B-3 surplus excavated material that meets the criteria for out-of-state landfilling, recycling or thermal desorption, and meets the receiving facility's operating permit(s) may be transported to the selected facility given the selected facility must be established, fully operational, appropriately insured, and be operating in compliance with all applicable local, State, and Federal regulations.
6. Remove rubble, metal, wood, plastic, and other debris materials as necessary, via screening or other suitable means and methods, to meet acceptance criteria for the selected facility. Dispose of screened/removed solid waste debris material including, but not limited to, rubble, metal, lumber, and plastic, be in accordance with these Specifications and all applicable local, State, and Federal regulations.

3.05 WEIGHT AND MEASUREMENT:

- A. The tare and gross weight for every vehicle, container, and trailer transporting soil and/or debris for off-Site reuse, recycling, treatment or disposal shall be measured to determine the net weight.
- B. The Contractor shall provide certified tare and gross weight slips for each load received at the accepted facility and these shall be attached to each returned Massachusetts manifests or Bill of Ladings within 21 days of obtaining final signatures.

3.06 WASTE PROFILES AND MANIFESTS:

11/01/2024

HANDLING, TRANSPORTATION, REUSE AND
OFF-SITE DISPOSAL OF EXCAVATED MATERIAL
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- A. The Contractor shall prepare and submit to the Engineer for review all waste profile applications and questionnaires, and coordinate with disposal facilities and all Federal and State Environmental Agencies.
- B. The Contractor shall prepare all Bills of Lading, and material shipping records with all applicable analytical backup, notification, and control forms. Final copies of Bills of Lading shall be signed by the Owner as generator and by the Engineer as LSP of record following submissions and approvals of draft Bills of Lading.
- C. The Contractor shall also provide certified tare and gross weight slips for each load received at the designated facility which shall be attached to each returned Massachusetts manifests or Bill of Ladings within 21 days of obtaining final signatures.
- D. The Owner will be designated as generator and will sign all manifests and waste profile application or questionnaires.
- E. The Contractor shall submit to the Engineer, prior to receiving progress payment, documentation certifying that all materials were transported to, accepted, and disposed of, at the selected disposal facility(ies). The documentation shall include the following, as a minimum.
 - 1. Documentation shall be provided for each load from the Site to the disposal facility, including all manifests and any other transfer documentation as applicable.
 - 2. All documentation for each load shall be tracked by the original manifest document number that was assigned by the Engineer at the Site.
 - 3. All ORIGINAL signatures (including signatures of Owner and disposal facility's representative) associated with shipment of any material from the Site under a Massachusetts Bill of Lading within 21 days of obtaining the final signatures.

3.07 TRANSPORT OF SURPLUS EXCAVATED MATERIAL:

- A. The Contractor shall not be permitted to transport surplus excavated materials off-site until all applicable disposal, or recycling facility documentation has been received, reviewed, and approved by the Engineer. The Contractor shall transport the surplus excavated material under a Massachusetts Bill of Lading, Material Shipping Record, or Hazardous Waste Manifest and the requirements of this Section.
- B. The Contractor shall take all precaution and any actions necessary, at no additional cost to the Owner, to prevent cross-contamination from transport vehicles to areas outside the

site. The Contractor shall decontaminate equipment and vehicles as specified in Section 01 35 29 – HEALTH AND SAFETY PLAN.

- C. The Contractor shall transport surplus excavated materials from the Site to the storage, disposal, reuse or recycling facility or off-Site reuse location in accordance with all USDOT, USEPA, Massachusetts Department of Environmental Protection (MassDEP), and applicable State and local regulations.
- D. The Hauler(s) shall be licensed in all states affected by transport.
- E. The Contractor shall be responsible for ensuring that free liquid is properly transported. “Wet soils” shall not be loaded for transport. The Contractor shall dewater “wet soils”, and properly dispose of free liquid in accordance with local, State, and Federal regulations and at no additional cost to the Owner. The Contractor shall also dispose of any free liquids that may result during transportation in accordance with local, State, and Federal regulations and at no additional cost to the Owner.
- F. Temporary stockpiled surplus excavated material must be removed from the Site within 90 days; however, no later than the completion date of this Contract as may be extended.
- G. Transporters shall submit proof of permit, license, or authorization to transport surplus excavated material, when applicable, in all affected states.
- H. A LSP Opinion from the Owner’s LSP shall be required for all material shipped using a Massachusetts Bill of Lading.
- I. Utilization of a Hazardous Waste Manifest shall require the use of a licensed hazardous material transporter in conformance with the Massachusetts Hazardous Material Regulations as required by 310 CMR 30.000. An LSP Opinion is not required when using a Hazardous Waste Manifest for transporting surplus excavated materials.

3.08 DISPOSAL AND RECYCLING:

- A. Surplus excavated material shall be disposed of at an approved facility as specified in Paragraph 3.04 of this Section and in accordance with all local, State, and Federal regulations.
- B. The Contractor shall remove rubble, metal, wood, plastic, and other debris materials in soils as necessary, via screening or other suitable means and methods, to meet acceptance criteria for the selected disposal/re-use facility.
- C. The Contractor shall perform analyses on surplus excavated material as necessary to fulfill any disposal testing requirements of the approved facility.

1. The Contractor shall bear all costs incurred in sampling and analyses for those tests required by the facility in excess of those specified in this Section.
 2. The Contractor shall submit a copy of all sampling analyses to the Engineer within two (2) days of receipt of the laboratory report. Analytical data shall be kept confidential, distributed to the Engineer only.
- D. The Contractor shall provide to the Engineer copies of all weight slips; both tare and gross, for every load weighed and disposed of at the approved facility. The slips shall be tracked by the original manifest document number that was assigned by the Engineer at the Site. The Engineer shall make progress payments after receipt of these weight slips.

3.09 LOGS, REPORTS, AND RECORDKEEPING:

- A. The Contractor shall maintain daily logs and reports covering the work to be performed for this Section of the Contract. The format shall be developed by the Contractor to include daily logs, weekly reports, and a phase out report. The Contractor shall provide Engineer with copies of all logs and reports on a weekly basis in a Microsoft Excel spreadsheet format.
- B. Weekly Reports shall include, at a minimum, the following:
1. A summary of the work performed during the week.
 2. Area (Site specific) of work being performed.
 3. Equipment being utilized by employees.
 4. Type of work performed.
 5. References to material shipping records, manifests, bills of lading, and waste profiles.
 6. Stockpile locations, sample locations, and sample identifications.
 7. Details and documentation of surplus excavated materials management including surplus excavated material from stockpiles to be used as backfill.
 8. Protective clothing being worn by employees.
 9. Project manager signature and date.
- C. Phase Out Report shall include, at a minimum, the following:
1. Summary of work performed under this Section of the Contract.
 2. Copies of all material shipping records, manifests, bills of lading, and waste profiles.

END OF SECTION

SECTION 03 05 00

FIELD CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers concrete and all related items necessary to place and finish the concrete work.
- B. Concrete thrust, and anchor blocks, to be provided at all water main bends, tees, plugs and wyes and at other locations required by the Engineer shall be installed in accordance with the details shown on the drawings and as specified in this section.
- C. Concrete for curb backing and setting shall be installed in accordance with the details shown on the drawings and as specified in this section.
- D. Concrete for footings and site improvements is described in Section 03 30 00 – CAST-IN-PLACE CONCRETE.
- E. Concrete for pavements is described in Section 32 13 13 – PORTLAND CEMENT CONCRETE PAVEMENT.

1.02 RELATED WORK:

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE
- B. Section 31 00 00, EARTHWORK
- C. Section 32 13 13, PORTLAND CEMENT CONCRETE PAVEMENT
- D. Section 32 16 00, CURBING

1.03 REFERENCES:

- A. The following standards form a part of this specification:

American Concrete Institute (ACI)

ACI 304	Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
ACI 305	Recommended Practice for Hot Weather Concreting
ACI 306	Recommended Practice for Cold Weather Concreting

ACI SP-66 ACI Detailing Manual

ACI 318 Building Code Requirements for Reinforced Concrete

ASTM International (ASTM)

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

ASTM C33 Concrete Aggregates

ASTM C94 Ready-Mixed Concrete

ASTM C143 Test for Slump of Portland Cement Concrete

ASTM C150 Portland Cement

ASTM C260 Air Entraining Admixtures for Concrete

ASTM C494 Chemical Admixtures for Concrete

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23
SUBMITTALS, SUBMIT THE FOLLOWING:

Statement of materials constituting the design of mixes for each size aggregate as required by ASTM C94 shall be submitted to the Engineer within one week following award of the Contract.

PART 2 - PRODUCTS

2.01 CONCRETE:

- A. All underground placed concrete, reinforced or non-reinforced, shall have a 28 day compressive strength of 3,000 psi unless otherwise noted on the design drawings. A minimum of 5.5 sacks of cement per cubic yard and a maximum water cement ratio of 6.9 gallons per sack shall be used.
- B. Concrete shall conform to ASTM C94. The Contractor shall be responsible for the design of the concrete mixtures. Slump shall be a maximum of 4-inches and a minimum of 2-inches, determined in accordance with ASTM C143.
- C. Admixtures shall be as specified in subsection 2.05. No additional admixtures shall be used unless approved by the Engineer.
- D. No additional water, except for the amount indicated by the design mix shall be added to the concrete without the prior permission of the Engineer.

2.02 REINFORCING:

Reinforcing as shown on the plans or as required by the Engineer, shall conform to ACI 318 and ASTM A615 and shall be detailed in accordance with ACI SP-66. All Steel reinforcing bars shall be grade 60.

2.03 CEMENT:

The cement shall be an approved brand of American manufactured Portland Cement, Type II conforming to the applicable requirements of ASTM C150.

2.04 AGGREGATES

- A. Except as otherwise noted, the aggregate shall conform to the requirements of ASTM C33.
- B. Maximum size aggregate shall be 3/4-inch.

2.05 ADMIXTURES:

- A. All concrete (unless otherwise directed) shall contain an air entraining agent. Air entrained concrete shall have air content by volume of 4 to 8 percent for 3/4-inch aggregate.
- B. Air entraining agent shall be in accordance with ASTM C260 and shall be Darex AEA, as manufactured by W.R. Grace & Company; Placewel (air entraining Type), as manufactured by Johns Manville; Sika AER as manufactured by Sika Chemical Company; or an approved equal product.
- C. Water reducing agent shall be WRDA, manufactured by W.R. Grace & Company; Placewel (non-air entraining Type), as manufactured by Johns Manville; Sika Plastiment as manufactured by Sika Chemical Company; or an approved equal product.
- D. Water reducing agent-retarder shall be "Daratard," manufactured by W.R. Grace & Company; Sika Plastiment as manufactured by Sika Chemical Company; or an approved equal product.

2.06 WATER:

- A. Water for concrete shall be potable, free of deleterious amounts of oil, acid, alkali, organic matter and other deleterious substances.

2.07 CONCRETE FORMS:

- A. Forms for exterior surfaces which will be exposed to view after the work is completed, whether such surfaces are painted or unpainted, shall be new plywood stock, steel, tempered masonite, or other materials which will provide smooth concrete surfaces without subsequent surface plastering. Plastic or plastic-faced forms shall not be used, except with the prior approval of the Engineer.
- B. Form ties shall be cone type or equal, with waterstop, which leaves no metal closer than 2-inches to finished face of concrete.
- C. Form release agent shall be a non-staining, non-yellowing, non-toxic liquid free from kerosene and resins of the type recommended by the manufacturer of the forming system being used such as EZ strip by L&M Construction Chemicals, Omaha, NB and "Magic Kote" by Symons Corp., Des Plaines, IL or approved equal.
- D. Where steel adjacent to vertical faces of forms cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to the finish vertical faces of the concrete

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint or the material which would tend to reduce the bond.
- B. Earth, concrete, masonry, or other water permeable material against which concrete is to be placed shall be thoroughly saturated with water immediately before concrete is placed.
- C. No concrete shall be placed until the consolidation of the ground and the arrangement and details of forms and reinforcing have been inspected and approved by the Engineer.

3.02 THRUST AND ANCHOR BLOCKS:

- A. Minimum bearing areas for thrust blocks and dimensions of anchor blocks shall be as shown on the drawings.
- B. Concrete for thrust and anchor blocks shall be placed against undisturbed earth, and wooden side forms shall be used to provide satisfactory lines and dimensions. Felt roofing paper shall be placed to protect joints. No concrete shall be placed so as to cover joints, bolts or nuts, or to interfere with the removal of the joints.

3.03 FILL CONCRETE:

- A. Fill concrete shall be placed in those locations as indicated on the design drawings. Fill concrete shall consist of materials as previously specified, with a minimum 28-day compressive strength of 3000 psi.
- B. Before fill concrete is placed, the following procedures shall be used to prepare surfaces; all dirt, scum and laitance shall be removed by chipping and washing. The clean, roughened base surface shall be saturated with water, but shall have no free water on the surface. A coat of 1:2 cement-sand grout, approximately 1/8-inch thick, shall be well scrubbed into the thoroughly dampened concrete base. The concrete fill shall be placed immediately, before the grout has dried or set.
- C. Fill concrete shall be brought to lines and grades as shown on the design drawings.

3.04 CONCRETE PLACING DURING COLD WEATHER:

- A. Concrete shall not be placed on frozen ground, and no frozen material or material containing ice shall be used. Materials for concrete shall be heated when temperature is below 40°F, or is expected to fall to below 40°F, within 73 hours, and the concrete after placing shall be protected by covering, heat, or both.
- B. All details of Contractor's handling and protecting of concrete during freezing weather shall be subject to the approval of the Engineer. All procedures shall be in accordance with the provisions of ACI 306.

3.05 CONCRETE PLACING DURING HOT WEATHER:

- A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. The Contractor shall make every effort to minimize delays, which will result in excessive mixing of the concrete after arrival on the job.
- B. During periods of excessively hot weather (90°F or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 90°F, when ready for placement, will not be acceptable, and will be rejected.

3.06 FIELD QUALITY CONTROL:

- A. Concrete inspection and testing shall be performed by the Engineer or by an inspection laboratory, designated by the Engineer, engaged and paid for by the Owner. Testing equipment shall be supplied by the laboratory, and the preparation of samples and all testing shall be performed by the laboratory personnel. Full assistance and cooperation, concrete for samples, and such auxiliary personnel and equipment as needed shall be provided by the Contractor.

- B. At least 4 standard compression test cylinders shall be made and tested and 1 slump test from each day's placement of concrete. A minimum of four compression test cylinders shall be made and tested for each 100 cubic yards of each type and design strength of concrete placed. One cylinder shall be tested at 7 days, and two at 28 days. The fourth cylinder from each set shall be kept until the 28 day test report on the second and third cylinders in the same set has been received. If the average compressive strength of the two 28 day cylinders does not achieve the required level, the Engineer may elect to test the fourth cylinder immediately or test it after 56 days. If job experience indicates additional cylinder tests or other tests are required for proper control or determination of concrete quality, such tests shall be made.
- C. The Engineer shall have the right to reject concrete represented by low strength tests. Rejected concrete shall be promptly removed and replaced with concrete conforming to the specification. The decision of the Engineer as to whether substandard concrete is to be accepted or rejected shall be final.

END OF SECTION

SECTION 03 11 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

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

1.02 DESCRIPTION OF WORK:

- A. This section of the specifications covers the furnishing and installation of forms for cast-in-place concrete.

1.03 RELATED WORK:

- A. SECTION 03 21 00 – CONCRETE REINFORCEMENT.
- B. SECTION 03 30 00 – CAST-IN-PLACE CONCRETE.

1.04 REFERENCES:

The following standards form a part of this specification:

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301 Standard Specifications for Structural Concrete

ACI 347 Recommended Practices for Concrete Formwork

U.S. ARMY CORPS OF ENGINEERS (CE)

CE 03300 Cast-in-Place Concrete

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Forms for exterior and interior surfaces which will be exposed to view after the work is completed, whether such surfaces are painted or unpainted, shall be new plywood stock, steel, tempered masonite, or other materials which will provide smooth concrete surfaces

11/01/2024

CONCRETE FORMWORK

03 11 00-1

without subsequent surface plastering. Plastic or plastic-faced forms shall not be used, except with the prior approval of the Engineer.

- B. Form ties shall be cone type or equal, with waterstop, which leaves no metal closer than 2-inches to finished face of concrete.
- C. Form release agent shall be a non-staining, non-yellowing, non-toxic liquid free from kerosene and resins of the type recommended by the manufacturer of the forming system being used such as EZ strip by L&M Construction Chemicals, Omaha, NB and "Magic Kote" by Symons Corp., Des Plaines, IL or approved equal.
- D. Where steel adjacent to vertical faces of forms cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to the finish vertical faces of the concrete.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Surfaces of forms to be in contact with concrete shall be greased with nonstaining form release compound. Wetting will not be accepted as a substitute. Approval of the Engineer shall be obtained before use of coated materials or liners in lieu of form release compound, except as modified herein.

3.02 CONSTRUCTION:

- A. For concrete surfaces which will be visible after completion of the structure, painted or unpainted, the type and the precise location of form ties, nails joints between form members, and any other features which will leave a visible trace in the finished concrete, will be subject to the approval of the Engineer.
- B. Formwork shall be so constructed, braced, or tied that the formed surfaces of the concrete will be perfectly true, smooth, and to the dimensions shown on the drawings. All forms used for circular sections shall be true arcs as indicated on the drawings. Short chords will not be acceptable. Form line shall present an uninterrupted surface conforming to radii indicated on the drawings.
- C. Forms shall be sufficiently tight to prevent leakage of mortar, and when necessary shall have temporary openings as required for thorough cleaning, and as required for introduction of concrete to avoid excessive free fall. Panels damaged in stripping or otherwise shall not be reused.
- D. Unless otherwise noted on the design drawings, forms shall be filleted and chamfered at all sharp corners, and exposed edges with a 3/4-inch chamfer. Chamfer shall not be used where masonry or other material will subsequently be installed flush with one of the

adjacent surfaces of the concrete. Where a wash or slope is indicated on the drawings no additional chamfer is required.

3.03 REMOVAL OF FORMS

- A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 30 percent of the ultimate strength prescribed by the design and not before reaching the following number of day-degrees [whichever is the longer]:

<u>Forms for</u>	<u>Day-Degree*</u>
Beams and Slabs	500
Walls and vertical surfaces	200

* Day-Degree: Total number of days times average daily air temperature at surface of concrete. For example, 5 days at a daily weighted average temperature of 60 deg F equals 300 day-degrees. Temperatures below 50 deg F are not to be considered in determining Day-Degree.

- B. Where beams, girder, columns, walls and similar vertical forms are adequately supported on shores, the side forms may be removed after 24 hours of cumulative curing time provided the side forms support no loads other than the lateral pressure of the plastic concrete. Cumulative curing time represents the sum of time intervals, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50 deg. F in accordance with American Concrete Institute standards.
- C. Shoring shall not be removed until the concrete has attained at least 70 percent of the specified strength and sufficient strength to support safely its own weight and the construction live loads upon it.
- D. Forms shall be removed in such a manner as not to impair safety and serviceability of the structure. Concrete exposed by form removal shall have sufficient strength not to be damaged by the removal operation.

END OF SECTION

SECTION 03 21 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

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

1.02 DESCRIPTION OF WORK:

- A. This section of the specification covers the furnishing and installation of reinforcement for cast-in-place concrete.

1.03 RELATED WORK:

- A. SECTION 03 11 00 – CONCRETE FORMWORK.
- B. SECTION 03 30 00 – CAST-IN-PLACE CONCRETE.

1.04 SYSTEM DESCRIPTION:

- A. Materials and construction shall conform to ACI 318 and ACI 350 unless otherwise noted on the design drawings or modified herein.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. The Contractor shall furnish the Owner's Representative with complete checked, reinforcing steel shop drawings and bar lists. Shop drawing shall include the grade of steel used as well as splice lengths.
- B. Mill test reports shall accompany drawings. Fabrication shall not commence until the drawings and mill test reports have been released by the Owner's Representative.
- C. When fiber reinforcement is used, the Contractor shall submit manufacturer's data confirming that material meets the specification.

1.06 REFERENCES:

- A. The following standards form a part of these specifications:

American Concrete Institute (ACI)

- ACI 318 Building Code Requirements for Concrete
- ACI 347 Recommended Practice for Concrete Formwork
- ACI 350 Environmental Engineering Concrete Structures
- ACI SP-66 ACI Detailing Manual

ASTM International (ASTM)

- ASTM A185 Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
- ASTM A497 Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
- ASTM A615 Deformed Billet-Steel Bars for Concrete Reinforcement
- ASTM A775 Epoxy-coated Reinforcing Steel Bars
- ASTM A884 Epoxy-coated Welded Wire Fabric

American Welding Society (AWS)

- AWS 12.1 Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Steel reinforcing bars shall conform to ASTM A615, Grade 60, and A775 if epoxy-coated bars are specified.
- B. Welded steel wire fabric shall conform to ASTM A185 or ASTM A497 and ASTM A884 if epoxy-coated fabric is specified. Gauge and spacing of wires shall be as indicated on the drawings.
- C. Reinforcing steel shall be detailed in accordance with ACI SP-66 modified as applicable to conform to ACI 350.

CONCRETE REINFORCEMENT

- D. Reinforcement shall be accurately formed to the dimensions indicated on the drawings. Bars shall be shipped to the site with bars of the same size and shape, fastened in bundles with securely wired-on metal identification tags listing both size and mark.
- E. Any bar showing cracks after bending shall be discarded.
- F. Steel failing to meet the requirements of this specification or the drawings will be rejected and shall be removed from the site immediately.

2.02 FIBER REINFORCEMENT

- A. When called for on the drawings, concrete engineered reinforcing fibers shall be polypropylene, collated, fibrillated fibers from Fibermesh Co., 4019 Industry Drive, Chattanooga, TN; Forta Corporation, One Hundred Forta Drive, Grove City, PA; or approved equal. Only fibers designed and manufactured specifically for use in concrete from virgin polypropylene and so certified by the manufacturer shall be acceptable.

PART 3 - EXECUTION

3.01 STEEL INSTALLATION:

- A. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust scale, dirt, and other coatings (including ice), that reduce or destroy bond. When there is a delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned as necessary.
- B. After forms have been oiled, but before concrete is placed, all steel shall be securely wired in the exact position called for and shall be maintained in that position until all concrete is placed and compacted. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Owner's Representative.
- C. Concrete blocks having a minimum bearing area of 2-inches by 2-inches and equal in quality to that specified for the slab, shall be used for supporting reinforcing bars for slabs on grade. Wood blocks, stones, brick chips, etc., shall not be used to support reinforcement.
- D. Metal supports shall be of types that will not penetrate the surface of formwork or slab, and which will not show through or stain surfaces that are to be exposed to view, painted or unpainted.
- E. Welding of reinforcing bars will be permitted only where permission of the Owner's Representative has been obtained in advance. Such welding shall be performed only under conditions established by the Owner's Representative, and in accordance with AWS 12.1.

CONCRETE REINFORCEMENT

- F. Reinforcement, which is to be exposed for a considerable length of time after having been placed, shall be painted with a heavy coat of cement grout, if required by the Owner's Representative.

3.02 FIBER INSTALLATION:

- A. Fibermesh fibers shall be used in concrete as indicated on the drawings or as specified and in strict accordance with the manufacturer's recommendations as to type and amount. The fiber manufacturer or approved distributor shall provide the services of a qualified employee for pre-job meeting and initial job start up.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers all concrete and all related items necessary to place and finish the concrete work.

1.02 RELATED WORK:

- A. SECTION 03 11 00 – CONCRETE FORMWORK.
- B. SECTION 03 21 00 – CONCRETE REINFORCEMENT.
- C. SECTION 32 13 13– PORTLAND CEMENT CONCRETE PAVEMENT.
- D. Items furnished under other Sections and installed under this Section include, but are not limited to:

Items embedded in concrete, including anchors, sleeves, floor drains, castings, frames for hatches, angles, nosings, and other miscellaneous metals.

1.03 REFERENCES:

- A. The following standards form a part of these specifications:

American Concrete Institute (ACI)

ACI	301	Structural Concrete for Buildings
ACI	302	Recommended Practice for Concrete Floor and Slab Construction
ACI	304	Recommended Practice for Measuring, Mixing, Transporting, and Replacing Concrete
ACI	305	Recommended Practice for Hot Weather Concreting
ACI	306	Recommended Practice for Cold Weather Concreting
ACI	318	Building Code Requirements for Reinforced Concrete
ACI	347	Recommended Practice for Concrete Formwork

ACI 350 Code Requirements for Environmental Engineering Concrete Structures

ASTM International (ASTM)

ASTM	C33	Concrete Aggregates
ASTM	C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM	C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM	C87	Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
ASTM	C94	Ready-Mixed Concrete
ASTM	C143	Standard Method for Slumps of Portland Cement Concrete
ASTM	C150	Portland Cement
ASTM	C171	Sheet Materials for Curing Concrete
ASTM	C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM	C260	Air-Entraining Admixtures for Concrete
ASTM	C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM	C494	Chemical Admixtures for Concrete
ASTM	D1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM	D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Shop drawings of the materials specified herein.
- B. Statement of materials constituting the design of mixes which satisfy the specified strength for each size aggregate as required by ASTM C94 shall be submitted to the Owner's Representative within one week following award of the contract.

- C. Provide one copy of the "Certificate of Delivery" for each load of concrete as it arrives on the site, under the provisions of ASTM C94.

PART 2 - PRODUCTS

2.01 CONCRETE:

- A. Concrete conforming to the requirements listed below shall be used where indicated on the drawings. Unless otherwise indicated, concrete used as fill under foundations, and elsewhere approved by the Owner's Representative, shall be the 3,000 psi mix.

TABLE

Minimum Comp. Strength at 28 days (psi)	Maximum Water/Cement ratio (gallons per bag of cement)*	Cement Factor: 94 lb. Bags per cubic yard minimum**
3000	0.59 (6.9)	5.5
4000	0.48 (5.6)	6.5
5000	0.40 (4.7)	7.4

* Based on air-entrained concrete. If non-air-entrained concrete is called for, the listed maximum water/cement ratios may be increased slightly, as approved by the Owner's Representative. The water is the total water in the mix, including free water on the aggregate.

** These are minimum amounts; increase as necessary to meet mix requirements.

- B. Concrete shall conform to ASTM C94. One copy of the Certificate of Delivery required by ASTM C94 shall be delivered to the Owner's Representative immediately upon arrival of each load of concrete at the site. The Contractor shall be responsible for the design of the concrete mixtures.
- C. Standard compression tests of all proposed mixes shall be made by the testing laboratory or other satisfactory evidence shall be presented that the design mixes will attain the minimum strengths listed on the design drawings or called for herein, within the limitations of the ACI Code. No concrete shall be delivered to the job site until the Owner's Representative has approved the design mixes.
- D. All concrete (unless otherwise directed) shall contain an air-entraining agent. Air entrained concrete shall have an air content by volume of 3 to 6 percent for 1-1/2-inch aggregate and 4 to 8 percent for 3/4-inch aggregate. The air content shall be the responsibility of the testing laboratory and in accordance with ASTM C231.

- E. All concrete shall contain a mid-range water reducer to minimize cement and water content of the mix, at the specified slump, in accordance with ASTM C494.
- F. Slump for all concrete shall be from 3-inch to 4-inch, except for concrete using a superplasticizer, when the maximum slump shall be 8-inches. Any concrete having a slump greater than 4-inches (8-inches with superplasticizer) shall be promptly removed from the site.
- G. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixture other than those specified shall be used in concrete without the specific written permission of the Owner's Representative in each case.
- H. No additional water, except for the amount indicated by the design mix shall be added to the concrete without the prior permission of the Owner's Representative.

2.02 CEMENT:

- A. The cement shall be an approved brand of American manufactured Portland Cement, Type IIA conforming to ASTM C150. The brand name and type of cement proposed for use shall be submitted to the Owner's Representative for approval immediately following award of contract. Only one color of cement, all of the same manufacture, shall be used for the work.
- B. When the use of high-early-strength Portland cement (Type IIIA) is permitted by the Owner's Representative the same strength requirements shall apply, but the indicated strengths shall be attained in 7 days instead of 28 days.

2.03 ADMIXTURES:

- A. Air entraining agent shall be in accordance with ASTM C260.
- B. Water reducing agent shall be a mid-range water reducer meeting ASTM C494, Type A.
- C. Water reducing agent-retarder shall be in accordance with ASTM C494, Type D.
- D. Superplasticizer agent shall be in accordance with ASTM C494, Type F or Type G and contain no more than 0.1% chloride ions. Product may be plant added or field added based on the best application considering distance, temperature and time.

2.04 AGGREGATES:

- A. Except as otherwise noted, the aggregate shall conform to the requirements of ASTM C33.
- B. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C33.

C. Coarse aggregate shall consist of well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33.

D. The following designated sizes of aggregate shall be the maximum employed in concrete.

2-inch for mass concrete

1½-inch for reinforced sections 18-inch and over in thickness

¾-inch for reinforced and unreinforced sections less than 18-inch thickness.

2.05 WATER:

A. Water for concrete shall be potable, free from injurious amounts of oil, acid, alkali, organic matter and other deleterious substances.

2.06 GROUT:

A. Grout shall be mixed in the proportions of one part Portland Cement to 2 parts sand, by volume. Only sufficient water shall be used to enable grout to barely hold its shape when squeezed into a ball in the hand. Aggregate for grout shall conform to the requirements of the reference specification for concrete. Prior approval of the Owner's Representative shall be obtained for the use of proprietary grouts, and the instructions of the Owner's Representative shall be followed in their use.

2.07 CURING MATERIALS:

A. Curing compound shall be a curing/hardener compound such as Acurion by AntiHydro, Sikaguard Cure/Hard by Sika, Super Diamond Clear by Euclid or approved equal.

B. Curing paper shall be a fiber-reinforced laminated Kraft bituminous product conforming to the requirements of ASTM C171.

2.08 JOINT FILLER:

A. Preformed joint filler strip shall conform to ASTM D1751 or D1752, having a thickness as indicated on the drawings.

B. Fillers shall be provided in pieces of the full thickness required. Use of multiple layers of thin pieces to make-up the full thickness will not be permitted.

2.09 JOINT SEALANT:

A. Joint sealant for construction and control joints shall be a two-part polysulfide base sealant conforming to Thiokol's Building Trade Performance Specification, Class A (self-leveling), Type II (hardness: 35-45 Shore A).

PART 3 - EXECUTION

3.01 GENERAL:

- A. Under no circumstances shall concrete that has set or partially set before placing be used; and no retempering of concrete or grout will be permitted.

3.02 PREPARATION:

- A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint or other material which would tend to reduce the bond.
- B. Unless otherwise indicated, a moisture barrier shall be used under all slabs placed on the ground in accordance with ACI 302.1R. The moisture barrier shall be fungi-resistant and shall have a vapor permeance rating not exceeding 0.01 perms (Perms [grains/ft²*hr.*in. Hg]) per ASTM F1249 or ASTM E96) and 10 mils thickness (49 lbs/MSF). The moisture barrier shall be a high-performance underslab vapor retarder made from polyethylene resins that exceed ASTM E1745, Class A. Sheets shall be lapped 6-inches at joints and sealed with 2-inch wide tape or as recommended by the manufacturer. The vapor barrier should have all laps, seams, penetrations and terminations sealed and should carry across footings.
- C. When no moisture barrier is used, the earth, concrete, masonry, or other water-permeable material against which concrete is to be placed shall be thoroughly saturated with water immediately before concrete is placed. No concrete shall be placed until the consolidation of the ground and the arrangement and details of forms and reinforcing have been inspected and approved by the Owner's Representative.
- D. When joining fresh concrete to concrete which has attained full set, the latter shall be cleaned by chipping and washing off all dirt and scum and laitance. It then shall be moistened prior to placing new concrete.
- E. Concrete surfaces that act as a seat for structural members (other than those resting on grout) shall be troweled to an extremely flat and level surface. If necessary, such surfaces shall be ground off to achieve the required flatness and level.

- F. Fill concrete on top of concrete shall be placed in the locations indicated on the drawings or designated by the Owner's Representative. Before fill concrete is placed, the following procedures shall be used to prepare surfaces; all dirt, scum and laitance shall be removed by chipping and washing. The clean, roughened base surface shall be saturated with water, but shall have no free water on the surface. A coat of 1:2 cement-sand grout, approximately 1/8-inch thick, shall be well scrubbed into the thoroughly dampened concrete base. The concrete fill shall be placed immediately, before the grout has dried or set. Fill concrete shall be brought to the lines and grades shown on the drawings or approved by the Owner's Representative.
- G. Concrete for thrust and anchor blocks shall be placed against undisturbed earth and wooden side forms shall be used to provide satisfactory lines and dimensions. Felt roofing paper shall be placed to protect joints. No concrete shall be placed so as to cover joints, bolts or nuts, or to interfere with the removal of the joints. Minimum bearing areas and dimensions shall be as shown on the drawings.

3.03 MIXING:

- A. Concrete shall be ready-mixed, or transit-mixed, as produced by equipment acceptable to the Owner's Representative. No hand-mixing will be permitted. Adding water in controlled amounts during the mixing cycle shall be done only with the express approval of, and in the presence of the Owner's Representative.
- B. Ready-mix or transit-mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities for the respective conditions as stated on the nameplate. Discharge at the site shall be within 1-1/2 hours after cement was first introduced into the mix. Central mixed concrete shall be plant-mixed a minimum of 1-1/2 minutes per batch and then shall be truck-mixed or agitated a minimum of 8 minutes. Agitation shall begin immediately after the pre-mixed concrete is placed in the truck and shall continue without interruption until discharge. Transit-mixed concrete shall be mixed at mixing speed for at least 10 minutes immediately after charging the truck, followed by agitation without interruption until discharged.
- C. All central plant and rolling stock equipment and methods shall conform to the latest Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready-Mixed Concrete Association, as well as ACI 304 and ASTM C94.
- D. Attention is called to the importance of dispatching trucks from the batching plant so that they shall arrive at the site of the work just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

3.04 INSTALLATION/APPLICATION/ERECTION:

- A. Placing

1. No concrete shall be placed by pumping methods without the prior written approval of the Owner's Representative. Should the Contractor be allowed to place concrete by pumping methods, procedures, mix design of concrete, and all other precautions shall be in accordance with ACI 304.2R and as approved by the Owner's Representative.
2. Concrete shall be placed in alternate areas, as defined by the construction and control joints indicated on the design drawings. A minimum of 3 days shall elapse between placement of adjacent sections.
3. Segregation of the concrete shall be prevented during handling; should any segregation occur, the concrete shall be remixed before it is placed. Concrete shall be placed in the forms in horizontal layers not over 1 to 2 feet thick. Concrete shall not be allowed to drop freely more than 4 feet. If the free drop to the point of placement must exceed 4 feet, the Contractor shall obtain the approval of the Owner's Representative for the proposed method of depositing the concrete. The concrete shall not be required to flow over distances greater than 3 feet in any direction in the forms or on the ground, unless otherwise permitted by the Owner's Representative.
4. Unless otherwise noted, the work begun on any day shall be completed in daylight of the same day.
5. "Cold Joints" are to be avoided, but if they occur, they are to be treated as bonded construction joints.
6. Chutes for conveying concrete shall be of U-shaped design and sized to insure a continuous flow of concrete. Flat (coal) chutes shall not be employed. Chutes shall be metal or metal-lined, and each section shall have approximately the same slope. The slope shall not be less than 25 nor more than 45 degrees and shall be such as to prevent segregation of the ingredients. The discharge end of the chute shall be provided with a baffle plate or spout to prevent segregation. If the discharge end of the chute is more than 5 feet above the surface of the concrete in the forms, a spout shall be used, and the lower end maintained as near the surface of deposit as practicable. When the operation is intermittent, the chute shall discharge into a hopper. Chutes shall be thoroughly cleaned before and after each run, and the debris and any water shall be discharged outside the forms. Concrete shall not be allowed to flow horizontally more than 5 feet.

7. Concrete during and immediately after depositing shall be thoroughly compacted by means of suitable tools. Internal type mechanical vibrators shall be employed to produce the required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on long enough to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents or "pumping" or migration of air. All vibrators shall be supplemented by proper wooden spade puddling adjacent to forms to remove included bubbles and honeycomb. This is essential for the top lifts of walls. All vibrators shall travel at least 10,000 rpm and be of adequate capacity. At least one vibrator shall be used for every 10 cubic yards of concrete per hour. In addition, one spare vibrator in operating condition shall be on the site.
8. Concrete slabs on the ground shall be well-tamped into place and foundation material shall be wet, tamped, and rolled until thoroughly compacted prior to placing concrete.
9. Concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams and planes of weakness within the section. If a section cannot be placed continuously, construction joints may be located at points as provided for in the drawings or approved by the Owner's Representative.
10. Chutes, hoppers, spouts, adjacent work, etc., shall be thoroughly cleaned before and after each run, and the water and debris shall not be discharged inside the form.

B. Concrete Placing During Cold Weather

1. Concrete shall not be placed on frozen ground, and no frozen material or material containing ice shall be used. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40°F, or is expected to fall to below 40°F, within 72 hours, and the concrete after placing shall be protected by covering, heat, or both. No accelerant shall be used to prevent freezing.
2. The temperature of concrete surfaces shall not be permitted to drop below 50°F. for at least 7 days after placement of the concrete.
3. All details of the Contractor's handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Owner's Representative. All procedures shall be in accordance with the provisions of ACI 306.

C. Concrete Placing During Hot Weather

1. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. The Contractor shall make every effort to minimize delays that will result in excessive mixing of the concrete after arrival on the job.
2. During periods of excessively hot weather (90°F, or above) ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 90°F, when ready for placement will not be acceptable, and will be rejected.
3. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. The record shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained.

D. Pipes And Embedded Metals

1. Special care shall be taken to bring the concrete into solid contact with pipes and iron work embedded in the walls and floors, particularly underneath and around all pipes where a head of water exists, making watertight joints.
2. In general, such embedded items are not shown on the structural design drawings. Design drawings of the other trades shall be consulted for their location and details.
3. Anchor bolt location, size and details shall be verified with the equipment manufacturer's certified drawings before installation.
4. Anchor bolts, reglets, sleeves, edge angles and similar embedded items will be provided, delivered to the site under other Sections of the specification, for installation under this Section.
5. Where edge angles, etc., have nuts welded on to receive machine screws, the threads of the nuts shall be protected from concrete, and the concrete shall be excluded from the space to be occupied by the screw, by the use of wood plugs or other effective means.
6. Inserts required for hanging mechanical and electrical items shall be provided and installed in the forms under the mechanical and electrical sections of the specification.

7. Should the Contractor be allowed to leave openings in the concrete for pipes or ironwork, to await the arrival of items that would delay the prosecution of the work, the openings shall be subject to the approval of the Owner's Representative. Appropriate construction joints shall be provided. In filling any such openings with concrete, a mixture of 1: 1-1/2 : 3 shall be used and a watertight bond shall be secured between the old and new concrete.
8. In bolting miscellaneous items to concrete after the concrete has set, expansion bolts of an approved pattern and type shall be used. The Contractor shall submit to the Owner's Representative, for approval, the types of expansion bolts. Expansion bolts shall not be used until they are approved.

E. Curing

1. Concrete curing shall be performed as specified in ACI 30I and as stated herein. All curing procedures shall have prior approval of the Owner's Representative.
2. Concrete Floors: Concrete floors which are to receive paint, concrete fill, mortar setting beds, grout fill, or any other subsequent finish shall be cured by one of the following procedures immediately after completion of placement and finishing:
 - a. Ponding or continuous sprinkling.
 - b. Application of absorptive mats or fabric kept continuously wet.
 - c. Application of sand kept continuously wet.
 - d. Application of waterproof sheet materials conforming to ASTM C171.
 - e. Application of curing compounds conforming to ASTM C309, if it can be demonstrated to the Owner's Representative's satisfaction that the compound is applicable and that it will not prevent bonding of the subsequent finish to be received. Compound shall be placed at a rate of 200 square feet per gallon, in two applications perpendicular to each other.
3. Curing procedure shall be continued for at least 7 days.
 - a. Moisture loss from surface placed against metal or wood forms shall be minimized by keeping forms wet until removal.
 - b. Curing shall be continued for at least 7 days. When forms are removed during the curing period, surfaces shall be cured by spraying or by the use of a curing compound as previously specified.

- c. Surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, 1/2-inch thick plywood sheets shall be used to protect the exposed surface.

F. Bracing And Supports

1. All concrete members shall be adequately and safely supported and braced until the permanent supports and braces are installed.
2. Backfilling against exterior walls shall not be done until supporting slabs are in place and have attained 70 percent of design strength, otherwise walls shall be braced against earth lateral pressure, using a system approved by the Owner's Representative.
3. Backfilling against retaining walls shall not commence until the wall concrete has reached its 28-day strength.

G. Removing Forms and Supports

1. Removal of forms shall take place in accordance with ACI 347, Section 3.6. Except as otherwise specifically authorized by the Owner's Representative, forms shall not be removed until the concrete has aged for the following number of day-degrees or attained 50 percent strength. (Day-degrees equals the total number of days times the average daily air temperature at the surface of concrete. For example, 5 days at a daily average temperature of 60°F. equals 300 day-degrees.)

<u>Location</u>	<u>Day-Degrees</u>
Beams and Slabs	500
Walls and Vertical Surfaces	200

2. Shores under beams and slabs shall not be removed until the concrete has attained at least 70 percent of the specified cylinder strength and also sufficient strength to support safely its own weight and the construction loads upon it.

H. Patching

1. Defective concrete and honeycombed areas as determined by the Owner's Representative shall be chipped down reasonably square and at least one-inch deep to sound concrete by means of hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly imbedded in the parent concrete, subject to Owner's Representative's final inspection. If honeycomb exists around reinforcement, chip to provide a clear space at least 1-inch wide all around the steel. For areas less than 1-1/2 inches deep, the patch may be made following the procedure for filling form tie holes, described in the subsection below, using adequately dry (non-trowelable) mixtures to avoid sagging. Thicker repairs will require build-up in 1-inch layers on successive days. Unless otherwise indicated, thicker repairs shall be made with Vertipatch mortar mixture blended with Acryl-Set, both by Master Builders, Inc., Cleveland, Ohio, or approved equal.
2. For concrete areas exposed to serious abrasion and/or impact forces, the Owner's Representative may order the use of grout with a non-shrink metallic aggregate (Embeco by Master Builders, Inc.; Ironite by Fox Industries, Madison, IL; or approved equal) as an additive in the proportions listed below:

Material	Small Patches		Large Formed Patches	
	Volumes	Weights	Volumes	Weights
Cement	1.0	1.0	1.0	1.0
Metal Aggregate	0.15	0.25	0.2	0.33
Sand	1.5	1.5	1.5	1.0
Pea Gravel	--	--	1.5	1.5

I. Finishing Of Formed Surfaces

1. All concrete that is to be left exposed to view shall be scraped to remove projecting imperfections left by voids in the forms.
2. In addition to scraping, exterior exposed concrete shall be covered with a cement-base plaster mix. The mix shall consist of Thoroseal Plastic Mix and Acryl 60, as manufactured by Standard Drywall Products, Miami, FL, or approved equal. It shall be mixed and applied in accordance with the manufacturer's recommendations.
3. In addition to scraping, interior concrete surfaces which will be exposed to view and concrete surfaces which are to be prepared and painted as specified in Section 09 90 00, PAINTING, shall receive a smooth rubbed finish, in accordance with ACI 301 and as described below.

4. To permit satisfactory finishing, forms shall be removed from the vertical faces of the concrete as early as is possible without damaging the surface. Immediately after stripping forms, any fins or projections left by the forms shall be chipped off, and the surfaces rubbed smooth.
5. Form tie holes and other voids and faults shall be patched. Voids shall be cleaned out, roughened, thoroughly wetted, coated with neat cement paste, and filled with mortar of cement and sand in the same proportions, materials, and color as used in the concrete. The surface of the patch shall be flush with the surrounding surface after finishing operations are complete. Surface shall be kept continuously damp until patches are firm enough to be rubbed without damage.
6. Rubbing shall be performed while the surface is wet using a carborundum or cement sand brick, to achieve a smooth uniform, even textured finish. Patched and chipped areas shall be blended to match as closely as possible the appearance of the rest of the surface. No cement wash or plastering will be permitted, and no mortar shall be used except as required above.
7. Where finishing is performed before the end of the curing period, concrete shall under no circumstances be permitted to dry out and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

J. Testing

1. The Contractor shall provide all field testing and inspection services and shall pay for all such services. The Owner's Representative shall approve the testing laboratory and shall inform the Contractor when samples are to be taken for testing. The Contractor shall forward all test results to the Owner's Representative as soon as they are available.
 - a. The Testing Laboratory shall conform to the requirements of ASTM E-329 as modified in 780 CMR R1 in the MA State Building Code. The State Board of Building Regulations and Standards shall license them.
2. At least one slump test shall be performed from each truckload of concrete. The sample for slump shall be taken from the middle third of a truckload. Air content tests shall be made at the discretion of the Owner's Representative. If the measured slump or air content falls outside the specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed the requirements of the specification and shall be immediately removed from the jobsite to be discarded.

3. The Contractor shall advise the Owner's Representative of its readiness to proceed with concrete placement at least one working day prior to each placement. The Owner's Representative will inspect the preparations for concrete, including the preparation of previously placed concrete, the reinforcing, and the alignment and tightness of formwork. No placement shall be made without the prior approval of the Owner's Representative.
4. A minimum of four standard compression test cylinders shall be made and tested for each 100 cubic yards or fraction thereof for each type and design strength of concrete from each day's placement of concrete. One cylinder shall be tested at 7 days and two cylinders at 28 days. The fourth cylinder from each set shall be kept until the 28 day test report on the second and third cylinders in the same set has been received. The Owner's Representative reserves the right to require test cylinders to be made for each truckload of concrete if the nature of the project or project experience indicates such additional tests are required for proper control of concrete quality; such tests will be at the Owner's expense.
5. The strength level shall be considered satisfactory so long as the averages of all sets of three consecutive strength test results equal or exceed the specified strength f'_c , and no individual strength test (average of two cylinders) result falls below the specified strength f'_c by more than 500 psi.
6. In the event the average compressive strength of the two 28-day cylinders do not achieve the required level, the Owner's Representative may elect to test the fourth cylinder immediately or test it after 56 days. Such tests will be at the Contractor's expense.

K. Failure To Meet Requirements

1. The Owner's Representative shall have the right to reject concrete represented by low strength tests or to agree to further testing of the concrete. Rejected concrete shall be promptly removed and replaced with concrete conforming to the specification. The decision of the Owner's Representative as to whether substandard concrete is to be accepted or rejected or additional tests shall be conducted shall be final. All direct and indirect costs associated with further curing and testing of the concrete shall be at the Contractor's expense. All costs associated

with removing rejected concrete, placing new concrete, and conducting tests on new concrete shall be at the Contractor's expense.

2. If the Owner's Representative agrees to consider further curing and/or testing of the concrete before making a final decision, the Contractor shall submit a detailed plan to the Owner's Representative, including proposed criteria for acceptance of the concrete. The plan may include additional curing of the concrete, drilling and testing of cores, load testing of the structure, or a combination.
3. If additional curing is permitted before further inspection and testing, the Contractor shall provide any necessary materials and labor to further cure the suspect concrete.
4. If drilling and testing of cores is permitted, the Contractor shall be responsible for obtaining the cores, including provision of ladders, scaffolding, and such incidental equipment as may be required. If additional curing is permitted, cores shall be drilled after the curing period, and shall be in accordance with ASTM Methods C39 and C42. The Contractor shall repair all core holes to the satisfaction of the Owner's Representative.
5. The burden of proof, including, but not limited to the work of cutting and testing the cores, inspection, evaluation, engineering, repair of the holes, or removal and replacement of the concrete in question, and all associated costs therefor, shall be at the expense of the Contractor.
6. If load testing of the concrete is permitted, and if not otherwise indicated, slabs or beams under load test shall be loaded with their own weights plus a superimposed load of 2 times the design live load. The load shall be applied uniformly over the portion being tested in the approved manner and left in position for 24 hours. The structure shall be considered satisfactory if deflection "D" in feet, at end of 24-hour period, does not exceed the following value:

$$D \text{ equals } 0.001 (L \times L)/t$$

in which "L" is span in feet, "t" is depth of slab, or beam in inches. If deflection exceeds "D" in the above formula, the concrete shall be considered faulty unless within 24 hours after removal of the load, the slab, or beam under test recovers at least 75 percent of the observed deflection.

7. If the suspect concrete still fails to meet specification requirements, the Owner's Representative shall have the right to reject the concrete, have it removed and replaced, in accordance with paragraph 5 above, or to require mechanical strengthening of the concrete to satisfy project requirements. The Contractor shall submit a removal and replacement plan for review by the Owner's Representative.

L. Test For Watertightness

1. All concrete shall be watertight against leakage or groundwater infiltration. Special care shall be taken in the construction joints and any noticeable leakage or seepage causing wet spots on the concrete walls or slabs shall be repaired by and at the expense of the Contractor and by methods approved by the Owner's Representative. Refer to Section 03 15 13 – WATERSTOPS.
2. All liquid holding concrete structures shall be tested for leakage before backfilling and after the concrete has attained the specified minimum 28-day design strength, as indicated by test cylinders.
3. The structure shall be filled with water to the overflow level, allowed to stand for at least 24-hours, and refilled to overflow to begin the test. After 72 hours, the liquid loss per 24 hour period shall be determined, either by measuring the amount required to refill the tank to overflow, by measuring the drop in water level, or by an equivalent procedure approved by the Owner's Representative. Evaporative losses shall be calculated and deducted from the measured loss to determine net liquid loss (leakage). If the leakage per 24-hour period exceeds the allowable, the structure shall be repaired and retested until the leakage falls within the allowable limit.
4. For structures designed to hold water, one twentieth of one percent leakage will be allowed during a 24-hour period. No leakage (zero leakage) will be permitted for structures designed to hold liquid chemicals or fuels.
5. The Contractor shall pay all costs (including water) incurred in the testing for watertightness.
6. The Owner's Representative shall be given a minimum notice of 48 hours prior to commencement of the leakage test.

END OF SECTION

SECTION 10 14 53

TRAFFIC AND SITE SIGNAGE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including the General and Supplementary Conditions and Division 0 – Bidding Documents, Contract Forms, and Conditions of the Contract and Division 1 – General Requirements, apply to the work of this Section.
- B. Carefully examine all the Contract Documents for requirements which affect the work of this Section. The exact scope of this Section cannot be determined without a thorough review of all specification sections and other Contract Documents.

1.1 REFERENCES

- A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 1, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 WORK INCLUDED

- A. The work of this Section consists of all park signage and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:
 - 1. Signage with posts

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. The following items of related work are specified and included in other Sections of the Specifications:
 - 1. Section 03 30 00, Cast-in-Place Concrete

1.4 STANDARDS

- A. The following standards including all current amendments form a part of these Specifications:
 - 1. American Society for Testing and Materials (ASTM):
 - A36 Structural Steel
- B. All signage shall be in compliance with the Manual on Uniform Traffic Control Devices (MUTCD)

1.5 SAMPLES AND SUBMITTALS: IN ACCORDANCE WITH SECTION 01 33 00 SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

- A. At least thirty days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with requirements of this specification. Do not order materials until Engineer's approval of samples, certifications or test results have been attained. Delivered materials shall closely match the approved samples.
 - 1. Shop Drawings: Submit detailed shop drawings for each item required to be fabricated or installed under work of this Section. Include plans, sections, and details as required to show completely materials, layout, jointing, clearances and connections for all items required. Shop drawings for handrails at stairs and at other site conditions requiring accurate dimensional relationships to as-built construction shall be prepared following a review and confirmation of as-built measurements and conditions for areas scheduled to receive miscellaneous metal items. Submit shop drawings for the following:
 - a. Signage
 - 2. Material Samples: Submit samples for each material for the following:
 - a. Steel post – submit one (1) sample
 - b. Sheet metal for signs– submit one(1) sample

PART 2 - PRODUCTS

2.1 SIGNS

11/01/2024

- A. The contractor shall furnish and install all signs included in the schedule. Shop drawings for each sign will be produced for review, comment and approval prior to final manufacturing.

2.2 STEEL SIGN POSTS

- A. Steel posts shall be Telspar or approved equivalent.
- B. Steel hardware shall conform to ASTM A325 requirements for galvanized hardware.
- C. Poured-in-place concrete footings, where required, shall conform to requirements of Section 03 30 00, CAST-IN-PLACE CONCRETE.

PART 3 - EXECUTION

3.1 STEEL SIGN POSTS

- A. Install steel sign posts in conformance to details, and approved shop drawings. Measure on-site conditions to receive posts prior to preparing shop drawings.

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The General Documents, as listed in the Table of Contents, and applicable parts of Division 1, General Requirements shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SCOPE OF WORK

- A. The work of this Section consists of all site improvements and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:
 - 1. ADA Detectable Warning Mat
 - 2. Vehicular Bollard

1.03 RELATED WORK UNDER OTHER SECTIONS

- A. The following items of related work are specified and included in other Sections of the Specifications:
 - 1. Section 31 00 00 – Earthwork
 - 2. Section 03 30 00 – Cast-In-Place Concrete

1.04 EXAMINATION OF CONDITIONS

- A. The Contractor shall fully inform himself of existing conditions of the site before submitting their bid and shall be fully responsible for carrying out all site work required to fully and properly executing the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.
- B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct to the best of the Landscape Architect's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.05 SCHEDULING

- A. The Contractor shall submit to the Landscape Architect, for approval by the Owner, a progress schedule for all work as specified herein.

SITE FURNISHINGS

12 93 00 - 1

1.06 QUALITY ASSURANCE

A. Materials and methods of construction shall comply with the following standards:

1. ASTM: American Society for Testing and Materials
2. ANSI: American National Standards Institute
3. FS: Federal Specifications
4. IMI: International Masonry Institute
5. PCA: Portland Cement Association

B. Qualifications of Workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

C. Layout: After staking out the work, and before beginning final construction, obtain the Landscape Architect's approval for layout. Contractor shall make adjustments as determined by the Landscape Architect. Landscape Architect may make adjustments to layout as is required to meet existing and proposed conditions without additional cost to the contract price.

1.07 SUBMITTALS: IN ACCORDANCE WITH SECTION 01 33 00 SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

A. Shop Drawings: Submit shop drawings for all products in accordance with Division 01 requirements.

B. Product Information: Provide manufacturer's data for all products showing installation and limitations in use. Supply Certificates of Compliance for all materials required for fabrication and installation, certifying that each material item complies with, or exceeds, specific requirements.

PART 2 - PRODUCTS

2.01 ADA DETECTABLE WARNING MAT

A. The ADA detectable warning mat shall be manufactured by ADA Solutions, Inc., Chelmsford, MA, or

B. An approved equal.

Contractor shall order and install warning mats to meet the following specifications:

Model: 2436REP

Color: Federal Yellow, Color No. 33538

2.02 VEHICULAR BOLLARD

- A. The vehicular bollard shall be manufactured by Architectural Iron; Milford Pennsylvania, or approved equal
- B. Contractor shall order and install vehicular bollard to meet the following specifications:
 - 1. Model: AIC-757-758DB Garden City "A" Direct Burial Bollard
 - 2. Color: to be selected by owner/owner's representative
 - 3. Size: 24 inches high x 4 ½ inch diameter
 - 4. Design: Cylindrical with base and cap-direct burial
 - 5. Material: Gray iron castings: ASTM a48 Class 30 Gray Iron
 - 6. Steel: ASTM A500 Steel
 - 7. Finish: to be selected by owner/owner's representative

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.
- B. The Contractor shall be responsible for timing the delivery of all site improvement elements so as to minimize on-site storage time prior to installation. All stored materials must be protected from weather, careless handling and vandalism.
- C. Contractor shall anchor all furnishings per manufacturer's recommendations.

END OF SECTION

SITE FURNISHINGS

12 93 00 - 3

SECTION 26 00 00

ELECTRICAL

1.1 RELATED DOCUMENTS:

- A. Division 01 Specifications, General and Supplemental Requirements apply to this section with additions and modifications specified herein.
- B. Instructions to Bidders, Bidding Forms, Forms of Agreement between Owner and Contractor, Contract Award Date, Starting and Completion Dates, Conditions of the Contract, Insurance Requirements, and other Owner Requirements shall be furnished separately by the Owner, General Contractor or Construction Manager. These documents, as well as any addenda issued, shall form a part of these Specifications, and this Contractor shall consult them in detail for instructions pertaining to their work.
- C. Each contractor and sub-contractor shall be provided with all drawings and specification sections issued as part of the overall bid package, as well as all subsequent Addenda, Architects Supplemental Instructions (ASI), Bulletins or other project contract documents. All contractors and sub-contractors are to receive, review, and coordinate all of their work as shown or referenced on the other trade documents. All work shown or referenced on the other trade documents shall be included as part of the overall project scope. It is each contractor or sub-contractor's responsibility to confirm, prior to submitting their bid, that they have received all contract documents and supplemental information.
- D. All work shall be in accordance with The City of Worcester Department of Public Works & Parks Standard Construction Specifications and Details, in addition to the Commonwealth of Massachusetts Department of Transportation Standard Specifications for Highways and Bridges. Any deviations shall be coordinated with Worcester DPW prior to work.

1.2 SCOPE OF WORK:

- A. These specifications, accompanying drawings and all other contract documents are intended to cover the furnishing of all labor, material, equipment and superintendence of the Electrical System for this project. They are also intended to cover performing all miscellaneous operations including excavations and backfilling, cutting, channeling, chasing and patching necessary for the installation of the Electrical systems, as shown on the drawings, as hereinafter specified, as directed by the Engineer or as may be required for a complete and fully functional electrical installation.
- B. It is the intent and purpose of these specifications, accompanying drawings and all other contract documents to cover and include each item, all materials, equipment, apparatus, and labor necessary to properly install, equip, adjust, and put into perfect operation the respective portions of the installations specified and to so interconnect the various items or sections of the work as to form a complete and properly operating whole.
- C. Drawings and specifications have been prepared with best knowledge of conditions available at the time of design and are intended to be complementary. What is called for by one shall be as

binding as if called for by both. Where conflicts occur between drawings and specifications, or between the Electrical documents and the documents of other disciplines, the situation shall be brought to the attention of the Design Professional before the work in question is installed. In case of conflict between provisions of the Specifications or between the drawings and the specifications, the more stringent requirement shall govern. Where a requirement is applied to a specific product, condition, system or Specification Section which conflicts with a more general requirement elsewhere, the specific shall supersede the general. If any obscurities or discrepancies exist, they shall be brought to the attention of the Design Professional before bids are submitted. If they are not discovered before bids are submitted, the Design Professional shall be notified and shall render a decision. This decision shall be final.

- D. Any equipment, apparatus, machinery, material and small items not mentioned in detail, and labor not hereinafter specifically mentioned, which may be found necessary to complete or perfect any portion of the installation in a substantial manner, and in compliance with the requirements stated, implied or intended in these specifications shall be furnished without extra cost. This shall include all materials, devices or methods peculiar to the machinery, equipment, apparatus, or systems furnished and installed as part of the ELECTRICAL work, and shall include major components if so required.
- E. The general arrangement of conduit, wiring and equipment shall be as identified on the contract drawings. Carefully examine all contract drawings and be responsible for the proper fitting of materials and equipment in each location as indicated. Inasmuch as the drawings are generally diagrammatic, due to their small scale, it is not possible to indicate all offsets, fittings and accessories, as may be required in the final installation. Carefully investigate the site, structural, and finish conditions affecting their work and arrange such work accordingly, providing such fittings and accessories as may be required to meet such conditions, at no additional cost to the Owner. The right to make any reasonable change in location of apparatus, equipment, outlets or routing of conduit and wiring, up to the time of roughing-in, is reserved by the Design Professional without involving any additional expense to the Owner.
- F. Should a bidder find discrepancies in or omissions from the drawings or specifications they shall notify the Design Professional before submitting their bid proposal. The Design Professional shall then send written instructions, via Addendum, to all known bidders. Oral instructions shall not be binding to either the Design Professional or the Owner.
- G. In the case of discrepancies or conflicts between the Drawings and Specifications, typically the Drawings will take precedence in the case of quantitative issues, while the Specifications will take precedence for qualitative issues; or as specified in other Divisions; however, when the scale and date of the Drawings are the same, or when a discrepancy exists within the Documents and specific written direction cannot be obtained from the Design Professional, Bidders shall include the most stringent requirements. Obtain written clarification from the Engineer prior to installation.
- H. Any such items not brought to the attention of the Design Professional prior to submission of the bids shall be subject to the interpretation of the Design Professional. All such interpretations shall be accepted by the Contractor and shall be incorporated into the construction in a timely manner, at no additional cost to the contract.
- I. These Specifications are arranged in accordance with the MasterFormat 2016, 35 Division format. The Specification is to be read as a whole. Items or work called for on one paragraph or Section, shall be applicable to the entire work, unless specifically indicated otherwise.

Specific contract scopes shall be as determined by the General Contractor or Construction Manager.

1.3 DEFINITIONS:

- A. The following are definitions of words found in the various Sections of Divisions 26, 27 and 28 and on the associated Electrical drawings:
1. “Concealed” shall indicate hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
 2. “Exposed” shall indicate work normally visible, including work in Mechanical or Electrical equipment rooms, tunnels, and similar spaces.
 3. “Provide” (and tenses of “provide”) – shall indicate “supply and install, complete in all respects, for a complete and fully functional installation.”
 4. “Install” (and tenses of “install”) – shall indicate “secure in position, make all final connections complete, test, verify and certify for a complete and fully functional installation.”
 5. “Furnish” (and tenses of “furnish”) – shall indicate “supply only, complete with all required accessories, mounting hardware, etc., for installation by others, or as spare “attic” stock for the Owner’s future use.”
 6. “Engineer” shall indicate person, firm or Corporation representing the Owner, and identified as such in the Contract Documents. The terms “Engineer” and “Architect” may be used interchangeably throughout the documents.
 7. “Authority Having Jurisdiction (AHJ)” shall indicate the organization, office, or individual responsible for enforcing the requirements of the applicable codes or standards in the location where the project is to be constructed.

1.4 LAWS, REGULATIONS AND CODES:

- A. Perform all work in strict compliance with all laws, regulations, and/or codes applying, including all Federal, State and local codes and any other authority having jurisdiction. Wherever drawings or specifications conflict with such regulations they shall be made to conform, and approval of the Design Professional obtained on such changes as may be involved.

1.5 QUALITY ASSURANCE:

- A. Perform all work hereunder in strict accordance with all requirements of the Authorities Having Jurisdiction over this work. The editions currently in force within the local jurisdiction of the following codes, regulations, standards and specifications, shall be strictly followed throughout prosecution of the work:
1. American National Standards Institute (ANSI)/National Institute of Standards and Technology (NIST)
 2. National Fire Protection Association (NFPA)
 3. NFPA-70 – National Electrical Code (NEC) 2023
 4. 527 CMR 12.00 Massachusetts Electrical Code
 5. NFPA 70E – Standard for Electrical Safety in the Workplace

6. NFPA-101 – Life Safety Code
7. National Electrical Manufacturers Association (NEMA)
8. Institute of Electrical & Electronic Engineers (IEEE)
9. International Electrical Testing Association (NETA) Acceptance Testing Specifications
10. Underwriters' Laboratories, Inc. (U.L.)
11. American Society for Testing and Materials (ASTM)
12. Occupational Safety and Health Administration (OSHA)
13. ANSI/NECA 1-2015, Standard Practices for Good Workmanship in Electrical Contracting
14. IEEE C2, National Electrical Safety Code (NESC)
15. Local Building and Electrical codes, or amendments to the above listed Codes
16. All other applicable Federal, State or Local Codes, Regulations and Legislation

- B. All packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with the OSHA Federal Regulations 29CFR1910.303 and .399, as well as National Electric Code (NEC, NFPA-70), Article 90.7.

1.6 PERMITS, FEES, AND CERTIFICATES OF APPROVAL:

- A. Unless stated otherwise in General Conditions or Division 01, obtain and pay for all permits, fees, and licenses required, including those of utilities and Agencies. Provide copies to Design Professional in the quantity requested.
- B. Utility company connection charges and fees will be paid directly by the Owner. "Fees" shall include connection charges construction costs, and other such charges by utility companies or service providers. Ascertain such charges during bidding period and include bid price.
- C. As a prerequisite to final acceptance, supply to the Design Professional a Certificate of Inspection from the local Electrical Inspector. Certificate shall cover rough wiring, fixtures, and equipment. All costs for the necessary inspections shall be included in the bid.

1.7 REQUESTS FOR INFORMATION (RFI)

- A. Contractor shall be responsible for submitting Requests for Information (RFI)s when discrepancies arise, logical discrepancies are found on the contract documents, or clarification is necessary. All RFIs must be clearly written and submitted including a suggested solution. All RFIs regarding changes to the intent indicated on plans must be accompanied by sketches, explanation, site pictures, and all other instruments necessary, to clearly convey the issue at hand and the suggested solution. The RFI process may only be utilized for legitimate purposes. RFIs may not be utilized to submit deviation or substitution requests, nor requesting confirmation of scope for items clearly defined on the contract documents, nor related to clarifications that should be resolved through the Contractor's coordination efforts. RFIs that do not comply will be summarily rejected and any delays caused as a result are the responsibility of the Contractor. In cases where the Contractor does not submit an RFI to clarify an issue and incorrectly proceeds, all work required to resolve such issues to be in compliance with the intent of the contract documents, as determined by the Engineer, shall be the Contractor's responsibility and at no additional cost to the project.

- B. Carefully examine all architectural, civil, and landscape drawings and all other disciplines and be responsible for the proper fitting of all material and equipment as planned and without interference with other piping, ductwork, conduit, equipment or structure. Proper judgment shall be exercised to secure best possible clearance and space conditions throughout; to secure neat arrangement for piping, equipment and conduit, and to overcome all local difficulties and interferences to best advantage. Approval for any and all changes to plans and specifications which may be incurred shall be obtained from the Design Professional and the Owner before proceeding.

1.8 ALTERNATE PRICES:

- A. Refer to Division 01 Sections for list of Alternate Prices being requested for this project, and if they are to be Add or Deduct alternates.
- B. Where Alternate Prices are solicited, the alternate price shall include all work reasonably associated with the work to be priced as an alternate. Base bid conditions shall provide a complete, and fully functional installation, less the work associated with the alternate price.

1.9 RECORD DRAWINGS:

- A. Throughout the construction keep an accurate, up-to-date record of all deviations of the work between that as shown on the drawings and that which is actually installed.
- B. Obtain a complete set of prints of the Electrical drawings and note changes thereon. The design professional will provide the CAD files or Revit model for the contractor's use. Make a complete record in a neat and accurate manner, of all changes and revisions to original design which exist in completed work. As-Built markups shall be updated on a daily basis.
- C. Submit As-Built documents in electronic CAD file format. The project design files will be provided to the Contractor by the Design Professional following proper execution of the Document Release and Indemnity Form as provided by the Design Professional. The electronic files returned by the Contractor shall be fully compatible with the native AutoCAD (*.dwg file format) software used by the Design Professional to create the original documents. In addition, submit a complete set of drawings in PDF format.
- D. The cost of preparing these record drawings shall be borne by the Contractor. When all revisions showing the work as finally installed are made, the prints and CAD files shall be submitted for review and approval by the Design Professional.
- E. Record drawings shall be delivered to Owner within 30 days of project Substantial Completion.

1.10 OPERATION AND MAINTENANCE MANUALS:

- A. Provide for the Owner's Use one (1) hard copy printed version and one (1) electronic copies in PDF format of a facility Operation and Maintenance Manual.
 - 1. Each hard copy Manual shall be bound in an extra heavy duty three-ring loose-leaf binder with the following title lettered on the front "Record and Information Manual (insert

name of project)". No sheets larger than 8-1/2" x 11" shall be used, except sheets that may be neatly folded to 8-1/2" x 11" and used as a pullout.

2. Each electronic format Manual shall be provided as a single .PDF file, fully bookmarked and indexed, containing all Owner's Manual data and project drawings.

B. Provide the following information in each Manual:

1. Cuts of all equipment with manufacturer's technical specifications. Material shall be manufacturer's brochures, catalog cuts, parts lists, wiring diagrams, etc. Also include approved shop drawings.
2. Operation, Maintenance and Servicing Procedures. Include frequency of inspection, cleaning and adjusting and other attention as may be required in accordance with manufacturer's instructions.
3. Copy of project Warranty.
4. Contact name, telephone number and email address for obtaining replacement parts and service for all equipment.
5. Copy of all individual equipment warranties.
6. Copies of all required Test Reports.
7. USB drive with all Special Systems drawings in both PDF and editable format.
8. Electronic copy of all Owners Instruction and Training Sessions.

- C. Furnish qualified personnel to instruct the Owner's personnel in the maintenance and operation of all equipment and systems. Instructing personnel shall remain on the job continuously during working hours until such instruction is complete, but not less than 16 hours.

1.11 WARRANTY:

- A. The material and workmanship of all parts of the electrical installations specified herein and shown on the drawings shall be warranted unconditionally for a period of two (2) years from date of Project Substantial Completion against mechanical and electrical defects arising from faulty materials or workmanship. Either replacement or repairs shall be made promptly on any defective materials or workmanship without charge for materials, equipment or labor during that period.
- B. Manufacturer's warranties on equipment provided under this contract shall be included in the operating and maintenance manuals.

1.12 CORRECTION OF WORK AFTER FINAL PAYMENT AND WARRANTY:

- A. This article is supplementary to Warranty Provisions of Division 01 and General Conditions.
- B. Final payment shall not relieve the Contractor of responsibility for correction of faulty equipment, materials and workmanship and, unless otherwise specified, they shall remedy any defects due thereto and pay for damage to other work resulting therefrom, which shall appear within the warranty period specified above.
- C. Include warranties by the respective equipment manufacturers which shall be subject to the terms and time limits defined under these Divisions of Specifications.

- D. Warranties furnished by Sub-Contractor and/or equipment manufacturers shall be counter-signed by the related Prime Contractor for joint and/or individual responsibility for subject item.
- E. Manufacturers' equipment guarantees or warranties extending beyond the warranty period described herein shall be transferred to the Owner along with the Contractor's warranties.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

- A. All installed materials and equipment shall be new and the best of their kind and shall conform to the grade, quality and standards specified herein.
- B. Unless otherwise specifically stated, all materials and equipment offered under these specifications shall be limited to products regularly produced and recommended by the manufacturer for the service intended. This material and equipment shall have capacities and ratings sufficient to amply meet the requirements of the project. The capacities and ratings shall be in accord with engineering data or other comprehensive literature made available to the public by the manufacturer and in effect at the time of opening of bids.
- C. Equipment shall be installed in accordance with manufacturer's instructions for type and quality of each piece of equipment used. These instructions shall be obtained from the manufacturer and shall be considered part of these specifications. Type, capacity and application of equipment shall be guaranteed suitable to operate satisfactorily. No experimental material or equipment shall be permitted.

2.2 ITEM 804.2 – 2 INCH ELECTRICAL CONDUIT TYPE NM – PLASTIC – (NEMA) FOR STREET LIGHTING & ITEM 804.21 – ADDITIONAL 2 INCH ELECTRICAL CONDUIT TYPE NM – PLASTIC – (NEMA) FOR STREET LIGHTING WITHIN THE SAME TRENCH

A. GENERAL

- 1. The work under this item shall conform to the relevant portions of Section 801 (MSSHB) and the following:
- 2. The work shall include the furnishing and the installation of 2 inch non-metallic conduit for the street lighting system in accordance with the plans and as directed by the Engineer.
- 3. The conduit material shall be Schedule 80 polyvinyl chloride (PVC plastic conduit).
- 4. The length of conduit estimated under this item is for the comparison of bids only and is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon the actual conditions encountered as provided for in Section 4.06 (MSSHB).

B. MATERIALS

- 1. Rigid Plastic Conduit - Schedule 80 PVC conduit of the sizes shown on the plans shall be used throughout the project. Minimum size shall be 2" I.D. Raceways and fittings shall be produced by the same manufacturer. National Grid may have specific requirements as to what manufacturers they carry available spare parts for. Therefore, one manufacturer

will be listed as preferred with their catalog numbers reflected, with the second listing being National Grid's acceptable equal.

2. The rigid plastic conduit must conform to and meet all current requirements and testing procedures of the American Society of Testing and Materials wherever such standards and test shall apply. The following ASTM standards shall apply as applicable: ASTM Specification D1784 – Schedule 80 PVC Cell Classification, ASTM Specification D2564 – Specification for Solvent Cements for PVC Plastic Pipe and Fittings.
3. All belled-end pipes shall have tapered sockets to create an interference-type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D2672.
4. PVC conduit manufacturers capable of meeting the specifications are Carlon, or approved equal.

C. FITTINGS

1. Provide all necessary couplings and elbows necessary for a complete system.
2. All conduits where the possibility of moisture or dirt is present shall be provided with Carlon PVC plugs, or approved equal, for 2" I.D. conduit.
3. All sweeps into lighting fixture bases shall be per the manufacturer's requirements.
4. Except where embedded in concrete, direct burial or indicated elsewhere in the contract documents, all conduits shall be supported to permit adequate lineal movement to allow for expansion and contraction of conduit due to temperature change.

D. CONSTRUCTION METHODS

1. The PVC conduit shall be installed in a trench as described in Section 801.60 (MSSHB). Refer to trench details for backfill requirements, warning tape and other requirements above the PVC conduits.

E. INSTALLATION

1. When crossing streets and driveways the conduit shall be encased with a minimum of 4 inches of concrete on all sides, extending a minimum of two (2) feet beyond the roadway or driveway access point of the conduit.
2. A polypropylene pull rope sized to properly support the installation of required electrical conductors shall be installed in all conduits.
3. Conduits entering pull boxes and/or handholes shall be terminated a minimum of two inches inside the wall of the pull box and/ or handhole.
4. All conduit installed in pull boxes and/or handholes shall be installed in knockouts or openings provided in the box. Any conduit installed in such a manner as to block complete access to any other conduit shall be removed and reset at the contractors own expense.

F. MEASUREMENT AND PAYMENT

1. Payment under this item will be as Linear Feet.
2. 2 inch Schedule 80 Electrical Conduit Type NM Plastic (NEMA) will be paid for at the contract unit bid price per linear foot installed, which price shall include all labor, material, tools and equipment for furnishing and installing conduit, fittings, bends, sweeps, clamps, plugs, couplings, all trench excavation (except rock), backfilling, concrete encasement, pull ropes, and all incidental costs required to complete the work.

2.3 ITEM 804.3 - 3-INCH ELECTRICAL CONDUIT TYPE NM PLASTIC (UL); ITEM 804.31 – ADDITIONAL 3-INCH ELECTRICAL CONDUIT TYPE NM PLASTIC (UL) IN THE SAME

TRENCH; ITEM 804.4 – 4-INCH ELECTRICAL CONDUIT TYPE NM PLASTIC; ITEM 804.41 – ADDITIONAL 4-INCH ELECTRICAL CONDUIT TYPE NM PLASTIC (UL) IN THE SAME TRENCH

A. GENERAL

1. The work under this Item shall conform to the relevant provisions of Section 801 (MSSHB) and the following:
2. The work shall include the furnishing and installation of 3-inch non-metallic conduit for traffic signal systems in accordance with the plans and as directed by the Engineer.
3. The conduit material shall be Schedule 80 polyvinyl chloride (PVC) plastic conduit.
4. The length of conduit estimated under this Item is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon actual conditions encountered as provided for in Section 4.06 (MSSHB).
5. Where new conduits are installed in existing grass areas outside the limits of grading, the work shall include the placement of a minimum of 4 inches of topsoil and sod to restore the disturbed areas to their original condition.
6. No separate payment will be made for this work, but all costs in connection therewith shall be included in the unit price bid.
7. Where conduit is installed in existing sidewalk or paved median areas to remain, the work shall include replacement of the gravel base material and the surface pavement to match preconstruction conditions. No separate payment will be made for this work, but all costs in connection therewith shall be included in the unit price bid.
8. When conduit is installed in cold plane and overlaid pavement, the trenches shall be sawcut through their full depth and the pavement removed. The conduit shall be placed on a sand bed and backfilled with excavatable controlled density fill conforming to Subsection M4.08.0 (MSSHB).
9. Where a telephone communications conduit is specified, a separate conduit shall be provided from the controller cabinet to the telephone manhole as shown on the plans. The Contractor shall provide a pull-string in the conduit for the telephone line. The Contractor shall be responsible for coordinating with the telephone company for installing the conduit into the telephone manhole.

B. CONDUIT CROSSING ROADWAYS

1. All conduits crossing the roadway shall be encased in Class C cement concrete with a minimum 9 inches of cover. Trenches in existing bituminous concrete pavements not subject to full depth reconstruction shall be saw cut to a 3-foot 6-inch width. The existing pavements shall be saw cut through their full depth and the pavement removed. Trench depth shall be a minimum of 3 feet. Backfill material shall consist of CDF Type IE excavatable flowable fill.
2. After conduit installation and backfill is complete, a 1 - foot (minimum) of high early strength cement concrete base course material cap shall be placed over the trench area. If the trench excavation or backfill operations have widened the top trench to the extent that a minimum of 12 inches of undisturbed soil is not available to support the concrete cap, the pavement shall be saw cut again and removed to provide the 12-inch width.
3. The finish grade of the concrete cap shall be 3.25 inches below existing pavement surface. One 1.75-inch lifts and one 1-1/2 inch lift of bituminous concrete pavement SUPERPAVE (binder and top course material) shall be placed over the concrete cap. If the existing pavement is to be resurfaced, then the concrete shall be finished flush with the existing surface.
4. No separate payment will be made for saw cutting, excavation and concrete, but all costs in connection therewith shall be included in the linear foot unit price bid for this item.

C. MEASUREMENT AND PAYMENT

1. Electrical Conduit will be paid for at the Contract unit price per foot, which price shall include sawcutting, excavation, ordinary borrow, gravel borrow, wood plank/ warning tape, sand bedding, all labor, materials, equipment and incidental costs required to complete the work.
2. Excavatable Controlled Density Fill will be paid for separately under Item 485.1.

2.4 ITEM 806.2 – 2 INCH ELECTRICAL CONDUIT; ITEM 806.21 – ADDITIONAL 2 INCH ELECTRICAL CONDUIT IN THE SAME TRENCH

A. GENERAL

1. The work under this item shall conform to the relevant portions of Section 801 (MSSHB) and the following:
2. The work shall include the furnishing and the installation of 2 inch metallic conduit for the street lighting system in accordance with the plans and as directed by the Engineer.
3. The length of conduit estimated under this item is for the comparison of bids only and is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon the actual conditions encountered as provided for in Section 4.06 (MSSHB).

B. MATERIALS

1. Rigid Metal Conduit - Rigid Metal conduit of the sizes shown on the plans shall be heavy wall zinc coated steel. Minimum size shall be 2" I.D. Raceways and fittings shall be produced by the same manufacturer. National Grid may have specific requirements as to what manufacturers they carry available spare parts for. Therefore, one manufacturer will be listed as preferred with their catalog numbers reflected, with the second listing being National Grid's acceptable equal.
2. The rigid metal conduit must conform to the following standards applied as applicable: American National Standard Institute C80.1, Federal Specification WW-C-581e, UL Specification No. 6, National Electrical Code Article 346.

C. FITTINGS

1. Provide all necessary couplings, elbows, and fittings necessary for a complete system.
2. Elbows, couplings, nipples, and other required fittings shall match the construction material of the rigid metal conduit. Couplings for rigid metal conduit shall be threaded type and rain proof.
3. All sweeps into lighting fixture bases shall be per the manufacturer's requirements.

D. CONSTRUCTION METHODS

1. The rigid metal conduit shall be installed in a trench as described in Section 801.60 (MSSHB). Refer to trench details for backfill requirements, warning tape and other requirements above the rigid metal conduits.

E. INSTALLATION

1. When crossing streets and driveways the conduit shall be encased with a minimum of 4 inches of concrete on all sides, extending a minimum of two (2) feet beyond the roadway or driveway access and egress points of the conduit.
2. A polypropylene pull rope sized to properly support the installation of required electrical conductors shall be installed in all conduits.

3. Conduits entering pull boxes and/or handholes shall be terminated a minimum of two inches inside the wall of the pull box and/or handhole.
4. All conduit installed in pull boxes and/or handholes shall be installed in knockouts or openings provided in the box. Any conduit installed in such a manner as to block complete access to any other conduit shall be removed and reset at the contractors own expense.

F. MEASUREMENT AND PAYMENT

1. 2 inch Electrical Conduit Type RM Steel (Galvanized) will be measured for payment by the linear foot of conduit installed.
2. 2 inch Electrical Conduit Type RM Steel (Galvanized) will be paid for at the contract unit bid price per linear foot installed, which price shall include all labor, material, tools and equipment for furnishing and installing conduit, fittings, bends, sweeps, clamps, plugs, couplings, all trench excavation (except rock), backfilling, concrete encasement, pull ropes, and all incidental costs required to complete the work.

2.5 ITEM 810.2 – ELECTRIC HANDHOLE PRECAST CONCRETE; ITEM 810.3 – PULL BOX 12” X 24” (SD 2.030) FOR SIGNAL CABLE; ITEM 810.4 – PULL BOX 12” X 12” (SD 2.031) FOR INTERCONNECTION CABLE

A. GENERAL

1. The work under this item shall conform to the relevant portions of Section 801 (MSSHB) and the following: The work shall include the furnishing and the installation of precast concrete electric handholes for street lighting system and traffic signal system shall be in accordance with the plans and as directed by the Engineer.
2. The quantity of handholes estimated under this item is for the comparison of bids only and is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon the actual conditions encountered as provided for in Section 4.06 (MSSHB).
3. All pull boxes shall be a pre-cast concrete with cast iron covers. The 12”x 24” pull boxes shall have the word “W.D.P.W.” stamped on the covers; the 12”x 12” pull boxes shall have “TRAFFIC” stamped on the covers and be used only for interconnection cable. The top of all pull boxes shall be flush with the finish grade.

B. MATERIALS

1. Refer to the plans for the details of the precast concrete electric handholes
2. Precast concrete electric handholes shall meet the requirements of Section 801.61.C (MSSHB).

C. CONSTRUCTION METHODS

1. All electric handholes shall be constructed per Section 801.61.C (MSSHB), except as deviations may be required based on field conditions. All deviations must be approved by the engineer prior to making any changes.
2. Electric handhole frames and covers shall be set flush with finish grade.

D. INSTALLATION

1. Electric handholes shall be placed per the plans and shall be positioned using an approved grade so that the frame and cover are flush with the finish grade. Provisions shall be made so that adjustment can be made to the frame and cover to close any opening

between the frame and precast handhole to prevent any contaminants or moisture from entering.

2. Furnish and install a gravel base, as per the plan, compact and level for placement of the precast concrete handhole.
3. Furnish and install a minimum of four (4) galvanized steel bolts of sufficient size and length to secure the frame to the precast concrete electric handhole. The bolts must be placed to allow for proper and sufficient adjustment of the frame and cover as necessary to make the frame and cover flush to finish grade.
4. Furnish and install a 5/8" X 8' long copper clad ground rod, a grounding clamp, and 3 feet of bare #4AWG wire in each electric handhole.
5. The electrical handhole shall be left free and clear of any foreign matter.

E. MEASUREMENT AND PAYMENT

1. Electric Handhole Precast Concrete (Municipal Standard) will be paid for at the contract unit bid price per each installed, which price shall include all labor, material, tools and equipment for furnishing and installing precast concrete electric handholes, cement mortar mix, galvanized threaded rod, galvanized bolts, galvanized nuts and washers, ground rod, clamp, wire, gravel base, compaction and leveling, leveling frame and cover, all excavation (except rock), backfilling, and all incidental costs required to complete the work.

2.6 ITEM 811.2 – ELECTRIC LOAD CENTER BASE CONCRETE

A. GENERAL

1. The work under this item shall conform to the relevant portions of Section 801 (MSSHB) and the following:
2. The work shall include the furnishing and the installation of concrete load center base for street lighting system in accordance with the plans and as directed by the Engineer.
3. The quantity of electric load center base estimated under this item is for the comparison of bids only and is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon the actual conditions encountered as provided for in Section 4.06 (MSSHB).

B. MATERIALS

1. Concrete electric load center bases shall meet the requirements of Section 801.62 (MSSHB).

C. CONSTRUCTION METHODS

1. All concrete electric load center bases shall be constructed per Section 801.62 (MSSHB), except as deviations may be required based on field conditions. All deviations must be approved by the engineer prior to making any changes.

D. INSTALLATION

1. Concrete electric load center bases shall be placed per the plans and shall be positioned using an approved grade so that the top of the concrete is 6 inches above the finish grade.
2. Furnish and install a gravel base, as per the plan, compact and level for placement of the concrete electric load center base.
3. Furnish and install a minimum of four (4) ¾" galvanized steel anchor rods, as shown on the plans, of sufficient length to secure the electric load center cabinet to the concrete base.

4. Furnish and install a 5/8" X 10' long copper clad ground rod, a grounding clamp, and 4 feet of bare #6 AWG wire in each electric load center cabinet.

E. MEASUREMENT AND PAYMENT

1. Electric Load Center Base Concrete will be paid for at the contract unit bid price per each installed, which price shall include all labor, material, tools and equipment for furnishing and installing concrete electric load center base, cement mortar mix, galvanized threaded rod, galvanized bolts, galvanized nuts and washers, ground rod, clamp, wire, gravel base, compaction and leveling, all excavation (except rock), backfilling, and all incidental costs required to complete the work.

2.7 ITEM 812.2 – LIGHT STANDARD FOUNDATION CONCRETE

A. GENERAL

1. The work under this item shall conform to the relevant portions of Section 801 (MSSHB) and the following:
2. The work shall include the furnishing and the installation of concrete light standard foundation for street lighting system in accordance with the plans and as directed by the Engineer.
3. The quantity of light standard foundations estimated under this item is for the comparison of bids only and is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon the actual conditions encountered as provided for in Section 4.06 (MSSHB).

B. MATERIALS

1. Refer to the plans for the details of the light standard foundations.
2. Light standard foundation concrete shall meet the requirements of Section 801.62 (MSSHB).

C. CONSTRUCTION METHODS

1. All light standard foundations shall be constructed per Section 801.62 (MSSHB), except as deviations may be required based on field conditions. All deviations must be approved by the engineer prior to making any changes.

D. INSTALLATION

1. Light standard foundations shall be placed per the plans and shall be positioned using an approved grade so that the top of the concrete is as indicated on the plans in comparison to finish grade.
2. Furnish and install 20 inch sonotube, reinforcing rods and hoops, as shown on the plans, and per the Structural Engineers recommendations. Confirm exact light fixture pole base anchor requirements with the manufacturer prior to furnish and installation and install accordingly.
3. Furnish and install a 5/8" X 10' long copper clad ground rod, a grounding clamp, and #8 ribbon braid ground conductor.
4. Furnish and install 2" rigid steel conduit, stubbed out from base, as shown on the plans.

E. MEASUREMENT AND PAYMENT

1. Light Standard Foundation Concrete will be paid for at the contract unit bid price per each installed, which price shall include all labor, material, tools and equipment for furnishing and installing light standard foundation, cement mortar mix, galvanized

reinforcing rod and hoops, galvanized threaded rod, galvanized bolts, galvanized nuts and washers, 2" rigid metal conduit, elbows, and sweeps, ground rod, clamp, wire, compaction and leveling, all excavation (except rock), backfilling, and all incidental costs required to complete the work.

2.8 ITEM 813.31 – CONDUCTOR #2 AWG; ITEM 813.32 – CONDUCTOR #6 AWG; ITEM 813.33 – CONDUCTOR #8 AWG

A. GENERAL

1. The work under this item shall conform to the relevant portions of Section 813 (MSSHB) and the following:
2. The work shall include the furnishing and the installation of conductors (wiring) for the street lighting system in accordance with the plans and as directed by the Engineer.
3. The length of the conductors estimated under this item is for the comparison of bids only and is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon the actual conditions encountered as provided for in Section 4.06 (MSSHB).

B. MATERIALS

1. The conductors shall be new and shall have the size, grade and insulation, voltage and manufacturer's name permanently marked on the outer covering at regular intervals. The conductors are to be in complete reels or coils with clear markings identifying type, size and insulation. All conductors shall be protected from weather and damage during storage and handling.
2. The conductors shall meet UL type RHH-RHW rated for the application per the National Electrical Code.
3. All wire, connectors, splices, etc. shall be rated for the application per the NEMA, or UL, whichever is applicable.
4. All material and workmanship shall conform to the requirements of the NEC, Standards of ASTM for Testing and Materials, USA Standards, and any local ordinances which may apply.
5. Wire size shall be based on American Wire Gauge (AWG), as applied to copper conductors.

C. CONSTRUCTION METHODS

1. All conductors shall be installed per Section 813 (MSSHB), except as deviations may be required based on field conditions. All deviations must be approved by the engineer prior to making any changes.

D. INSTALLATION

1. Installation of conductors (wiring) shall not begin until such time as the conduit has been successfully tested and verified, meeting the requirements of Section 801.60 (MSSHB) Conduit, Paragraph H. Testing Installation.
2. All conductors shall be installed in conduit by hand, without damaging the cover, sheath, insulation or wires. No conductor installation shall commence until such time as all work which may cause damage to the conductors has been completed. When installing conductors into conduit, conductors shall be pulled into conduit freely without any bends, kinks, twisting or lapping. All conductors in a particular conduit shall be pulled at the same time, fed from unobstructed, free moving reels. Powdered soapstone, talcum or

other approved lubricant may be used to assist in installation of the conductors in the conduit.

3. Splices in conduit shall not be allowed. All conductors are to be continuous between electric handholes. A splice shall be installed in each conductor at each and every handhole with a minimum of 2 feet of slack coiled with each handhole (2 feet of slack will be measured from the top of the cover, extending out of the handhole).
4. All splices, taps, and wire terminals shall be secured with materials and methods hereinafter specified and as per Section 813.60 of the Standard Specifications.

E. SPLICING

1. Splices shall be made per the requirements of Section 813.60 (MSSHB) Wire and Cable, C Splicing.
2. Splices shall be made in handholes and control cabinets only.
3. The conductors shall be joined by the use of terminal lugs, listed by UL, and meeting all requirements of the NEC and Massachusetts Electrical Code.
4. Splices shall be insulated and waterproofed.

F. CIRCUIT IDENTIFICATION

1. All incoming and outgoing wires in street lighting control boxes, handholes, and light bases shall be banded and labeled per Section 813.60 (MSSHB) Wire and Cable, D. Highway Lighting Circuit Identification.

G. TESTING

1. Prior to energizing any circuit or conductor, complete testing as required within Section 813.62 (MSSHB) Ground Electrodes B. Resistance Tests.

H. MEASUREMENT AND PAYMENT

1. Conductors #2 AWG, #6 AWG, and #8 AWG will be paid for at their respective contract unit bid price per foot, which prices shall include all labor, material, tools and equipment, connectors, splices, sealing and waterproofing, for furnishing and installing conductors in conduit, handholes, manholes, light fixtures, and cabinets and all incidental costs required to complete the work.

2.9 ITEM 813.80 – ELECTRICAL SERVICE

A. GENERAL

1. The work under this item shall conform to the relevant portions of Section 813 (MSSHB) and the following:
2. The work shall include the electric service connections from the utility company point of service to the street lighting system in accordance with the plans and as directed by the Engineer.

B. MATERIALS

1. Refer to the specifications provided herein for conduit, conductor and handhole requirements.

C. CONSTRUCTION METHODS

1. Electric service shall be coordinated with the local utility company providing power to the area.

2. Electric service shall conform to all utility company policies and practices. All back charges from the utility company to the contractor shall be paid for by the contractor and shall be included within this pay item. Service connections shall be coordinated and installed in accordance with the local utility company requirements as provided by the utility company.
3. Each service shall include a three wire single phase solid neutral service conductors, conduits, conduit risers, core drilling and sealing of manholes, and splicing connections required to complete the installation. Meters will be furnished and installed by the local utility company.

D. MEASUREMENT AND PAYMENT

1. Electric Service payment will be measured for payment by linear foot of conduit between service location and the lighting control cabinet.
2. Electric Service will be paid for at the contract unit bid price per foot, which prices shall include all labor, material, tools and equipment, conduit, conductors, sweeps, bends, couplings, connectors, splices, sealing and waterproofing, for furnishing and installing conductors in conduit, handholes, manholes, core drilling and sealing and all incidental costs required to complete the work.

2.10 ITEM 819 – CIMCON CONTROLLER

A. GENERAL

1. The unit, accessories, and finish shall adhere to the following details or approved equal.

B. MEASUREMENT AND PAYMENT

1. Payment under this item shall be at the contract unit bid price per each location (complete in place).

2.11 CONNECTIONS AND ALTERATIONS TO EXISTING WORK:

- A. Any electrical work which will interfere with the normal use of existing power and lighting systems in any manner shall be done at such time or times as shall be mutually agreed upon between the Contractor and the Owner's representative.
- B. All existing electrical systems in occupied areas shall be kept in operation throughout the progress of the work. Temporary electrical connections shall be provided to all systems or equipment, where necessary to maintain continuous operation until the new systems and equipment are ready for operation.
- C. Outages of electric, fire alarm, telephone, data network, or other special system services to existing areas shall be coordinated with and shall be subject to the approval of the Owner. Any and all outages shall be scheduled in writing with the Owner's Representative and the Architect at least seven (7) days in advance of the planned outage. Scheduled outages may be canceled at any time by the Owner. Extra compensation shall not be allowed for rescheduling outages which may be canceled by the Owner. Where necessary or where required by the Owner, outages shall be scheduled at other than normal working hours. Where the duration of proposed outages cannot be tolerated by the Owner, provide temporary connections as required to maintain service with the minimum disruption possible.

- D. Any work required to be performed at other than normal working hours (nights, holidays, weekends, etc.) shall be taken into consideration by the Contractor when computing their bid. Extra compensation shall not be allowed to the Contractor for any work performed at other than normal working hours.
- E. When the work specified hereunder connects to any existing conduit, wiring or other equipment, perform all necessary alterations, cutting and fitting of the existing work as may be necessary or required to make satisfactory connections between the new and existing work and shall leave the completed work in a finished and workmanlike condition, to the entire satisfaction of the Engineer.
- F. Reuse of existing feeders:
 - 1. Where existing low voltage (<1,000 volts) feeders are to be reused for the new work, they shall be individually megger tested to ensure insulation integrity.
 - 2. Submit Test Reports. Reports shall list the typical design standard, the actual recorded value and the acceptable range of values.
- G. While performing connections and alterations to existing electrical work, take extreme care to protect all existing equipment from dirt, debris, and damage. Prior to making any modifications to existing electrically operated equipment, the equipment shall be fully tested in the presence of the Owner's Representative, and a complete list of any defects or operating errors shall be compiled by the Contractor and signed by the Owner's Representative. At that time the Owner may elect to have the equipment repaired or direct the contractor to proceed with the knowledge that portions of the equipment are non-functional. Following completion of electrical modifications, the equipment shall be demonstrated to the Owner's Representative as fully functional to the level of functionality prior to the start of work. Any portions of the equipment which were functional prior to the work but are not functioning properly after the electrical modifications shall be repaired or replaced by the Contractor, at no expense to the Owner.
- H. When the work specified hereunder or under other specification Divisions of the contract necessitates relocation of existing conduit, wiring, or electrical equipment, perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike condition to the entire satisfaction of the Engineer. All existing electrically operated equipment which is to remain, shall be left fully operational. Modify existing connections as required to maintain full and proper operation.

2.12 REMOVAL OF EXISTING EQUIPMENT AND MATERIALS:

- A. The extent of electrical demolition shall be as generally noted on the drawings.
- B. Existing electrical work in the areas surrounding the project area shall remain in service at all times unless otherwise coordinated with the City DPW and local utility. Where existing circuits pass through the project area, they shall be maintained in service at all times or relocated to avoid interference with construction activities. Field verify which circuits must remain in service.
- C. Wherever existing electrical work is to be removed, the following shall apply:

1. All existing wiring shall be removed back to location noted on drawing or as otherwise coordinated with utility or DPW.
 2. All existing conduit which is exposed, or which becomes exposed at any time during construction, shall be removed in its entirety.
 3. Where existing conduit is to be intercepted, remove conduit and wire to appropriate location and extend to new handholes or light poles as indicated.
 4. Conduit stubs through the floor shall be cut off flush with grade, filled with concrete, and made ready to accept new floor finishes where applicable.
 5. Conduit which remains concealed within walls or slabs shall be abandoned in place after removal of all wiring.
 6. All existing voice, data, and video wiring and equipment which is abandoned in place or which is no longer required shall be disconnected and removed.
 7. All surfaces which are disturbed by demolition under this division shall be patched with materials to match the surrounding surface. Patching shall be done to the complete satisfaction of the Design Professional.
- D. Where electrical systems pass through the renovated areas to serve other portions of the premises, they shall be suitably relocated, and the system restored to normal/proper operation.
- E. All outages shall be coordinated with the Owner's Representative as specified above.
- F. All existing electrical materials not reused and not salvaged by the Owner shall become the property of the Contractor. All such materials and equipment shall be disposed of in strict accordance with all applicable Codes and Regulations.
- G. All removal work shall be performed in a neat and workmanlike manner and shall be executed with the least possible disturbance to the building. The scheduling of all removal work shall be coordinated with other trades and with the operation of the Owner's facility.
- H. Where removal work is performed, repair all building surfaces damaged by such work. Provide finishes to match existing adjacent surfaces.
- I. Remove all superfluous wiring, fixtures, devices, controls, equipment, etc. Where removals are shown on Drawings, they are a general indication only, and may not necessarily indicate the full extent of the work.
- J. No existing equipment or material shall be reused without specific approval of the Owner's Representative.
- K. All equipment and material to be removed, and not desired by the Owner, shall be removed from the site by the Contractor.
- L. Prior to removal of any electrical equipment from the project, determine whether the Owner wishes to retain the material. Should the Owner desire to retain an item, it shall be moved, by the contractor, to the location on the site directed by the Owner. All electrical equipment, wiring, etc. not desired by the Owner shall be removed from the project site and properly disposed of by the contractor at no expense to the Owner.

2.13 EXCAVATION, BACKFILL AND GRADING:

- A. Provide all excavation, bedding, backfill and final grading work required for the installation of the electrical systems under this project.
- B. All excavation shall be unclassified, including the excavation and removal of all soil, shale, rock, boulders, existing foundations, fill and every kind of sub-surface condition encountered in the excavation area. Perform all excavation of whatever substance encountered, to the depths indicated on the drawings or as required to route electrical utilities to avoid conflicts with new and existing underground utilities. No extra or additional compensation for excavation will be paid under this Contract.
- C. All excavation shall be made by open cut. The banks of the trenches shall be kept as nearly vertical as safe and practicable. Where required provide sheeting, shoring and bracing.
- D. All excavation material not required or suitable for fill or backfill shall be removed from the project site and shall be properly and legally disposed of in strict accordance with all applicable laws and regulations.
- E. To protect persons from injury, and to avoid property damage, provide adequate barricades; construction, danger and warning signs; warning lights; lanterns and guards. All such protections shall be placed and maintained throughout the progress of the construction work and until it is safe for traffic use. Rules and regulations of the Owner and local authorities respecting safety provisions shall be strictly observed.
- F. Trenches shall be of sufficient width to provide a free working space of not less than 24 in. on each side of the conduit, whichever is greater. Trenches shall also be wide enough to thoroughly compact the backfilling around the conduit or ductbank and to secure a firm bed.
- G. In earth excavation, the trench shall be carried to the bottom of the conduit. Where rock excavation is encountered, the trench shall be carried to a point 6 in. below the construction. No construction shall be bedded directly upon rock but shall be cushioned by a 6 in. layer of selected crushed stone or gravel.
- H. Where material is removed below the grade of the bottom of a structure it shall be replaced with concrete of the same quality as the concrete in the structure. Where material is removed below the grade of a trench it shall be replaced with a lean concrete mix. Make no excavation to depth below a line of slope one ft. rise on 2 ft. length from such excavation to bottom of footing on other construction.
- I. Maintain banks at all times by means of shoring and bracing to avoid cave-in and make good any damage done to property or work of others due to failure to properly shore any excavation. Shoring shall be removed after installation and testing of lines have been approved. Material for shoring shall be placed in accordance with the regulations of the Occupational Safety and Health Agency.
- J. All excavations shall be left open until inspected and approved by the Design Professional or Inspection Authority. After the work has been installed and inspected, the excavation shall be backfilled with best carefully selected material free from stones, large pebbles, hard lumps or frozen earth. All backfill shall be made in 8 in. layers. The first 2 layers shall be of fine earth, hand tamped. The remainder of the fill over new construction to the surface shall ordinary

approved excavated material placed in 8 in. layers and thoroughly compacted to not less than 90% of maximum Modified Density as determined by ASTM D1557-70. No water soaking will be permitted. All excess materials shall be disposed of as directed.

- K. Where excavation is required under existing walkways and roadways, surface shall be restored with new materials equivalent to the material originally used. Whole cement pavement blocks shall be removed and replaced; removal and repair of partial blocks is not permitted.
- L. Excavation through unpaved areas shall be seeded and straw covered.
- M. Provide poly plastic warning tape, 6" wide, with foil backing, imprinted "CAUTION BURIED ELECTRIC LINE BELOW" continuously along full length of all trenches above all direct buried cables, and conduits and ductbanks. Tape shall be printed with black ink on APWA (American Public Works Association) and local electric utility approved color. Tape shall be minimum 12" below grade. Tape shall be Seton or approved equal.

2.14 PUMPING/DEWATERING:

- A. Provide pumping equipment to pump all water to prevent it from collecting in trenches, basement areas, and any other excavations necessary to carry out contract requirements. Prepare run-off trenches as required to pump water into and use surplus earth to form dam at top of excavation to run back surface water.

2.15 CUTTING AND PATCHING:

- A. Provide all cutting, channeling, chasing and patching required for work performed under this Contract.
- B. No holes may be cut or drilled in structural members without prior approval of Owner's Representative and Design Professional. Cutting shall be done by mechanics skilled in their respective trades.
- C. No cutting that may impair the strength of the building construction shall be done. No holes may be drilled in or attachments welded to the beams or other structural members without prior approval from the Owner's Representative and Design Professional. All work shall be done by mechanics skilled in their trade.
- D. Provide sleeves for conduits passing through poured concrete decks, footings, walls, etc. Cut all openings for conduits passing through precast concrete or existing concrete masonry. Such holes shall be cut with core drill or similar equipment. They shall not be cut with hammer or chisel, or with any power tool depending on impact for its cutting power.

2.16 CONCRETE:

- A. Form work shall be of sufficient strength to maintain desired shape during pouring of concrete and tight enough to prevent leakage of the grout through joints.
- B. Submit shop drawings for approval showing dimensions, reinforcing and dowelling.

- C. Furnish and set, with proper templates, at the time of pouring concrete, all anchor bolts and inserts required for the proper attachment of equipment to the concrete foundations. Anchor bolts shall be of the size and quantity required by the equipment manufacturer and shall be in accordance with the requirements detailed on the drawings and/or specified for the equipment.

2.17 TESTING AND ENERGIZING:

- A. Provide all labor, materials, instruments, fuel and power required to perform all necessary tests on all electrical systems (feeders, branch circuits, power distribution systems, electrical equipment, etc.). All tests shall be performed in accordance with industry standards and recommendations of the equipment manufacturer, and to the satisfaction of the Design Professional. All defective materials and/or workmanship discovered as a result of these tests, shall be removed and replaced at the Contractor's expense and the test shall be repeated until all associated work passes the test.
- B. Test the entire electrical system in accordance with all applicable requirements of the latest edition of the InterNational Electrical Testing Association (NETA) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems (ANSI/NETA ATS) and ANSI/NETA Standard for Electrical Commissioning Specifications for Electrical Power Equipment and Systems.
- C. On completion of the installation and wiring covered by this Specification the installation shall be thoroughly proved free from grounds and short circuits and left ready for operation. Necessary adjustments to all equipment shall be made in cooperation with the equipment manufacturer.
- D. Balance all three-phase panels to within a maximum of ten percent (10%) imbalance. Submit a report of current readings obtained for each panel after balancing has been completed.
- E. Test all special systems or equipment for proper operation as described in the respective specification sections.
- F. Test all motors for proper rotation. Indicate that rotation by affixing an adhesive arrow, equal to Brady Label Co., to the end bell or case of the motor.
- G. All Test Reports shall list the design standard value, the actual recorded value and the acceptable range of values.
- H. Certify by letter on Company letterhead, that all of the above testing has been successfully completed.

2.18 SUBSTITUTIONS:

- A. Equipment may be shown or specified in several ways:
 - 1. Manufacturer and catalogue or model number with the words "no substitutions," "no equal," "(manufacturer) only," or words of similar respect: Furnish the specified item.:
 - 2. Several manufacturers and model numbers listed; or one manufacturer and model number, followed by "equals by (mfr A), (mfr B), (mfr C)," or words of similar respect:

- a. If one of the manufacturers is listed on the drawings, that manufacturer shall be considered the Basis of Design. If none is so listed, the first manufacturer named in the Specification shall be considered the Basis of Design, and one of the others listed may be considered as Substitutions.
 - b. Where manufacturer's or supplier's name, style and catalog numbers are mentioned in the description of material and equipment in the specifications or on the drawings, it is to be understood that they are for the purpose of setting a standard.
 - c. If Contractor elects to furnish equipment other than the Basis of Design, they shall verify and be responsible for capacities, physical size, weight, electrical requirements, methods of connection to other parts of the system, and all other relevant data.
 - d. Inform the Design Professional of all changes required to other equipment, spaces, structure or systems in order to install the substituted equipment. Furnish all required shop drawings or sketches required for Design Professional and the remainder of the Design Team to evaluate the required changes and shall be responsible for all costs associated with such changes, including costs of design or engineering, if such are necessary, and costs of other trades.
 3. Where manufacturer's or supplier's names are listed in conjunction with the manufacturer or supplier that is Basis of Design, they are given to approve the firm name only. Equipment or material submitted by such firms must meet the detailed technical specifications written for the respective item. Contractor shall be responsible for verifying capacities, physical sizes, weights, electrical requirements, methods of connection to other parts of the system, etc. Contractor shall furnish all required shop drawings for equipment, and for its connection and installation.
 - B. If any substituted items are submitted after contracts have been awarded, and there is any question of equality of such items, samples may be required to be submitted both for the item specified and that to be substituted, or, further proof of equality may be required to the entire satisfaction of the Design Professional. In no case shall additional remuneration be allowed because of the rejection of a substitute.
 - C. When the equipment is relocated to a place other than that shown on the drawings, or when equipment other than that specified is used, the Contractor shall pay the extra cost of required revisions such as structural steel, concrete, electrical, piping, etc.
 - D. The Design Professional's costs to evaluate substitutions and to revise Drawings and Specifications because of substitutions will be paid by the Contractor.
- 2.19 SHOP DRAWINGS:
- A. Prior to submission of any shop drawing submittals, and not more than thirty (30) days after award of the contract, submit to the Engineer, for approval, a complete list of all Sub-Contractors, Materials and Equipment Manufacturers proposed for the project. This list shall include the proposed manufacturer of all equipment proposed for the project; the local sales agency (not the distributor) for the lighting package, and the vendor for each special/low voltage system.

- B. No shop drawing submittals will be considered for review or approval until the complete lists of sub-contractors, and materials and equipment manufacturers have been received and approved by the Engineer.
- C. Furnish shop drawings, catalog cuts, performance data and other required data to the Design Professional for approval for all material and equipment specified hereinafter. Sufficient data shall be submitted to show compliance with the requirements of the plans and specifications. All shop drawings submitted shall be first checked and corrected before submitting for approval. Approval for shop drawings by the Design Professional will not relieve the Contractor from responsibility for errors or omissions therein. All such errors or omissions must be made good by the Contractor irrespective of any approval by the Design Professional.
- D. The following applies to all materials and equipment being submitted for this project. Refer to the individual specification sections for additional submittal requirements.
- E. It is the responsibility of the manufacturer's representative and the installing contractor to thoroughly review all shop drawing equipment submittals and state in writing that the products meet or exceed the design specifications and design intent as indicated on the contract documents, prior to submitting them for review by the Engineer.
- F. The General Contractor or Construction Manager shall review and stamp all shop drawings noting their review process has taken place and that the shop drawings are in compliance with the design documents, prior to submitting the for review by the engineer. Any shop drawings found to not be in compliance shall be returned to the contractor stating such, with a copy of the statement (only) forwarded to the engineer.
- G. On submissions beyond the initial one, clearly identify all of the changes made from the initial submittal those requested by the Design Professional will review only those changes they requested and those identified by the Contractor.
- H. The Engineer will review up to three (3) submissions (one original submission and up to two (2) revised submissions) on any single component requested for review. If the contractor and/or vendor fail to comply with the drawings, specifications, and/or review comments and additional submissions are required, the cost for review and processing of those submissions will be borne by the contractor, OR if, in the Engineers opinion, it is felt that the submitted equipment cannot meet the project requirements, the Basis of Deign equipment shall be provided at no additional cost.
- I. The design documents are based and coordinated on the scheduled manufacturers. Any substitutions of products or materials (from those approved and listed in the specifications) must be thoroughly coordinated by the submitting contractor. This includes but is not limited to power, space, structural, control and performance requirements.
- J. Prepare and submit detailed dimensioned shop drawings, together with wiring diagrams, specifications, and operating data, for all specifically fabricated or designed equipment modified from standard items.
- K. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristic, finishes for materials, and installation and startup instructions for each type of product indicated.

- L. Each control device labeled with setting or adjustable range of control.
- M. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Schematic flow diagrams showing all controlled equipment and control devices.
 - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Written description of sequence of operation.
 - 4. Listing of connected data points, including connected control unit and input device.
 - 5. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
- N. Shop Drawings shall be submitted and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Shop drawings shall also contain complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, and any other details required to demonstrate that the system will function properly. Drawings shall show proposed layout and installation of all equipment and the relationship to other parts of the work.
- O. Shop Drawings shall be approved before any equipment is installed. Therefore, shop drawings must be submitted in time for review so that all installations can be completed per the project completion schedule. Ten (10) working days shall be allowed for submittals to be reviewed.
- P. All drawings shall be reviewed after the final system checkout and updated or corrected to provide "as-built" drawings to show exact installation. All shop drawings will be acknowledged in writing before installation is started and again after the final checkout of the system. The system will not be considered complete until the "as-built" drawings have received their final approval. The Contractor shall deliver a complete set of "as-built" drawings.
- Q. On submissions beyond the initial one, clearly identify changes made from the initial submittal other than those requested by the Design Professional. The Design Professional will review only those changes they requested and those identified by the Contractor.
- R. If the Contractor elects to proceed to install equipment for which approved Shop Drawings have not been received, they do so at their own risk; the Owner and Design Professional are not obligated to accept such equipment or work, nor will the Owner or Design Professional be liable for claimed costs or delays required by correction of such work.
- S. Shop Drawing Review Comment Definitions:
 - A> **No Exception Taken:**

The shop drawing or equipment submittal as submitted is approved without exception. No changes or corrections required. The materials, equipment or system submitted can be released for fabrication and construction. No Further Submission Required.
 - B> **Make Corrections Noted:**

The shop drawing or equipment submittal as submitted is not completely correct but is approved as noted. Make the corrections noted on the shop drawing or submittal. The materials, equipment or system submitted can be released for fabrication and construction once the corrections have been made. The submittal must be corrected and resubmitted for record unless noted by "E: Resubmit". See "E: Resubmit definition below.

C> Submit Specified Item:

The shop drawing or equipment submittal as submitted is missing a component of the system that it represents or is not of the approved and specified manufacturers. Submit the missing or incorrect item. The materials, equipment or system submitted cannot be released for fabrication and construction.

D> No Further Submission Required:

The shop drawing or equipment submittal as submitted is approved as noted. No changes or corrections required. The materials, equipment or system submitted can be released for fabrication and construction. No Further Submission Required.

E> Resubmit:

The shop drawing or equipment submittal as submitted is not approved. The shop drawing or equipment submittal needs significant corrections and does require another submission to verify that the comments and changes have been incorporated. Make the corrections noted on the shop drawing or submittal. The materials, equipment or system submitted cannot be released for fabrication and construction.

F> Rejected:

The shop drawing or equipment submitted is not as specified or a non-approved manufacturer or product and rejected.

G> Resubmit for Record Only:

Make the corrections noted on the shop drawing or submittal. The shop drawing or equipment submittal as submitted is approved with minor exception. Changes or corrections are required. The materials, equipment or system submitted can be released for fabrication and construction.

- T. Refer to the Project General Conditions and Division 01 Requirements for additional shop drawing submittal requirements, as well as specific requirements in various Divisions 26-28 Technical Specifications.

PART 3 - EXECUTION

3.1 VISIT THE SITE PRIOR TO PLACING BID:

- A. Visit the site and observe the conditions under which the work shall be performed or other circumstances which will affect the contemplated work.
- B. Bidders shall thoroughly familiarize themselves with all installation parameters, including means and methods of getting equipment and materials into and out of the facility.
- C. No subsequent allowance will be made for any error, omission or negligence on the Contractor's part.

3.2 WORKMANSHIP:

- A. All work shall be installed in a first class, neat and workmanlike manner by mechanics skilled in the trade involved. All details of the installation shall be mechanically and electrically correct. Should the Design Professional direct removal, change, or installation of any equipment or systems not installed in a neat and workmanlike manner, such charges shall be made by the Electrical Contractor at no expense to the Owner.
- B. Equipment shall be installed in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. The Contractor shall obtain these instructions from the manufacturer and these instructions shall be considered part of these Specifications.
- C. Drawings are generally indicative of the work to be installed, but do not indicate all conduit bends, fittings, pullboxes, and specialties which may be required, or the exact locations of all conduits. Field investigate and coordinate conditions affecting the work, along with the work installed by other trades and arrange the work; accordingly, furnish such fittings and appurtenances as may be required to meet such conditions. Contractor is responsible for exercising proper judgment to arrange their work and materials so as to avoid interference with other trades.
 - 1. The essentially diagrammatic nature of drawings shall not be interpreted as reason to redesign project. No reduction in size or number of raceways or cables will be permitted. In general, quantity of wires in each raceway or cable has not been indicated but shall be provided as required.
 - 2. Details and schematics generally indicate wiring to be used in various systems involved. This information may or may not be duplicated on the plans, but equipment shown on either plans or Riser or One Line diagrams and schematics shall be provided as if shown on both.
 - 3. All grades, elevations, dimensions and clearances of equipment shown on drawings are approximate and shall be verified at site.
 - 4. Where work or equipment is referred to in singular terms, such reference shall be deemed to apply to as many items of work or equipment as required to complete entire installation.
- D. Electrical junction boxes, pull boxes, panel boards, switches and controls and other apparatus requiring periodic maintenance and operation shall be accessible.

3.3 LINES AND GRADES:

- A. A competent Electrical Foreman shall be on the premises at all times during the construction to check, layout, coordinate and superintend the installation of the work performed under Divisions 26-28. The foreman shall be approved by the Construction Manager or General Contractor, the Owner and the Design Professional prior to start of construction.
- B. Establish all grades and lines relative to the work before any work has been started and be responsible for the accuracy thereof.
- C. Lay out work and establish heights and grades for work in strict accordance with the intent expressed by the drawings and all the physical conditions at the building and be responsible for the accuracy of same.

3.4 FIELD MEASUREMENTS:

- A. Before ordering any material or doing any work, verify all measurements at the building and site and be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and measurements and those indicated on the drawings. Any difference which may be found shall be submitted to the Design Professional for consideration before proceeding any further with the work.

3.5 DELIVERY OF EQUIPMENT:

- A. Be responsible for delivery of equipment, unload and store in a manner not to interfere with the operation of other trades. Additional expense incurred because of equipment or material delivery delays shall be assumed by the responsible Contractor.

3.6 RESTRICTIONS ON EARLY USE OF ELECTRICAL EQUIPMENT:

- A. Any electrical equipment placed into service and used prior to project Substantial Completion shall be used at the onus of the contractor and they shall assume full responsibility for repairing or replacing any equipment damaged as a result of the use and pay all costs associated with the action required to restore the equipment to "like new" condition at the end of the project. This includes extension of warranties, payment of Design Professional fees required to investigate and enforce this requirement, and the correction of any other detrimental conditions which is determined by the Design Professional to be related to the early use of the equipment.
- B. Should the early use of equipment result in manufacturer's warranty being void or of limited duration, the contractor shall assume the cost of furnishing an equivalent warranty to the Owner. Refer to Article "Warranty" in Part 1 above.

3.7 PROTECTION OF WORK:

- A. All work, equipment and materials shall be protected at all times. All raceway openings shall be closed with caps or plugs during the installation. All equipment shall be tightly covered and protected against dirt, water, plaster, paint and other foreign material or mechanical injury

during entire progress of installation. Make good all damage caused either directly or indirectly by workmen employed to fulfill requirements of the Electrical Work.

3.8 REMOVAL OF RUBBISH:

- A. During the course of construction, periodically remove from the premises all trash, rubbish and miscellaneous debris resulting from work of this trade so as to prevent its accumulation. At the completion of the work contemplated under these Specifications remove from the building and site all rubbish and accumulated materials of whatever nature not caused by the other trades and leave work, and equipment free of all foreign matter including plaster, cement, and paint and leave in a clean, orderly, acceptable and usable condition.

3.9 COORDINATION WITH OTHER TRADES:

- A. Coordinate the entire electrical installation with the work of all other trades on the project to provide a fully coordinated installation, with proper access to all equipment requiring same, proper electric service to each piece of equipment requiring electrical power and proper provisions for servicing and maintenance of all equipment of all trades. Install electrical raceways and equipment to minimize interference with other trades and allow proper access to all equipment of all trades. Follow National Electrical Code requirements for equipment access and clearances.
- B. Do not depend solely on the electrical drawings to determine construction arrangements. Verify actual conditions base on the individual discipline documents, approved submittals and approved equipment cuts.
- C. Minor relocations of outlets, devices, fixtures and rough-in locations is to be expected prior to rough-in and shall be accommodated at no additional cost.
- D. Participate in on-going contractor coordination efforts in order to create a finalized, well-coordinated layout of all equipment, fixtures, devices, raceways and all other items within their respective scope. The coordination effort shall include coordinating information from all other trade contractors involved in the project scope, all existing conditions, and all new work in order to provide a complete and thorough coordination effort. Any work which must be modified due to lack of coordination shall be the responsibility of the Contractor and shall be corrected at no additional cost to the project. Minor relocations and shifts of equipment and raceways, which do not change the design intent indicated on the contract documents, required to accommodate field conditions, and which do not involve changes in project cost or schedule, may be made at the Contractor's discretion and do not require Design Professional's approval.

3.10 COORDINATION OF ELECTRICAL CHARACTERISTICS:

- A. It is the intention and requirement of this specification that the proper electrical service be provided to all pieces of equipment on the project requiring same. As far as is possible, the proper service to each piece of equipment has been indicated on the plans. Verify the service requirements of all pieces of equipment before making final provisions. All manufacturer's details shall be available for check before installation. Check the exact point of connection for

each piece of equipment so that the service may be brought to the proper location. Locations indicated on the plans are diagrammatic and approximate only.

- B. Carefully examine the drawings of all other trades for equipment requiring electrical connection to confirm that all electrical characteristics of equipment indicated thereon matches the service available. Wherever possible, obtain approved shop drawings and equipment rough-in drawings for the actual item of equipment to be installed prior to rough-in. This shall apply to all equipment, whether it is to be installed by the contractor or by the Owner.
- C. If any discrepancies are noted, immediately notify the Design Professional and request resolution. If characteristics are correct, Electrical Contractor is responsible for ascertaining method of connection, "rough-in" dimensions, correct plug and receptacle configurations, etc. While Design Professional has made every effort to provide such information as is known at time of design, Contractor shall obtain final data from approved shop drawings before proceeding.
- D. For all equipment of other trades which electrical characteristics are not indicated on the drawings of that trade, notify the Contractor furnishing such equipment as to the characteristics required.

3.11 SEISMIC RESTRAINTS:

- A. All electrical equipment and material required by applicable Codes to be installed or supported in accordance with seismic restraint criteria shall be installed in accordance with this Article. This applies to materials specified in this section.
- B. Engage the services of a registered professional engineer whose practice comprises the design of seismic restraints. All costs for these services shall be included in the bid.

3.12 OWNER'S INSTRUCTIONS:

- A. Upon completion of all work provided under these Divisions of the specifications, thoroughly instruct the Owner's representatives in the operation and maintenance of all the various apparatus and equipment to the approval and complete satisfaction of the Engineer. This shall be done after the completed systems have been put in full operating condition and all tests are successfully completed.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall make excavations of normal depth in earth for trenches and structures, shall backfill and compact such excavations to the extent necessary, shall furnish the necessary material and construct embankments and fills, and shall make miscellaneous earth excavations and do miscellaneous grading.

1.02 RELATED WORK:

- A. Section 00 31 33, ENVIRONMENTAL SUBSURFACE DATA
- B. Section 01 11 00, CONTROL OF WORK AND MATERIALS
- C. Section 01 57 19, ENVIRONMENTAL PROTECTION
- E. Section 03 30 00, CAST-IN-PLACE CONCRETE
- F. Section 31 05 19.13, GEOTEXTILE FABRICS
- G. Section 31 23 19, DEWATERING
- H. Section 32 12 16.13, HMA PAVEMENT
- I. Section 32 13 13, PORTLAND CEMENT CONCRETE PAVEMENT
- J. Section 32 91 00, LOAM AND PLANTING PREPARATION
- K. Section 32 92 00 TURF AND GRASSES
- L. Section 32 93 00 TREES, SHRUBS, GROUNDCOVER, AND LANDSCAPING
- M. Section 33 41 13.22 CORRUGATED POLYETHYLENE (HDPE) DRAINAGE PIPE
- N. Section 33 44 19.13 STORMWATER TREATMENT SYSTEM

1.03 REFERENCES:

ASTM International (ASTM)

ASTM	C131	Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM	C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM	C330	Specification for Lightweight Aggregate for Structural Concrete.
ASTM	D1556	Test Method for Density of Soil in Place by the Sand Cone Method.
ASTM	D1557	Test Methods for Moisture-density Relations of Soils and Soil Aggregate Mixtures Using Ten-pound (10 Lb.) Hammer and Eighteen-inch (18") Drop.
ASTM	D2321	Bedding and backfill for surface drainage inlets
ASTM	D2922	Test Methods for Density of Soil and Soil-aggregate in Place by Nuclear Methods (Shallow Depth).

Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges.

Code of Massachusetts Regulations (CMR) 310.40.0032 Contaminated Media and Contaminated Debris

Code of Massachusetts Regulations (CMR) 520 CMR 14.00 Excavation & Trench Safety Regulation

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00 SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

- A. Material Test Reports: From a qualified independent testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 and moisture content according to ASTM D 2216 of each on-site and borrow soil and/or fill material proposed for fill and backfill.

2. Laboratory compaction curve according to ASTM D 1557 for each onsite and borrow soil and/or fill material proposed for fill and backfill.

1.05 PROTECTION OF EXISTING PROPERTY:

- A. The work shall be executed in such manner as to prevent any damage to facilities at the site and adjacent property and existing improvements, such as but not limited to streets, curbs, paving, service utility lines, structures, monuments, benchmarks, observation wells, and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout and other hazards created by earthwork operations.
- B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at its own expense, make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to at least the condition that existed at the start of operations. The Contractor shall replace, at its own cost, existing benchmarks, observation wells, monuments, and other reference points, which are disturbed or destroyed.
- C. Buried drainage structures and pipes, including those which project less than eighteen inches (18") above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment and shall be maintained at all times until completion of project.

1.06 DRAINAGE:

- A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff will not adversely affect construction procedures or cause excessive disturbance of underlying natural ground or abutting properties.

1.07 FROST PROTECTION AND SNOW REMOVAL:

- A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work.
- B. The Contractor shall protect the subgrade beneath new structures and pipes from frost penetration when freezing temperatures are expected.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. GRAVEL BORROW:

Gravel Borrow shall satisfy the requirements listed in MassDOT Specification Section M1.03.0, Type b.

B. DENSE GRADED CRUSHED STONE

1. Dense Graded Crushed Stone shall satisfy the requirements listed in MassDOT Specification Section M2.01.7.

C. CRUSHED STONE

1. Material shall be compacted and free draining angular crushed stone. Crushed stone shall be uniformly blended and conform to MassDOT Crushed Stone M2.01.0.
2. Where crushed stone is used as a stone pad below concrete foundations, the stone pad should extend a minimum of 6" beyond footing in all directions.
3. Provide Tencate Mirafi® S-Series Non-woven Filter Fabric or approved equal between undisturbed native soil and stone pads.

D. PEASTONE:

1. Peastone shall be smooth, hard, naturally occurring, rounded stone meeting the following gradation requirements:
2.

Passing 5/8 inch square sieve opening	-100%
Passing No. 8 sieve opening	-0%

E. CLASS B BACKFILL:

1. Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30 percent or less passing the No. 200 sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.

F. R-TANK DRAINAGE MATERIALS:

1. IN ACCORDANCE WITH SECTION 33 46 23

G. FOCAL POINT BIOFILTRATION SYSTEM FILTER DRAINAGE /FABRIC:

1. IN ACCORDANCE WITH SECTION 33 44 19.13

H. STORM TREE FILTER SYSTEM DRAINAGE / FABRIC:

1. IN ACCORCDANCE WITH SECTION 33 44 19.13

PART 3 - EXECUTION**3.01 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION:**

- A. Contractor shall take the necessary steps to avoid disturbance of subgrade during excavation and filling operations, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering and other acceptable control measures.
- B. All excavated or filled areas disturbed during construction, all loose or saturated soil, and other areas that will not meet compaction requirements as specified herein shall be removed and replaced with a minimum 12-inch layer of compacted crushed stone wrapped all around in non-woven filter fabric. Costs of removal and replacement shall be borne by the Contractor.
- C. The Contractor shall place a minimum of 12-inch layer of special bedding materials and crushed stone wrapped in filter fabric over the natural underlying soil to stabilize areas which may become disturbed as a result of rain, surface water runoff or groundwater seepage pressures, all at no additional cost to the Owner. The Contractor also has the option of drying materials in-place and compacting to specified densities.

3.02 EXCAVATION:**A. GENERAL:**

1. The Contractor shall perform all work of any nature and description required to accomplish the work as shown on the Drawings and as specified.

2. Excavations, unless otherwise required by the Engineer, shall be carried only to the depths and limits shown on the Drawings or as described herein. If unauthorized excavation is carried out below required subgrade and/or beyond minimum lateral limits shown on Drawings, it shall be backfilled with gravel borrow and compacted at the Contractor's expense as specified below, except as otherwise indicated. Excavations shall be kept in dry and good conditions at all times, and all voids shall be filled to the satisfaction of the Engineer.
3. In all excavation areas, the Contractor shall strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils. In paved areas, the Contractor shall first cut pavement as specified in paragraph 3.02 B.1 of this specification, strip pavement and pavement subbase separately from underlying soils. All excavated materials shall be stockpiled separately from each other within the limits of work.
4. The Contractor shall follow a construction procedure, which permits visual identification of stable natural ground. Where groundwater is encountered, the size of the open excavation shall be limited to that which can be handled by the Contractor's chosen method of dewatering, and which will allow visual observation of the bottom and backfill in the dry.
5. The Contractor shall excavate unsuitable materials to stable natural ground where encountered at proposed excavation subgrade, as required by the Engineer. Unsuitable material includes topsoil, loam, peat, other organic materials, snow, ice, and trash. Unless specified elsewhere or otherwise required by the Engineer, areas where unsuitable materials have been excavated to stable ground shall be backfilled with compacted special bedding materials or crushed stone wrapped all around in non-woven filter fabric.

B. TRENCHES:

1. Prior to excavation, trenches in pavement shall have the traveled way surface cut in a straight line by a concrete saw or equivalent method, to the full depth of pavement. Excavation shall only be between these cuts. Excavation support shall be provided as required to avoid undermining of pavement. Cutting operations shall not be done by ripping equipment.
2. The Contractor shall satisfy all dewatering requirements specified in Section 31 23 19 DEWATERING, before performing trench excavations.
3. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, and depths of cover indicated on the Drawings. Trench widths shall be as shown on the Drawings or as specified.

4. Where pipe is to be laid in bedding material, the trench may be excavated by machinery to, or just below, the designated subgrade provided that the material remaining in the bottom of the trench is not disturbed.
5. If pipe is to be laid in embankments or other recently filled areas, the fill material shall first be placed to a height of at least 12-inches above the top of the pipe before excavation.
6. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed.
7. If, in the opinion of the Engineer, the subgrade, during trench excavation, has been disturbed as a result of rain, surface water runoff or groundwater seepage pressures, the Contractor shall remove such disturbed subgrade to a minimum of 12 inches and replace with crushed stone wrapped in filter fabric. Cost of removal and replacement shall be borne by the Contractor.
8. The Contractor shall obtain a trench permit from the municipality where the trench is located prior to making any excavations of trenches (any subsurface excavation greater than three (3) feet in depth and fifteen (15) feet or less between soil walls as measured from the bottom).
9. All trenches required to be permitted must be attended, covered, barricaded, or backfilled. Covers must be road plates at least ¾-inch thick or equivalent, barricades must be fences at least 6-feet high with no openings greater than 4-inches between vertical supports and all horizontal supports required to be located on the trench-side of the fencing.

C. FOUNDATION EXCAVATION:

1. Excavations shall not be wider than required to set, brace, and remove forms for concrete, or perform other necessary work.
2. After the excavation has been made, and before forms are set for footings or other structures, and before reinforcing is placed, all loose or disturbed material shall be removed from the subgrade. The bearing surface shall then be compacted to meet the requirements of this specification.

3. If, in the opinion of the Engineer, the existing material at subgrade elevation is unsuitable for structural support, the Contractor shall excavate and dispose of the unsuitable material to the required width and depth as required by the Engineer. If, in the opinion of the Engineer, filter fabric is required; the Contractor shall place filter fabric, approved by the Engineer, as per manufacturer's recommendations. Crushed stone shall then be placed in lifts and compacted to a firm and unyielding condition with at least 4 passes of a vibratory compactor. Backfill shall be placed to the bottom of the proposed excavation.

D. EXCAVATION NEAR EXISTING STRUCTURES:

1. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the drawings, but the completeness or accuracy of the given information is not guaranteed.
2. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.
3. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

3.03 BACKFILL PLACEMENT AND COMPACTION:

A. GENERAL:

1. Prior to backfilling, the Contractor shall compact the exposed natural subgrade to a firm and unyielding condition with several passes of the compaction equipment.
2. After approval of subgrade by the Engineer, the Contractor shall backfill areas to required contours and elevations with specified materials.
3. The Contractor shall place and compact materials to the specified density in continuous horizontal layers, not to exceed nine (9) inches in uncompacted lifts. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557. The minimum degree of compaction for fill placed shall be as follows:

Percent of

- | <u>Location</u> | <u>Maximum Density</u> |
|----------------------------------|------------------------|
| Below pipe centerline | 95 |
| Above pipe centerline | 92 |
| Below pavement (upper 3 ft.) | 95 |
| Below and behind retaining walls | 95 |
| Below pipe in embankments | 95 |
| Adjacent to utility structures | 92 |
| Below structures | 95 |
4. The Engineer reserves the right to test backfill for conformance to the specifications and the Contractor shall assist as required to obtain the information. Compaction testing will be performed by the Engineer or by an inspection laboratory designated by the Engineer, engaged and paid for by the Owner. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work by recompacting where appropriate or replacing as necessary and approved by the Engineer, to bring the work into compliance, at no additional cost to the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.
 5. Where horizontal layers meet a rising slope, the Contractor shall key each layer by benching into the slope.
 6. If the material removed from the excavation is suitable for backfill with the exception that it contains stones larger than permitted, the Contractor has the option to remove the oversized stones and use the material for backfill or to provide replacement backfill at no additional cost to the Owner.
 7. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.
- B. TRENCHES:**
1. Bedding as detailed and specified shall be furnished and installed beneath the pipeline prior to placement of the pipeline. A minimum bedding thickness shall be maintained between the pipe and undisturbed material, as shown on the Drawings.
 2. As soon as practicable after pipes have been laid, backfilling shall be started.

3. Unless otherwise indicated on the Drawings, Gravel Borrow shall be placed by hand shovel in 6-inch thick lifts up to a minimum level of 12-inches above the top of pipe. This area of backfill is considered the zone around the pipe and shall be thoroughly compacted before the remainder of the trench is backfilled. Compaction of each lift in the zone around the pipe shall be done by use of power-driven tampers weighing at least 20 pounds or by vibratory compactors. Care shall be taken that material close to the bank, as well as in all other portions of the trench, is thoroughly compacted to densities required.
4. Class B backfill shall be placed from the top of the Gravel Borrow to the specified material at grade (loam, pavement subbase, etc.). Fill compaction shall meet the density requirements of this specification.
5. If the materials above the trench bottom are unsuitable for backfill, the Contractor shall furnish and place backfill materials meeting the requirements for trench backfill, as shown on the drawings or specified herein.
6. Should the Engineer order crushed stone for utility support or for other purposes, the Contractor shall furnish and install the crushed stone as directed.
7. In shoulders of streets and road, the top 12-inch layer of trench backfill shall consist of processed gravel for sub-base, satisfying the requirements listed in MassDOT standard specification M1.03.1.

C. BACKFILLING ADJACENT TO STRUCTURES:

1. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads to which they will be subjected. Excavated material approved by the Engineer may be used in backfilling around structures. Backfill material shall be thoroughly compacted to meet the requirements of this specification.
2. Contractor shall use extra care when compacting adjacent to pipes and drainage structures. Backfill and compaction shall proceed along sides of drainage structures so that the difference in top of fill level on any side of the structure shall not exceed two feet (2') at any stage of construction.
3. Where backfill is to be placed on only one side of a structural wall, only hand-operated roller or plate compactors shall be used within a lateral distance of five feet (5') of the wall for walls less than fifteen feet (15') high and within ten feet (10') of the wall for walls more than fifteen feet (15') high.

3.04 DISPOSAL OF SURPLUS MATERIALS:

- A. Surplus excavated materials, which are acceptable to the Engineer, shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill. Upon written approval of the Engineer, surplus excavated materials shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes as indicated by the Owner, within its jurisdictional limits; all at no additional cost to the Owner.
- B. Surplus excavated material not needed as specified above shall be hauled away and disposed of by the Contractor at no additional cost to the Owner, at appropriate locations, and in accordance with arrangements made by it. Disposal of all rubble shall be in accordance with all applicable local, state and federal regulations.
- C. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Engineer.
- D. The Contractor shall comply with Massachusetts regulations (310 CMR 40.0032) that govern the removal and disposal of surplus excavated materials. Materials, including contaminated soils, having concentrations of oil or hazardous materials less than an otherwise Reportable Concentration and that are not a hazardous waste, may not be disposed of at locations where concentrations of oil and/or hazardous material at the receiving site are significantly lower than the levels of those oil and /or hazardous materials present in the soil being disposed or reused.

END OF SECTION

SECTION 31 05 19.13

GEOTEXTILE FABRICS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

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

1.02 WORK INCLUDED:

- A. This Section covers furnishing of all labor, materials, and equipment necessary to install specified geotextile fabrics in locations shown on the drawings and as required by the Owner's Representative.

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Shop drawings or working drawings and material specifications shall be submitted to the Owner's Representative for review for each type of geotextile fabric furnished. General installation practices and installation schedule shall be included.

PART 2 - PRODUCTS

2.01 EROSION CONTROL FABRIC:

- A. IN ACCORDANCE WITH SECTION 31 25 00

2.02 FILTER/DRAINAGE FABRIC:

- A. The filter/drainage fabric shall be composed of continuous-filament fibers bonded together to form a sheet. The fabric shall be an average of 20 mils thick and possess the characteristics of Tencate Mirafi 140N, or approved equal.

2.03 CONTAINMENT FABRIC:

- A. The containment fabric shall be created from high tenacity polypropylene filaments and possess the characteristics of Tencate Mirafi H2Ri.

2.04 R-TANK FILTER/DRAINAGE FABRIC:

- A. IN ACCORDANCE WITH SECTION 33 46 23

GEOTEXTILE FABRICS

2.05 FOCAL POINT BIOFILTRATION SYSTEM FILTER/DRAINAGE FABRIC:

B. IN ACCORDANCE WITH SECTION 33 44 19.13

2.06 STORM TREE FILTER SYSTEM DRAINAGE FABRIC:

C. IN ACCORDANCE WITH SECTION 33 44 19.13

2.07 GEOGRID :

IN ACCORDANCE WITH SECTION 33 46 23

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. GENERAL: Installation of geotextile fabrics shall be strictly in accordance with manufacturer's instructions and specific layout plans and details reviewed by the Owner's Representative.
- B. FILTER/DRAINAGE FABRIC: The filter/drainage fabric shall be installed in the final graded trench bottom prior to placement of the crushed stone bedding and at other locations shown on the drawings or designated by the Owner's Representative. The drainage fabric in place shall cover the entire trench bottom and trench sides as shown on the drawings. Each width of drainage fabric shall be overlapped in accordance with manufacturer's recommendations, but not less than 2 feet, to prevent intrusion of soil fines into the bedding.

3.02 FINAL INSPECTION AND ACCEPTANCE:

- A. The Contractor shall, at its expense, have a manufacturer's representative inspect the work at completion of the installation. Any work found to be unsatisfactory shall be corrected at the Contractor's expense.
- B. The Owner's Representative, at the Contractor's expense, reserves the right to have a manufacturer's representative inspect the installation process at any time during construction.

END OF SECTION

SECTION 31 23 16.26

ROCK EXCAVATION AND DISPOSAL

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall excavate rock, if encountered, to the lines and grades indicated on the drawings or as required, shall dispose of the excavated material, and shall furnish the required material as specified in Section 31 00 00 EARTHWORK for backfill in place of the excavated rock.

1.02 RELATED WORK:

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE
- B. Section 31 00 00, EARTHWORK
- C. Section 31 50 00, SUPPORT OF EXCAVATION

1.03 DEFINITIONS:

- A. The word "rock," wherever used as the name of the excavated material or material to be excavated, shall mean only boulders and pieces of concrete or masonry exceeding one cubic yard* in volume, or solid ledge rock which, in the opinion of the Engineer, requires for its removal, drilling and blasting, wedging, sledging, barring, or breaking up with a power-operated tool. No soft or disintegrated rock which can be removed by normal earth excavation methods, no loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere, and no rock exterior to the maximum limits of measurement allowed, which may fall into the excavation, will be measured or allowed as "rock."
- B. The word "earth," wherever used as the name of an excavated material, or material to be excavated shall mean all kinds of material other than rock as above defined.

1.04 QUALITY ASSURANCE:

- A. The Contractor shall conform to all municipal ordinances and state and federal laws relating to the transportation, storage, handling, and use of explosives. In the event that any of the above mentioned laws, ordinances, or regulations require a licensed blaster to perform or supervise the work of blasting, said licensed blaster shall, at all times, have his license on the work site and shall permit examination thereof by the Engineer or other officials having jurisdiction.
- B. The Contractor shall procure all permits required for blasting.

11/01/2024

1.05 SUBMITTALS:

- A. At least two weeks before beginning blasting operations, in accordance with requirements of Section 01 33 00 SUBMITTAL PROCEDURES, the Contractor shall submit to the Engineer for record the following data:
 - 1. Name of Contractor or Subcontractor responsible for blasting and monitoring operations and license number.
 - 2. Name, affiliation, and license number of the person or persons who will be directly responsible for designing each blast, supervising the loading of the shot, and firing it.
- B. Copies of all permits required for blasting.
- C. Results of pre-blast survey.
- D. When blasting is in progress, daily reports on blasting operations and blast monitoring results.

1.06 DELIVERY/STORAGE AND HANDLING:

Delivery, storage and handling of explosives shall conform to all federal, state and local regulations and permits.

PART 2 - PRODUCTS - NOT APPLICABLE**PART 3 - EXECUTION****3.01 PREPARATION/PRE-BLAST SURVEY**

If required, the pre-blast survey shall be conducted in accordance with state regulations and/or local permit requirements.

3.02 EXCAVATION:

- A. The Contractor shall excavate rock to the lines and grades indicated on the drawings or as required by the Engineer. The excavated rock shall be removed and disposed of by the Contractor as specified for surplus excavated materials under Section 31 00 00, EARTHWORK.
- B. Work damaged by blasting shall be repaired or replaced at the Contractor's expense.
- C. If rock is excavated beyond the limits of payment indicated on the drawings, specified, or authorized in writing by the Engineer, the excess excavation, whether resulting from

11/01/2024

overbreakage or other causes, shall be backfilled, by and at the expense of the Contractor, as specified below:

1. In pipe trenches, excess excavation shall be filled with the required material and compacted in the same manner as specified for the material in the zone around the pipe under Section 31 00 00 EARTHWORK.
2. In excavations for structures, excess excavation in the rock beneath foundations shall be filled with concrete which shall have a minimum 28-day compressive strength of 3000 psi. Other excess excavation shall be filled with Class B backfill compacted to a minimum of 92 percent density (ASTM D1557 Method C) as specified under Section 31 00 00, EARTHWORK.
3. If the rock below normal depth is shattered due to drilling or blasting operations of the Contractor, and the Engineer considers such shattered rock to be unfit for foundations, the shattered rock shall be removed and the excavation shall be backfilled with concrete as required, except that in pipe trenches crushed stone may be used for backfill, if approved. All such removal and backfilling shall be done by and at the expense of the Contractor.

- D. When required by the Engineer, the Contractor shall remove all dirt and loose rock from designated areas and shall clean the surface of the rock thoroughly to determine whether seams or other defects exist.
- E. When concrete is to be placed on rock, the rock shall be free of all vegetation, dirt, sand, clay, boulders, scale, excessively cracked rock, loose fragments, water, ice, snow, and other objectionable substances.

3.03 VIBRATION AND AIR BLAST MONITORING:

- A. The Contractor shall measure air blast and vibration levels of blasting operations to assure compliance with all applicable regulations and local permits.
- B. Records of each day's air blast and vibration measurements shall be submitted to the Engineer in writing no later than the start of the next day's work. Records shall include, as a minimum:
 - Identification of instrument
 - Name of observer
 - Name of interpreter
 - Distance and direction of recording station from the area of detonation

- Date and exact time of reading
- Type of ground at recording station
- Peak particle velocity for all components as well as resultant for all frequencies of vibrations
- Duration of motion with a velocity in excess of one thousandth of an inch per second
- A copy of the photographic record of seismograph readings
- Peak air blast level.

3.04 BLASTING RECORDS:

The Contractor shall prepare and submit to the Engineer daily blast reports, including logs of each blast. Reports shall be submitted to the Engineer no later than the start of the next day's work. However, during each day of blasting, the Contractor shall review and shall provide access for the Engineer to review the data from that day's blasting. Reports after each blast shall include at least the following information for each blast:

- Date, time, and location of blast
- Permit number and expiration date
- Amount and type of explosives used by weight and number of cartridges
- Total number of delays used and number of holes used for each delay
- On a diagram of the blast pattern, indicate total number and depth of holes, maximum charge per delay, maximum charge per hole, and corresponding delay number
- An evaluation of the blast indicating areas of significant overbreak, unusual results, and any recommended adjustments for the next blast.

3.05 POST BLASTING INSPECTIONS:

The Contractor shall examine any properties, structures, and conditions where complaints of damage have been received or damage claims have been filed. Advance notice shall be given to all interested parties so that the parties may be present during the final examination. Records of the final examination shall be signed and distributed to the owner of the property, the head of the local fire department, and the Engineer.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section specifies designing, furnishing, installing, maintaining, operating and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; disposing of pumped water; constructing, maintaining, observing and, except where indicated or required to remain in place, removing of equipment and instrumentation for control of the system.

1.02 RELATED WORK:

- A. Section 00 31 43, PERMITS
- B. Section 01 57 19, ENVIRONMENTAL PROTECTION
- C. Section 31 00 00, EARTHWORK
- D. Section 31 50 00, SUPPORT OF EXCAVATION

1.03 SYSTEM DESCRIPTION:

- A. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture or heaving of the bottom of any excavation; and disposing of pumped water.

1.04 QUALITY ASSURANCE:

- A. The Contractor is responsible for the adequacy of the dewatering systems.
- B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise required by the Engineer, so that all excavation bottoms are firm and dry.
- C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent that they will not be floated or otherwise damaged.

- D. The dewatering system and excavation support (see Section 31 50 00, SUPPORT OF EXCAVATION) shall be designed so that lowering of the groundwater level outside the excavation does not adversely affect adjacent structures, utilities or wells.

1.05 SUBMITTALS:

- A. In accordance with Section 01 33 00, Contractor shall submit a plan indicating how it intends to control the discharge from any dewatering operations on the project, whether it is discharge of groundwater from excavations or stormwater runoff during the life of the project.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 DEWATERING OPERATIONS:

- A. All water pumped or drained from the work shall be disposed of in a manner that will not result in undue interference with other work or damage to adjacent properties, pavements and other surfaces, buildings, structures and utilities. Suitable temporary pipes, flumes or channels shall be provided for water that may flow along or across the site of the work. All disposal of pumped water shall conform to the provisions of Section 01 57 19 ENVIRONMENTAL PROTECTION and Section 00 31 43 PERMITS.
- B. Dewatering facilities shall be located where they will not interfere with utilities and construction work to be done by others.
- C. Dewatering procedures to be used shall be as described below:
 - 1. Crushed stone shall encapsulate the suction end of the pump to aid in minimizing the amount of silt discharged.
 - 2. For dewatering operations with relatively minor flows, pump discharges shall be directed into straw bale sedimentation traps lined with filter fabric. Water is to be filtered through the straw bales and filter fabric prior to being allowed to seep out into its natural watercourse.
 - 3. For dewatering operations with larger flows, pump discharges shall be into a steel dewatering basin. Steel baffle plates shall be used to slow water velocities to increase the contact time and allow adequate settlement of sediment prior to discharge into waterways.

11/01/2024

Green Island Phase II

4. Where indicated on the contract drawings or in conditions of excess silt suspended in the discharge water, silt control bags shall be utilized in catch basins.
- D. The Contractor shall be responsible for repair of any damage caused by his dewatering operations, at no cost to the Owner.

END OF SECTION

11/01/2024

SECTION 31 50 00

SUPPORT OF EXCAVATION

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section of the specification covers wood sheeting and bracing for support of excavations. The requirements of this section shall also apply, as appropriate, to other methods of excavation support and underpinning which the Contractor elects to use to complete the work.
- B. The Contractor shall furnish and place timber sheeting of the kinds and dimensions required, complying with these specifications, where indicated on the drawings or required by the Engineer.

1.02 RELATED WORK:

- A. Section 31 23 19, DEWATERING.
- B. Section 31 00 00, EARTHWORK.

1.03 QUALITY ASSURANCE:

- A. This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Safety and Department of Labor, Division of Occupational Safety "Excavation & Trench Safety Regulation (520 CMR 14.00)" and "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et seq.)." Contractors shall be familiar with the requirements of these regulations.
- B. The excavation support system shall be of sufficient strength and be provided with adequate bracing to support all loads to which it will be subjected. The excavation support system shall be designed to prevent any movement of earth that would diminish the width of the excavation or damage or endanger adjacent structures.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Timber sheeting shall be sound spruce, pine, or hemlock, planed on one side and either tongue and grooved or splined. Timber sheeting shall not be less than nominal 2-inches thick.

11/01/2024

- B. Timber and steel used for bracing shall be of such size and strength as required in the excavation support design. Timber or steel used for bracing shall be new or undamaged used material which does not contain splices, cutouts, patches, or other alterations which would impair its integrity or strength.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Work shall not be started until all materials and equipment necessary for their construction are either on the site of the work or satisfactorily available for immediate use as required.
- B. The sheeting shall be securely and satisfactorily braced to withstand all pressures to which it may be subjected and be sufficiently tight to minimize lowering of the groundwater level outside the excavation, as required in Section 31 23 19, DEWATERING.
- C. The sheeting shall be driven by approved means to the design elevation. No sheeting may be left so as to create a possible hazard to safety of the public or a hindrance to traffic of any kind.
- D. If boulders or very dense soils are encountered, making it impractical to drive a section to the desired depth, the section shall, as required, be cut off.
- E. The sheeting shall be left in place where indicated on the drawings or required by the Engineer in writing. At all other locations, the sheeting may be left in place or salvaged at the option of the Contractor. Steel or wood sheeting permanently left in place shall be cut off at a depth of not less than two feet below finish grade unless otherwise required.
- F. All cut-off will become the property of the Contractor and shall be removed by him from the site.
- G. Responsibility for the satisfactory construction and maintenance of the excavation support system, complete in place, shall rest with the Contractor. Any work done, including incidental construction, which is not acceptable for the intended purpose shall be either repaired or removed and reconstructed by the Contractor at his expense.
- H. The Contractor shall be solely responsible for repairing all damage associated with installation, performance, and removal of the excavation support system.

END OF SECTION

SECTION 32 12 16.13

HOT MIX ASPHALT PAVEMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. Under this Section, the Contractor shall furnish all necessary labor, materials, equipment, and transportation necessary to construct the following:
 - 1. The hot mix asphalt pavement for all walkways/service drives shall be composed of materials as specified herein and shall be constructed on a prepared base course to the depth, grade and cross-section shown on the plans, as specified herein and as required by the Engineer.
 - 2. Unless otherwise specified in the Contract Drawings:
 - a. Hot mix asphalt pavement for pedestrian walks shall be composed of a one and one half (1 ½) inch hot mix asphalt binder course, and a one and one half (1 ½) inch hot mix asphalt dense mix course.
 - b. Hot mix asphalt pavement for vehicular pavement shall be composed of a two and one half (2 ½) inch hot mix asphalt binder course, and a one and one half (1 ½) inch hot mix asphalt dense mix course.
 - 3. Any reference to hot mix asphalt (HMA) on the plans or in the specifications shall relate to this section.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS:

- A. Reference to the standards, specifications and tests of technical societies, organizations and governmental bodies are made in the Contract Documents.
 - 1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).
 - 2. ASTM - ASTM International.
 - 3. Mass. Standard Specs. - Latest edition of the MassDOT Standard Specifications for Highways and Bridges hereinafter referred to as "The MassDOT Standard Specifications."

HOT MIX ASPHALT PAVEMENT

32 12 16.13-1

1.03 SUBMITTALS: IN ACCORDANCE WITH SECTION 01 33 00 SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

- A. Asphalt emulsion product and application specification.
- B. Six sets of complete job mix formula shall be submitted to the Engineer at least two weeks before any of the work of this section is to begin.

PART 2 - PRODUCTS

2.01 DENSE GRADED CRUSHED STONE SUBBASE:

- A. Dense graded crushed stone subbase shall consist of inert material that is hard durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials.
- B. Gradation requirements for dense graded crushed stone subbase shall be as specified in Section 31 00 00, EARTHWORK.

2.02 HOT MIX ASPHALT PAVEMENT:

- A. Hot mix asphalt pavement shall consist of binder mix and dense mix courses constructed to the thickness shown on the plans or specified herein and shall conform to the relevant provisions of Sections 460 and (M3.11.03) of the MassDOT Standard Specifications, unless specified otherwise hereinafter.
- B. Base/Binder Courses
 - 1. Base/Binder Courses shall be Bituminous Concrete Pavement, Dense Finish Course Type I-1.
- C. Leveling/Overlay Courses
 - 1. Leveling/Overlay Courses may conform to "Surface Treatment" dense mix, Table A, Section M3.11.03 of the MassDOT Standard Specifications, comprised of Class I Dense Bituminous Concrete, Type St or Dense Mix Type I-1, at the Contractor's option.
 - 2. The general composition of the bituminous concrete mixture (the proportion of asphalt cement to mineral aggregate) shall be in accordance with MHD requirements.

HOT MIX ASPHALT PAVEMENT
32 12 16.13-2

3. The mineral aggregate composition for Type St shall be as follows:

TYPE ST SIEVE ANALYSIS U.S. Standard Sieve No.	MINERAL AGGREGATE Percent Passing by Weight (per ASTM C-136)	
<u>Size</u>	<u>Minimum</u>	<u>Maximum</u>
1/2	100	-
3/8	80	100
4	55	80
8	48	63
16	36	49
30	24	38
50	14	27
100	6	18
200	4	8

2.03 ASPHALT EMULSION:

- A. Asphalt emulsion tack coat shall be Type SS-1 or SS-1H as specified by the Asphalt Institute.

2.04 SEAL COAT:

- A. Seal coats shall be within the composition limits for protective seal coat emulsion in accordance with MassDOT M3.03.3.
- B. Silica sand when blended with seal coat emulsion shall be No. 30 silica sand.

2.05 PAVEMENT MARKINGS:

- A. Pavement markings shall conform to the requirements of MassDOT 860.
- B. The mixture of the marking material shall be within the composition limits for reflectorized pavement markings as described in the MassDOT Specifications as follows:
1. Thermoplastic reflectorized pavement markings - M7.01.03/04.

- C. Application of the glass beads to be used as reflector material on the striping shall conform to Sections 860.62 and M7.03.07 of the MassDOT Specifications.

2.06 PAINT FOR PARKING LOTS

- A. Paint for parking lot lines shall conform to Federal Specification TT-P-115-E Type 1. Paint shall be 11-3 PPG Industries, Pittsburgh, PA or approved equal.

PART 3 - EXECUTION

3.01 GENERAL:

Paving courses required for the project shall be as shown on the drawings and as specified herein. Pavement thicknesses specified are measured in compacted inches. If a pavement course thickness exceeds 2-1/2 compacted inches, the course shall be installed in multiple lifts with each lift not exceeding 2-1/2 compacted inches in thickness.

3.02 DENSE GRADED CRUSHED STONE SUBBASE:

- A. The dense graded crushed stone subbase to be placed under pavement shall consist of 12-inches of gravel evenly spread and thoroughly compacted.
- B. The dense graded crushed stone shall be spread in layers not more than 4-inches thick, compacted measure. All layers shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM D1557 Method C at optimum moisture content.

3.03 TEMPORARY HOT MIX ASPHALT PAVEMENT:

- A. Where specified and required by the Engineer and after placement of the dense graded crushed stone subbase, the Contractor shall place temporary bituminous pavement. It shall consist of hot mix asphalt, 1 1/2"-inches thick, in accordance with MassDOT 460.
- B. The temporary pavement shall be repaired as necessary to maintain the surface of the pavement until replaced by permanent pavement. When so required by the Engineer, the Contractor shall remove the temporary pavement and install or regrade the subbase for installation of permanent pavement.

3.03 PERMANENT HOT MIX ASPHALT PAVEMENT:

- A. The hot mix asphalt mixtures shall be placed on the approved base only when, in

HOT MIX ASPHALT PAVEMENT
32 12 16.13-4

the opinion of the Engineer, the course is sufficiently dry and weather conditions are suitable.

- B. Where walls, curbing, or other suitable permanent supports are not present, the Contractor shall secure proper alignment and adequate compaction of the binder and surface courses as shown on the Contract Drawings and finish all edges with a neat, tamped edge.
- C. The mixture shall be placed in two (2) courses as shown on the Contract Drawings. Each course shall be spread and finished as required in the MassDOT Standard Specifications, Section 460.63.
- D. All joints between binder and top course shall be staggered a minimum of 6-inches.
- E. Prior to completion of bituminous concrete overlay, the Contractor shall have the existing patched surfaces tack coated and leveled to eliminate all “birdbaths” or extreme lows which may create ponding or drainage problems. Leveling course (surface treatment) bituminous concrete applied as necessary, shall be raked and feathered and be properly rolled and compacted. The Contractor shall apply “level” lines, screeds, or use other measures to achieve the proper leveling surface suitable for overlay.
- F. After completion, the hot mix asphalt courses shall conform to the thickness shown on the Contract Drawings or specified herein, smooth and even and of a dense and uniform structure. When tested with a sixteen (16) foot straight edge placed parallel to the centerline of the pavement, there shall be no deviation from a true surface in excess of one-quarter (1/4) inch.
- G. The surface area to be seal coated, as shown on the drawings, shall be swept and air cleaned. The first coat shall be applied with eight (8) pounds of #30 silica sand blended with each gallon of emulsion applied at a rate of 0.15 gallons per square yard. The second coat shall be a straight sealer applied at the rate of 0.1 gallons per square yard.
- H. The Contractor shall prepare the pavement surface for painting lines according to the recommendations of the paint manufacturer. Applied markings shall have clean-cut edges, true and smooth alignment and uniform film thickness of 15 mils, +/- 1.0. The Contractor shall be responsible for removing, to the satisfaction of the Engineer, tracing marks, and spilled paint applied in an unauthorized area.

3.04 ASPHALT EMULSION TACK COAT:

HOT MIX ASPHALT PAVEMENT 32 12 16.13-5

- A. To all existing surfaces to be paved against or overlaid, apply a single very thin (0.05 to 0.15 gallons per square yard) application of diluted asphalt emulsion (Type SS-1) to cover the entire surface of existing pavement.
- B. Essential qualities of coverage are (1) it must be very thin and (2) uniformly cover entire surface of existing pavement.
- A. Place only that amount of tack coat which can be overlaid with new pavement by the end of each day, and; IF RAIN IS ANTICIPATED DO NOT APPLY TACK COAT.

PART 4 – GUARANTEE/WARRANTY

- A. The Contractor shall be solely responsible for protecting surfaces until final acceptance of the project by the Owner and shall take all necessary precautions to secure premises during the initial drying periods.
- B. The pavement shall be guaranteed against defects in workmanship or quality for a period of one (1) year after final acceptance. The Contractor shall replace, repair, recoat or otherwise make satisfactory to the Owner any unacceptable pavement and or coating at no additional cost to the Owner.

END OF SECTION

SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

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

1.02 WORK INCLUDED: Construct Portland Cement sidewalk slabs and miscellaneous items as shown on the plans or as indicated.

1.03 RELATED WORK:

- A. SECTION 03 30 00 – CAST-IN-PLACE CONCRETE.

1.04 SUBMITTALS – IN ACCORDANCE WITH SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Design mixes for all concrete products intended for use and detailed plan and necessary drawings. Plan submitted shall indicate pour sequencing and incorporate specified time lag before pouring adjacent sections of concrete.

1.05 SPECIAL CURING REQUIREMENTS:

- A. The Contractor shall leave concrete forms in place a minimum of five (5) days after each pour. In addition, the Contractor shall moist cure the concrete during this period.

1.06 REFERENCES:

ASTM International (ASTM)

ASTM	C33	Specification for Concrete Aggregates
ASTM	C88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM	C94	Specification for Ready-Mixed Concrete
ASTM	C150	Specification for Portland Cement

PORTLAND CONCRETE PAVEMENT

32 13 13-1

ASTM	C226	Specifications for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement
ASTM	C233	Air-entraining Admixtures for Concrete
ASTM	D1751	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
American Concrete Institute		
ACI	318	Building Code Requirements for Reinforced Concrete
ACI	604	Recommended Practice for Winter Concreting
ACI	605	Recommended Practice for Hot Weather Concreting
ACI	613	Recommended Practice for Selecting Proportions for Concrete
ACI	614	Recommended Practice for Selecting Proportions for Structural Lightweight Concrete
ACI	614	Recommended Practice for Measuring, Mixing and Placing Concrete
ACI	315	Manual of Standard Practice for Detailing Reinforced Concrete Structures
ACI	544	Manual of Concrete Practices for Fiber Reinforced Concrete

PART 2 – PRODUCTS

2.01 CONCRETE:

- A. 4500 PSI compressive strength concrete at the end of 28 days.
- B. Air Content: $6\% \pm 1\%$, W/C, = 0.38, batch with high-range water reducer.
- C. Slump: 4- to 6-inches with high-range water reducer.
- D. Portland Cement: ASTM C150, Type 1, natural color. Minimum mix content 575 lbs./cy.
- E. Fine Aggregate: ASTM C-33 except as noted below. Contain maximum of two percent (2%) by weight of the following: shale, schist, alkali, earth, loam, mica, coated grains,

PORTLAND CONCRETE PAVEMENT

32 13 13-2

soft and flaky particles. No more than four percent (4) clay by volume. 95% pass No. 4 sieve. Less than 3 percent (3%) pass No. 100 sieve.

- F. Coarse Aggregate: Crushed quarried stone, ASTM C-33. Aggregate Size No. 57.

2.02 WATER:

- A. Clean and free from oil, acid and injurious materials and amounts of vegetable matter, alkalis, and other salts.

2.03 WATER REDUCING AGENT:

- A. Shall be listed on the current approved list of the MASSDOT Materials Bureau.

2.04 AIR ENTRAINING AGENT:

- A. Shall be listed on the Current Approved List of the MASSDOT Materials Bureau.

2.05 NON-SHRINK GROUT:

- A. Shall be "EMBECO" as manufactured by Master Builders.

2.06 CONCRETE FORMS:

- A. Wood or metal designed to support concrete at time of placement, reinforcing, placement equipment and personnel involved during pouring and finishing operations. Form design shall provide for leak-proof joints. Include bracing and shoring required to prevent deflection of joints.

2.07 FORM TIES:

- A. Exposed Concrete: Plastic cone snaptie, similar and equal to Superior's Type 3M; with Superior's 1-inch concrete plugs, color to be selected.
- B. Unexposed Concrete: Snap-off metal ties, designed to prevent form deflection, and prevent spalling surfaces upon removal. Portion remaining after removal shall be at least 1-inch from concrete surface.

2.08 FORM COATINGS:

- A. Commercial formulation form-coating compounds shall not bond with, stain, nor adversely affect concrete surfaces, and shall not impair subsequent treatments, nor impede wetting of surfaces to be cured with water or curing compound.

PORTLAND CONCRETE PAVEMENT

32 13 13-3

2.09 EXPANSION JOINT MATERIAL:

- A. 1/2-inch thick ASTM D994 pre-molded expansion joint filler strips; full slab depth, except top portion shall be removable after concrete placement to accommodate sealant placement.

2.10 JOINT SEALANT:

- A. Premium grade, high performance, moisture cured, one component, polyurethane base, non-sag elastomeric sealant.
- B. Federal Specification TT-S000230C, Type II, Class A.
- C. Sikaflex 1A, as manufactured by the Sika Corporation, or approved equivalent.

2.11 CURING SHEET MATERIAL:

- A. ASTM C-171.

2.12 BACKER ROD:

- A. Sonofoam polyethylene foam by Sonneborn, or approved equivalent, unless otherwise instructed by the sealant manufacturer.

PART 3 – EXECUTION

3.01 TESTING:

- A. The Contractor shall coordinate and schedule an independent testing laboratory 24 hours in advance of any concrete pours. The Contractor shall employ and pay for services for an independent testing laboratory to perform specified inspection and testing. It shall be the responsibility of the Contractor to schedule the concrete testing laboratory to be on site during all concrete pours. Reschedule planned concrete pours as necessary to ensure the on-site presence of the concrete testing laboratory. Caution: No concrete shall be installed without on-site testing by the concrete testing laboratory. The Contractor shall not be entitled to additional compensation for concrete which cannot be incorporated into the work due to the failure to schedule and have a concrete tester on site. The Contractor's independent testing laboratory shall be approved by the Owner's Representative.

3.02 MIX PROPORTIONING:

- A. The responsibility for selection of proportions to be submitted to meet the MASSDOT Specification shall be that of the concrete supplier.

PORTLAND CONCRETE PAVEMENT

32 13 13-4

- B. The proportions of ingredients shall be such as to produce a mixture which can be satisfactorily placed and consolidated by the methods to be employed.

3.03 PRODUCTION:

- A. Ready Mixed Concrete: Except as otherwise provided in these specifications, ready mixed concrete shall be batched, mixed, and transported in accordance with "Specifications for Ready Mixed Concrete" (ASTM C-94).
- B. Mixing Water Control:
 - 1. Concrete which arrives at the site with slump below that suitable for placement may be adjusted by the addition of water to increase slump provided that the maximum slump is not exceeded. Any addition of water to increase slump shall be followed by mixing of at least 30 revolutions of the drum.
 - 2. After adjustment to the proper slump, discharging shall be allowed for as long as the concrete retains its workability without the addition of water.

3.04 INSTALLATION:

- A. Forms
 - 1. Forms, cores, molds, etc. shall be constructed so that the finish concrete will conform to the shapes, lines, grades, and dimensions indicated on the drawings. All forms shall remain in place for a minimum of 120 hours after completion of all concrete work, including finish work.
 - 2. Slots, chases, recesses, inserts, keys and temporary openings:
 - a. Box out for all slots, chases, recesses, or openings as shown on the drawings and as required by the work of all other trades.
 - b. Build bulkheads with keys in walls and footings for stopping concrete. Keys shall be clean, reused or new chamfered 2 x 4's.
 - c. Box out for all temporary openings such as shafts, pipe spaces, etc., and build forms to seal up when and as required.
 - d. Build into concrete all inserts, anchors, PVC or metal reglets, ties, hangers, collars, sleeves, thimbles, sockets, nailing blocks, miscellaneous and ornamental iron as required to secure the work of other trades.
 - e. General - Ample opportunity and full cooperation shall be given to the various

trades and other contractors to install their required embedded items. Suitable templates or instructions, or both, will be provided for setting such items as are not placed in the forms by the trades themselves. Openings in floor slabs shall be provided for pipes, ducts, etc., prior to or at the time of placing the form work. All embedded items shall be subject to inspection by the Owner's Representative before concrete is placed.

B. Preparation for Placing Concrete

1. Notify the Owner's Representative 24 hours in advance of the beginning of the following stages of work:
 - a. Final grade for slab bearing.
 - b. Pouring concrete slabs, foundations or walls.
 - c. Schedule date and time of pour with Owner's concrete testing laboratory.
2. Remove water from excavations or forms before depositing concrete. Divert any water flow through proper side drains. Remove without washing over freshly deposited concrete, debris, foreign materials from form interiors, from mixing, conveying equipment inner surfaces.
3. Provide runways or other means for wheeled equipment to convey concrete to deposit points. Do not wheel equipment used to deposit concrete over reinforcement. Do not support runways on reinforcement.
4. Spray existing concrete surfaces with water to a surface saturated condition prior to pouring concrete.

C. Placing Concrete:

1. Re-tempered concrete shall not be allowed. Air-slaked or lumpy concrete shall not be used. The contents of the mixer shall be completely discharged before each new batch is loaded.
2. In form work, spade or vibrate thoroughly to ensure contact with concrete. Tamping shall be done with an internal mechanical vibrator. Vibrators shall not be used to move or flow concrete.
3. No honeycombed work will be accepted.
4. Vertical and/ or horizontal plumb bulkheads with keys shall be used at joints (locations shown on plans) for ending day's work and arranged at right angles to

PORTLAND CONCRETE PAVEMENT

32 13 13-6

planes of stress and in areas of minimum shear. Provide water stop(s) where water tightness is required as shown on the plans. Water tightness is required for structures designed to contain fluid.

5. Concrete shall be placed in lifts not to exceed 18-inches.
6. Continuous vibration shall be used with the interval of insertion not to exceed 18-inches in any direction.
7. Placing shall be performed to prevent the forming of cold and/or irregular joints.
8. No free fall of concrete over 4'-0" will be permitted.
9. Maximum concrete pours shall be as follows: 25' maximum dimension, 600 sq. ft. maximum area, maximum length to width ratio of 2.

3.05 CONSTRUCTION JOINTS, CONTROL JOINTS AND EXPANSION JOINTS:

- A. All joints shall be formed, and caulked joints made at such locations shown on plans as will least impair the strength of the structure, and as may be required by the Owner's Representative.
- B. Furnish and install keying and supplementary reinforcement at each construction joint and stoppage. Install water stops as shown on plans, as required for watertight structures or as required by Owner's Representative.
- C. Before pouring the next section, clean exposed reinforcement, clean and roughen exposed concrete and slush with neat cement grout.
- D. Install expansion joint material at all locations where new concrete is cast against existing structures, walls, etc. Install expansion joints at 20' intervals within all new walks and as shown on the Contract Drawings, other than the above noted structures, walls, etc.
- E. Construct control joints, in slabs, at the locations shown on the drawings or at 5-foot intervals in each direction.

3.06 TOLERANCES:

- A. Unless otherwise indicated, all concrete work to be faced with other materials shall have a tolerance not to exceed 1/4-inch as measured on a ten-foot straight edge.
- B. If any concrete varies beyond tolerances indicated, Contractor may be required to grind it down at no extra cost. Ground surface may require surface treatment. Provide required treatment as ordered by Owner's Representative at Contractor's expense.

PORTLAND CONCRETE PAVEMENT

32 13 13-7

3.07 PATCHING CONCRETE:

- A. Immediately after removal of forms, patch all holes including those at form ties, honeycombing, and other voids in concrete surfaces. Remove all fins and other projections on concrete surfaces.
- B. Wet the surface to be patched and patch with stiff mortar of one-part Portland cement to two parts sand. All exposed surfaces: The cement portion shall be one-part white Portland and one-part regular cement. Sand shall pass #30 sieve. Permit patching grout, before use, to set 20 to 30 minutes and re-temper without adding additional water.
- C. Compact mortar thoroughly into place and screed it off a little higher than adjacent work and finish flush after initial set.
- D. Work that cannot be properly patched, in the opinion of the Owner's Representative, shall be rejected.

3.08 SLABS ON GRADE:

- A. Construct structures as shown on the drawings. Include all material, forms, etc. required.
- B. Compacted porous fill shall be placed before installing concrete slabs which bear on the ground. See applicable specifications and details on plans. Place vapor barrier over gravel base as shown on plans.
- C. Upon the prepared base, place a monolithic concrete slab, reinforced as indicated.

3.09 CONCRETE FINISHING:

- A. No concrete finishing operation shall be conducted while there is free water on the surface, and no dusting of cement, sand or cement-sand mixture is to be used to dry up the surface water on the concrete. Power finishing tools may be used except that area adjacent to electrical trench header ducts, vertical surfaces, electrical fittings, etc. shall be hand finished.
- B. All concrete slabs shall be, after finishing, true and level to within 1/8-inch of 10' unless indicated to have drainage slopes. Remedial action at the Contractor's expense may be required, at the Owner's Representative's discretion, for any slab not meeting the above standards.
- C. Should spalling occur in surface of concrete, the slab shall be removed and replaced at the Contractor's expense. Patching the surface of the concrete after initial set has taken place will not be accepted.

PORTLAND CONCRETE PAVEMENT

32 13 13-8

3.10 SPECIFIC SLAB FINISHES:

- A. All slabs shall receive the following preliminary finish:
 - 1. Bring the concrete to the correct level and, at the proper times, screed, darby and float with a magnesium float. Additional operations shall be applied as indicated.
- B. Broom Finish (Final): Provide a medium broom finish or as noted on the plans, where broom finish is scheduled.
- C. Trowel Finish (Final): All other slab surfaces: Immediately following floating, steel trowel, steel trowel a second time at the proper time for a dense, hard surface.

3.11 PROTECTION AND CURING:

- A. General
 - 1. The following rules are for the minimum requirements of protection only and the Contractor shall remain fully responsible to produce concrete which has not been weakened or injured on the surface by frost or freezing or by incomplete protection during hot weather.
 - 2. Protection shall consist of heating the materials, fully enclosing the concrete, and maintaining the temperature of the enclosure at not less than 50° F. for five (5) days.
 - 3. Aggregates and water shall be heated to not more than 140° F. and the concrete shall not be less than 50° F, nor more than 90° F. when deposited.
 - 4. Contractor shall provide adequate protection during hot weather against rapid drying and cold joints. Accelerating, retarding, or anti-freeze admixtures will not be permitted. Provide facilities necessary for moist curing.
 - 5. Prevent use of concrete for a period of five (5) days after installation.
 - 6. Forms shall be left in place a minimum of 120 hours after completion of each pour.
- B. Cold Weather Concreting
 - 1. When placing concrete at or below a temperature of 40° F., or whenever atmospheric temperatures will probably fall below this limit within the next 24 hours and after placing concrete, the mixing water and aggregates shall be heated, and the freshly placed concrete protected by adequate housing or covering and heating.

PORTLAND CONCRETE PAVEMENT

32 13 13-9

2. The Contractor shall have on the job ready to install adequate equipment for heating the materials and for maintaining the proper temperatures and atmospheric moisture for the freshly placed concrete, and for enclosing the work in accordance with the requirements specified herein. Do not use salamanders or open fires. Submit diagrams showing the type of equipment to be used and how it will be placed in order to maintain proper temperatures required during cold weather concreting for approval of the Owner's Representative.
3. Either aggregates or water or both, as may be necessary, shall be heated with steam coils or other approved devices so that the average temperature of the concrete as it is deposited in a form shall fall within the limits specified herein. Aggregates containing frozen lumps shall be independently heated and no materials containing frozen lumps, ice or snow shall be allowed to enter the mixer.
4. Before placing the concrete in any form or on any surface, or around any reinforcement, heat shall be applied in such a manner that ice or snow will be completely removed, and the reinforcement will be at the same temperatures as the concrete being placed. No concrete shall be placed on a subgrade that is frozen or on one that contains frozen materials.
5. Concrete, when placed in the forms, shall have a temperature of not less than 70° F. and not above 80° F. Freshly placed concrete shall be maintained at a temperature of not less than 50° F. for five (5) days for normal concrete, and not less than 50° F. for three (3) days for high early strength concrete. Cooling of the concrete to outside temperatures shall not be at a rate faster than one (1) degree each hour for the first day, and two (2) degrees each hour thereafter.
6. The use of salts, chemicals, or other foreign materials in the mix to lower the freezing point of the concrete is prohibited.
7. Before concreting any section of a structure, the section shall be completely housed or enclosed in a manner that will ensure the maintenance of the specified temperatures. The housing shall be left in place for the curing period specified except that sections may be temporarily removed as required to accommodate the placing of column forms or concrete provided that they are replaced immediately after the form or concrete is in its final position.
8. A permanent temperature record shall be kept showing the date, hour, outside temperature, and temperatures at several points within the enclosure to show the most favorable and unfavorable condition to which the concrete is subjected. Thermometer readings will be taken at the start of the work in the morning and again in the late afternoon and the data so obtained shall be recorded in such manner that it will show the location of each reading and any conditions which might have

PORTLAND CONCRETE PAVEMENT
32 13 13-10

an effect on the temperature. A copy of the temperature records shall be furnished to the Owner's Representative upon request.

C. Hot Weather Concreting

1. Hot weather, for the purposes of this specification, shall be defined as 80° F. and rising, or 85° F. and falling.
2. During hot weather, Contractor shall plan for prompt placement by assuring an adequate number of personnel to handle and place concrete, and it shall provide adequate protection during finishing and during operations.
3. Forms, reinforcing subgrade should be sprinkled with cold water just prior to concrete placement.
4. Concrete with a temperature exceeding 90° F shall not be placed, and an attempt shall be made to keep the concrete temperature well below 90° F. Contractor shall check the temperature of concrete just prior to placement and after placement. This information shall be recorded together with the location where the concrete was placed.
5. Cooling of concrete materials before mixing and during mixing using methods as recommended by the American Concrete Institute shall be adhered to.
6. Concrete shall be placed as soon as possible after mixing and/or delivery. On flat work, all finishing operations should be conducted promptly.
7. Protection and Curing: Exposed surfaces shall be protected from accelerated drying by using continuous water curing methods and surfaces shall be kept moist for at least 120 hours. On flat slab or other work exposed to wind or other evaporating conditions, surfaces shall be protected by wet sand or sisal-kraft paper. If water is used directly on new surfaces, the temperature of water should not be much cooler than the concrete.
8. Test of concrete conducted during hot weather shall be in accordance with latest ACI and PCA Standards and/or recommendations.
9. During hot weather, a log shall be kept indicating air temperature, weather condition, relative humidity, and temperature of concrete before and after placement. These tests shall be conducted at frequent intervals and as required by the Owner's Representative.
10. Admixtures to delay setting time will not be permitted.

D. Curing

1. Concrete shall be protected against loss of moisture, rapid drying, or temperature changes, mechanical injury, or injury from rain or flowing water for a period of seven (7) days. Concrete shall be maintained above 50° F., and in a moist condition during curing period.
2. Curing shall commence as soon as free water has disappeared from the surfaces after finishing. Curing of formed soffits of beams, girders, floor slabs, and similar surfaces shall be accomplished by moist curing with forms for full curing period.
3. Except where specified methods of curing are specified, curing may be accomplished by any one of the following methods:
 - a. Moist Curing: Surfaces shall be kept continuously wet by covering with burlap, mats, or sand, thoroughly saturated with water and covering kept wet by spraying or hosing. Place materials to provide complete surface coverage and lap all joints minimum 3-inches.
 - b. Impervious-Sheeting Curing: Surfaces shall be thoroughly wetted with a fine spray of water and then covered with waterproof paper, polyethylene sheeting, or polyethylene coated waterproof paper. Edges and ends of sheeting shall be overlapped not less than 4-inches and securely cemented or taped to form a continuous cover. Sheeting shall be weighted down to prevent displacement and shall be repaired or replaced if torn, damaged, or removed during the curing period. Under this curing method, the surface of the concrete shall always be covered with a water film. Spray concrete surface periodically to ensure that at no time will concrete cure under "dry" conditions.
4. Concrete curing of exposed floor slabs shall incorporate one of the two methods described above. Use of a concrete cure, seal agent is not acceptable for curing exposed floor slabs or sidewalks. Use of this product for sealing and/or curing in other locations may be allowed at Owner's Representative's discretion.

3.12 CONCRETE TESTING STANDARDS:**A. American Society for Testing Materials**

1. Method of making and curing concrete compression and flexure test specimens in the field.
2. Method of test for compressive strength of molded concrete cylinders.
3. Method of test for securing, preparing and testing specimens from hardened

concrete for compressive and flexural strengths.

4. Method of test for weight per cubic foot, yield, content (gravimetric) of concrete.
5. Method of test for slump of Portland cement concrete.
6. Standard method for sampling fresh concrete.
7. Method of test for air content of freshly mixed concrete by the volumetric method.
8. Method of making and curing concrete compression and flexure test specimens in the laboratory.
9. Method of test for air content of freshly mixed concrete by the pressure method.

3.13 CONCRETE TESTS:

- A. During the progress of the work, compression test specimens shall be made and cured in accordance with the "Standard Method of Making and Curing Compression and Flexure Test Specimens in the Field" (ASTM Standard C-31). Not less than five specimens (2 for 7 day, 2 for 28-day tests and one spare specimen) shall be made for each test, nor less than one test for each 50 cubic yards of concrete of each class or fraction thereof placed in one day. Specimens shall be cured under laboratory conditions. Except that when, in the opinion of the Owner's Representative, there is a possibility of the surrounding air temperature falling below 40° F., and it may require additional specimens to be cured under job conditions. Cost for laboratory tests for compression test cylinders shall be borne by the Contractor.
- B. Specimens shall be tested in accordance with the standard method of test for compressive strength of molded cylinders (ASTM Standard C-39).
- C. Slump tests shall be conducted for each individual concrete batch or as frequently as may be required to assure that no concrete shall have more than the required slump. All tests shall be conducted in the presence of the Owner's Representative. Tests shall be performed in accordance with ASTM requirements. Tolerance is $\pm 1/2$ ".
- D. Entrained air tests for air-entrained concrete shall be conducted every hour and/or as frequently as may be required to assure that the concrete shall contain the air content specified. All tests will be conducted in the presence of the Owner's Representative, and testing of each batch will be done by the same representative of the testing laboratory. Take tests at the point of placement for pumped concrete.

PORTLAND CONCRETE PAVEMENT 32 13 13-13

- E. All cylinders, air content test, and slump tests shall be made by qualified personnel acceptable to the Owner's Representative.
- F. The standard age test shall be 28 days, but 7-day tests may be used provided that the relation between 7-day and 28-day strengths of the concrete is established by tests for materials and proportions used. If 28-day tests fall below the compressive strengths called for in the specifications, the spare test cylinder shall be broken at 56 days as a final check.
- G. If the average strength of the laboratory-cured field cylinders for any portion of the structure falls below the compressive strengths called for in the specifications, the Owner's Representative may require tests in accordance with the "Standard Methods of Securing, Preparing, and Testing Specimens of Hardened Concrete for Compressive Flexural Strength" (ASTM Standard C-42) or order load tests to be made on the portions of the building so affected. Costs for hardened concrete tests and load tests shall be borne by the Contractor.
- H. If the average strength of the laboratory-cured field cylinders falls below the compressive strength called for, the concrete covered by these tests shall be assumed as inadequate for the structure and the Owner's Representative may require that load tests be placed on the portions of the structure in question. Loading shall be in accordance with Section 203 of the ACI Building Code Requirements for Reinforced Concrete, and the method of loading and conducting the test shall be submitted in advance to the Owner's Representative for its approval. If the tested portion of the structure does not fulfill the requirements of the test, it shall be deemed to have failed and shall be removed and replaced. The Owner's Representative reserves the right to reject sub-standard concrete work as indicated by hardened concrete field cylinders regardless of the load tests.
- I. The laboratory shall furnish copies of all tests as follows:

Owner's Representative:	1 copy
General Contractor:	2 copies
Concrete Supplier:	1 copy

- J. At the end of the week, the Contractor shall submit to the Owner's Representative a record showing the results of all slump and air tests made during the previous week. This record shall indicate the location in the project where this concrete was used.

3.14 EVALUATION AND ACCEPTANCE:

- A. Evaluation: Test results of standard cylinders, molded, cured and tested according to ASTM C-31 and C-39, shall be evaluated separately for each concrete mix according to the "Recommended Practice for Evaluation of Compression Test Results of Field

PORTLAND CONCRETE PAVEMENT

32 13 13-14

Concrete" (ACI 214).

- B. Acceptance: The criteria for acceptance of concrete shall be detailed in "Building Code Requirements for Reinforced Concrete" (ACI 318, Chapter 4, Paragraph 4.3).

END OF SECTION

PORTLAND CONCRETE PAVEMENT
32 13 13-15

SECTION 32 14 00

PRECAST CONCRETE UNIT PAVING

PART 1 – GENERAL1.01 WORK INCLUDED:

- A. The Contractor shall furnish all necessary labor, materials, equipment, transportation and services necessary to complete the work of this Section as specified herein, as shown on the drawings, or both.
- B. The work of this Section includes, but is not limited to the following:
 - 1. Concrete Unit Pavers

1.02 RELATED WORK

- A. Section 01 33 23, SUBMITTALS
- B. Section 03 30 00, CAST IN PLACE CONCRETE
- C. Section 31 00 00, EARTHWORK

1.03 QUALITY ASSURANCE:

- A. Installation shall be by a contractor and crew with at least one year of experience in placing interlocking concrete pavers on projects of similar nature.

1.04 SUBMITTALS – IN ACCORDANCE WITH SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Shop or product drawings and product data.
 - 1. Pavers.
 - 2. Joint Sand.
- B. Full size samples of concrete paving units to indicate color and shape selections.
- C. Sieve analyses for grading of bedding and joint sand.
- D. Test results from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936 or other applicable requirements.
- E. The layout, pattern, and relationship of paving joints to fixtures and project formed

details.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Concrete pavers shall be delivered to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift. The pavers shall be unloaded at the job site in such a manner that no damage occurs to the product.
- B. Bedding and joint sand shall be covered with a secure waterproof covering to prevent exposure to rainfall or removal by wind.
- C. Delivery and paving schedules shall be coordinated in order to minimize interference with normal use of buildings adjacent to paving.

1.06 ENVIRONMENTAL CONDITIONS:

- A. Sand or pavers shall not be installed during heavy rain or snowfall.
- B. Sand and pavers shall not be installed over frozen base materials.
- C. Frozen sand shall not be installed.

PART 2 – PRODUCTS

2.01 CONCRETE PAVERS:

- A. Concrete Pavers: Holland Stone by Unilock, Uxbridge, MA, 508-278-4536 or approved equivalent.
 - 1. Pattern: B Running Bond
 - 2. Color: Granite 50%, Charcoal 50%
 - 3. Size: 4"x8"x3"
- B. Pavers shall meet the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units. Efflorescence shall not be a cause for rejection.

2.02 BEDDING AND JOINT SAND:

- A. Bedding and joint sand shall be clean, non-plastic, and free from deleterious or foreign matter. The sand shall be natural or manufactured from crushed rock. Limestone screenings or stone dust that do not conform to the grading requirements in Table 1 shall not be used.
- B. The bedding sand shall conform to the grading requirements of ASTM C 33 as shown in Table 1.

TABLE 1
BEDDING SAND GRADING REQUIREMENTS

ASTM C 33	
Sieve Size	Percent Passing
No. 4	95 to 100
No. 8	85 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

- C. The joint sand shall conform to the grading requirements of ASTM C 144 as shown in Table 2 below:

TABLE 2
JOINT SAND GRADING REQUIREMENTS

ASTM C 144		
	Natural Sand	Manufactured Sand
Sieve Size	Percent Passing	Percent Passing
No. 4	100	100
No. 8	95 - 100	95 to 100
No. 16	70 - 100	70 to 100
No. 30	40 - 75	40 to 75
No. 50	10 - 35	20 to 40
No. 100	2 - 15	10 to 25
No. 200	0	0 to 10

PART 3 – EXECUTION

3.01 SITE PREPARATION:

- A. **Complete all underground utility work, curbing, foundations, and wall construction prior to commencement of subbase construction.**
- B. Compact the existing subgrade prior to placement of subbase material to at least 95% Standard Proctor Density per ASTM D 698.

- D. Under no circumstances shall further pavement construction proceed until the subgrade has been inspected and approved by the Landscape **Architect/Engineer**.
- E. Joint Sand Color to be grey.

3.02 SUBBASE AND BASE INSTALLATION:

- A. Place subbase materials in uniform lifts not exceeding 4-inch, loose thickness and compacted to at least 100 percent Standard Proctor Maximum Dry Density as per ASTM 698.
- B. The upper surface of the subbase shall be sufficiently well graded and compacted to prevent infiltration of the bedding sand into the base both during construction and throughout its service life. Segregated areas of the granular base shall be blended by the application of crushed fines that have been watered and compacted into the surface.
- C. Before commencing the placing of the concrete slab and, sand bedding course and the placement of the interlocking concrete pavers, the base shall be inspected by the **Landscape Architect/Engineer** to insure surface is clean and built in conformance with details. The Contractor shall verify elevation difference between concrete slab and adjacent finish concrete surface to ensure concrete paver can be installed flush with bordering concrete pavement.

3.03 PAVER INSTALLATION:

- A. The sand shall be spread evenly over the concrete base and base course and screeded to a nominal 1-inch (25 mm) thickness, not exceeding 1-½-inch thickness. The screeded sand should not be disturbed. Sufficient sand shall be placed to stay ahead of the laid pavers. Bedding sand shall not be used to fill depressions in the base surface.
- B. Pavers shall be free of foreign material before installation.
- C. Pavers shall be inspected for color distribution and all chipped, damaged or discolored pavers shall be replaced.
- D. The pavers shall be laid in the layout pattern as indicated on plans.
- E. Joints between the pavers on average shall be 1/16-inch wide, hand tight.
- F. Gaps at the edges of the paved area shall be filled with cut pavers or edge units.
- G. Pavers to be placed along the edge shall be cut with a double blade paver splitter or masonry saw.

- H. The paver surface shall be swept clean of all debris before compacting, in order to avoid damage from point loads.
- I. A low amplitude, high frequency plate compactor shall be used to compact the pavers into the sand. Use Table 3 below to select size of compaction equipment:

TABLE 3
PAVER THICKNESS AND REQUIRED MINIMUM COMPACTIVE EFFORT

Paver Thickness	Compactive Effort
3-1/8-inches	5,000 lbs.

- J. The pavers shall be compacted, and dry joint sand shall be swept into the joints until the joints are full. This will require at least two or three passes with the compactor. Do not compact within 3 ft. of the unrestrained edges of the paving units.
- K. All work to within 3 ft. of the laying face must be left fully compacted with sand-filled joints at the completion of each day.
- L. Excess joint sand shall be swept off when the job is complete.

3.04 FIELD QUALITY CONTROL:

- A. Final elevations shall be checked for conformance to the drawings after removal of excess joint sand.
- B. Remove and reset any pavers not conforming to the elevations shown and all other requirements previously specified herein.

END OF SECTION

SECTION 32 16 00

CURBING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers furnishing and installation of granite curb, hot mix asphalt curb and precast parking curb, where required, as shown on the Drawings and herein specified.
- B. This section also covers replacement of curbing removed during construction.

1.02 RELATED WORK:

- A. Required earthwork is specified under Section 31 00 00 EARTHWORK.
- B. Section 32 12 16.13, HMA PAVEMENT.

1.03 REFERENCES:

The following standards form a part of these specifications, as referenced:

Massachusetts Department of Transportation (MassDOT) Standard Specifications for
Highways and Bridges

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00
SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

Shop drawings, showing dimensions of typical curb sections.

PART 2 - PRODUCTS

2.01 GRANITE CURBING:

- A. Granite curbing shall be Type VAI conforming to Subsection M9.04.1 of the latest edition of the MassDOT Standard Specifications for Highways and Bridges.
- B. Special shapes and corners shall be supplied as required.

CURBING
32 16 00-1

PART 3 - EXECUTION

3.01 GRANITE CURBING:

- A. Removal and resetting and/or removal and replacing of granite curbing shall be in accordance with Subsection 580 of the latest edition of the MassDOT Standard Specifications for Highways and Bridges. The curbing shall have a 7-inch reveal unless otherwise required by the Engineer.
- B. Except as modified herein or on the drawings, installation of curbing shall conform to Section 500 of the MassDOT Standard Specifications for Highways and Bridges.
- C. Excavation shall be made to the bottom of the 6-inch gravel base below the curbing, the trench being sufficiently wide to permit thorough tamping. The base shall be compacted to a firm, even surface and shall be approved by the Engineer.
- D. The curbing shall be set on edge and settled into place with a heavy wooden hand-rammer, to the line and grade required, straight and true for the full depth. The joints of the stone curbing shall be pointed with mortar for the full depth of the curbing. At approximately 50-foot intervals, a 1/2-inch joint shall not be filled with mortar but left free for expansion. The ends of the stone curbing at driveways and intersections shall be cut at a bevel or rounded as required by the Engineer.
- E. The trench for the stone curbing shall be backfilled with approved material; the first layer to be 4 inches in depth, thoroughly rammed; the other layers to be more than 6 inches in depth and thoroughly rammed until the trench is filled.
- F. Where indicated on the plans, or as required, drainage openings shall be made through the curbing at the elevations and of the size required.

END OF SECTION

CURBING
32 16 00-2

SECTION 32 91 00
LOAM AND PLANTING PREPARATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 apply to the work of this Section.

1.02 DESCRIPTION OF WORK

- A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Subgrade preparations.
2. Loam from off-site, if on-site loam is insufficient.
3. Sampling and testing of on-site and off-site loam.
4. Sand.
5. Modifying, screening, placing, spreading and grading of loam.
6. Fine grading.
7. Inspection and acceptance.
8. Cleaning and protection.

1.03 RELATED WORK

- A. Carefully examine the site and all of the Contract Documents for requirements that affect the work of this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions. Other specifications sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 03 30 00 – Cast-In-Place Concrete
2. Section 31 00 00 – Earthwork
3. Section 32 12 16.16 – Hot Mix Asphalt Paving
4. Section 32 13 13 – Portland Cement Concrete Pavement
5. Section 32 16 00 – Curbing
6. Section 32 92 00 – Turf and Grasses
7. Section 32 93 00- Trees, Shrubs, Ground Cover and Landscaping
8. Section 33 10 00 – Water Utilities
9. Section 33 30 00 – Sanitary Sewerage Utilities
10. Section 33 40 00 – Storm Drainage Utilities

- B. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work of the Contract.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):

D 75	Practice for Sampling Aggregates
D 422	Test Method for Particle-Size Analysis of Soils
D698-00a	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³)
D1557	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb rammer and 18-in. drop

- B. O.A.C.: Association of Official Agricultural Chemists.

- C. State of Massachusetts, Standard Specifications for Highways and Bridges, Department of Public Works, latest edition.

- D. American Association of Nurserymen, American Standards for Nursery Stock, (ANSI Z60.1), latest edition, published by the American Association of Nurserymen, 1250 I Street, N.W., Suite 500 Washington, D.C. 20005.

1.05 SUBMITTALS

- A. At least 30 days prior to ordering materials, the Contractor shall submit to the Architect representative samples, certifications, manufacturer's product data and certified test results for materials as specified below. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Architect. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Architect reserves the right to reject, on or after delivery, any material that does not meet these Specifications.

- B. Existing On-Site loam: Sample and test existing on-site loam. The Contractor shall sample the existing loam soils of the construction site in the following manner:

1. The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard on-site stockpile of existing loam for testing. All stockpile sampling shall be per ASTM D 75 and Appendixes for securing samples from stockpiles.

LOAM AND PLANTING PREPARATION

2. Preparation of Samples: Contractor shall place these soil slices into a large, clean plastic container and mix thoroughly. Contractor shall take one cup of soil mixture and dry it at room temperature (do not dry samples in an oven or on a stove or radiator). Once soil is dry, place soil in sandwich size zip-type plastic bag and close it tightly. Label each sample on outside of bag, identifying sample by soil type and acre. Provide an approved site plan showing locations of stockpiles cross referenced to soil samples and test results.
- C. Loam from off-site, if on-site loam is insufficient: The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard proposed stockpile of loam borrow for testing. All stockpile sampling shall be per ASTM D 75 and Appendixes for securing samples from stockpiles.
- D. Testing will be at the Contractor's expense. Contractor shall deliver all samples to testing laboratories via overnight courier and shall have the testing report sent directly to the Architect. Perform all tests for gradation, organic content, soil chemistry and pH by UMASS Soil and Plant Tissue Laboratory, West Experiment Station, North Pleasant Street, University of Massachusetts, Amherst, MA 01003, (413) 545-2311. Testing reports shall include the following tests and recommendations:
1. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System.
 2. Percent of organics shall be determined by the loss on ignition of oven-dried samples. Test samples minus #10 material shall be oven-dried to a constant weight at a temperature of 450 degrees Fahrenheit (752 degrees Centigrade).
 3. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, extractable Aluminum, Lead, Zinc, Cadmium, Copper, Soluble Salts, and pH and buffer pH. A Conductivity Meter shall be used to measure Soluble Salts in 1:2 soil/water (v/v). Except where otherwise noted, nutrient tests shall be for available nutrients.
 4. Soil analysis tests shall show recommendations for soil additives to correct soils deficiencies as necessary, and for additives necessary to accomplish lawn and planting work as specified.
- E. Compost: Submit supplier's certification of contents.
- F. Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications.
- G. Acidulant: Submit supplier's certification that the acidulant being supplied conforms to these Specifications.

LOAM AND PLANTING PREPARATION

32 91 00 - 3

H. Fertilizer:

1. Submit product data of seeding/sodding and planting fertilizer and certificates showing composition and analysis. Submit fertilization rates for fertilizer product based upon soil testing, analysis, and recommendations as specified, performed and paid for under in this Section.

1.06 REGULATORY REQUIREMENTS

- A. Strictly comply with all applicable codes, regulations and requirements having jurisdiction.
- B. All fertilizer applications shall be performed by a licensed applicator in strict conformance with all local, state and federal regulations. Notify the Owner's Project Representative at least two (2) weeks prior to scheduled date of application.

1.07 EXAMINATION OF CONDITIONS

- A. The Contractor and any sub-Contractor responsible for the execution of the Work of this Section, shall review the subgrades and elevations to verify that the subgrades have been prepared as required by the Contract Documents, prior to proceeding with the spreading of the planting loam. Carefully review the requirements of this Section, to understand the requirements of percolation testing, compaction, slope and absence of debris of the subgrade prior to spreading of the loam borrow.
- B. The Contractor shall be solely responsible for judging the full extent of work requirements involved, including but not limited to sampling and testing of all materials prior to final planting installation.

1.08 DEFINITIONS/QUALITY ASSURANCE

- A. The following definitions shall apply to the work of this Section.

The following size distributions of mineral particles by diameter and sieve size shall apply to the following conventional names of soil types:

<u>Conventional Name</u>	<u>Retained on U.S. Sieve No.</u>	<u>Diameter (mm)</u>
Very coarse sand	#18	1 - 2
Coarse sand	#35	0.5 - 1
Medium sand	#60	0.25 - 0.5
Fine sand	#140	0.10 - 0.25
Very fine sand	#270	0.05 - 0.10
Silt	by hydrometer	0.002 - 0.05
Clay	by hydrometer	Less than 0.002

LOAM AND PLANTING PREPARATION

32 91 00 - 4

- B. Subgrade: Soil material and levels resulting from the approved rough grading work.
- C. Existing Topsoil: In place soil on the site that will be stripped, screened and amended and re-used as a component of soil blends. The upper 6-12 inches of topsoil stripped from the project site and stockpiled for soil blending. Contractor is responsible for ensuring neither B-horizon subsoils nor subgrade is stripped with the topsoil.
- D. Imported Base Loam: Base Loam obtained by an approved soil supplier for off-site manufacture of soil blends to be imported to the project site.
- E. Lawn and Planting Soils: Lawn and Planting Soils are composed of a blend of stripped topsoil, organic material and sand. The quality of the blend depends on the quality of the original components. Locate and obtain approval of sources for base loam, organic material and sand that meet the Specification requirements. Contractor is then responsible for mixing the components. Approximate mixing ratios depend on the initial materials, and with the approval of the Architect or their representative, in order to meet Specification requirements for Lawn and Planting Soils.
- F. Contractor is solely responsible for quality control of the Work.
- G. The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the Work, including the preparation, mixing and installation of custom Planting Soil and planting mixes.
- H. Soil work shall be performed by a firm that has sufficient earthwork machinery at the job site simultaneously to amply provide for the vigorous execution of the site work without interruption or delay, except for unforeseen circumstances, such as weather. Machinery operators shall be well experienced in this type of work.
- I. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
- J. Comply with all requirements for control of silt and sediment during soil installation work as indicated in the contract documents. Provide additional silt and sediment control to maintain silt and sediments within the working area as required by the progress of the work or as directed by the Landscape Architect.
- K. Pre-installation Conference: Conduct conference at project site prior to the start of any work related to Planting Soil preparation and shall meet the requirements of this Section.

LOAM AND PLANTING PREPARATION

32 91 00 - 5

1.09 DELIVERY

- A. Material shall not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall, early spring or if frozen. Soil shall be handled only when the moisture content is compliant with this Specification. Protection of stockpiles during the winter and spring months is essential. The Landscape Architect, Soil Scientist and the Owner shall be consulted to determine if the soil is too wet to handle.
- B. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from the Owner. Deliver materials only after preparations for placement of soil have been completed.
- C. Prohibit vehicular and pedestrian traffic on or around stockpiled soil.
- D. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than ten feet high. Windrows are the preferred manner of stockpiling.
- E. Vehicular access to the site is restricted. Before construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access.

PART 2 - PRODUCTS

2.01 LOAM

- A. Loam: The Contractor shall provide additional loam as necessary to complete the work of this Section from off-site sources if there is not sufficient material on site suitable to complete the Work. The Contractor shall submit samples and an analysis from each proposed source of material. Provide loam that is fertile, friable, natural loam reasonably free from subsoil, clay lumps, brush, litter, roots, stones and other foreign materials.
- B. Loam shall be one of the following sandy loams; “coarse sandy loam”, “sandy loam”, “fine sandy loam”, determined by mechanical analysis ASTM D-422 and based on the USDA Classification System, and as defined in this Section. It shall be uniform in composition, without admixture of subsoil. It shall be free of stones greater than one and one-quarter inches, lumps, plants and their roots, debris and other extraneous matter, such as glass, brick, metals, plastics, etc. as determined by the Landscape Architect.
 - 1. Planting loam for trees, shrubs, groundcover and vines, and perennials shall have the following grain size distribution for material passing the #10 (2.0 mm) sieve:

LOAM AND PLANTING PREPARATION

32 91 00 - 6

<u>US Sieve No.</u>	<u>Percent Passing by Weight</u>	
	<u>Maximum</u>	<u>Minimum</u>
10	-----	100
18	93	75
35	80	50
60	56	29
140	32	19
270	23	18

- 1) Percent Gravel in the loam mix shall be <15%.
 - 2) $D_{80}/D_{30} = <8.0$.
 - 3) Organic Matter = 5.0 – 10.0%
 - 4) pH shall be between 5.5 – 6.5.
2. Planting loam for general lawns shall have the following grain size distribution for material passing the #10 (2.0 mm) sieve:

US Sieve No.	Percent Passing by Weight	
	MAX	MIN
10	---	100
18	93	75
35	80	50
60	56	29
140	32	19
270	23	18

- 1) Percent Gravel in the loam mix shall be <15%.
 - 2) Organic Matter = 3.5 – 8.0%.
 - 3) pH shall be between 6.3 – 6.8.
 - 4) Saturated hydraulic conductivity of the mix shall not be less than 2.5 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 88% Standard Proctor, ASTM 698.
- C. One hundred percent by weight shall pass a one-inch (1") sieve opening, and the maximum retained on the 1/4" sieve shall be 20 percent by weight of the total sample.

LOAM AND PLANTING PREPARATION

32 91 00 - 7

- D. Organic content and pH: loam shall contain not less than 6% or more than 10% organic (unless specified differently herein) matter of the sample that passes a 1/4" sieve when determined by the wet combustion method on a sample dried at 105 degrees.
- E. The pH value shall be as noted in the soil blends above.
1. Loam borrow shall be pH adjusted for particular planting applications and shall be adjusted prior to delivery to the Project sites as recommended by UMASS Soil & Plant Tissue Laboratory test results.
 - 1) When pH of loam borrow is equal to or greater than 7 use aluminum sulfate to adjust pH downward to required levels.
 - 2) When pH of loam borrow is less than 7 use either sulfur or ferrous sulfate to adjust pH downward to required levels.
 - 3) When pH of loam borrow must be raised to the required levels use limestone.
 - 4) Regardless of amendment Contractor chooses to use, Contractor, not the Owner, shall be responsible for obtaining specified pH by seeding and/or planting time.
- F. Loam shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. Topsoil shall not have levels of extractable aluminum greater than 200 parts per million except for acid-loving plants. Cation Exchange Capacity (CEC) shall be between 10 and 15.
- G. All planting loam provided from off-site sources shall be brought to the site meeting all specification requirements. There must be no mixing or amending of soil on site. The loam borrow must not be handled or moved when in a wet or frozen condition.
- H. To assure planting loam purchased and screened loam stockpiled fulfills specified requirements regarding textural analysis, organic matter content, and pH, soil testing results will be obtained by the Contractor and submitted to the Architect for approval before any soil is delivered to the site.

2.02 SOIL ADDITIVES.

- A. Soil additives shall be used to counteract soil deficiencies as recommended by the soils analysis.
- B. Lime: Provide approved agricultural limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates. Lime shall meet Massachusetts Department of Food and Agriculture standards for Fine-Sized Classification so that 50% passes a 100 mesh, 60% passes through a 60-mesh sieve, and 95% will pass a 20 mesh sieve.

LOAM AND PLANTING PREPARATION

- C. Aluminum Sulfate shall be unadulterated, 57% (Ortho Division, Chevron Chemical Company), or approved equal.
- D. Sand additive shall be comprised of clean, coarse, granular sand, subangular to sub-round, free from organic matter and deleterious substances. Sand shall be washed sand in accordance with the table below.

<u>SIEVE SIZE</u>	<u>% passing</u>
No. 4	100
No.8	90-100
No. 16	80-100
No. 30	25-60
No. 50	0-25
No. 100	0-5
No 200	0-3

1. The sand should have a coefficient of uniformity (D60/D10) of less than 4.0
 2. Amend existing loam to achieve requirements as described above.
- E. Compost: Provide compost as needed to raise the Organic Content of the topsoil to within specified range. Compost shall be:
1. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and

meeting the following criteria as reported by laboratory tests.
The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.

2. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.
 3. Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition.
 4. pH: The pH shall be between 6.5 to 7.4 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis.
 5. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).
 6. The compost shall be screened to 1/2-inch maximum particle size and shall contain not more than 3 percent material finer than 0.002mm as determined by hydrometer test on ashed material.
 7. Nutrient content shall be determined by the Soil Testing Laboratory and utilized to evaluate soil-required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.
 8. Acceptance of composted products shall be based on the following submittals by the Contractor:
 - 1) Approval of a Material Source.
 - 2) A copy of the Composting Permit for the Material Source selected.
 - 3) Certification by the supplier that the compost product meets state EPA guidelines and that it originates from 100 percent recycled vegetation material, no Bio-Solids will be accepted, that has been aerobically composted.
- F. Bone meal shall be fine ground, steam cooked, packing house bone with a minimum analysis of 23% phosphoric acid and 4% nitrogen.

LOAM AND PLANTING PREPARATION

32 91 00 - 10

- G. Fertilizers: Commercial fertilizer shall be a complete fertilizer complying with all State and Federal Fertilizer laws. Fifty-percent of available nitrogen shall be in a slow-release form as is found in certain urea-form products, or natural organic forms, or a combination of both. The salt index of the fertilizer shall not exceed 35. It shall contain the following percentages by weight.

Lawns		
Nitrogen	(N)	10%
Phosphorus	(P)	10%
Potash	(K)	10%

- H. Fertilizer shall be delivered and mixed as specified, in standard size unopened containers, showing weight, analysis in compliance with Massachusetts Department of Food and Agriculture regulations, and name of manufacturer. It shall be stored in a weatherproof storage place, in such a manner that it will be kept dry, and its effectiveness not impaired.
- I. Fertilizer for planting shall be formulated for top-dressing, soil surface application to plants. Fertilizer shall be designed and certified by the manufacturer to provide controlled release of fertilizer continuously for not less than 9 months. One hundred percent of the nitrogen content shall be derived from organic materials. Nitrogen source shall be coated to ensure slow release. Fertilizer percentages of weight of ingredients shall be as recommended by the soil testing and analysis specified, performed, and paid for under this Section, Loam and Planting Preparation.
- J. Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) shall be agricultural grade, granular form. Gradation shall conform to the following:

<u>Sieve Designation</u>	<u>Percent Passing by Weight</u>
No. 8 (2.36 mm)	100
No. 16 (1.18 mm)	97
No. 30 (0.60 mm)	82
No. 50 (0.30 mm)	46
No. 100 (0.15 mm)	21

PART 3 - EXECUTION

3.01 KICKOFF MEETING:

- A. At least 10 working days prior to the start of work, the Contractor shall request a landscape construction kickoff meeting with the owner's representative, landscape architect and any other parties involved with landscape construction. Contractor shall articulate the means and methods of subgrade preparation, soil placement and other steps outlined in the Specification.

LOAM AND PLANTING PREPARATION

32 91 00 - 11

- B. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- C. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect and Soil Scientist in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions.
- D. Examination of Subgrade: The subgrade shall be examined by the Contractor prior to the start of soil installation. Any deficiencies shall be noted and related to the Landscape Architect. Deficiencies include, but shall not be limited to the following:
 - 1. Construction debris present within the planting areas.
 - 2. The subgrade is at incorrect depths for installing the designed soil profile.
 - 3. Incomplete irrigation.
 - 4. Incomplete lighting and exterior electrical installation.
 - 5. Conflict with underground utilities.
 - 6. Subgrade contaminated with oils, compressible material, silt or clay.
- E. Confirm that the subgrade is at the proper elevation and prepared as required. Subgrade elevations shall slope parallel to the finished grade as shown on the drawings
 - 1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Provide protection measures as required for public safety.
 - 2. All subgrade areas to be filled with Soil shall be free of construction debris, refuse, vegetation, compressible or decay able materials, all stones greater than three inches, concrete washout or soil crusting films of silt or clay that reduces or stops drainage from the soil into the subsoil; and/or standing water. Such material shall be removed from the site.
 - 3. The subgrade must slope toward the bottom of slopes and subdrains. Subgrade levels shall be adjusted as required to ensure that all planted areas have adequate drainage.
- F. Do not proceed with the installation of soil, until all utility work in the area has been installed
 - 1. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.

LOAM AND PLANTING PREPARATION

32 91 00 - 12

3.02 WORKING AROUND UTILITIES

- A. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Known underground and surface utility lines are indicated on the utility drawings – See Civil and Architect’s plans. Contact the local Dig Safe organization and give them their required time to respond and mark the property. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand-excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Perform work in a manner that will protect utilities from damage. Hand-excavate as required and provide adequate means of support and protection of utilities during soil installation operations. Maintain grade stakes set by others until parties concerned mutually agree upon removal. The Contractor shall repair all utilities damaged by soil operations at the Contractor’s expense.

3.03 FILLING AND COMPACTION.

- A. Verify that the subgrade preparations have been reviewed and accepted, including removal of all existing vegetation prior to placement of planting soils.
 - 1. Notify the Landscape Architect of soil placement operations at least seven calendar days prior to the beginning of work.
- B. Perform percolation tests on existing subsoils or placed fill prior to placing and spreading loam for seeding, sodding, and planting:
 - 1. Perform percolation testing of Subsoil or Placed Fills to determine whether or not the subgrade will drain properly. Perform percolation tests as specified in this Section. Perform percolation tests as a rate of one (1) per 10,000sf or as directed by the Landscape Architect. A minimum of three (3) infiltration tests per plating area shall be conducted on the site.
 - 1) Dig a hole in the installed subgrade soil that is a minimum of 8 inches in diameter and 8 inches deep.
 - 2) Place a 6 inch deep by 6 inch diameter plastic bucket with a minimum of 50 holes in the sides and bottom to allow free flowing of water, in the excavated hole. Fill the 1-inch space between the bucket and hole sidewall and bottom with concrete sand. Fill the bucket with water and let it drain completely. Immediately refill the bucket with water and measure the rate of fall in the water level.
 - 3) In the event that the water drains at a rate less than one and a quarter inch per hour (1.25” / 60 minutes), till the sub-soil to a depth required to break the over compaction (min of 6”).

LOAM AND PLANTING PREPARATION

32 91 00 - 13

2. Perform percolation testing of installed Loam to determine whether or not it will drain properly. Perform percolation tests as a rate of one (1) per 10,000sf or as directed by the Landscape Architect. A minimum of three (3) infiltration tests per planting area shall be conducted on the site. Locations of Loam infiltration tests shall not be within 5' from any previous infiltration test conducted on the subgrade.
 - 1) Dig a hole in the installed subgrade soil that is a minimum of 8 inches in diameter and 8 inches deep.
 - 2) Place a 6 inch deep by 6 inch diameter plastic bucket with a minimum of 50 holes in the sides and bottom to allow free flowing of water, in the excavated hole. Fill the 1-inch space between the bucket and hole sidewall and bottom with concrete sand. Fill the bucket with water and let it drain completely. Immediately refill the bucket with water and measure the rate of fall in the water level.
 - 3) In the event that the water drains at a rate less than the following, till the soil to a depth required to break the over compaction:
 - i. General Lawn Areas: 2.0" / 60 minutes.
 - ii. Planting Beds: 2.0" / 60 minutes.
3. In the event that percolation testing indicates that the Subsoil, Placed Fills or ordinary borrow has been over compacted and will not drain, the contractor shall loosen up the top eighteen inches (18") of the subgrade to be planted, seeded, or sodded by ripping or other mechanical means. Recompact the borrow by driving a small, tracked bulldozer over the area at low speeds so that the tracks of the bulldozer pass over the affected area and the soil is compacted to a density that will percolate as specified under the work of this Section.
 - 1) Under no circumstances shall wheeled vehicles be driven over subsoil, placed fills or ordinary borrow that have been shown to percolate or subsoil, placed fills or ordinary borrow that has been loosened and shown to percolate.
4. Perform sufficient percolation tests in areas of poorly draining or compacted subsoil or compacted placed fills as directed by the Architect to ensure that these underlying soils drain. Likewise, perform sufficient percolation tests after ripping and loosening to ensure that the soils are no longer too compact to drain.

LOAM AND PLANTING PREPARATION

32 91 00 - 14

- C. Subsoil or ordinary borrow shall have been excavated and filled as required by the Contract Documents. Do not damage the work previously installed. Maintain all required angles of repose of materials adjacent to the loam as shown on the Contract Documents. Do not over excavate compacted subgrades of adjacent pavement or structures during loaming operations.
- D. Confirm that the subgrade is at the proper elevation and that no further earthwork is required to bring the subgrade to proper elevations. Subgrade elevations shall slope parallel to the finished grade and or toward any subsurface drain lines as shown on the Contract Documents. Provide a written report to the Architect that the subgrade has been placed to the required elevations and that the subgrade drains water at the rates specified under the required percolation tests specified, performed and paid for under this Section, Loam and Planting Preparation. Perform no work of placing and spreading loam until elevations have been confirmed and written report has been accepted by the Architect.
- E. Clear the subgrade of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Such construction debris, trash, rubble and foreign material shall be removed from the site and disposed of in a legal manner. Fill any over excavation with approved fill and compact to the required subgrade compaction levels.
- F. Do not proceed with the installation of loam until all utility work in the area has been installed.
- G. Protect adjacent walls, walks and utilities from damage or staining by the loam. Use 0.5-inch plywood and or plastic sheeting to cover existing concrete, metal and masonry work and other items as directed during the progress of the work. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.

3.04 FINE GRADING

- A. Immediately prior to dumping and spreading loam, the subgrade shall be in a friable condition, cleaned of all stones greater than 2 inches and all debris or rubbish. Such material shall be removed from the site, not raked to the edges and buried. Notify the Architect that the subsoil has been cleaned and request his/her attendance on site to review and approve subgrade conditions prior to spreading loam borrow.
- B. Loam borrow delivered to the site shall be protected from erosion at all times. Materials shall be spread immediately. Otherwise, materials that set on site for more than 24 hours shall be covered with tarpaulin or other soil erosion system acceptable to the Architect and surrounded by silt fence.
- C. No loam borrow shall be handled, planted, or seeded in any way if it is in a wet or frozen condition. A moist loam borrow is desirable.

LOAM AND PLANTING PREPARATION

32 91 00 - 15

- D. Soil additives shall be spread and thoroughly incorporated into the layer of loam by harrowing or other methods reviewed by the Architect. The following soil additives shall be incorporated:
1. Ground limestone or acidulant as required by soil analysis to achieve the required pH as described in this Section. Spread limestone at the rate required by soil analysis up to a maximum limit of 200 pounds per 1,000 square feet. Should recommendations of soil analysis require greater rates of application than 200 pounds per 1,000 square feet, a surface application of limestone not in excess of 50 pounds per 1,000 square feet shall be made to the established lawn during the season after Final Acceptance. This second application of limestone shall be performed and paid for under the work of Section 32 92 00, Turf and Grasses, at rates determined under the testing requirements of this Section, Loam and Planting Preparation.
 2. Fertilizer at the rate and of analysis recommended by the soil analysis. For lawn areas this fertilizer application shall be the first in a series of fertilizer applications made under this Contract and shall be applied and incorporated under this Section, Loam and Planting Preparation. A second and third application of fertilizer for turf areas shall be specified, spread and paid for under Section 32 92 00 Turf and Grasses, of this Specification. For planting areas this fertilizer application shall be primary application and the process of application described under Section 32 90 00, Planting of this Specification and specified, provided, performed and paid for under this Section, Loam and Planting Preparation.
 3. Compost, sand or other soil amendments as required by soil analysis.
- E. Loam shall be sampled and tested as specified, performed and paid for under the work of this Section, to verify application and incorporation of limestone, fertilizer and other soil amendments.
- F. After loam and required additives have been spread, carefully prepare the loam by scarifying, harrowing, or tilling the loam to integrate soil additives into the top 8 inches of the loam. Remove all large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. Remove from unscreened soils all stones over 3/4 inch in diameter from the top 6 inches of the loam bed. Loam shall also be free of smaller stones in excessive quantities as determined by the Architect and as specified herein.
- G. Sufficient grade stakes shall be set for checking the finished grades. Stakes must be set in the bottom of swales and at the top of slopes. Deviation from indicated elevations that are greater than one-tenth of a foot shall not be permitted. Connect contours and spot elevations with an even slope. Finish grades shall be smooth and continuous with no abrupt changes at the top or bottom of slopes.

LOAM AND PLANTING PREPARATION

32 91 00 - 16

- H. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional loam and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.
- I. The Contractor shall install loam in successive horizontal lifts no thicker than 6 inches (6") in turf areas and 12 inches (12") in plant bed areas to the desired compaction as described herein. The Contractor shall install the soil at a higher level to anticipate any reduction of loam borrow volume due to compaction, settling, erosion, decomposition, and other similar processes during the warranty period. The Architect will ensure that the full depths of loam for lawn and plant beds are obtained by digging holes in the loam at the same frequency as for compaction testing.
1. Compact loam to the required density as specified.
 2. Maximum dry density for loam shall be determined in accordance with ASTM D698. The following percentages of minimum to maximum dry densities shall be achieved for fill materials or prepared subgrades.

In lawn, plant beds and tree pits:

	<u>MIN</u>	<u>MAX</u>
Soils within planting areas in top eighteen inches of finished grade	80%	85%
Soils within Lawn Areas in top eighteen inches of finished grade	84%	86%

3. The surface area of each lift shall be scarified by raking prior to placing the next lift.
- J. In addition to the range cited above, compact each lift sufficiently to reduce settling but not enough to prevent the movement of water and feeder roots through the soil. The loam borrow in each lift should feel firm to the foot in all areas and make only slight heel prints. At completion of the loam borrow installation, the soil should offer a firm, even resistance when a soil sampling tube is inserted from lift to lift. After the placement of each lift, perform percolation tests to determine if the soil has been over compacted. Perform the following percolation test procedure:
1. Dig a hole in the installed soil that is a minimum of 4 inches in diameter. Holes in 6-inch lift in turf areas shall be 4 inches deep. Holes in 12-inch lifts in plant beds shall be 8 inches deep. Do not penetrate through the lift being tested.
 2. Fill the hole with water and let it drain completely. Immediately refill the hole with water and measure the rate of fall in the water level.
 3. In the event that the water drains at a rate less than one inch per hour, till the soil to a depth required to break the over compaction.

LOAM AND PLANTING PREPARATION

32 91 00 - 17

4. Perform a minimum of one soil percolation test per 10,000 square feet area of turf area and 2,500 square feet of tree and shrub planting area as directed by the Architect.
- K. Select equipment and otherwise phase the installation of the loam to ensure that wheeled equipment does not travel over subsoil, placed fills or ordinary borrow or already installed soil. Movement of tracked equipment over said soils will be reviewed and considered for approval by the Architect. If it is determined by the Architect that wheeled equipment must travel over already installed soil, provide a written description of sequencing of work that ensures that compacted soil is loosened and uncompacted as the work progresses or place one-inch thick steel plate ballast (or equivalent ballast approved by the Architect) over the length and width of any travel way to cover loam borrow to protect it from compaction.
- L. Disturbed areas outside the limit of lawn work shall be graded smooth and spread with a minimum of 6 inches of loam to the finished grade.
 1. Periphery Lawn and undisturbed soil areas and other areas depicted on the plans, shall remain protected for the duration of the Work. Any areas that become disturbed shall be returned to pre-construction conditions at no additional cost to the Owner.
 2. When working within or adjacent to the wood line, Contractor shall use manual tools, air spade or other minimally invasive excavation equipment to perform all work within Existing Soil Areas to preserve the integrity of existing root systems.
- M. Contractor shall be responsible for maintaining all stockpiles of existing, on-site loam on the site until final placement of all loam has been approved by the Architect in writing. No loam shall be removed from the site unless approved by the Architect in writing. Upon written approval by the Architect, Contractor shall remove all excess, unused existing on-site loam from the site and dispose of it in a legal manner.
- N. The contractor shall install erosion control matting where required on the drawings and specified under this Section.

3.05 PROTECTION

- A. The Contractor shall protect landscape work and materials from damage due to landscape operations, operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Treat, repair or replace damaged Planting Soil installation work immediately.

LOAM AND PLANTING PREPARATION

32 91 00 - 18

- B. Provide all means necessary, including fences, to protect all soil areas from compaction and contamination by trash, dust, debris, and any toxic material harmful to plants or humans after placement. Any area that becomes compacted, shall be de-compacted and tilled to the extent determined by the soil scientist and recompressed to the density ranges specified. Any uneven or settled areas shall be filled, re-graded and re-compacted to meet the requirements of this Specification. Soil that becomes contaminated shall be removed and replaced with specified soil material.
- C. Phase the installation of the planting soil such that equipment does not have to travel over already installed planting soil. Use of haul roads is acceptable provided that the haul road is completely re-worked to meet the requirements of this Specification. Under no circumstances shall heavy equipment or trucks be allowed to traverse placed topsoil or prepared subgrade unless said equipment is tracked or has low ground pressure tires. Apply filter fabric covering and planking or other engineering controls over soil to minimize compaction and collect dust and debris in any area where the Contractor must work after the installation of Planting Soil.
- D. Till compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Landscape Architect. Planting Soil shall be tilled or replaced by the Contractor at no expense to the Owner.

3.06 COORDINATION AND EXCESS MATERIALS

- A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities after placement.
- B. Excess Soil and Materials: Remove the excess soil and materials from the site at no additional cost to the Owner unless otherwise requested.

3.07 CLEAN-UP

- A. During installation, keep pavements clean and work area in an orderly condition.
- B. Keep the site free of trash and debris at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.
- C. All trash and debris shall be removed from the site.
- D. Once installation is complete, remove any excess soil from pavements or embedded in fixtures.

LOAM AND PLANTING PREPARATION

32 91 00 - 19

3.08 ACCEPTANCE

- A. Confirm that the final grade of the loam borrow is at the proper finish grade elevations. Adjust grade as required to meet the contours and spot elevations noted on the Plans. Request the presence of the Architect to inspect final grade. Do not proceed with the remaining work of this Contract until the Architect has given his/her written approval of the final grade.
- B. Placed Lawn, Planting and Athletic Soils must be capable of infiltrating water at the minimum rate provided in this Specification for each type of planting soil.

END OF SECTION

LOAM AND PLANTING PREPARATION

32 91 00 - 20

SECTION 32 92 00
TURF AND GRASSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 apply to the work of this Section.

1.02 DESCRIPTION OF WORK

- A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

- 1. Seeding
 - a. General Lawn.
 - b. Temporary Seeding for Erosion Control.
- 2. Maintenance
- 3. Inspection and acceptance
- 4. Cleaning and protection

1.03 RELATED WORK

- A. Carefully examine the site and all of the Contract Documents for requirements that affect the work of this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions. Other specifications sections that directly relate to the work of this Section include, but are not limited to, the following:

- 1. Section 31 00 00 – Earthwork
- 2. Section 32 92 00- Turf and Grasses

- B. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work of the Contract.

- 1. The planting subcontractor shall become fully acquainted with the nature and requirements of the project including the location of all underground utilities prior to starting the work of this Section.

1.04 SUBMITTALS

- A. Material Samples and testing:

1. Provide full analysis of existing on-site loam, and off-site loam source from a laboratory that has been approved in writing by the Architect. Sampling and testing shall be as specified, and performed under the work of Section 32 91 00 Loam and Planting Preparation.
2. Provide manufacturers' certified analysis for soil amendments and fertilizers to meet the requirements of this Section, Turf and Grasses.
3. Provide certified analysis for seed mixtures required including percentages of purity, germination and weed seed.
4. Provide organic pre-emergent weed treatment product and safety data, application rates.
5. Product Data.

1.05 REGULATORY REQUIREMENTS

- A. Strictly comply with all applicable codes, regulations and requirements having jurisdiction.
- B. All fertilizer and pesticide applications shall be performed by a licensed applicator in strict conformance with all local, state and federal regulations. Notify the Architect at least two (2) weeks prior to scheduled date of application.

1.06 QUALITY ASSURANCE

- A. All work shall be performed by experienced landscape professionals familiar with planting procedures and under the full-time supervision of a foreman who is a Massachusetts Certified Landscape Professional (MCLP).
- B. Analysis of Materials: For each type of packaged material required for the work of this Section, provide manufacturers' certified analysis.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Packaged Materials: Deliver packaged materials in manufacturer's original unopened containers showing weight, analysis and name of manufacturer. Comply with manufacturer's instructions and recommendations for storage and handling. Protect all materials from damage, deterioration, injury and theft while stored at the site.

1.08 EXAMINATION OF CONDITIONS

- A. All areas to be seeded shall be inspected by the Contractor prior to starting work and any incorrect grading or inadequate drainage shall be reported to the Architect prior to beginning work.

PART 2 - PRODUCTS

2.01 LOAM

- A. Loam for lawns shall be approved, specified, provided, and installed under the work of Section 32 91 00, Loam and Planting Preparation, and loam amendments required by the test results and the work of this Section including but not limited to humus, fertilizers and limestone shall be applied separately at the required rates to the rough graded loam and shall be thoroughly and evenly incorporated to the full depth of the in-place loam. Apply approved limestone in sufficient quantity to bring the acidity of the loam to pH 6.5.

2.02 SOIL ADDITIVES

- A. Soil additives shall be specified, provided, and installed under the work of Section 32 91 00 Loam and Planting Preparation.

2.03 SEED

- A. Seed Material: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination establish by Official Seed Analysis of North America. Seed shall be composed of the following varieties that shall be mixed in the proportions stated and shall test to minimum percentages of purity and germination. Deliver seed in fully labeled, standard, sealed containers. Seed that has become wet, moldy, or otherwise damaged, will not be accepted.
- B. General Lawn Seed Mix, shall have the following seed mixture composition:

<u>Common Name</u>	<u>By Weight</u>	<u>Purity</u>	<u>Germination</u>
Cochise IV Fescue	80%	95%	90%
Fiesta 4 Perennial Ryegrass	10%	95%	90%
Impact Kentucky Bluegrass	10%	85%	90%

1. All varieties shall be within the top 50 percent and 25 percent respectively, of varieties tested in National Turfgrass Evaluation Program, or currently recommended as low maintenance varieties by University of Massachusetts or the University of Rhode Island.
2. Seeding rate for the seed mix shall be 6 pounds per 1,000 square feet.
3. Seed used for overseeding as specified herein shall be Perennial Ryegrass having 95% purity and 90% germination.

Species	Rate: lbs/ac	Percent Purity
Grain Oats (<i>Avena sativa</i>)	10	98%
Cereal Rye (<i>Secale cereale</i>)	10	97%
Winter Wheat (<i>Triticum aestivum</i>)	10	95%
Annual Ryegrass (<i>Lolium multiflorum</i>)	6	97%
TOTAL	36	

2.04 FERTILIZERS

- A. Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. Fertilizer shall contain not less than the percentages of weight of ingredients as recommended by the soil analysis.
- B. Nitrogen fertilizer shall be slowly soluble ureaformaldehyde, methylene urea, or isobutylidene diurea; or slow release sulfur-coated urea.
- C. Phosphorus shall be superphosphate or triple superphosphate.
- D. Potassium shall be sulfate of potash, K₂SO₄.
- E. Salt indexes per unit of nutrient for nitrogen, phosphorous, and potassium shall be less than 1.0 when compared to sodium nitrate (6.3).

2.05 LIMESTONE

- A. Ground limestone for adjustment of loam borrow pH shall contain not less than 85 percent of total carbonates and shall be ground to such fineness that 40 percent will pass through 100 mesh sieve and 95 percent will pass through a 20 mesh sieve. Contractor shall be aware of loam borrow pH and the amount of lime needed to adjust pH to specification in accordance with testing lab recommendations.

2.06 WATER

- A. Water: Shall be furnished by the Contractor from a legal off-site source via water truck and be suitable for irrigation, free of toxic ingredients. Sources of water at or near the site that are made available to the Contractor are a convenience to the Contractor. Limitations of site water sources shall be supplemented by off-site sources at the Contractor's expense to meet the maintenance requirements of this Section. Any municipal fees associated with providing water for this work shall be borne by the Contractor.

1. Watering Equipment: The Contractor shall furnish sufficient watering equipment to distribute water evenly with complete coverage daily to all seeded areas.

2.07 STRAW

- A. Straw for mulch at seeded areas shall be mowings of acceptable herbaceous growth reasonably free from noxious weeds or woody stems and shall be reasonably dry. Straw Mulch shall consist of stalks or stems of grain after threshing. No salt hay shall be used.

2.08 HYDROSEED MULCH, TACKIFIERS AND WATER RETENTION AGENTS

- A. Wood fiber mulch for Hydroseed application shall be a manufactured product of natural wood cellulose fibers with a non-toxic green marking dye incorporated to ensure uniform distribution. Mulch shall be packed in sealed original containers, clearly labeled with brand name and manufacturer. It shall have delivered moisture content less than 12 percent.
- B. Hydroseed tackifier shall be a powdered starch-based product approved by the Engineer. Hydroseed tackifier shall be applied in conjunction with the hydroseed slurry in accordance with the manufacturer's recommendations.
- C. Moisture retention agent shall be a powdered starch-based product, approved by the Engineer, and shall be capable of retaining up to 400 times their weight in water. Moisture retaining agents shall be added to the hydroseed slurry in accordance with the manufacturer's recommendations. Moisture retention agent shall be 'Hydro-Gel', as manufactured by Finn Corporation, Fairfield, OH.
- D. The rate of application for wood fiber mulch shall be in accordance with manufacturer's guidelines.

2.09 HERBICIDES, CHEMICALS AND INSECTICIDES

- A. No insecticides, herbicides or fungicides shall be used on-site without the Contractor notifying and obtaining the prior approval of the Engineer.
- B. Provide chemicals and insecticides as needed for fungus or pest control. All chemicals and insecticides shall be approved by the Massachusetts Department of Food and Agriculture for the intended uses and application rates.
- C. Insecticides.
 1. Shall be EPA registered and approved for use in public open spaces. All insecticides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
 2. Insecticide use shall be limited and selective, only to control specific insect infestations, as identified by the Contractor or the Owner's Representative that may result in the disfigurement, decline, or death of plant materials.

11/01/2024

D. Herbicides.

1. Herbicides shall be EPA registered and approved for use in public open spaces. All herbicide shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
2. Herbicide for post-emergent application shall be of a formulation that will not kill, damage, limit or prevent germination or establishment of the lawn seed mix.
3. Herbicide use shall be limited and selective, only to control specific weed infestations that have been identified by the Contractor or the Owner's Representative.
4. Provide post emergent crab grass control throughout the maintenance period to ensure a germinated and mown lawn free of crab grass.

E. Fungicides.

1. Fungicides shall be EPA registered and approved for use in public open spaces. All fungicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
2. Fungicide use shall be limited and selective, only to control specific fungal pathogenic disease infestations, as identified by the Contractor or the Owner's Representative, that may result in the disfigurement, decline, or death of plant materials.

PART 3 - EXECUTION

3.00 GENERAL

- A. All areas within the Limit of Work lines not required to be otherwise developed shall be seeded as shown in the Contract Documents. The Contractor shall restore all lawn areas disturbed because of this Contract with specified loam and seed, as directed by Owner, whether within or outside the Limit of Work line.

3.01 PREPARATION OF SUBGRADE AND SPREADING OF LOAM

- A. Preparation of subgrade and spreading of loam shall be specified, and performed under the work of Section 32 91 00 Loam and Planting Preparation.

3.02 FINE GRADING

- A. Fine grading shall be specified, and performed under the work of Section 32 91 00 Loam and Planting Preparation.

11/01/2024

3.04 SEEDING

- A. Contractor shall obtain Landscape Architect's written approval of fine grading and be preparation before doing any seeding work.
- B. Seeding shall be done immediately after fine grading provided the seedbed has remained in a friable condition and has not become muddy or hard. If it has become hard, it shall be tilled to a friable condition and fine graded again.
- C. Protection of all newly loamed and graded areas is required and shall be accomplished by whatever means necessary such as mulch applied with a tackifier, or by other means approved by the Engineer. The Contractor shall be responsible for the prevention of siltation in areas beyond the limit of work and for all means of protection throughout the maintenance period at no additional cost to the Owner.
- D. Slope erosion control blankets shall be placed as indicated on the plans or as required by the Engineer. Refer to Section Section 32 91 00 – LOAM AND PLANTING PREPARATION for requirements. Seeding operations shall be conducted before the installation of the slope erosion control blanket, or as directed by the Landscape Architect or Engineer.
- E. Seeding shall be done when soil and weather conditions permit in early spring to June 15; and from August 15 to October 15. The actual planting of seed shall be done, however, only during periods within this season which are normal for such work as determined by weather conditions and by accepted practice in this locality. To prevent loss of soil via water and wind erosion and to prevent the flow of sediment, fertilizer, and pesticides onto roadways, sidewalks, and into catch basins, seed loam areas within 5-Days of spreading the loam.
 - 1. If there is insufficient time in the planting season to complete soil preparations, fertilizing, and seeding; permanent seeding may be left until the following planting season, at the option of the Contractor, or as required by the Engineer. In that event, a temporary cover crop shall be sown. This cover crop shall be cut and watered as necessary until the beginning of the following planting season, at which time the permanent seed crop shall be sown as specified.
- F. Sow seed using a spreader or hydroseeder. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing equal quantity of seed specified or scheduled. Apply seed at one half the rate in two directions at right angles to each other. Roll the seeded areas lightly and water with a fine spray.

1. After the grass has germinated, all areas and parts of areas that fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded and such areas and parts of areas shall be reseeded repeatedly until all areas are covered with a uniform germination.
2. Install straw mulch at areas seeded by spreader and cellulose fiber mulch at areas seeded by hydroseeder. Install mulch immediately after fine grading topsoil and seeding.
3. Sow seed using a spreader in lawn areas directly adjacent to building structures as an alternative to Hydroseeding in these areas.

E. Seeding of lawn shall be by Hydroseeding Method specified as follows:

1. Prior to the start of work, furnish a certified statement as to the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of hydroseeding that can be covered with the quantity of solution in the hydroseeder.
2. Hydroseed with wood cellulose fiber mulch at a rate of 46 pounds per 1,000 square feet or 2,000 pounds per acre.
3. Seed shall be incorporated with the mulching material to obtain a minimum hydroseeded sown coverage of 200 pounds of the specified seed mix per acre, as recommended by the seed suppliers, or as required by the Engineer.
4. For the hydroseeding process, a mobile tank with a capacity of at least 500 gallons shall be filled with water and the mixture noted above in the specified proportions. The resulting slurry shall be thoroughly mixed by means of positive agitation in the tank and kept in an agitated state in order that the materials may be uniformly suspended in the water. Apply the slurry by a centrifugal pump using the hose application techniques from the mobile tank. Only hose application shall be permitted. At no time shall the mobile tank or tank truck be allowed onto the prepared hydroseed beds. The hose shall be equipped with a nozzle of a proper design to ensure even distribution of the hydroseeding slurry over the area to be hydroseeded and shall be operated by a person thoroughly familiar with this type of seeding operation.
5. The Contractor shall immediately cleanup hydroseed oversprays from plant materials, pavements, furnishings, etc., to the satisfaction of the Engineer.

3.05 LAWN MAINTENANCE

- A. The Contractor shall maintain and protect the entire seeded area, as necessary to ensure dense healthy growth. Maintenance shall begin immediately after any area is seeded and shall continue for a minimum of 60 days during the active growing period for seeded areas or until Final Acceptance, whichever is longer.
- B. In the event that seeding operations are completed too late in the Fall for adequate germination and growth of grass, maintenance shall continue through the following spring for at least 60 days. Maintenance shall include watering as specified, liming, fertilizing, removal of stones, control of weeds, insect pests and fungal pathogens, and regular mowing. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit Following the completion of all lawn construction work, and until final acceptance of the project.
- C. Maintenance shall include watering as specified, liming, fertilizing, removal of stones, control of weeds, insect pests and fungal pathogens, repair of ruts and erosion, repair of protective devices and reseeding and regular mowing.
 - 1. Weed treatment: At lawns that were seeded the previous fall, a pre-emergent herbicide application is required in early spring. A post-emergent shall also be applied in late spring.
- D. Watering: The Contractor shall include in his base bid costs for daily and, if necessary, continuous watering of all grass areas during a normal eight hour working day to maintain the seed bed in a continuous moist condition satisfactory for good germination and turfgrass development. Water equivalent of one-inch of water per week (1"/week), applied over a minimum of 3 non-consecutive days. Control weeds as necessary to maintain grass at 98% weed free.
- E. Maintenance shall include all temporary protection fences, barriers and signs and all other work, tools and equipment incidental to proper maintenance.
- F. The Contractor shall be responsible for all maintenance of lawns necessary to establish a uniform germination of the specified grasses.
- G. Mowing and Edging:
 - 1. The Contractor shall keep all General Lawn and Sod areas mowed until Acceptance of the contract by cutting to a height of 2 inches when growth reaches 3 inches or as directed by the Landscape Architect.. The lawn shall be cut no shorter than 2-inches in height and shall be regularly mowed as necessary to maintain the above-prescribed conditions
 - 2. At each mowing, all edges of walks, drives, plant beds and other border conditions shall be edge trimmed by hand or machine to produce straight and uniform edge conditions.

11/01/2024

3. Remove and discard from paved areas only clippings and debris generated by each mowing and edging operation legally off-site. Landscape Architect, if practical and aesthetic, may allow sweeping (not blowing) clippings back into grass. Mowers shall be equipped with mulching blades. Do not remove from grass areas any clippings that have been generated by mowing operations. Do not mow grass when wet.
- H. Fertilizing at General Lawn seeded areas: The first application of fertilizer is specified, provided, performed and paid for under the Section 32 91 00, LOAM AND PLANTING PREPARATION. A second application of fertilizer shall be applied to seeded areas at the time of the first mowing and shall be performed and paid for under this section, TURF AND GRASSES. This second application shall be applied at a rate that ensures that one-half pound of nitrogen is applied per 1,000 square feet. Phosphorus and potassium shall be applied proportionally in accordance with the recommendations of the soil tests and the quantities previously integrated into the soil during the first application. A third application of nitrogen fertilizer shall be applied to seeded areas approximately two months after the second application and shall be paid for under this section, TURFS AND GRASSES. This third application shall correspond to the following application rates dependent upon the month of application.
1. May 1-15: Apply 1.0 pound of nitrogen per 1,000 square feet.
 2. June 15-30: Apply 1.0 pound of nitrogen per 1,000 square feet.
 3. August 15 through September 15: Apply 1.0 pound of nitrogen per 1,000 square feet.
 4. November 1-15: Apply 1.5 pounds of nitrogen per 1,000 square feet.

Nitrogen fertilizer shall be composed of 50 percent slowly soluble or slow release nitrogen fertilizer.

3.06 LAWN REVIEW AND ACCEPTANCE

- A. At the end of the maintenance period, seeded and sodded areas shall have a close stand of grass as defined above with no weeds present and no bare spots greater than 3 inches in diameter over greater than 5 percent of the overall seeded area. At least 90 percent of the grass established shall be permanent grass species. If seeded areas are deficient, the Contractor's responsibility for maintenance of all seeded areas shall be extended until deficiencies are corrected. Seeded areas to be corrected shall be prepared and reseeded in accordance with the requirements of this Section, TURF AND GRASSES.
- B. The Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals, or replacements.

- C. At the time of acceptance, the Contractor shall remove temporary barriers used to protect lawn areas.
- D. The conditions of lawns will be noted and determination made by the Architect whether maintenance shall continue in any part. When acceptance is made in writing to the Contractor, the Contractor's responsibility for maintenance of lawns or parts of lawns shall cease.
- E. Areas of lawn not meeting the criteria for establishment specified herein will be noted. Remedial work and maintenance shall continue until the lawn is accepted by the Owner.
- F. Seeded areas shall be guaranteed until final acceptance of the project, or, in the case of late summer or fall planting, the guarantee period shall extend through the following spring.

3.07 CLEANING AND PROTECTION

- A. During operations, keep pavements clean and work area in an orderly condition. Protect lawns from damage by other contractors and trades and trespassers. After completion of the work, the Contractor shall remove all debris, materials, rubbish, excess dirt, etc. from the site and dispose of them in a legal manner. The premises shall be left clean and presentable to the satisfaction of the Architect.

END OF SECTION

SECTION 32 93 00

TREES, SHRUBS, GROUNDCOVERS, AND LANDSCAPING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section includes furnishing all labor, materials, equipment, plants, and incidental materials necessary to perform all operations related to the planting of all trees, shrubs, vines, herbaceous plants, ground covers, and for all appurtenant work, complete in place, maintained, and accepted, in accordance with the Contract Drawings and Specifications.
- B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of plant materials, as part of the work of this contract.

1.02 RELATED WORK:

- B. Section 32 91 00, LOAMING AND PLANTING SOIL PREPERATION

1.03 SUBMITTALS:

In accordance with requirements of Section 01 33 00 SUBMITTAL PROCEDURES, the Contractor shall submit the following:

- A. Prior to planting, State nursery inspection certificates for all plant materials.
- B. Samples of the manufacturer's product data, as applicable, for the following materials:
 - 1. Limestone.
 - 2. Fertilizer.
 - 3. Sphagnum Peat Moss.
 - 4. Humus.
 - 5. Organic Compost.
 - 6. Manure.
 - 7. Mulch.

TREES, SHRUBS, GROUNDCOVERS,
AND LANDSCAPING

32 93 00-1

8. Guying and Staking Apparatus.
9. Crepe Wrapping for tree trunks.
10. Anti-transpirant/Anti-desiccant.
11. Insecticides.
12. Herbicides.
13. Fungicides.

PART 2 - PRODUCTS

2.01 PLANT MATERIALS:

- A. The Contractor shall furnish and plant all plant materials as shown on the plans and in the quantities and sizes listed thereon. No substitutions shall be permitted without the written approval of the Engineer.
- B. Plants larger than those specified in the Plant List may be used if approved by the Engineer. However, use of such oversized plants shall not be considered grounds for any increase in the contract price. If the use of larger plants is approved, the required spread of roots or ball of earth shall be increased in proportion to the size of the plant and plant pits shall be increased as necessary.
- C. All plants shall be certified to have passed all required Federal and State inspection laws requiring ensuring freedom from plant diseases and insect infestations. The Contractor shall obtain clearance from applicable governing agencies, as required by law, before planting any plants delivered from outside the state in which they are to be planted.
- D. All plants shall be nursery-grown under climatic conditions and environmental stresses similar to those in the locality of the project. All plants shall originate from nurseries that are no more than one Hardiness Zone higher (as established by the Arnold Arboretum, Jamaica Plain, MA) than where the plant is to be installed. Plants also shall conform to the botanical names and standards of size, culture, and quality for the highest grades and standards as adopted by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock, ANSI-Z60.1, latest edition. All plants shall be legibly tagged with their proper botanical name.
- E. No heeled-in plants or plants from cold storage shall be used. All plants shall be typical

TREES, SHRUBS, GROUNDCOVERS,
AND LANDSCAPING

32 93 00-2

of their species or variety and shall have a normal habit of growth. Plants shall be sound, healthy, and vigorous, well branched and densely foliated when in leaf; shall be free of disease, insects, eggs or larvae; and shall have healthy, well-developed root systems. All parts of the plant shall be moist and shall show active green cambium when cut.

- F. All nursery plants shall be balled and burlapped or container-grown and shall have been acclimatized for at least one growing season. Container-grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together, firm and whole, after removal from the container. No plants shall be loose in the container. Container-grown plants shall have no girdling roots and shall not be in a root-bound condition. Plants shall remain in their container until planted.
- G. Care shall be exercised in digging and preparing field-grown plants for shipment and planting. Balled and burlapped materials shall have solid unbroken balls of earth of sufficient size to encompass all fibrous feeding roots necessary to ensure successful recovery and development of the plants. Balls shall be firmly wrapped in untreated biodegradable burlap and tied securely with wire cages and/or jute twine. Roots or balls of plants shall be adequately protected at all times from sun and drying winds. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during planting, or after the burlap, staves, wire cage, rope, or platform in connection with its transplanting have been removed. Soil characteristics (i.e., composition, texture, pH, etc.) of all field-grown plants shall closely match those of the soil where plant materials are to be planted.
- H. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the Plant List in the Drawings. The branching height for deciduous trees installed adjacent to or within walks shall be 7 feet minimum, having been pruned to this height at least 1 year prior to transplanting. Except when a clump is designated, the trunk of each tree shall be a single trunk growing from a single, unmutated crown of roots. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety. The trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. All pruning cuts shall comply with acceptable horticultural practices. No pruning wounds having a diameter of more than 1½-inches shall be present. Any such wounds must show vigorous bark growth on all edges. Evergreen trees shall be branched to within 1 foot of the ground. No tree that has had its leader cut or die shall be accepted.
- I. Caliper measurements for tree trunks shall be taken 6-inches above ground for trees up to and including 4-inch caliper size and at 12-inches above ground for larger sizes.
- J. Shrubs shall meet the requirements for spread and/or height stated in the Plant List on the Drawings. The measures for height are to be taken from the crown or root flare to the average height of the top of the shrub mass (not the longest branch). The fullness of each

TREES, SHRUBS, GROWDCOVERS,
AND LANDSCAPING

32 93 00-3

shrub shall correspond to the trade classification "No. 1". Single stemmed or thin plants will not be accepted. The side branches must be generous, well-twiggged and the plant as a whole must be well-bushed to the ground. The plants must be in a moist, vigorous condition, free from dead wood, bruises or other root or branch injuries.

- K. Herbaceous plants, vines and groundcovers shall be of the size, age and/or condition designated in the Plant List on the Drawings.
- L. Plants shall be delivered only after preparations for planting have been completed. Plants shall be handled and packed in a horticulturally approved manner and all necessary precautions shall be taken to ensure that plants arrive on-site in a healthy vigorous condition. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn, desiccation, and overheating during transport. Plants that have not been thoroughly watered shall not be accepted at the planting site. Any plants delivered to the site in a dry or wilted condition shall be rejected and replaced at no expense to the Owner. All plant materials shall be protected, watered and otherwise maintained prior to, during, and upon delivery to the site.
- M. Plants shall be subject to inspection and approval by the Engineer at the place of growth, or upon delivery, for conformity to specification requirements as to quality, size, variety, and condition. Inspection and selection of plants before digging shall be at the option of the Engineer. The Contractor, or his representative, shall be present, if requested by the Engineer, for inspection of plants at the Nursery. Such approval shall not impair the right of inspection and rejection upon delivery at the site or during the progress of work, for size and condition of balls and roots, disease, insects and latent defects or injuries. Rejected plants shall be removed immediately from the site. Certificates of inspection of plant materials shall be furnished as may be required by Federal, State and other authorities to accompany shipments.

2.02 LOAM:

Loam shall be as specified in Section 32 91 19, LOAM AND SEEDING.

2.03 SOIL ADDITIVES AND AMENDMENTS:

A. LIMESTONE:

Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

TREES, SHRUBS, GROUNDCOVERS, AND LANDSCAPING

32 93 00-4

B. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogeneous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.
2. Fertilizer for tree, shrub and groundcover plantings shall contain all major plant nutrients and minor trace elements essential to sustain plant growth and shall have the following analysis:

Nitrogen (N)	Phosphorous (P)	Potassium (K)
10%	10%	10%

3. As approved by the Engineer, a slow release root contact fertilizer installed at the time of planting, may be used in place of the above, at the discretion of the Contractor.
- C. Organic Compost shall be a standard commercial product comprised of fully decomposed, 100 percent plant-derived, natural organic matter. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Compost shall be free of sticks, stones, weed seeds, roots, mineral or other foreign matter and delivered air dry. It shall be free from excessive soluble salts, heavy metals, phytotoxic compounds, and/or substances harmful to plant growth and viability. Organic compost shall have an acidity range of 4.5 to 7.0 pH.
- D. Sphagnum Peat Moss shall be a standard commercial product. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Peat moss shall be free of sticks, stones, weeds or weed seeds, roots, mineral or other foreign matter. It shall be free from toxic substances and/or compounds harmful to plant growth and viability. It shall be delivered air dry in standard bales and shall have an acidity range of 3.5 to 5.5 pH.
- E. Humus shall be natural humus, reed peat, or sedge peat. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Humus shall be free of sticks, stones, weeds, roots, mineral or other foreign matter and/or toxic substances harmful to plant growth and viability. It shall be low in wood content, free from hard lumps and excessive amounts of zinc and delivered air dry in a shredded or granular form. The acidity range for humus shall be 5.5 to 7.5 pH, and the organic matter content shall be not less than 85 percent, as determined by loss on

**TREES, SHRUBS, GROUNDCOVERS,
AND LANDSCAPING**

32 93 00-5

ignition. The minimum water holding capacity shall be 200 percent by weight on an oven-dry basis.

- F. Manure shall be well-rotted, leached, cow manure not less than 8 months or more than 2 years old. It shall be free of sawdust, shavings, or refuse of any kind and shall not contain more than 25 percent straw. It shall contain no substances harmful to plant growth. The Contractor shall furnish information regarding chemical disinfectants, if any, that may have been used in storage of the manure.

2.04 PLANTING MIXTURE:

Planting mix shall consist of 7 parts loam borrow and 1 part organic compost, humus, sphagnum peat moss, or manure, thoroughly blended.

2.05 WATER:

Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability. The delivery and distribution equipment required for the application of water shall be furnished by the Contractor, at no additional cost to the Owner.

2.06 MULCH:

Mulch shall be fibrous pliable shredded softbark mulch, not exceeding ½-inch in width. It shall be 98 percent organic matter with a pH range between 3.5 and 4.5 and a moisture content not to exceed 35 percent. It shall be free of weeds, weed seeds, debris, and other materials harmful to plant growth and viability. Organic mulch shall be aged no longer than 2 years.

2.07 MATERIALS FOR STAKING, GUYING, AND WRAPPING:

- A. Tree stakes shall be sound, untreated 2 x 3 (nominal) x 8-foot length Douglas Fir reasonably free of knots. No paint or stain shall be used in conjunction with tree stakes. Tying material shall be flexible braided nylon webbing, ¾-inch wide and have a tensile strength of 900 pounds. Webbing shall be ‘ArborTie’, or approved equal.
- B. Drive anchors and guy wire assemblies shall be suitable for protecting trees and shall be sized in accordance with the manufacturer’s recommendations. No materials shall be used for guying that will girdle, chafe, or otherwise injure trees.
- C. Tree wrap shall be duplex, waterproof kraft paper crinkled to 33-1/3 percent stretch, 4 to 6-inch wide strips. Tying materials shall be jute twine, 2-ply for shrubs and trees less than 3-inch caliper; 3-ply for larger plants.

TREES, SHRUBS, GROWDCOVERS,
AND LANDSCAPING

32 93 00-6

2.08 TREE PAINT:

Tree paint shall not be used.

2.09 ANTI-TRANSPIRANT/ANTI-DESICCANT:

Anti-transpirant or anti-desiccant shall be 'Wilt-Pruf', as manufactured by Nursery Specialty Products, Inc., Groton Falls, NY, or approved equal. It shall be delivered in original sealed manufacturer's containers and used in accordance with the manufacturer's instructions.

2.10 INSECTICIDES:

- A. No insecticides shall be used on-site without the Contractor notifying and obtaining the prior approval of the Engineer.
- B. Insecticides shall be EPA registered and approved for use in public open spaces. All insecticides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
- C. Insecticide use shall be limited and selective, only to control specific insect infestations, as identified by the Contractor or the Engineer that may result in the disfigurement, decline, or death of plant materials.

2.11 HERBICIDES:

- A. No herbicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.
- B. Herbicides shall be EPA registered and approved for use in public open spaces. All herbicide shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
- C. Herbicide for post-emergent application shall be glyphosate contact, 'Roundup', as manufactured by Monsanto, Inc., or approved equal.
- D. Herbicide use shall be limited and selective, only to control specific weed infestations that have been identified by the Contractor or the Engineer.

**TREES, SHRUBS, GROUNDCOVERS,
AND LANDSCAPING**

32 93 00-7

2.12 FUNGICIDES:

- A. No fungicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.
- B. Fungicides shall be EPA registered and approved for use in public open spaces. All fungicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
- C. Fungicide use shall be limited and selective, only to control specific fungal pathogenic disease infestations, as identified by the Contractor or the Engineer, that may result in the disfigurement, decline, or death of plant materials.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. All plants shall be subject to inspection and approval by the Engineer upon delivery to the site. No materials shall be planted until approval is received.
- B. All work shall be performed by skilled workers with a minimum of 2 years planting experience, in accordance with accepted horticultural/nursery practices, under the full-time supervision of a Certified Nurseryman or Arborist.
- C. All balled and burlapped plants that cannot be planted immediately upon delivery shall be set on the ground and the root balls shall be well protected with soil, wet moss, or other acceptable material. All foliage shall be protected and covered with perforated shade materials.
- D. The planting season for evergreen trees and shrubs shall extend from the time the soil becomes workable in the spring until new growth appears, and from September 15 until November 30 in the fall. Deciduous trees and shrubs shall be planted only when dormant, either prior to bud break and/or before leaves appear in the spring, or subsequent to their leaf drop in the fall. Ground covers shall be planted only after the last frost in the spring through mid-May. Planting season periods may be extended if weather and soil conditions permit only with the written approval of the Engineer. Extended or out-of-season planting requirements shall include application of antitranspirant and extra water as needed. Plant guarantee periods shall remain as stated below. Planting shall not be permitted in frozen ground.
- E. All plant locations and outlines for planting beds shall be staked out for review and potential adjustment by the Engineer before any excavation is begun. In the event that rock, underground construction work or obstructions are encountered in any proposed

TREES, SHRUBS, GROUNDCOVERS,
AND LANDSCAPING

32 93 00-8

planting pit or bed, the Engineer may select alternate locations. Where locations cannot be changed, the obstruction shall be removed, subject to the Engineer's approval, to a depth of not less than 3 feet below grade and not less than 6-inches below the bottom of the root ball when plant is properly set at the required grade. Removal of boulders or obstructions greater than 1 cubic yard in size shall be subject to approval and will be paid for by the Owner. No ledge will be removed to create planting pits or beds

- F. All planting pits shall be excavated with sloped walls, wider at the top than at the bottom, and scarified to eliminate glazing. Tree pits shall be at least 2 feet greater in diameter than the root ball of earth or root system. Shrub pits shall be at least 1 foot greater than the diameter of the root ball. Planting pits shall not be deeper than the height of the root ball.
- G. When excavation occurs in areas of heavily compacted earth, stones, concrete chunks or other foreign matter, pits shall be dug at least 3 times the width of the rootball. Excavated material from plant pits shall be disposed of as required.
- H. Container plants shall be removed from their growing container before planting. If roots are densely matted, the outer root mass shall be scored, sliced vertically, with a sharp knife to separate roots. All herbaceous plants and groundcovers shall be evenly spaced to produce a uniform effect and staggered in rows at intervals designated on the contract drawings.
- I. Shrubs and trees shall be set in the center of planting pits, plumb and straight, and at such a level that after settlement the crown of the roots will be 1-inch above the surrounding finished grade. Root ball masses shall not be loosened, broken or damaged. When balled and burlapped plants are set, planting mixture shall be compacted around bases of balls to fill all voids. All tying materials, twine and rope shall be cut and removed. Biodegradable burlap shall be laid back or cut away from the top half of the ball. If a wire basket is present, the upper 2/3 of the basket shall be cut away and removed. Do not remove the entire basket. Roots or bare root plants shall be properly spread out and planting mixture carefully worked in among them. Broken or frayed roots shall be cleanly cut.
- J. Backfill plant pits with planting mixture in layers of not more than 9-inches and firmly tamp each layer and water to sufficiently settle the backfilled soil before the next layer is put in place. When the planting pit is 2/3 backfilled, the hole shall be flooded and watered thoroughly so that the water level reaches the top of the planting pit. Allow water to soak in, then complete the backfilling operation. Immediately after planting pit is backfilled, a shallow basin 3-inches deep and slightly larger than the pit shall be formed with a ridge of soil for water retention. Form a common basin for plant materials throughout mass planting beds. After planting, lightly till the soil in planting beds between planting pits and rake smooth to eliminate compaction of soils.

TREES, SHRUBS, GROUNDCOVERS,
AND LANDSCAPING

32 93 00-9

- K. All planting hole basins shall be flooded with water twice within the first 24 hours of planting, and watered not less than twice per week until final acceptance of the work.
- L. All thin barked deciduous trees shall be wrapped after they are planted and before they are staked. Prior to wrapping, inspect trees for injury to trunks or improper pruning. Take corrective measures as necessary. Wrap trunks of all trees spirally from bottom to top with tree wrap and secure top and bottom at 2-foot intervals with jute twine. The wrapping shall overlap and entirely cover the trunk from the ground to the height of the second branches and shall be neat and snug. Overlap shall be approximately 2-inches.
- M. Stake trees immediately after planting as detailed. All staking apparatus shall be adequate to hold the tree in a vertical position under severe weather conditions. All staking apparatus and tree trunk wrapping shall be removed and disposed of off-site by the Contractor at the end of one growing season.
- N. Immediately after planting and staking operations are complete, all plant pit basins and plant beds shall be covered with approved mulch to the depths designated on the plans. Mulch shall not contact tree bark, cover tree root flares, or shrub crowns. No mulch shall be applied prior to the first watering.
- O. The pruning of trees and shrubs shall only be permitted to remove dead or dying branch limbs and tips, sucker growth, water sprouts, crossing or rubbing branches, broken or damaged branches, diseased or insect infested limbs, and to preserve the natural character of the plant. Plant materials shall be pruned in accordance with American Nurserymen Association Standards and as required by the Engineer. Questionable weak limbs and branch removals that may disfigure the plant shall be left to the discretion of the Engineer. The tree leader shall never be permitted to be cut. Pruning shall be done with clean, sharp tools. All large pruning cuts that are ½-inch in diameter or larger shall be made along the bark branch ridge. Pruning cuts shall not breach or otherwise interfere with the branch collar. All pruning cuts less than ¼-inch diameter shall be made with hand pruners as close to the main stem as possible without damaging the cambium or bud. Tree paint shall not be used to cover pruning cuts.
- P. As the work proceeds, the Contractor shall remove all debris from the site, including but not limited to branches, rock, paper, and rubbish. All areas shall be kept clean, neat and in an orderly condition at all times. Prior to final acceptance, the Contractor shall cleanup the entire area to the satisfaction of the Engineer.

3.02 MAINTENANCE:

- A. Maintenance shall begin immediately after each plant is planted and shall continue until completion of the guarantee period and final acceptance of the project. Plants shall be

TREES, SHRUBS, GROWDCOVERS, AND LANDSCAPING

32 93 00-10

watered, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected. Tree guys and stakes shall be tightened and repaired. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.

- B. Settled plants shall be reset to proper grade and position, planting pits and common basins restored, and dead materials removed and replaced. Planting beds and individual basins shall be neat in appearance, maintained to their original layout lines and kept free of weeds. Mulch shall be replaced as required to maintain proper depths.
- C. Contractor shall make arrangements to provide sufficient water to maintain all trees, shrubs and plant materials until final acceptance. Plants shall be sprayed with anti-transpirant or anti-desiccant if required by seasonal conditions or as required by the Engineer.
- D. Planting areas shall be protected against trespass and damage of any kind during the maintenance period. This shall include the furnishing and installation of approved temporary fencing if necessary. If any plants become damaged during the maintenance period, they shall be treated or replaced as required by the Engineer at no additional cost to the Owner.

3.03 INSPECTION AND PRELIMINARY ACCEPTANCE:

- A. Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.
- B. Inspection and acceptance of plantings may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with clearly definable boundaries. Acceptance and use of these areas by the Owner shall not waive any other provisions of this Contract.

3.04 GUARANTEE:

- A. All plant materials shall be guaranteed for a period of one year after the date of completion of the specified maintenance period and preliminary acceptance of the project by the Owner.
- B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.
- C. Plants shall be healthy, free of pests and disease. Plants shall exhibit vigorous growth,

TREES, SHRUBS, GROUNDCOVERS, AND LANDSCAPING

32 93 00-11

shall bear foliage of normal density, size and color and shall have no less than seventy-five percent (75%) of their branches alive at the end of the guarantee period. If the leader of any single-leader species is dead, the entire plant shall be considered dead.

- D. Any plant required under this Contract that is dead or unsatisfactory, as determined by the Engineer, shall be removed from the site. These shall be replaced as soon as weather permits during the specified planting season, at no additional cost to the Owner, until the plants live through one year.
- E. All replacements shall be plants of the same kind and size as specified on the Plant List. They shall be furnished and planted as specified above.
- F. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance as replacement.
- G. Guarantee shall not apply to the replacement of unacceptable plants resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.
- H. In the instance of curtailment of water by local water authorities (when supply was to be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

3.05 FINAL INSPECTION AND FINAL ACCEPTANCE:

- A. At the end of the guarantee period, the Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.
- B. The Engineer shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

END OF SECTION

TREES, SHRUBS, GROUNDCOVERS,
AND LANDSCAPING

32 93 00-12

SECTION 33 01 30.16

TELEVISION INSPECTION OF NEW PIPELINES

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall furnish all materials, tools, labor and equipment necessary to visually inspect by means of a closed-circuit television all gravity sewers (except building connections) installed under this Contract, as hereinafter specified. The sewers shall be inspected throughout their entire length.
- B. The Contractor shall repair all defects in the system discovered during the television inspection. Prior to making the repairs, the Contractor shall submit to the Engineer a plan for making the repairs.

1.02 RELATED WORK:

- A. Section 01 33 19, DOCUMENTATION
- B. Section 01 33 23, SUBMITTALS
- C. Section 33 41 13.28 REINFORCED CONCRETE PIPE

1.03 QUALITY CONTROL:

- A. The work described herein shall be performed by a company with not less than five years of experience in providing the required services, employing experienced workers and experienced supervisory personnel. Supervisory personnel shall have not less than three years of experience in providing the required services and shall be present at the jobsite during all work related to the required services.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Prior to beginning work, submit the following:
 - 1. Qualifications of the firm/personnel who will perform the work;
 - 2. Description of system proposed for handling existing flows during the various procedures to be carried out;

11/01/2024

3. Description of the system and equipment proposed for televising the pipe.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

- A. Video system capable of producing DVD's in MPEG-1 format with audio.
- B. The television camera used for the inspection shall be a pan and tilt closed circuit color television camera specifically designed and constructed for such inspections. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing a minimum 400-line resolution color video picture. Picture quality and definition shall be to the satisfaction of the Engineer and, if unsatisfactory, equipment shall be removed and no payment made for the unsatisfactory inspection.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. The inspection shall be done one manhole section at a time and the section being inspected shall be suitably isolated from the remainder of the sewer line as required. No sanitary sewer lines shall be inspected until they have been cleaned. The camera shall be moved through the line in either direction at a uniform slow rate, stopping when necessary to insure proper documentation of the sewer's condition, but in no case will the television camera be pulled at a speed greater than 30 feet per minute.
- B. Manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall reset up its equipment in a manner so that the inspection can be performed from the opposite manhole. The Contractor is required to repeat the TV inspection of areas repaired subsequent to the original TV inspection.
- C. Whenever nonremote powered and controlled winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two winches, the pumping unit and the monitor control.
- D. Measurement for location of defects shall be at the ground level by means of a meter device. Marking on cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Measurement meters will be accurate to 0.2 feet. A

11/01/2024

TELEVISION INSPECTION PIPES

33 01 30.16-2

measuring target (or the sealing packer) in front of the television shall be used as an exact measurement reference point, and the meter reading shall show this exact location of the measurement reference point.

3.02 DOCUMENTATION:

- A. Documentation shall be provided for all sewer reaches as described in Section 01 33 19 of these specifications.
- B. The Contractor shall furnish printed internal inspection logs and two (2) DVD's of the entire inspection to the Owner on completion.

END OF SECTION

SECTION 33 01 30.61

SEWER CLEANING, INSPECTION, TESTING, AND SEALING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers cleaning, inspection, testing and sealing of pipelines as called for herein and on the drawings. The work includes furnishing all equipment, material and labor required to perform the services described herein.

1.02 RELATED WORK:

- A. Section 00 31 19.22, TELEVISION AND MANHOLE INSPECTION LOGS
- B. Section 01 12 16, SCOPE AND SEQUENCE OF WORK
- C. Section 01 14 19.22, HANDLING EXISTING FLOWS
- D. Section 01 33 19, DOCUMENTATION
- E. Section 01 33 23, SUBMITTALS
- F. Section 33 01 30.16, TELEVISION INSPECTION OF PIPES
- G. Section 33 01 30.65, SERVICE CONNECTION REHABILITATION
- H. Section 33 01 30.71, GROUNDWATER MONITORING
- I. Section 33 41 13.28, REINFORCED CONCRETE PIPE

1.03 QUALITY CONTROL:

- A. The work described herein shall be performed by a company with not less than five (5) years of experience in providing the required services, employing experienced workers and experienced supervisory personnel. Supervisory personnel shall have not less than three (3) years of experience in providing the required services and shall be present at the jobsite during all work related to the required services.

1.04 REFERENCES:

- A. The following standards form a part of this specification as referenced:

The National Association of Sewer Service Companies (NASSCO)

11/01/2024

Sewer Pipe Cleaning Specification Guideline

Specification entitled Pipeline Packer Injection Capital Grouting

ASTM International (ASTM)

ASTM F2304 Standard Practice for Rehabilitation of Sewers Using Chemical Grouting

1.05 SYSTEM DESCRIPTION:

- A. Unless otherwise indicated herein, the pipe cleaning, inspection, testing and sealing of the specified length of pipe shall be carried out in accordance with Part 3, Execution, of the latest edition of the NASSCO Specification entitled Pipeline Packer Injection Capital Grouting. Sewer flow control shall comply with Section 01 14 19.22, HANDLING OF EXISTING FLOWS. Sealing materials shall comply with Part 2, Products, of the NASSCO Specification entitled Pipeline Packer Injection Capital Grouting.
- B. The Contractor may propose alternative processes and/or products for review and approval by the Engineer.

1.06 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Prior to beginning work, submit the following:
 - 1. Qualifications of the firm/personnel who will perform the work.
 - 2. Description of system proposed for handling existing flows during the various procedures to be carried out.
 - 3. Description of the system and equipment proposed for cleaning the pipe.
 - 4. Description of the equipment and system proposed for inspecting the pipe after cleaning.
 - 5. Description of the equipment and system proposed for testing the joints.
 - 6. Description of the equipment, the sealing compound and the system proposed for sealing selected joints and circular cracks.
 - 7. Manufacturer's warranty.
 - 8. Submit MSDS for the sealing compound to be used.

11/01/2024

SEWER CLEANING, INSPECTION, TESTING, AND SEALING

33 01 30.61-2

- B. Refer to Section 01 33 19, DOCUMENTATION for required documentation to be submitted.

1.07 WARRANTY:

- A. The joint and circular crack sealing shall be warrantied for one year after the project is accepted by the Owner.

PART 2 - PRODUCTS

2.01 CLEANING AND SEALING MATERIALS:

- A. The Contractor shall use a chemical grout which is environmentally safe for the sealing of sewers. The chemical sealing materials shall be in accordance with Part 2, Products, of the NASSCO Specification entitled Pipeline Packer Injection Capital Grouting. All other products used for sealing, patching and cleaning of sewers shall also be environmentally safe.
- B. The chemical sealing material shall be EPA registered and labeled for use in sewer lines and acceptable to the State Agencies having jurisdiction over its use.
- C. The Contractor shall submit MSDS data sheets for all materials used.

PART 3 - EXECUTION

3.01 PIPE CLEANING:

- A. Chemical root treatment, where required, shall be applied under Section 02437, SEWER LINE AND MANHOLE CHEMICAL ROOT TREATMENT before the cleaning operation is carried out. Sufficient time shall be allowed between the two operations as recommended by the root control herbicide manufacturer.
- B. The Contractor may elect to use either high velocity jet, or mechanically powered equipment, as described in the NASSCO Specification entitled Pipeline Packer Injection Capital Grouting. Selection of equipment shall be based upon field conditions such as access to manholes, quantity of debris, size of sewer, depth of flow, etc.
- C. All sludge, dirt, sand, rocks, grease, and other solid or semisolid material resulting from the cleaning operation shall be disposed of in accordance with all applicable regulations and in a method acceptable to the Owner. Pipe cleaning shall be performed in advance of pipe television inspection.
- D. The Contractor shall be responsible for the legal disposal of all debris removed from the sewers during the cleaning operation including any costs incurred. The Contractor shall not expect the Owner to provide a dump site.

11/01/2024

SEWER CLEANING, INSPECTION, TESTING, AND SEALING

33 01 30.61-3

- E. Acceptance by the Engineer of the cleaning results will be based on the results of television inspection. If the results are unsatisfactory, the Contractor shall repeat the cleaning until accepted by the Engineer at no additional cost to the Owner.

3.02 PIPE INSPECTION:

- A. Pipe shall be visually inspected by means of closed-circuit television. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture, with minimal reflective glare, for the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing a minimum 400 line resolution color video picture. Picture quality and definition shall be to the satisfaction of the Engineer.
 - 1. Refer to Section 00 31 19.22, DOCUMENTATION, in regard to external hard drives to be given to the Owner upon completion of project and before the project is accepted by the Owner.
- B. The camera shall have a remote controlled, pan and tilt type lens and lighting system capable of turning perpendicular to the direction of flow and rotating 360 degrees while inside the pipe. The camera shall be able to view a minimum service connection length of 4 feet in order to determine whether the connection is active or inactive.
- C. Electronic video equipment shall be capable of displaying and recording during the entire inspection, as a minimum, the following data for each sewer reach videotaped:
 - 1. Project identification
 - 2. Date recorded
 - 3. Sewer reach identification (street location, MH to MH)
 - 4. Footage counter
- D. The camera shall be moved through the line in either direction at a uniform rate, stopping when necessary to ensure proper identification of the sewer's condition. Manual winches, power winches, television cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation the television camera will not pass through the entire sewer section, the Contractor shall re-set its equipment in a manner so that the inspection can be performed from the opposite manhole.
- E. Flow control shall be in accordance with Section 01 14 19.22, HANDLING OF EXISTING FLOWS.
- F. Standing water within a sagging pipe shall be removed so that the pipe can be adequately television inspected. A minimum of 80% of the pipe shall be visible before television inspection.

11/01/2024

SEWER CLEANING, INSPECTION, TESTING, AND SEALING

33 01 30.61-4

- G. Removal of obstruction caused by protruding taps shall be in accordance with Section 33 01 30.65, SERVICE CONNECTION REHABILITATION.
- H. Television inspection shall be performed in advance of pipe joint testing, sealing, pipe repair and pipe lining activities.

3.03 EQUIPMENT TESTING:

- A. The Contractor shall perform an above ground demonstration test in a test cylinder with the same diameter as the proposed pipe being tested to simulate a pipe leak. The setup shall have a valve and pressure gauge to simulate leaks and monitor pressure. The tests shall be performed in accordance with ASTM F 2304, Standard Practice for Rehabilitation of Sewers Using Chemical Grouting, Section 11.4.1, Control Testing.
- B. The pressure displayed by the testing equipment shall be within ± 0.5 psi of the gauge pressure to pass successfully. The void pressure should drop to within ± 0.5 psi of the pre-test pressure displayed by the testing equipment after the pressure is released to pass successfully. Test pressures shall be between 7 and 10 psi.
- C. If the demonstration test cannot be performed successfully, the contractor shall repair or modify the equipment and perform the test again until the test is passed.
- D. The Contractor shall perform the demonstration test for each chemical sealing unit prior to the equipment being used on the Project. Additional tests may be required by the Engineer at various times during the Project.

3.04 PIPE TESTING:

- A. Testing of pipe joints or circular cracks to identify joints or circular cracks that are defective and that can be successfully sealed by the internal pipe joint sealing process, shall be in accordance with Part 3 of the latest edition of the NASSCO Specification entitled Pipeline Packer Injection Capital Grouting. The test medium may be liquid or gas, at the Contractor's option. Test pressure used shall be acceptable to the Engineer.
- B. Pressure testing shall be equal to 0.5 psi per vertical foot of pipe depth plus 3 psi, whichever is greater; however, test pressure shall not exceed 12 psi, nor be lower than 6 psi unless required by the Engineer. Once the designated pressure in the isolated void is displayed on the meter of the control panel, the application of air pressure shall be stopped, and a 15 second waiting period shall commence. If the void pressure drop is greater than 1.0 psi within 15 seconds, the joint will have failed the test and shall be sealed.
- C. Electronic video equipment shall be capable of displaying and recording, at a minimum the following data for each pipe joint:

11/01/2024

1. Project Identification
2. Date Recorded
3. Footage counter
4. Test Pressure
5. Sewer Reach Identification (Street, location, start MH and second MH).

3.05 PIPE SEALING:

- A. Pipe joints and circular cracks to be sealed shall be designated by the Engineer and shall be sealed in accordance with the procedures described in Part 3 of the NASSCO Specification entitled Pipeline Packer Injection Capital Grouting. The chemical sealing materials used shall be as described in Part 2, Products, of the NASSCO Specification entitled Pipeline Packer Injection Capital Grouting.

3.06 FIELD TESTING/INSPECTION:

- A. Prior to the expiration of the warranty period, an initial test sample of approximately 10% of the linear feet of the total project will be selected and approved by the Engineer. The test sample will consist of manhole-to- manhole segments from throughout the project area that are representative of the sealing work originally performed. The Contractor shall television inspect and test all previously sealed joints and circular cracks within the initial test sample as specified in paragraphs 3.02 and 3.04 of this Section. Any joints or circular cracks failing the test shall be resealed as specified in paragraph 3.05 of this Section. If the failure rate of re-tested joints and circular cracks is less than 10%, the work will be considered satisfactory, and no further testing will be required.
- B. If the failure rate in the initial test sample equals or exceeds 10%, an additional 15% test sample will be selected and approved by the Engineer. If the failure rate in the additional test sample is less than 10%, the work will be considered satisfactory, and no further testing will be required. No previously tested joints or circular cracks can be included in the additional test sample.
- C. If the failure rate in the additional test sample equals or exceeds 10%, the Contractor shall television inspect and test 100% of the joints.
- D. Testing and resealing of sealed joints and circular cracks shall be performed prior to the expiration of the warranty period, during periods of high groundwater, and at a time to be approved by the Engineer.
- E. All inspecting, re-testing, and re-grouting shall be provided at no additional cost to the Owner and shall be completed within the warranty re-test period.

END OF SECTION

11/01/2024

SEWER CLEANING, INSPECTION, TESTING, AND SEALING

33 01 30.61-6

SECTION 33 01 30.65

SERVICE CONNECTION REHABILITATION

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers the rehabilitation of service connections, including cutting of protruding services, television inspection and testing of services, and grouting of services as called for herein and on the drawings. The work includes furnishing all equipment, material and labor required to perform the services described herein.

1.02 RELATED WORK:

- A. Section 00 31 19.22, TELEVISION AND MANHOLE INSPECTION LOGS
- B. Section 01 12 16, SCOPE AND SEQUENCE OF WORK
- C. Section 01 14 19.22, HANDLING EXISTING FLOWS
- E. Section 01 33 19, DOCUMENTATION
- F. Section 01 33 23, SUBMITTALS
- G. Section 33 01 30.61, SEWER CLEANING, INSPECTION, TESTING AND SEALING
- H. Section 33 01 30.71, GROUNDWATER MONITORING
- I. Section 33 41 13.28, REINFORCED CONCRETE PIPE

1.03 QUALITY CONTROL:

- A. The work described herein shall be performed by a company with not less than five (5) years of experience in providing the required services, employing experienced workmen and experienced supervisory personnel. Supervisory personnel shall have not less than three (3) years of experience in providing the required services and shall be present at the jobsite during all work related to the required services.

1.04 REFERENCES:

- A. The following standards form a part of this specification as referenced:

The National Association of Sewer Service Companies (NASSCO)

Pipeline Packer Injection Capital Grouting

Sewer Pipe Cleaning Specification Guideline

ASTM International (ASTM)

ASTM F2454 Standard Practice for Sealing Lateral Connections and Lines from the Mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting

1.05 SYSTEM DESCRIPTION:

- A. Unless otherwise indicated herein, service connection rehabilitation shall be carried out in accordance with Part 3 – Execution, of the NASSCO Specification for Pipeline Packer Injection Capital Grouting.
- B. The Contractor may propose alternative processes and/or products for review and approval by the Engineer.
- C. The location of the service connection rehabilitations are indicated on the drawings.

1.06 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Prior to beginning the work, submit the following:
 - 1. Qualifications of the firm/personnel who will perform the work.
 - 2. Descriptions of system proposed for handling existing flows, if necessary, during the procedures to be carried out.
 - 3. Description of the system, equipment and material proposed for the service connection rehabilitations.
 - 4. Manufacturer's warranty.
 - 5. Submit MSDS Data Sheets for proposed chemicals to be used.
- B. Refer to Section 01 33 19, DOCUMENTATION, for documentation required to be submitted.

1.07 WARRANTY:

- A. The service connection rehabilitations shall be warrantied against infiltration and faulty workmanship and materials for one year from the date the project is accepted by the Owner.

PART 2 - PRODUCTS

2.01 CHEMICAL GROUT:

- A. The Contractor shall use chemical grout which is environmentally safe for the sealing of sewers. The chemical sealing materials shall be used in accordance with Part 2, Products, of the latest edition of NASSCO Specification for. Pipeline Packer Injection Capital Grouting.
- B. All other products used for sealing, patching and cleaning of sewers shall also be environmentally safe.

PART 3 - EXECUTION

3.01 PIPE CLEANING AND INSPECTION:

- A. Pipe cleaning and inspection shall be carried out in accordance with Section 33 01 30.61, SEWER CLEANING, INSPECTION, TESTING AND SEALING.

3.02 FLOW CONTROL:

- A. Flow control, if required, shall be in accordance with Section 01 14 19.22, HANDLING EXISTING FLOWS.

3.03 CUTTING OF PROTRUDING SERVICE CONNECTIONS:

- A. The Contractor shall cut protruding service connections where called for on the drawings. The protruding services shall be cut flush with the wall of the sewer, using either a lateral cutter or grinder.
- B. After the protruding services are cut, the service connections shall be grouted in accordance with paragraph 3.06 of this Section. No additional payment shall be made for grouting service connections.

3.04 EQUIPMENT TESTING:

- A. The Contractor shall perform an above ground demonstration test in a test cylinder with the same diameter as the proposed pipe being tested to simulate a pipe leak. The setup shall have a valve and pressure gauge to simulate leaks and monitor pressure. The tests shall be performed in accordance with ASTM F2454, Standard Practice for Sealing

Lateral Connections and Lines from the Mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting, Section 11.3.3, Initial Testing.

- B. The pressure displayed by the testing equipment shall be within ± 0.5 psi of the gauge pressure to pass successfully. The void pressure should drop to within ± 0.5 psi of the pre-test pressure displayed by the testing equipment after the pressure is released to pass successfully. Test pressures shall be between 7 and 10 psi.
- C. If the demonstration test cannot be performed successfully, the Contractor shall repair or modify the equipment and perform the test again until the results are satisfactory to the Engineer
- D. The Contractor shall perform the demonstration test for each chemical sealing unit prior to the equipment being used on the Project. Additional tests may be required by the Engineer at various times during the Project.

3.05 TELEVISION INSPECTION AND TESTING OF SERVICE CONNECTIONS:

- A. The Contractor shall television inspect and test service connections where called for on the drawings. Television inspection of services shall utilize a pan and tilt camera which shall inspect a minimum of 4 feet of the service connection from the main sewer.
- B. Pressure Testing: Air testing is accomplished by isolating the area to be tested with the packer and applying positive pressure into the isolated VOID area. VOID area shall include a minimum 3 feet of service connection pipe.
- C. Pressure testing shall be carried out in accordance with Part 3 – Execution, of the latest edition of NASSCO Specification for Pipeline Packer Injection Capital Grouting.
- D. Pressure testing shall be equal to 0.5 psi per vertical foot of pipe depth plus 3 psi; however, test pressure shall not exceed 12 psi nor be lower than 6 psi unless required by the Engineer. Once the designated pressure in the isolated void is displayed on the meter of the control panel, the application of air pressure will be stopped and a 15 second waiting period will commence. If the void pressure drop is greater than 1.0 psi within 15 seconds, the lateral shall be considered to have failed the air test.
- E. The television inspection and testing equipment shall be capable of inspecting and testing 4-inch, 5-inch and 6-inch diameter service connections.
- F. If the service fails the pressure test, the service shall be grouted in accordance with paragraph 3.06 of this Section and retested.

3.06 GROUTING OF SERVICE CONNECTIONS:

- A. The Contractor shall grout service connections where indicated on the drawings or when a service fails the pressure test, as described in paragraph 3.05 of this Section. The Contractor shall grout all service connections reinstated as described in Section 33 01 30.72, CURED-IN-PLACE PIPE or Section 33 01 30.73, CURED-IN-PLACE SHORT LINER, regardless of the results of the pressure test. Grouting of service connections shall be carried out in accordance with Part 3 - Execution, of the NASSCO Specification for Pipeline Packer Injection Capital Grouting.
- B. When pumping grout commences, operate the pump until a minimum back pressure of 8 psi is achieved.
- C. The grouting equipment shall be capable of grouting 4-inch, 5-inch and 6-inch diameter service connections.
- D. The chemical sealing materials shall be as described in Part 2, Products of the latest edition of NASSCO Specification for Pipeline Packer Injection Capital Grouting.
- E. If a service connection becomes clogged with grout, the Contractor shall clear the grout from the lateral. This work shall be done at no additional cost to the Owner.

3.07 FIELD TESTING/INSPECTION:

- A. Prior to the expiration of the warranty period, an initial test sample of approximately 10% of the original service connection rehabilitation work will be selected and approved by the Engineer. The test sample will consist of manhole sections from throughout the project area that are representative of the sealing work originally performed. The Contractor shall television inspect and test all previously grouted service connections within the initial test sample as specified in paragraph 3.05 of this Section. Any service connections failing the re-test shall be re-grouted as specified in paragraph 3.06 of this Section. If the failure rate in the initial test sample is less than 10%, the work will be considered satisfactory, and no further testing will be required.
- B. If the failure rate in the initial test sample equals or exceeds 10%, an additional 15% test sample will be selected and approved by the Engineer. If the failure rate in the additional test sample is less than 10%, the work will be considered satisfactory, and no further testing will be required. No previously tested service connection can be included in the additional test sample.
- C. If the failure rate in the additional test sample equals or exceeds 10%, the Contractor shall television inspect and test 100% of the service connections.
- D. Any remaining service connection rehabilitation work not television inspected and tested as part of a test sample shall be television inspected. The Contractor shall repair any defects found and shall re-grout the services until there are no visible leaks through television inspection.

- E. Television inspecting, testing, and re-grouting of service connections shall be performed prior to the expiration of the warranty period, during periods of high groundwater and at a time to be approved by the Engineer.
- F. All inspecting, re-testing, and re-grouting shall be provided at no additional cost to the Owner and shall be completed within the warranty re-test period.

END OF SECTION

SECTION 33 01 30.71

GROUNDWATER MONITORING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers installation and monitoring of groundwater monitoring gauges. The work includes furnishing all equipment, material, and labor required to perform the services described herein.

1.02 RELATED WORK:

- A. Section 01 14 19.22, HANDLING EXISTING FLOWS
- B. Section 33 01 13.28, REINFORCED CONCRETE PIPE
- C. Section 33 01 30.61, SEWER CLEANING, INSPECTION, TESTING AND SEALING
- D. Section 33 01 30.65, SERVICE CONNECTION REHABILITATION

1.03 QUALITY ASSURANCE:

- A. The work described herein shall be performed by a company with not less than five years of experience in providing the required services, employing experienced workers and experienced supervisory personnel. Supervisory personnel shall have not less than three years of experience in providing the required services and shall be present at the jobsite during all work related to the required services.

1.04 SYSTEM DESCRIPTION:

- A. Groundwater monitoring gauges shall be installed in selected manholes. The exact manhole locations shall be determined by the Engineer.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Prior to beginning the work, submit the following:
 - 1. Qualification of the firm/personnel who will perform the work.
 - 2. Description of the system, equipment and material proposed for the groundwater

11/01/2024

monitoring gauges.

1.06 WARRANTY:

- A. The groundwater monitoring gauges shall be warranted for the duration of the contract until such time as all warranty inspections have been successfully completed and passed. The gauges shall be maintained in working order throughout the warranty period.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Gauges shall consist of piezometer taps into the walls of selected manholes. The tube shall be inserted into the manhole wall approximately one foot above the manhole invert and shall extend vertically to the bottom of the cone/corbel.
- B. The Contractor shall install gauges as directed by engineer. The locations of the gauges shall be determined by the Engineer.
- C. Gauges shall be supported along the wall of the manhole.

3.02 GROUNDWATER MONITORING:

- A. The Contractor shall read the gauges on a monthly basis during periods of construction. The gauges shall also be read as necessary during the warranty period to determine adequate groundwater levels for warranty inspections.
- B. Groundwater levels shall be measured as the height of the groundwater above the manhole invert.

3.03 FIELD TESTING/INSPECTION:

- A. The groundwater monitoring gauges shall be removed by the Contractor once all field testing and inspection has been successfully completed under warranty inspection as approved by the Engineer.
- B. The gauges shall be removed, and the remaining hole shall be grouted or patched in accordance with Section 02439, sub section 3.03.B.
- C. The cost for removal of the groundwater monitoring gauges and sealing of remaining holes shall be incidental to the work of this section

END OF SECTION

SECTION 33 05 13.13

RAISING AND/OR RESETTING OF SEWER MANHOLE FRAME AND COVER

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers raising and/or resetting of sewer manhole frame and cover. The work includes raising, resetting, and/or adjusting of structures to line and grade.

1.02 RELATED WORK

- A. Section 01 12 16, SCOPE AND SEQUENCE OF WORK
- B. Section 01 33 19, DOCUMENTATION
- C. Section 01 33 00, SUBMITTALS
- E. Section 33 39 13, PRECAST MANHOLES AND CATCH BASINS

PART 2 - PRODUCT

2.01 SEWER COVER:

- A. The Manhole cover shall be supplied by EJ, Brockton, MA., Catalog Number (frame and cover) 1056Z UND Frame LC239 or approved equal (approximate weight of frame and cover = 450 pounds).

PART 3 - EXECUTION

3.01 RAISING AND/OR RESETTING OF SEWER MANHOLE FRAME AND COVER:

- A. In areas where bituminous pavement exists, existing sewer manhole castings shall be raised to the proper grade where indicated on the contract drawings or as required by the Engineer.
- B. Cut around manhole castings a minimum of 8-inches from casting. Excavate and remove old masonry to such a depth as required by the Engineer and rebuild masonry below the

RAISING AND RESETTING OF
SEWER MANHOLE FRAME AND COVER

33 05 13.13-1

bottom of the casting. Backfill with mortar or bituminous concrete. Place high, early strength concrete or bituminous concrete collar, as required, to approximately 1-1/2-inches below the raised casting grade.

- C. Masonry work shall conform to the applicable provisions of Section 33 39 13, PRECAST MANHOLES AND CATCH BASINS.
- D. The Contractor shall provide a top course approximately 1-1/2-inches thick and shall match existing surrounding grades and pavement materials. The Contractor shall provide a watertight seal between the masonry work and the casting.

3.02 INSTALLATION OF MANHOLE FRAME AND COVER:

- A. Where necessary, replacement covers and frames shall be furnished and installed in-place by the Contractor. The cover and frame shall provide a watertight seal.

END OF SECTION

RAISING AND RESETTING OF
SEWER MANHOLE FRAME AND COVER

33 05 13.13-2

SECTION 33 05 26.13

TRACER TAPE

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the furnishing, handling and installation of tracer tape, as called for on the drawings.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00 SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

- A. Manufacturer's literature on the materials, colors and printing specified herein, shall be submitted to the Engineer for review.
- B. Tape samples shall also be submitted to the Engineer for review.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

Tracer tape shall be by Reef Industries, Houston, TX; Empire Level, Mukwonago, WI; Pro-Line Safety Products Co., W. Chicago, IL; or approved equal.

2.02 TRACER TAPE:

- A. Tracer tape shall be at least 3-inches wide.
- B. Tracer tape for non-ferrous pipe or conduit shall be constructed of a metallic core bonded to plastic layers. The metallic tracer tape shall be a minimum 5-mil thick and must be locatable at a depth of 18-inches with ordinary pipe locaters.
- C. Tracer tape for ferrous pipe or conduit shall consist of multiple bonded plastic layers. The non-metallic tracer tape shall elongate at least 500% before breaking.
- D. The tape shall bear the wording: "BURIED DRAIN LINE BELOW" (with "DRAIN" replaced by "WATER", "SEWER", "ELECTRICAL", "GAS", "TELEPHONE", or "CHEMICAL" as appropriate), continuously repeated every 30-inches to identify the pipe.
- E. Tape colors shall be as follows, as recommended by the American Public Works Association (APWA):

TRACER TAPE
33 05 26.13-1

Electric	Red
Gas & Oil	Yellow
Communications	Orange
Water	Blue
Sewer & Drain	Green
Chemical	Red (not APWA)

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Tracer tape shall be installed directly above the pipe or conduit it is to identify, approximately 12-inches below the proposed ground surface.
- B. The Contractor shall follow the manufacturer's recommendations for installation of the tape, as approved by the Engineer.

END OF SECTION

SECTION 33 11 13.16

SERVICE CONNECTIONS (WATER SERVICES)

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the furnishing and installation of new water service connections and the repair, replacement, and/or transfer of existing water service connections as shown on the drawings, as specified herein, and as required by the Engineer.

1.02 RELATED WORK:

- A. Section 32 13 13, PORTLAND CEMENT CONCRETE PAVEMENT

1.03 REFERENCES:

- A. The following standards form a part of this specification:

ASTM International (ASTM)

ASTM B88 Seamless Copper Water Tube

ASTM B584 Copper Alloy Sand Castings for General Applications

ASTM D2737 Polyethylene (PE) Plastic Tubing

American Water Works Association (AWWA)

AWWA C800 Water-Service Line Fittings

AWWA C651 Disinfecting Water Mains

AWWA C901 Polyethylene Pressure Pipe & Tubing, 1/2-inch through 3-inch for Water Service

Federal Specifications (FS)

FS WW-T-799C Tube, Copper, Seamless

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23
SUBMITTALS, SUBMIT THE FOLLOWING:

Manufacturer's literature of the materials of this section for review.

SERVICE CONNECTIONS (WATER SERVICE)

33 11 13.16-1

PART 2 - PRODUCTS

2.01 SERVICE PIPING:

- A. Piping for buried copper water services shall be continuous Type K annealed seamless copper water tubing conforming to ASTM B88 Standard Specification for Seamless Copper Water Tube or U.S. Federal Specification WW-T-799C for Tube, Copper, Seamless. Tubing shall be 1-inch diameter unless otherwise indicated.
- B. Piping for buried polyethylene (PE 4710) water services shall conform to ASTM D2737 and be as specified in AWWA C901. Polyethylene piping shall be designed for 200 psi minimum service and tested at 330 psi for 1,000 hours or greater. The tubing shall be copper O.D. size and be suitable for use with standard industry brass compression fittings without special adapters. Stainless steel insert stiffeners shall be provided for use with all compression joint connections.
- C. Couplings, if required, for existing to new service pipe connections shall have compression connections on the inlet and compression connections on the outlet. Couplings shall be made of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the coupling shall be 5 parts per billion (ppb). Couplings shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.

2.02 CORPORATION STOPS:

- A. Corporations stops shall be made of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the corporation stops shall be 5 ppb. Corporation stops shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.
- B. Corporation stops shall be by Ford Meter Box Co., Inc., Wabash, IN; Red Hed Manufacturing Co., Lincoln, RI; Mueller Co., Decatur, IL; or approved equal.

2.03 CURB STOPS:

SERVICE CONNECTIONS (WATER SERVICE)

33 11 13.16-2

- A. Curb stops shall be of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the curb stops shall be 5 ppb. Curb stops shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.
- B. Curb stops shall be the OWNER's standard ball style and the inlet and the outlet shall have compression connections.
- C. Curb stops shall be by Red Hed Manufacturing Co., Lincoln, RI; Ford Meter Box Co., Inc., Wabash, IN; Mueller Co., Decatur, IL; or approved equal.

2.04 CURB BOXES:

- A. The cast iron box shall be the sliding Buffalo type with Arch pattern base. The minimum inside diameter of the upper section shall be 1-1/2-inch for 3/4-inch and 1-inch curb stops and 2-inch for 1-1/2-inch and 2-inch curb stops. The curb box lid shall be Erie pattern.
- B. Boxes shall be equipped with 30-inch stationary extension rods with pinned connections to the curb stop.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Where new water mains are being installed and existing water services are to be transferred to the new main, the Contractor shall discontinue the existing water services by shutting down the corporation stop at the old water main, unless specifically otherwise required by the Engineer. The Contractor shall take special care to minimize the interruption of existing water service.
- B. The Contractor shall tap a new corporation stop, cut the existing service piping and connect the new service piping to the old service piping using an approved coupling at a point between the main and the existing curb stop and box.
- C. Where transfers are to be made and the existing curb stop and box cannot be utilized or a new curb stop and box is required, the Contractor shall connect the new service piping to the existing service piping using an approved coupling approximately 12-inches from the curb stop on the building side of the stop.

SERVICE CONNECTIONS (WATER SERVICE)

33 11 13.16-3

- D. Where transfers are being made and the existing service is of lead, galvanized steel, or iron, the service shall be replaced to the curb stop and box unless otherwise required. If required, the curb stop and box shall be replaced as specified above.
- E. Curb stops and boxes shall be set plumb, flush with the ground or paved surface, and centered with the box located directly over the stop. The box shall be set on a concrete block or flat stone. Earth fill shall be carefully tamped around the boxes to a distance of 4 feet on all sides of the box or to the undisturbed face of the trench, if less than 4 feet.
- F. Curb stops shall be operational and accessible at all times during construction and warranty period. The Contractor shall verify the proper operation of all curb stops in the presence of the Engineer and/or Owner following completion of the project and prior to the acceptance of substantial completion.
- G. All services shall be installed at 5 feet 0 inches of cover unless otherwise required by the Engineer.
- H. Service connections shall be tested and disinfected in accordance with AWWA standards.

END OF SECTION

SERVICE CONNECTIONS (WATER SERVICE)

33 11 13.16-4

11/01/2024

SECTION 33 11 13.34

CONNECTIONS TO EXISTING WATER MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers connections to existing water mains, complete.
- B. The Contractor shall furnish all pipe, fittings, valves, tapping machines, if required, and appurtenances. The Contractor shall do all excavation and backfill as required.

1.02 RELATED WORK:

- A. Section 03 05 00, FIELD CONCRETE
- B. Section 33 11 13.13, DUCTILE IRON PIPE AND FITTINGS.
- D. Section 33 11 13, SERVICE CONNECTIONS. (Tapping sleeves and valves specified).

PART 2 - PRODUCTS: NOT APPLICABLEPART 3 - EXECUTION

3.01 CONTRACTOR OPERATIONS:

- A. The Contractor shall make all connections to the existing mains as indicated on the drawings and as herein specified.
- B. The Contractor shall develop a program for the construction and putting into service of the new work subject to the approval of the Engineer. All work involving cutting into and connecting to the existing work shall be planned so as to interfere with operation of the existing facilities for the shortest possible time and when the demands on the system best permit such interference even to the extent of working outside of normal working hours to meet these requirements.
- C. The Contractor shall have all possible preparatory work done prior to making the connection and shall provide all labor, tools, material, and equipment required to do the work in one continuous operation.
- D. The Contractor shall have no claim for additional compensation, by reason of delay or inconvenience, for adapting its operations to the needs of the Owner's water supply. No

CONNECTIONS TO EXISTING
WATER MAINS

damages shall be claimed by the Contractor for delays in dewatering pipelines nor shall any damages be claimed because of water leaking through closed valves after dewatering is completed.

- E. Under no circumstances shall any customers be without water for a period of more than 4 hours without prior approval of the Owner. Should it appear that any customer will be without water for more than 4 hours, the Contractor shall install temporary water service as specified in Section 01 51 36, TEMPORARY WATER SERVICE where required by the Engineer.
- F. Existing pipeline that is not to be abandoned but is damaged by the Contractor during the work shall be replaced by it at its own expense in a manner approved by the Engineer.

3.02 TAPPING CONNECTION TO EXISTING MAINS:

- A. Tapping connections to the existing mains, where indicated on the drawings, shall be made with service pressure in the main, using tapping sleeves and valves and a suitable tapping machine.
- B. Other connections to existing mains shall be made with the main out of service, unless otherwise required by the Engineer. Such connections will not require tapping sleeves and valves but connections as indicated on the drawings.

END OF SECTION

CONNECTIONS TO EXISTING
WATER MAINS

SECTION 33 31 13.16

POLYVINYL CHLORIDE GRAVITY PIPE AND FITTINGS
(SDR-35)PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the furnishing and installation of Polyvinyl Chloride (PVC) pipe and fittings, as indicated on the drawings and as specified herein.

1.02 RELATED WORK:

- A. Section 31 00 00, EARTHWORK
- B. Section 31 50 00, SUPPORT OF EXCAVATION
- C. Section 33 05 26.13, TRACER TAPE
- D. Section 33 39 13, PRECAST MANHOLES AND CATCH BASINS

1.03 REFERENCES:

- A. The following standards form a part of these specifications as referenced:

ASTM International (ASTM)

ASTM	D2321	Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
ASTM	D3034	Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM	D3212	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM	F679	Specification for Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings (18" - 27")

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00
SUBMITTALS, SUBMIT THE FOLLOWING:POLYVINYL CHLORIDE GRAVITY
PIPE AND FITTINGS
33 31 13.16-1

Manufacturer's literature of the materials of this section.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. PVC nonpressure sewer pipe 4-inches through 15-inches diameter shall conform to ASTM D3034, 18-inches through 27-inches diameter to ASTM F679, all with SDR of 35 unless noted, and shall meet the specific requirements and exceptions to the aforementioned specifications that follow.
- B. PVC nonpressure sewer pipe shall be furnished in standard lengths.
- C. One pipe bell consisting of an integral wall section with a solid cross section rubber ring, factory assembled, shall be furnished with each standard, random and short length of pipe. Rubber rings shall be provided to the requirements of ASTM D3212.
- D. The rubber ring shall be retained within the bell of the pipe by a precision formed groove or recess designed to resist fishmouthing or creeping during assembly of joints.
- E. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper jointing of the two pipes.
- F. PVC fittings shall be provided with bell and/or spigot configurations with rubber gasketed joints compatible with that of the pipe. Bend fittings with spigot ends shorter than the pipe recess bells will not be allowed. The shorter spigot end would not allow proper seating of the spigot in the mating bell and would permit undesired contact between the mating bell and the outside of the fitting bell.
- G. All pipe delivered to the job site shall be accompanied by independent testing laboratory reports certifying that the pipe and fittings conform to the above-mentioned specifications. In addition, the pipe shall be subject to thorough inspection and tests, the right being reserved for the Engineer to apply such of the tests specified as it may from time to time deem necessary.
- H. All cutting of pipe shall be done with a machine suitable for cutting PVC pipe. Cut ends shall be beveled when recommended by the pipe manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION:

POLYVINYL CHLORIDE GRAVITY
PIPE AND FITTINGS
33 31 13.16-2

- A. Except as modified herein, installation of the PVC pipe shall be in accordance with ASTM D2321.
- B. Each pipe length shall be inspected before being laid to verify that it is not cracked. Pipe shall be laid to conform to the lines and grades indicated on the drawings or given by the Engineer. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
- C. The pipe shall be supported by compacted crushed stone. Crushed stone shall be as specified under Section 31 00 00, EARTHWORK.
- D. The pipe shall not be driven down to grade by striking it with a shovel handle, timber, rammer, or other unyielding object. When each pipe has been properly bedded, enough of the backfill material shall be placed and compacted between the pipe and the sides of the trench to hold the pipe in correct alignment.
- E. Before a joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that inverts are matched and conform to the required line and grade.
- F. For pipe placed on crushed stone, immediately after the joint is made, the jointing area shall be filled with suitable materials so placed and compacted that the ends of either pipe will not settle under backfill load.
- G. No pipe or fitting shall be permanently supported on saddles, blocking, or stones.
- H. Branches and fittings shall be laid by the Contractor as indicated on the drawings, and/or as required by the Engineer. Open ends of pipe and branches shall be closed with PVC caps secured in place with premolded gasket joints or as required by the Engineer.
- I. All pipe joints shall be made as nearly watertight as practicable. There shall be no visible leakage at the joints and there shall be no sand, silt, clay, or soil of any description entering the pipeline at the joints. Where there is evidence of water or soil entering the pipeline, connecting pipes, or structures, the defects shall be repaired to the satisfaction of the Engineer.
- J. The Contractor shall build a tight bulkhead in the pipeline where new work enters an existing sewer. This bulkhead shall remain in place until the Engineer authorizes its removal.
- K. Care shall be taken to prevent earth, water, and other materials from entering the pipe, and when pipe laying operations are suspended, the Contractor shall maintain a suitable stopper in the end of the pipe and also at openings for manholes.

POLYVINYL CHLORIDE GRAVITY
PIPE AND FITTINGS
33 31 13.16-3

- L. As soon as possible after the pipe and manholes are completed on any street, the Contractor shall flush out the new pipeline using a rubber ball ahead of the water, and none of the flushing water or debris shall be permitted to enter any existing sewer.

3.02 QUALITY ASSURANCE

A. LEAKAGE TESTING:

1. On completion of a section of sewer, including building connections installed to the property line, the Contractor shall install suitable bulkheads as required, dewater and test the sewer for leakage.
2. Unless otherwise approved, the section shall be tested using low pressure air test procedures. If circumstances permit, the Engineer may allow testing by infiltration or exfiltration in lieu of air testing.
3. The air test procedures shall conform to the Uni-Bell Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe, UNI-B-6. The starting air pressure for the test shall be 4 psig (greater than the average groundwater back pressure of any groundwater above the pipe, but not greater than 9.0 psig). The minimum duration permitted for the prescribed low pressure air exfiltration pressure drop between two consecutive manholes shall not be less than provided in Table I or Table II of UNI-B-6. **Note that UNI-B-6 suggests that use of the 0.5 psig pressure drop is more efficient since the time requirements are half of the 1.0 psig-pressure drop.** The two tables are reproduced on the following pages.
4. Using the air pressure test, if there has been no leakage (zero psig drop) after one hour of testing, the section undergoing test shall have passed.
5. If either infiltration or exfiltration testing is permitted by the Engineer, the test shall be conducted for at least 24 hours. The amount of infiltration or exfiltration shall not exceed 100 gallons per inch-diameter per mile of sewer per 24 hours.
6. The infiltration test measures leakage into a section of sewer and may be used only where the groundwater level is one foot or more above the crown of the section of sewer pipe at its upper end and at least one foot above the top of building connections and chimneys. For making the infiltration tests, underdrains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable. Allowances shall be made for water that may enter the sewer through pipe connections and inlets during the infiltration test.
7. Where the groundwater level is less than 1 foot above the top of the pipe at its upper end, the exfiltration test may be used. The sewers shall be subjected to an internal pressure by

POLYVINYL CHLORIDE GRAVITY
PIPE AND FITTINGS
33 31 13.16-4

plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 2 feet above the highest point in the system to be tested, including main pipeline, service connections and chimneys. When slopes between manholes are steep, the Contractor shall insure that this test can be accomplished without danger of forcing stoppers from wye or tee branches.

8. The rate of exfiltration from the sewers shall be determined by measuring the amount of water required to maintain the water level at the elevation established at the beginning of the test.
9. The Contractor shall construct such weirs or other means of measurements as may be required, shall furnish water and shall do all necessary pumping to enable the test to be properly made.
10. The Contractor shall be responsible for the satisfactory watertightness of the entire section of sewer. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing leaks and retesting as the Engineer may require without additional compensation. A plan of the method of repairing any leaks that are found shall be submitted to the Engineer for review.

B. PIPE DEFLECTION MEASUREMENT:

1. In accordance with ASTM D3034, no less than 30 days after completion of the PVC sewer pipe installation, the Contractor shall test the pipeline for deflection using a "go/no-go" deflection mandrel having a minimum of nine evenly spaced arms or prongs. The "go/no-go" gauge shall be hand pulled through all sections of the pipeline by the Contractor. The Contractor shall submit drawings of the "go/no-go" gauge to the Engineer for approval prior to testing. Complete dimensions of the gauge for each diameter of pipe to be tested shall be in accordance with ASTM D3034.
2. Any section of pipe found to exceed 7.5 percent deflection shall be deemed a failed pipe and shall be excavated and replaced by the Contractor at its own expense.

TABLE I

SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR $Q=0.0015$

POLYVINYL CHLORIDE GRAVITY
PIPE AND FITTINGS
33 31 13.16-5

Pipe Diameter (in)	Minimum Time (min:sec)	Length for Min. Time (ft)	Length for Longer Length (sec)	Specification time for length (L) shown (min:sec)							
				<u>100 ft</u>	<u>150 ft</u>	<u>200 ft</u>	<u>250 ft</u>	<u>300 ft</u>	<u>350 ft</u>	<u>400 ft</u>	<u>450 ft</u>
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.52 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	31:09	35:36
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

POLYVINYL CHLORIDE GRAVITY
PIPE AND FITTINGS
33 31 13.16-6

TABLE II

SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

Pipe Diameter (in)	Minimum Time (min:sec)	Length for Min. Time (ft)	Length for Longer Length (sec)	Specification time for length (L) shown (min:sec)							
				<u>100 ft</u>	<u>150 ft</u>	<u>200 ft</u>	<u>250 ft</u>	<u>300 ft</u>	<u>350 ft</u>	<u>400 ft</u>	<u>450 ft</u>
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	26:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10:683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12:926 L	21:33	32:19	43:56	53:25	64:28	75:24	86:10	96:57
36	17:00	66	15:384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

END OF SECTION

POLYVINYL CHLORIDE GRAVITY
PIPE AND FITTINGS
33 31 13.16-7

SECTION 33 39 13

PRECAST MANHOLES AND CATCH BASINS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers all precast manholes and catch basins complete, including, but not limited to, bases, walls, cones, mortar, inverts, frames and covers.

1.02 RELATED WORK:

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE
- B. Section 31 00 00, EARTHWORK
- C. Section 32 12 16.13, HMA PAVEMENT
- D. Section 32 13 13, PORTLAND CEMENT CONCRETE PAVEMENT

1.03 SYSTEM DESCRIPTION:

- A. Precast sections shall conform in shape, size, dimensions, materials, and other respects to the details indicated on the drawings or as required by the Engineer.
- B. All manholes and catch basins shall have concrete bases. Concrete bases shall be precast unless otherwise specified. Invert channels shall be formed of brick and mortar upon the base.
- C. Catch basins shall have a 3-foot deep sump unless otherwise specified. Leaching basins shall have a bottom opening as shown on the drawings.
- D. Riser and cone sections shall be precast concrete.

1.04 REFERENCES:

- A. The following standards form a part of this specification as referenced:

ASTM International (ASTM)

ASTM A48	Gray Iron Castings
ASTM C32	Sewer and Manhole Brick
ASTM C144	Aggregate for Masonry Mortar
ASTM C207	Hydrated Lime for Masonry Purposes
ASTM C478	Precast Reinforced Concrete Manhole Sections
ASTM C923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
ASTM C1244	Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M198	Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
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Occupational Safety and Health Administration

OSHA 29 CFR 1910.27	Fall Prevention Protection
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1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00 SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

- A. Manufacturer's literature of the materials of this section.
- B. Test reports as required by the Engineer.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE SECTIONS:

- A. All precast concrete sections shall conform to ASTM C478 with the following exceptions and additional requirements:

PRECAST MANHOLES AND CATCH BASINS

1. The wall thickness of precast sections shall be as designated on the drawings, meeting the following minimum requirements:

<u>Section Diameter (Inches)</u>	<u>Minimum Wall Thickness (Inches)</u>
48	5
60	6
72	7
84	8

2. Type II cement shall be used except as otherwise approved.
 3. Sections shall be steam cured and shall not be shipped until at least five days after having been cast.
 4. Minimum compressive strength of concrete shall be 4000 psi at 28 days.
 5. No more than two lift holes may be cast or drilled in each section.
 6. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
 7. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.
 8. Circumferential steel reinforcement in walls and bases shall be a minimum of 0.12 sq. in./lin. ft. for 4-foot diameter sections and 0.15 sq. in./lin. ft. for 5- and 6-foot diameter sections. Reinforcing shall extend into tongue and groove.
- B. Conical reducing sections shall have a wall thickness not less than 5-inches at the bottom and wall thickness of 8-inches at the top. Conical sections shall taper from a minimum of 48-inches diameter to 24 or 30-inches diameter at the top, as shown on the drawings.
- C. Except where insufficient depth of cover dictates the use of a shorter base, bases shall be a minimum of 4 feet in height.
- D. Slab top sections and flat riser sections (Grade Rings) shall conform to the contract drawings, with particular attention focused upon the reinforcing steel and be designed to meet or exceed an HS-20 Loading requirement.
- E. The tops of the bases shall be suitably shaped by means of accurate ring forms to receive the riser sections.
- F. Precast sections shall be manufactured to contain wall openings of the minimum size to receive the ends of the pipes, such openings being accurately set to conform with line and grade of the sewer or drain. Subsequent cutting or tampering in the field, for the purpose

PRECAST MANHOLES AND CATCH BASINS

of creating new openings or altering existing openings, will not be permitted except as required by the Engineer.

- G. "Drop-over" manholes shall be placed where indicated on the drawings. The Contractor shall accurately measure the diameter of the existing outlet pipe and inform the manufacturer of its size, so that the "Drop-over" type opening can be cut into the precast manhole base. The bottom shall be cast in place by the Contractor in accordance with Section 03 30 00, CAST-IN-PLACE CONCRETE. The invert channel shall be formed of brick and mortar, as specified in this specifications section. The sub-base shall be a compacted, level foundation of crushed stone, at least 6-inches thick, as specified in Section 02300 EARTHWORK, but shall vary to the depth necessary to reach sound undisturbed earth.
- H. The exterior surfaces of all precast manhole bases, walls, and cones shall be given a minimum of one shop coat of bituminous dampproofing.
- I. The Engineer reserves the right to reject any unsatisfactory precast section and the rejected unit shall be tagged and removed from the job site immediately.
- J. The Engineer may also require the testing of concrete sections as outlined under Physical Requirements in ASTM C478 with the Contractor bearing all testing costs.

2.02 BRICK MATERIALS:

- A. Brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Engineer. Bricks shall comply with ASTM C32, for Grade SS, hard brick, except that the mean of five tests for absorption shall not exceed 8 percent by weight.
- B. Rejected brick shall be immediately removed from the work and brick satisfactory to the Engineer substituted.
- C. Mortar shall be composed of portland cement, hydrated lime, and sand in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime. The proportions of cement and lime shall be as required by the Engineer and may vary from 1:1/4 for dense hard-burned brick to 1:3/4 for softer brick. In general, mortar for Grade SS Brick shall be mixed in the volume proportions of 1:1/2:4-1/2; portland cement to hydrated lime to sand.
- D. Cement shall be Type II portland cement as specified for concrete masonry.
- E. Hydrated lime shall be Type S conforming to ASTM C207.
- F. The sand shall comply with ASTM C144 specifications for "Fine Aggregate," except that all of the sand shall pass a No. 8 sieve.

2.03 FRAMES, GRATES, COVERS AND STEPS:

PRECAST MANHOLES AND CATCH BASINS

- A. Castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.
- B. All castings shall be thoroughly cleaned and may be subject to a careful hammer inspection at the Engineer's discretion.
- C. Castings shall be ASTM A48 Class 30B or better.
- D. The surface of the manhole covers shall have a diamond pattern with the cast words "WATER," "DRAIN" or "SEWER," whichever is appropriate.
- E. Manhole frames with 32-inch covers for 30-inch openings shall be 500 pounds minimum by EJ, No. V-1419; Quality Water Products, Style 47; Neenah Foundry Co., R1740B or approved equal.
- F. Watertight type manhole frames with 32-inch diameter covers (bolted and gasketed) shall be EJ, No. 2006APT 2008ZPT; Quality Water Products, Style C47WT; Neenah Foundry Co., R-1916-H or approved equal.
- G. Manhole frames with 26-inch covers for 24-inch openings shall be 475 pounds minimum by EJ No. 2110 (formerly LK110A); Neenah Foundry Co. R1720; Quality Water Products, Style 40; or approved equal.
- H. Watertight type manhole frames with 26-inch diameter covers (bolted and gasketed) shall be EJ No. 1268; Mechanics Iron Foundry Type A2073; Quality Water Products, Style 40WT; or approved equal.
- I. Frostproof manhole frames, with 30-inch diameter covers and inner lids, shall be R-1755 series by Neenah Foundry Co., Neenah, WI; 2006A1 2009Z by EJ, Brockton, MA; B-3045 (or similar) by Mechanics Iron Foundry, Boston, MA; or approved equal.
- J. 2-inch thick polystyrene insulation shall be firmly adhered to all frostproof inner lids.
- K. Catch basin frames and 23-7/8-inch square grates with 2-inch square openings shall be 8-inches in height minimum. They shall be Neenah Foundry Co. No. R3588-A; Quality Water Products No. 45-600; EJ 5548Z 5520M; or approved equal.
- L. Catch basin frames with bar grate openings and 23-7/8-inch square grates shall be 8-inches in height minimum. Bar grates shall not be used in areas where bicycle traffic could be present. They shall be Neenah Foundry Co. No. R-3589; Quality Water Products No. 45; EJ 5521Z 5520M3 BIKE GR LK121; or approved equal.

PRECAST MANHOLES AND CATCH BASINS

- M. Catch basin frames with cascade grate openings and 23-7/8-inch square grates shall be 8-inches in height minimum. They shall be Neenah No. R-3589; Quality Water Products LK121; EJ 5548Z 5520M; or approved equal.
- N. Catch basin frames set against curbing shall have three flanges only.

2.04 SEWER MANHOLE ACCESSORIES:

- A. Gasket materials shall be top grade (100% solids, vulcanized) butyl rubber and shall meet or exceed AASHTO M-198.
- B. Couplings at the manhole-pipe interface shall be made with a rubber seal system (with or without stainless steel straps) meeting the requirements of ASTM C923 and recommended for this type of connection.
- C. Stubs installed as specified and indicated on the drawings shall be short pieces of the same class pipe as that entering the manhole and shall have either stoppers or end caps as shown on the drawings. Stoppers or end caps shall be especially designed for that application.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. PRECAST SECTIONS:

- 1. Precast bases shall be supported on a compacted level foundation of crushed stone, as specified in Section 31 00 00 EARTHWORK, at least 6-inches thick, but shall vary to the depth necessary to reach sound undisturbed earth.
- 2. Precast reinforced concrete sections shall be set vertical and with sections in true alignment.
- 3. Butyl rubber joint sealant shall be installed between each concrete section. Catch basin sections do not require joint sealant if so indicated on the drawings.
- 4. All holes in sections used for handling the sections shall be thoroughly plugged with mortar. Mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch (just short of "balling"), hammered into the holes until it is dense, and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

B. BRICK WORK:

PRECAST MANHOLES AND CATCH BASINS

1. Bricks shall be moistened by suitable means, as required by the Engineer, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.
2. Each brick shall be laid as a header in a full bed and joint of mortar without requiring subsequent grouting, flushing or filling, and shall be thoroughly bonded as directed.

C. CASTINGS:

1. Cast iron frames, grates and covers shall be as specified. The frames and covers shall be set by the Contractor to conform accurately to the grade of the finished pavement, existing ground surface, or as indicated on the drawings. Frames shall be adjusted to meet the street surface.
2. Cast iron manhole frames and covers not located in paved areas shall be set 6-inches above finished grade, at a height as required by the Engineer, or as indicated on the drawings. The top of the cone shall be built up with a minimum of 1 course and a maximum of 5 courses of brick and mortar used as headers for adjustment to final grade.
3. Frames shall be set concentric with the top of the concrete section and in a full bed of mortar so that the space between the top of the concrete section or brick headers and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to be flush with the top of the flange and have a slight slope to shed water away from the frame.
4. Covers and/or grates shall be left in place in the frames, for safety reasons, except while work is being performed.

D. ACCESSORIES:

1. Accessories shall be installed in accordance with the manufacturer's instructions.
2. Stubs shall be set accurately to the dimensions indicated on the drawings. Stubs shall be sealed with suitable watertight plugs.

3.02 LEAKAGE TESTS:

- A. Leakage tests shall be made by the Contractor and observed by the Engineer on each manhole. The test shall be by vacuum or by water exfiltration as described below:
- B. VACUUM TEST:

1. The vacuum test shall be conducted in accordance with ASTM C1244. Test results will be judged by the length of time it takes for the applied vacuum to drop from 10 inches of mercury to 9 inches. If the time is less than that listed in Table 1 of ASTM C1244, the manhole will have failed the test. Test times from Table 1 are excerpted below.

TABLE 1

Minimum Test Times for Various Manhole Diameters

Depth (Feet)	Diameter (Inches)		
	48	60	72
	<u>Times (Seconds)</u>		
0-12	30	39	49
12-16	40	52	67
16-20	50	65	81
20-24	59	78	97
26-30	74	98	121

2. If the manhole fails the initial test, the Contractor shall locate the leaks and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material. If the manhole should again fail the vacuum test, additional repairs shall be made, and the manhole water tested as specified below.

C. WATER EXFILTRATION TEST:

1. After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out. The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test.
2. The manhole shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily water-tight. If the test, as described above, is unsatisfactory as determined by the Engineer or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption by the manhole. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour loss rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the

PRECAST MANHOLES AND CATCH BASINS

leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as required by the Engineer to bring the leakage within the allowable rate of one gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day, shall be cause for rejection of the manhole. It shall be the Contractor's responsibility to uncover the rejected manhole as necessary and to disassemble, reconstruct or replace it as required by the Engineer. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.

3. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Engineer that the water table is below the bottom of the manhole throughout the test.
4. If the groundwater table is above the highest joint in the manhole, and there is no leakage into the manhole, as determined by the Engineer, such a test can serve to evaluate water-tightness of the manhole. However, if the Engineer is not satisfied with the results, the Contractor shall lower the water table and carry out the test as described hereinbefore.

3.03 CLEANING:

All new manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind, prior to final inspection.

END OF SECTION

SECTION 33 41 13.22

CORRUGATED POLYETHYLENE (HDPE) DRAINAGE PIPE

PART 1 – GENERAL

1.01 WORK INCLUDED:

- A. This section includes furnishing all materials, labor and equipment and installing corrugated polyethylene [HDPE] drainage pipe and fittings as shown on the drawings and as specified herein.

1.02 RELATED WORK:

- A. Section 31 00 00 – EARTHWORK
- B. Section 31 50 00 – SUPPORT OF EXCAVATION

1.03 REFERENCES:

- A. The following standards form a part of this specification, as referenced:

ASTM International (ASTM)

ASTM D2321	Standard for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
ASTM F405	Standard Specification for Corrugated Polyethylene Pipe and Fittings
ASTM F667	Standard Specification for Large Diameter Corrugated Polyethylene Pipe and fittings

American Association of State Highway and Transportation Officials

AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe
AASHTO MP6	Standard Specification for Corrugated Polyethylene Pipe 42” and 48” Diameter

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Manufacturer’s literature on the materials of this Section.
- B. Manufacturer’s certification that the product was manufactured, tested, and supplied in accordance with this specification.

CORRUGATED POLYETHYLENE
(HDPE) DRAINAGE PIPE

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Pipe shall be packaged to withstand shipment without damage and handled carefully on the jobsite. Pipe shall be stored so that it is not exposed to sunlight.

PART 2 – PRODUCTS:

2.01 MATERIALS:

- A. This Section applies to corrugated polyethylene pipe with an integrally formed smooth interior.
- B. The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe.
- C. The pipe and fittings shall be free of foreign inclusions and visible defects. Fittings may be either molded or fabricated. Fittings supplied by manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Engineer. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.

2.02 MANUFACTURERS:

- A. Pipe and fittings shall be manufactured by Ipex, Inc.; Plexco, Division of Chevron Chemical Co.; J-M Pipe Co.; Advanced Drainage Systems, Inc. (ADS) or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION:

- A. Pipe interiors, fitting interiors, and joint surfaces shall be thoroughly cleaned before installation. Pipes and fittings shall be maintained clean.
- B. Pipes shall be installed in the locations and to the required lines and grades shown on the drawings and provided in these Specifications, using an approved method of control.
- C. Excavations shall be maintained free of water during the progress of the Work. No pipes shall be laid in water, nor shall there be any joints made up in water.
- D. If any defective pipe is discovered after being placed, removal and replacement with sound pipe will be required at no additional cost to the Owner.

END OF SECTION

CORRUGATED POLYETHYLENE
(HDPE) DRAINAGE PIPE

SECTION 33 41 13.28

REINFORCED CONCRETE PIPE

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the furnishing and installation of reinforced concrete pipe, complete.

1.02 RELATED WORK:

- A. Section 31 00 00, EARTHWORK
- B. Section 33 39 13, PRECAST MANHOLES AND CATCH BASINS

1.03 QUALITY ASSURANCE:

- A. Acceptance of pipe will be on the basis of plant load-bearing tests, material tests, and inspection of the complete product. The required tests are enumerated herein. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to inspection by the Engineer, at the place of manufacture or on the work site after delivery or at both locations. The pipe will be subject to rejection at any time if it fails to meet the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. Rejected pipe shall be promptly removed from the project site by the Contractor.
- B. All tests shall be made in accordance with the latest applicable ASTM specifications, which are as follows:
 - 1. Reinforcing Steel. Mill test reports, or reports on samples taken from each shipment to the pipe manufacturer, shall be submitted for reinforcing steel to be used on this project stating that the reinforcing meets the specified requirements.
 - 2. Cement. Mill test reports shall be submitted for each shipment to the pipe manufacturer of cement to be used on this project stating that the cement meets the specified requirements. Flyash may be used as specified in ASTM C76.
 - 3. Aggregates. Test reports shall be submitted stating that the aggregates to be used on this project meet the requirements of ASTM C33 except that the requirements for gradation shall not apply. The first report shall be submitted prior to the manufacture of any pipe for this project. Additional tests and reports shall be made monthly thereafter during the production of the pipe.

11/01/2024

4. Absorption Tests. Three cores shall be taken from each pipe unit that is to be load tested. The cores shall be taken before the load-bearing tests are performed. All cores shall be tested for absorption. Absorption results shall not exceed the requirements of ASTM C76.
 5. Pipe Unit Load-Bearing Tests. A load-bearing test shall be made on one pipe unit of each size and class to be furnished and the report of the test shall be submitted before that size and class of pipe unit is delivered. An additional test will be required for each 200 units of each size and class of pipe. The load-bearing test shall be performed after the cores for the absorption tests have been taken. Each load-bearing test shall be carried to the specified load to produce the 0.01-inch crack. If the 0.01-inch crack is not formed until the specified load is reached, the pipe unit may be used in the project.
 6. Water Testing. All pipe units shall be water tested at the manufacturer's plant prior to shipment. Test pressures shall be 120% of the internal working pressure for which the pipe is designed, per ASTM C361. Each joint shall be checked during this testing and both pipe units shall be rejected if their joint shows leakage. Moisture appearing on the surface of the pipe in the form of patches or beads adhering to the surface will not be considered leakage.
- C. The Owner may have any or all pipe units inspected or tested, or both, by a lab designated by the Owner. Such additional inspection and/or tests shall be at the Owner's expense and shall be the test results of record.
- D. All pipe units to be tested shall be selected at random by the Owner. Unless otherwise approved, all load-bearing tests on pipe units shall be made in the presence of the Owner.

1.04 REFERENCES:

- A. The following standards form a part of this specification and indicate the minimum standards required:

ASTM International (ASTM)

ASTM	C33	Standard Specification for Concrete Aggregates
ASTM	C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM	C361	Standard Specification for Reinforced Concrete Low-Head Pressure Pipe
ASTM	C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

ASTM C655 Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

ASTM C924 Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

American Society of Civil Engineers (ASCE)

ASCE Vol. 90 Journal of Sanitary Engineering
No. SA2 Division
Part 1
April 1964

1.05 SUBMITTALS: IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Shop drawings of reinforced concrete pipe, fittings, and gaskets.
- B. Test results on each batch of each size and class of pipe, for the materials and for the finished pipe units as described herein. If less than 100 units of a given size and class of pipe are required, the Contractor may submit certified copies of tests made on identical pipe units produced within the past year.
- C. Design calculations and reinforcing configurations for special classes of pipe and certified copies of test results of tests itemized in Subsection 1.03 of this specification shall be submitted to the Engineer for record purposes.
- D. Before shop drawing submittals are processed, the Owner or Engineer may elect to visit and inspect the proposed concrete pipe manufacturer's plant.

1.06 DELIVERY/STORAGE:

- A. Pipe sections shall not be stored on areas over newly laid pipe or other existing pipelines which might be damaged by the superimposed load. Storage of sections shall be restricted to approved areas.
- B. Prior to installation, gaskets shall at all times be stored in a location with a minimum temperature of 50°F. Any gaskets not meeting the above requirements shall be rejected and promptly removed from the site.

PART 2 - PRODUCTS

2.01 MATERIAL:

- A. PIPE:

11/01/2024

1. The pipe shall be reinforced concrete pipe manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
2. Pipes 24-inches in diameter and smaller shall be of the bell and spigot type. Pipes larger than 24-inches may be bell and spigot or tongue and groove.
3. The pipe shall have an interior surface which is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Pipe shall conform to the latest requirements of ASTM C76 and shall be Wall B or Wall C for the class indicated on the drawings, and with additions and exceptions as follows:
 - a. Type II cement shall be used unless otherwise approved by the Engineer. Admixtures shall not be used except with prior approval of the Engineer.
 - b. Elliptical reinforcement will not be permitted. Longitudinal reinforcement shall be continuous. Reinforcement shall have a minimum cover of $\frac{3}{4}$ -inches.
 - c. Absorption shall be as specified under Quality Assurance.
 - d. Concrete pipe shall be manufactured by a vibratory process such as a packerhead or Vihy process. Concrete cast in vertical forms shall be dry mix concrete consolidated by internal or external mechanical vibration or both. The vibrating equipment shall be operated at high speed (more than 5,000 rpm) and have a low amplitude. Pipes manufactured by the modified packerhead process shall have a supplementary concrete densification operation that shall assure the attainment of full bond between reinforcement and concrete and also eliminate any displacement of the reinforcement. Additional passes with the revolving packerhead or the use of additional vibrators attached to the platform or exterior forms will not be acceptable.
 - e. Pipe units shall have a minimum laying length of 8 feet except as otherwise indicated or approved by the Engineer.
 - f. Pipe units shall not be shipped until the concrete has reached its 28 day design strength.
 - g. Mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days for use with reinforced concrete pipe up to Class IV, and a compressive strength of 6,000 psi at the end of 7 days and 7,000 psi at the end of 28 days for use with reinforced concrete Class V pipe when tested in 3-inch by 6-inch cylinders stored in the standard manner. Only those repairs permitted by the above-mentioned ASTM C76 will be allowed.

- h. The date of manufacture, class of pipe unit, size of pipe units, consecutive number of pipe unit, and trademark of the manufacturer shall be clearly and permanently marked on the inside or outside at one end of each pipe unit.

B. PIPE JOINTS/GASKETS:

1. Pipe joints shall conform to ASTM C433. Pipe joints shall be of the rubber gasket type in which the gaskets are in compression, and which will permit both longitudinal and angular movement. The ends shall be designed to confine the gasket when the joint is in its final position. Each unit of pipe shall be provided with proper ends made of concrete formed on machined rings to ensure accurate joint surfaces.
2. The gaskets sealing the joint shall be made of natural rubber, synthetic rubber, or a blend of both having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five years' experience in the manufacturing of rubber gaskets for pipe joints. The gasket shall be of a solid circular cross section having a composition and texture which is resistant to common ingredients of sewerage, industrial wastes, and groundwater and which will endure permanently under the conditions likely to be imposed by this service. The gasket shall conform to Section 5, Materials and Manufacture for Gaskets, ASTM C443.

B. SPECIAL PIPE CLASSES:

1. Special pipe classes shall conform to ASTM C655. The class designation at 3500, 4000, 4500 and 5000 refers to the D-load required to produce a 0.01-inch crack.
2. All material and testing parameters shall be the same as the standard classed pipe.

C. PIPE JOINTS/GASKETS:

1. Pipe joints shall conform to ASTM C361. Pipe joints shall be of the rubber gasket type in which the gaskets are in compression, and which will permit both longitudinal and angular movement. The ends shall be designed to confine the gasket when the joint is in its final position. Each unit of pipe shall be provided with proper ends made of concrete formed on machined rings to ensure accurate joint surfaces. The diameters of the joint surface, depended upon to compress the gasket, shall be in accordance with ASTM C361, Section 8. The joint shall be sealed by a rubber gasket so that the joint will remain tight under all conditions of service.
2. The gaskets sealing the joint shall be made of natural rubber, synthetic rubber, or a blend of both having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five years' experience in the manufacturing of rubber gaskets for pipe joints. The gasket shall be of a solid

circular cross section having a composition and texture which is resistant to common ingredients of sewerage, industrial wastes, and groundwater and which will endure permanently under the conditions likely to be imposed by this service. The gasket shall conform to Section 6.9 Rubber Gaskets C361.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Pipe shall be laid to the lines and grades indicated on the drawings or given by the Engineer. Each pipe unit shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
- B. Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer approves as satisfactory. The Contractor will be required to furnish approved devices to permit satisfactory supports of all parts of the pipe unit when it is lifted.
- C. The Contractor shall take all necessary precautions to prevent flotation of the pipe in the trench.
- D. Where so indicated on the drawings, the pipe shall be supported by compacted crushed stone, concrete cradle or envelope or any other bedding material as specified or as shown on the plans. Crushed stone shall be as specified under Section 31 00 00 EARTHWORK.
- E. When each pipe unit has been properly bedded, enough of the backfill material shall be placed and compacted between the pipe and the sides of the trench to hold the pipe in correct alignment.
- F. Where a concrete cradle or envelope is used, the pipe shall be laid on concrete saddles and braced, so as to provide both vertical and lateral support for the pipe while the cradle or envelope is being placed. The location, dimensions and class of concrete required for cradle or envelope are indicated on the drawings.
- G. After the pipe units are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned. Each pipe unit shall then be carefully pushed into place without damage to pipe ends. Suitable devices shall be used to force the pipe together so that they will fit with a minimum open recess inside and outside between the sections of pipe. Pipe joints shall then be mortared together with a 2000 psi mortar both on the inside and outside of the joint.
- H. After the pipe units are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned. Immediately before jointing the pipe, the groove shall be lubricated in accordance with the manufacturer's recommendation. Each pipe unit shall then be carefully pushed into place without damage to pipe or gasket. Suitable devices shall be used to force the pipe together so that they will fit with a minimum open recess inside

11/01/2024

REINFORCED CONCRETE PIPE

33 41 13.28-6

and outside and have tightly-sealed joints. Care shall be taken not to use such force as to wedge apart and split the groove ends. Joints shall not be "pulled" or "cramped" without approval of the Engineer.

- I. Immediately after the pipe units are put together, the position of the gasket in the joint shall be inspected using an approved feeler gage furnished by the Contractor, to be sure it is properly put together and is tight. Joints where the gasket is damaged or not properly positioned shall be pulled apart and remade using a new gasket.
- J. Details of gasket, attachment, and joint formation shall follow the directions of the manufacturers of the joint material and of the pipe, all subject to review by the Engineer.
- K. No pipe or fitting shall be permanently supported on saddles, blocking or stones.
- L. At all times when pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of earth or other materials entering the pipe has passed.

3.02 REPAIR OF PIPE:

Chipped, gouged or damaged pipe shall be repaired if the defects affect the structural integrity of the pipe. Surface imperfections need not be repaired. The pipe shall be repaired by an authorized representative of the pipe manufacturer following a repair procedure approved by the Engineer. The repaired pipe will be inspected by the Engineer prior to being used on the project.

3.03 FIELD QUALITY ASSURANCE:

- A. Upon completion of a section of the pipeline, the Contractor shall dewater it and conduct a satisfactory test to measure the infiltration or, where necessary, exfiltration for at least 24 hours. The amount of infiltration or exfiltration shall not exceed 200 gallons per inch-diameter per mile of pipeline per 24 hours. The Contractor shall be responsible for the satisfactory watertightness of the entire section of sewer and shall satisfactorily repair all joints or other locations that are not sufficiently watertight.
- B. The infiltration test measures leakage into a section of pipeline and shall be used where the groundwater level is 1 foot or more above the crown of the section of pipe at its upper end. For making the infiltration tests, underdrains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable. Allowances shall be made for water which may enter the pipeline through connections and inlets during the infiltration test.
- C. As required, suitable bulkheads shall be installed to permit the testing of the pipeline.

- D. Where the groundwater level is less than 1 foot above the top of the pipe at its upper end, the exfiltration test shall be used. The pipelines shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 2 feet above the top of the pipeline at its upper end. When slopes between manholes are steep, the Contractor shall insure that this test can be accomplished without danger of forcing stoppers from connections.
- E. The rate of exfiltration from the pipeline shall be determined by measuring the amount of water required to maintain the level 2 feet above the top of the pipe.
- F. The lower pressure air test may be used if approved by the Engineer. The air test procedures shall be in accordance with ASTM C924.
- G. The Contractor shall construct such weirs or other means of measurements as may be required, shall furnish water and shall do all necessary pumping to enable the test to be properly made.
- H. Should the sections under the test fail to meet the requirements, the Contractor shall do all work of locating and repairing leaks and retesting as the Engineer may require without additional compensation. The Contractor will not be allowed to make repairs by using injection grouting of the surrounding soil.

END OF SECTION

SECTION 33 44 19.13

STORMWATER TREATMENT SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install all precast concrete storm-water treatment systems and appurtenances in accordance with the Drawings and these specifications.

1.02 RELATED WORK:

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE
- B. Section 31 00 00, EARTHWORK
- B. Section 32 13 13, PORTLAND CEMENT CONCRETE PAVEMENT

1.03 REFERENCES

ASTM International (ASTM)

ASTM	C891	Standard Specification for installation of underground precast concrete utility structure
ASTM	C478	Standard specification for precast reinforced concrete manhole sections
ASTM	C858	Standard specification of underground precast concrete utility structures
ASTM	C857	Standard practice for minimum structural design loading for underground precast concrete utility structure.

1.04 QUALITY CONTROL INSPECTION:

- A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections which have been damaged beyond repair during delivery will be rejected and, if already installed, shall be

STORMWATER TREATMENT SYSTEM

33 44 19.13-1

repaired to the Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.

- B. All sections shall be inspected for general appearance, dimensions, soundness, etc. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.
- C. Imperfections may be repaired, subject to the acceptance of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi when tested in accordance with ASTM C-109. Epoxy mortar may be utilized for repairs.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Shop Drawings:

- 1. Structural design calculations and shop drawings, which shall be certified by a Professional Engineer retained by the system manufacturer or Contractor and licensed in the state where the system is to be installed.

B. Operations and Maintenance Manual

- 1. Furnish four copies of the operation and maintenance manuals for each stormwater treatment system. Operation and Maintenance procedures shall be as specified by the manufacturer.

C. Performance Documentation

- 1. The following documentation must be submitted by the contractor and approved by the Engineer prior to the manufacture and delivery of any materials.
 - a. Manufacturing Experience: The manufacturer shall provide evidence of at least 5 years of successful product design and use. The supplier shall provide an installation list of projects, model sizes installed and installation dates where the same type systems as specified herein have been designed and produced by the supplier.

D. Product Data

- 1. Submit manufacturer's product data for all stormwater treatment components.

E. Certification

- 1. Manufacturer shall submit a letter of certification that the complete system meets or exceeds technical and packaging requirements.

STORMWATER TREATMENT SYSTEM

33 44 19.13-2

Biofiltration media packaging must bear a batch number making from the manufacture which matches a letter from the manufacture certifying performance testing of the batch to meet or exceed the required infiltration rate.

F. Drawings

1. Manufacture shall provide dimensional drawing including details for construction, materials, specifications

G. Manufacturer's Warranty

1. Manufacturer shall provide a warranty for all components of the HPMBS for a period of one year provided the unit is installed, operated and maintained in accordance with the manual.

H. Substitutions

1. Any proposed equal alternative product substitution to this specification must be submitted for review and approved prior to bid opening.

1.06 GENERAL

- A. Contractor shall furnish and install a precast concrete tree filter system, complete and operable as shown and specified herein, and in accordance with the requirements of the plan and contract documents.
- B. Precast concrete structure shall be manufactured at a concrete products plant with approved facilities. A sample structure shall be made available for inspection by the Engineer. Selected structure shall meet the requirements of the manufacturer.

PART 2 - PRODUCTS

2.01 STORM TREE FILTER SYSTEM

- A. Each stormwater treatment system shall be a "Storm Tree Filter System with Interior Sump" as manufactured by StormTree, 24 Corliss Street, Suite 9092, Providence, RI 02940, (401)-626-8999, www.storm-tree.com, or approved equal.
- B. Each fiberglass tree grate and cast iron fiberglass assembly shall be fabricated by U.S. Foundry (to meet requirements by the "Buy American" Provisions; [U.S. Foundry | Buy American Provisions \(usfoundry.com\)](http://U.S. Foundry | Buy American Provisions (usfoundry.com)))
- C. Storm Tree Filter Design and Materials
 1. Precast Concrete Structure: the precast concrete structure shall consist of a four-sided, two chamber rectangular box with open sides below the elevation of the root ball and an open bottom with an interior sump with an enclosed bottom. The two chambers shall be separated by a precast weir as shown on the Plan. The sump chamber shall have weep holes cast into one or more sidewalls. The dimensions of the structure shall match those shown on the Plan. The curb portion of the structure shall conform to the requirements of and be capable of supporting HS-20 wheel loading based on local regulatory specifications unless otherwise modified or specified by the engineer.

STORMWATER TREATMENT SYSTEM

33 44 19.13-3

2. Grating: The structure shall include a two-piece fiberglass (tree) grate. The grating shall be designed to withstand a minimum pedestrian loading of 500 lbs/ft² as a uniform live loading during the life of the installation. All pieces shall be removeable allowing access for the cleaning and maintenance of the system interior. The two-piece grate shall have an opening in each piece that forms a square to provide an opening for a planted tree. The grates shall be recessed flush into the top of the precast structure as shown on the plan. The grate shall be of fiberglass fabrication and be ADA compliant having no greater than a .50" opening. The fiberglass grate shall be 1-1/2 inches deep and supported in the recess of the precast concrete.
3. An engineered media consisting of both organic and inorganic aggregates with a minimum depth of 24 inches. The media is designed to provide high flow rate infiltration and promote healthy plant growth. Engineered media shall consist of the following components:
 - a. 60-70% Sand
 - b. 15-25 % Topsoil of one of the following classifications per USDA Soil Texture
 - Sandy loam
 - Loamy sand
 - Loam
 - c. 15-25% organic matter

PH level of engineering soil media shall be 5.2-7.0

4. A geotextile mesh, meeting the manufacturer's requirements placed between the media and stone layers. The mesh shall be such as to allow for the passage of water and restricting sediment transport while minimizing occlusion.
5. A perforated PVC underdrain pipe of specific dimension within a washed crush stone layer to convey infiltrating water and provide for sediment accumulation. The underdrain pipe is connected to a vertical closed riser pipe with an open top to serve for overflow/bypass, or access for cleanout.
6. Angular, crushed, washed stone with a dimension of between 0.25-0.75 inches.

2.02 FOCAL POINT HIGH-PERFORMANCE MODULAR BIOFILTRATION (HPMBS) SYSTEM

- A. Focal Point HPMBS shall be manufactured by Convergent Water Technologies Inc., (800) 711-5428, www.convergentwater.com (or approved equal)
- B. Plant Component
 2. Planting shall be in accordance with construction documents.
- C. Biofilter Components
 1. This component employs a high performance cross-section in which each element is highly dependent on the others to meet the performance specifications for the complete system.

STORMWATER TREATMENT SYSTEM

33 44 19.13-4

2. As indicated in the approved drawings, the elements of the biofilter include:
 - a. Mulch protective layer (if specified)
 - b. An advanced high infiltration rate biofiltration planting media bed which utilizes physical chemical and biological mechanisms of the soil, plant, and microbe complex to remove pollutants found in storm water runoff.
 - c. A separation layer which utilizes the concept of bridging to separate the biofiltration media from the underdrain without the use of geotextile fabrics.
 - d. A wide aperture mesh layer utilized to prevent bridging stone from entering the underdrain/storage element.
 - e. A modular, high infiltration rate flat pipe style underdrain/ storage system which is designed to directly infiltrate or exfiltrate water through its surface. The modular underdrain must provide a minimum of 95% void space.
3. Energy Dissipation Component
 - a. An energy Dissipation Component is typically specified to slow and spread out water as it enters the system. This component is dependent upon the design in the approved drawings, but typically consists of a rock gabion, rock filter dam, or dense vegetation element such as native grasses, either surrounding the biofiltration component or located immediately upstream.
4. Pretreatment Component
 - a. Pretreatment, when specified, is typically accomplished by locating the biofiltration component downstream of a swale, curb cut / rock apron, sediment forebay, deep or shallow sump water quality manhole, etc. These bmps should target trash and debris and medium to coarse sediment.
5. Observation maintenance Component
 - a. An observation and maintenance port shall be installed per the approved drawings to provide for easy inspection of the underdrain/storage element, and cleanout access if needed.
6. Extreme Event Overflow (by others)
 - a. An extreme event overflow should be located external to, but near the biofiltration element to provide bypass when needed. This may be an overland flow bypass structure, beehive overflow grate structure, or equivalent that serves the purpose. Beehive overflow structure should include a removable filter insert to provide a minimum 50% TSS removal and control of gross pollutants, trash and floatables.
7. Mulch
 - a. Mulch shall be double shredded hardwood (non-floatable), shall comply with the type and size required by the approved drawings, and shall be screened to minimize fines. Rock mulch is an alternative to wood-based mulch and typically consists of clean, rounded river rock (3-4" diam in size).

8. Biofiltration Media

- a. Biologically active biofiltration media shall be visually inspected to ensure appropriate volume, texture and consistency with the approved drawings, and must bear a batch number marking from the manufacturer which certifies performance testing of the batch to meet to exceed the required infiltration rate of 100 in/hour. A third party laboratory test must be provided to certify the 100i in/hour rate.
- b. Pollutant removal performance, composition, and characteristics of the biofiltration media must meet or exceed the following minimum standards as demonstrated by testing acceptable to the project engineer:

Pollutant	Removal Efficiency
TSS	91%
Phosphorus	66%
Nitrogen	48%
Composition and Characteristics	
Sand - Fine	< 5%
Sand - Medium	10% - 15%
Sand - Coarse	15% - 25%
Sand - Very Coarse	40% - 45%
Gravel	10% - 20%
Infiltration Rate	>100 inches per hour
Peat Moss*	5% - 15%
* Peat Moss Specification	
Listed by Organic Materials Review Institute 100% natural peat (no composted, sludge, yard or leaf waste) Total Carbon >85% Carbon to Nitrogen Ratio 15:1 to 23:1 Lignin Content 49% to 52% Humic Acid >18% pH 6.0 to 7.0 Moisture Content 30% to 50% 95% to 100% passing 2.0mm sieve > 80% passing 1.0mm sieve	

9. Underdrain/Storage System

- a. Underdrain/ storage components shall be manufactured in an ISO certified facility and be manufactured from at least 90% post-consumer recycled materials.
- b. Underdrain/Storage components shall meet or exceed the following characteristics:

Property	Value
Surface Void Area	≥ 85%
Unit Weight	3.25 lbs/cf
Service Temperature	-14° to 167°
Unconfined Crush Strength	32.48 psi
180 Day Creep Test	
Load Applied – Initial and Sustained	11.16 psi
• Creep Sustained – After 180 Days	0.20 inches
• Creep Sustained – After 180 Days	1.13 %
• Projected Creep – 40 years	1.72%

10. Separation Mesh

- a. Separation mesh shall be composed of high tenacity monofilament polypropylene yarns that are woven together to produce an open mesh geotextile which shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis and acids. The mesh shall meet or exceed the following characteristics.

Properties	Test Method	Unit	Min Ave Roll Value	
			MD	CD
Tensile Strength	ASTM D4595	kN/m (lbs/ft)	21 (1440)	25.3 (1733)
Creep Reduced Strength	ASTM D5262	kN/m (lbs/ft)	6.9 (471)	8.3 (566)
Long Term Allowable Design Load	GRI GG-4	kN/m (lbs/ft)	5.9 (407)	7.2 (490)
UV Resistance (at 500 hours)	-	% strength retained	90	
Aperture Size (machine direction)	-	mm (in)	2 (0.08)	
Aperture Size (cross machine direction)	-	mm (in)	2 (0.08)	
Mass/Unit Area	ASTM D5261	g/m ² (oz/yd ²)	197 (5.8)	

11. Bridging Stone

- a. Bridging stone shall be 3/8" pea gravel, or other diameter sized to prevent migration of filter media, as specified by manufacturer.
- b. Biofiltration media shall be segregated from any other aggregate materials and shall be protected against contamination, including contamination from any stormwater runoff from areas of the site which are not stabilized.

2.04 STORMWATER TREATMENT PERFORMANCE

- A. Function: The tree filter system shall function to remove pollutants by the following treatment process: sedimentation, physical, and biological processes.
- B. Pollutants: The tree filter system is designed to reduce or remove debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.
- C. Bypass: The tree filter system shall utilize an internal bypass to divert excessive flows.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Each stormwater treatment system shall be installed per the manufacturer's specifications.

END OF SECTION

SECTION 33 46 23

MODULAR STORMWATER STORAGE UNITS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install the underground stormwater system and appurtenances in accordance with the Drawings and these specifications.

1.02 RELATED WORK:

- A. Section 31 00 00, EARTHWORK

1.03 QUALITY CONTROL INSPECTION:

- A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections which have been damaged beyond repair during delivery will be rejected and, if already installed, shall be repaired to the Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.
- B. All sections shall be inspected for general appearance, dimensions, soundness, etc.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00 SUBMITTAL PROCEDURES, SUBMIT THE FOLLOWING:

A. Shop Drawings

Structural design calculations and shop drawings, which shall be certified by a Professional Engineer retained by the system manufacturer or Contractor and licensed in the state where the system is to be installed.

B. Performance Documentation

The following documentation must be submitted by the Contractor and approved by the Engineer prior to the manufacture and delivery of any materials.

MODULAR STORMWATER STORAGE UNITS

33 46 23-1

1. Manufacturing Experience

The manufacturer shall provide evidence of at least 5 years of successful product design and use. The supplier shall provide an installation list of projects, model sizes installed and installation dates where the same type systems as specified herein have been designed and produced by the supplier.

C. Operation and Maintenance Manuals

1. Furnish four copies of the operation and maintenance manuals for the stormwater treatment system. Operation and Maintenance procedures shall be as specified by the manufacturer.

D. Product Data

1. Submit manufacturer's product data for all underground stormwater systems.

E. Certification

1. Manufacturer shall submit a letter of certification that the complete system meets or exceeds technical and packaging requirements.

F. Drawings

1. Manufacturer shall provide dimensional drawing including details for construction, materials, specifications.

G. Manufacturer's Warranty

1. Manufacturer shall provide warranty for all components of the HPMBS for a period of one year provided the unit is installed, operated and maintained in accordance with the manual.

H. Substitutions

1. Any proposed equal alternative product substitution to this specification must be submitted for review and approved prior to bid opening.

PART 2 - PRODUCTS

2.01 MATERIALS AND DESIGN:

- A. Underground Stormwater System, materials, and design shall conform to those indicated on the drawings, or, if applicable, in shop drawings and installation instructions provided by the system manufacturer.

MODULAR STORMWATER STORAGE UNITS

33 46 23-2

2.02 R-TANK UNITS

- A. Contractor shall install R-TANK HD UNIT as manufactured by Ferguson Waterworks, (800)-448-3636, www.acfenvironmental.com
- B. GEOSYNTHETICS
1. Geotextile: A geotextile envelope is required to prevent backfill material from entering the R-Tank Modules
 - a. The standard geotextile shall be an 8 oz per square yard nonwoven geotextile (ACF No80 or equivalent)
 2. Geogrid: For installations subject to traffic loads and/or required by project plans, install geogrid (ACF BX12 or equivalent) to reinforce backfill above the R-Tank system. Geogrid is not always required for R-Tank installation and is often not required for non-traffic load applications.
- C. BACKFILL & COVER MATERIALS
1. Bedding Materials: Stone (angular and smaller than 1.5" diameter) or soil (GW, GP, SW, or SP as classified by the Unified Soil Classification System) shall be used below the R-Tank system (3" minimum). Material must be free from lumps, debris, and any sharp objects that could cut the geotextile. Material shall be within 3 percent of the optimum moisture content as determined by ASTM D698 at the time of installation. For infiltration applications, bedding material shall be free draining.
 2. Side and Top Backfill: Material must be free from lumps, debris, and any sharp objects that could cut the geotextile. Material shall be within 3 percent of the optimum moisture content as determined by ASTM D698 at the time of installation.
 3. Traffic Applications- Free draining material shall be used adjacent to (24" minimum) and above (for the first 12") the R-Tank system.
 - a. For HD and SD modules, backfill materials shall be free draining stone (angular and smaller than 1.5 in diameter) or soil (GW, GP, SW, or SP as classified by the Unified Soil Classification System).
 - b. For UD modules with less than 14" of top cover, backfill materials shall be free draining stone (angular and small than 1.5" in diameter). The use of soil backfill on the sides and top of the UD module is not permitted unless the modules are installed outside of traffic areas or with cover depths of 14" or more. The top backfill material (from top of module to bottom of pavement base or 12" maximum must be consistent with side backfill.
 4. Non-Traffic/ Green Space Applications- For all R-Tank modules installed in green spaces and not subjected to vehicular loads, backfill materials may either follow the guidelines for Traffic Applications above, or the top backfill layer (12" minimum) may consist of AASHTO #57 stone blended with 30-40% (by volume) topsoil to aid in establishing vegetation.
 5. Additional Cover Materials : Structural fill shall consist of granular materials meeting the gradational requirements of SM, SP, SW, GM, GW as classified by the Unified Soil Classification System. Structural fill shall have a maximum of 25% passing the No. 200 sieve, shall have a maximum clay content of 10 percent and maximum Plasticity Index of 4. Material shall be within 3 percent of the optimum moisture content as determined by ASTM D698 at the time of installation.

MODULAR STORMWATER STORAGE UNITS

2.03 STORMWATER PRETREATMENT COMPONENTS: RAIN GUARDIAN TURRET

- D. Each rain guardian turret pretreatment chamber shall be manufactured by Stoneworks Architectural Precast/Cast Stone, 11555 205th Ave NW, Elk River, MN 55330 (763)-633-2200, www.stoneworksap.com, or approved equal.
- E. Rain Guardian Turret Design and Materials
1. Top Grate mechanically separates larger debris pieces from stormwater runoff, thereby increasing storage space for sediment and finer debris within the unit. In addition, the top grate of the box must minimally support pedestrian foot traffic loads due to frequent positioning in the road.
 2. Impermeable side walls when connected to water permeable filter sidewall, create a debris and sediment trap. Chamber therefore allows heavier solids to settle and collect in an easy to clean location. The sidewalls also contain flow, thereby preventing inlet erosion.
 3. Water permeable filter sidewall is independently connected to the impermeable side walls. Permeable filter allows for the box to dry out between runoff events, easing maintenance by preventing the need to remove sediment/debris in a slurry state. It also prevents anoxic conditions and habitat for mosquito reproduction.
 4. The concrete dry filter box must provide for high volume overflow during large storm events such that water within the structure does not overtop the sidewalls, which would reduce the box's ability to retain floatables and maintain a stable inlet. The overflow points also ensure stormwater will not bypass the BMP until it reaches capacity.
 5. The box should include a splash pad downstream of the principal (permeable filter wall) and emergency overflow (concrete weir) points to reduce scouring below the box (i.e. within the aggregate base and BMP soil).
 6. All components must be easily cleaned without specialized equipment.
 7. Turret shall have a 3 point pick using recessed lifting pockets with a standard hook.
 8. Fiberglass top grate shall be 32 lbs, 1-1/2" thick- 1,760 lb concentrated load or 409 lb/sq-ft uniform load.
 9. Concrete filter box shall comply to the following values:

MODULAR STORMWATER STORAGE UNITS

33 46 23-4

PROPERTY OF BOX INLET STRUCTURE	VALUE OR METHOD
Steel reinforced, cold joint secured monolithic concrete structure, weight	1,030 lbs.
Concrete minimum compressive strength	4,500 psi at 28 days
Concrete air entrained	5-8.5% by volume
Manufactured and designed standard	ASTM C858
Standard exterior dimensions	46" x 50" base, 19.5" total height

10. The stormwater pretreatment component of the underground stormwater chamber system has been designed to meet the requirements of the Massachusetts Stormwater Handbook and has been approved by the local Conservation Commission. Configuration of the stormwater pretreatment component of the system must be as indicated on the plans in order to comply with local approval. If the Contractor wishes to propose an alternative pretreatment approach, the Contractor must secure approval from the local Conservation Commission for the alternative approach at no additional cost to the owner.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Each stormwater system shall be constructed according to the sizes shown on the Drawings and as specified herein. Install at elevations and locations shown on the Drawings or as otherwise required by the Engineer.
- B. Installation of Chambers, stone and fabric shall be completed as indicated in the manufacturer's installation instructions.

3.02 MAINTENANCE

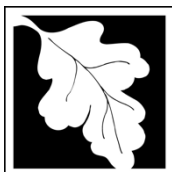
- A. Maintenance for each stormwater system shall be in accordance to manufacturer's specifications.

END OF SECTION

MODULAR STORMWATER STORAGE UNITS

33 46 23-5

Appendix A



WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

349-1405

MassDEP File #

eDEP Transaction #

Worcester

City/Town

A. General Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. From: City of Worcester
Conservation Commission
2. This issuance is for (check one): a. ☒ Order of Conditions b. ☐ Amended Order of Conditions
3. To: Applicant:

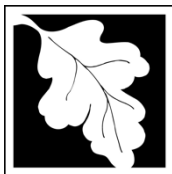
- | | | |
|---|--------------|-------------|
| a. First Name | b. Last Name | |
| City of Worcester, Executive Office of Economic Development – Neighborhood Development Division | | |
| c. Organization | | |
| 455 Main Street, 4 th Floor | | |
| d. Mailing Address | | |
| Worcester | MA | 01608 |
| e. City/Town | f. State | g. Zip Code |

4. Property Owner (if different from applicant):

- | | | |
|--|--------------|-------------|
| a. First Name | b. Last Name | |
| City of Worcester Department of Public Works & Parks | | |
| c. Organization | | |
| 20 East Worcester Street | | |
| d. Mailing Address | | |
| Worcester | MA | 01604 |
| e. City/Town | f. State | g. Zip Code |

- ### 5. Project Location:

- | | |
|--|----------------------|
| Endicott Street Right-of-Way & Bigelow Street Right-of-Way | Worcester |
| a. Street Address | b. City/Town |
| n/a | n/a |
| c. Assessors Map/Plat Number | d. Parcel/Lot Number |



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

349-1405

MassDEP File #

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Worcester

City/Town

Latitude and Longitude, if known: 42d 15m 3.096s

d. Latitude

-71d 48m 9.342s

e. Longitude

A. General Information (cont.)

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):

Worcester

a. County

b. Certificate Number (if registered land)

c. Book

d. Page

7. Dates: 07/03/2024 09/30/2024 10/07/2024

a. Date Notice of Intent Filed

b. Date Public Hearing Closed

c. Date of Issuance

8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):

Endicott and Bigelow Complete Street

a. Plan Title

Weston & Sampson

James I. Pearson

b. Prepared By

c. Signed and Stamped by

1" = 10'

d. Final Revision Date

e. Scale

NOI Application Materials

07/03/2024

Stormwater Report

06/27/2024

f. Additional Plan or Document Title

g. Date

B. Findings

1. Findings pursuant to the Massachusetts Wetlands Protection Act:

Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:

- a. ☒ Public Water Supply b. ☐ Land Containing Shellfish c. ☒ Prevention of Pollution
- d. ☒ Private Water Supply e. ☒ Fisheries f. ☒ Protection of Wildlife Habitat
- g. ☒ Groundwater Supply h. ☒ Storm Damage Prevention i. ☒ Flood Control

2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

Approved subject to:

- a. ☒ the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

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349-1405

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City/Town

B. Findings (cont.)

Denied because:

- b. ☐ the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**
- c. ☐ the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**
3. ☐ Buffer Zone Impacts: Shortest distance between limit of project disturbance and the wetland resource area specified in 310 CMR 10.02(1)(a) a. linear feet

Inland Resource Area Impacts: Check all that apply below. (For Approvals Only)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. <input type="checkbox"/> Bank	<u> </u> a. linear feet	<u> </u> b. linear feet	<u> </u> c. linear feet	<u> </u> d. linear feet
5. <input type="checkbox"/> Bordering Vegetated Wetland	<u> </u> a. square feet	<u> </u> b. square feet	<u> </u> c. square feet	<u> </u> d. square feet
6. <input type="checkbox"/> Land Under Waterbodies and Waterways	<u> </u> a. square feet	<u> </u> b. square feet	<u> </u> c. square feet	<u> </u> d. square feet
7. <input checked="" type="checkbox"/> Bordering Land Subject to Flooding	<u> </u> e. c/y dredged 114,666 <u> </u> a. square feet	<u> </u> f. c/y dredged 114,666 <u> </u> b. square feet	<u> </u> c. square feet	<u> </u> d. square feet
Cubic Feet Flood Storage	<u> </u> 8,100 <u> </u> e. cubic feet	<u> </u> 8,100 <u> </u> f. cubic feet	<u> </u> 324 <u> </u> g. cubic feet	<u> </u> 324 <u> </u> h. cubic feet
8. <input type="checkbox"/> Isolated Land Subject to Flooding	<u> </u> a. square feet	<u> </u> b. square feet		
Cubic Feet Flood Storage	<u> </u> c. cubic feet	<u> </u> d. cubic feet	<u> </u> e. cubic feet	<u> </u> f. cubic feet
9. <input type="checkbox"/> Riverfront Area (25' - Worcester)	<u> </u> a. total sq. feet	<u> </u> b. total sq. feet		
Sq ft within 25 ft	<u> </u> c. square feet	<u> </u> d. square feet	<u> </u> e. square feet	<u> </u> f. square feet



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
349-1405

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Worcester

City/Town

B. Findings (cont.)

Coastal Resource Area Impacts: Check all that apply below. (For Approvals Only)

	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. <input type="checkbox"/> Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. <input type="checkbox"/> Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12. <input type="checkbox"/> Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. <input type="checkbox"/> Coastal Beaches	a. square feet	b. square feet	c. nourishment cu yd	d. nourishment cu yd
14. <input type="checkbox"/> Coastal Dunes	a. square feet	b. square feet	c. nourishment cu yd	d. nourishment cu yd
15. <input type="checkbox"/> Coastal Banks	a. linear feet	b. linear feet		
16. <input type="checkbox"/> Rocky Intertidal Shores	a. square feet	b. square feet		
17. <input type="checkbox"/> Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18. <input type="checkbox"/> Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19. <input type="checkbox"/> Land Containing Shellfish	a. square feet	b. square feet	c. square feet	d. square feet
20. <input type="checkbox"/> Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	a. c/y dredged	b. c/y dredged		
21. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	a. square feet	b. square feet		
22. <input type="checkbox"/> Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

349-1405

MassDEP File #

eDEP Transaction #

Worcester

City/Town

B. Findings (cont.)

* #23. If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c (BVW) or B.17.c (Salt Marsh) above, please enter the additional amount here.

23. ☐ Restoration/Enhancement *:

a. square feet of BVW

b. square feet of salt marsh

24. ☐ Stream Crossing(s):

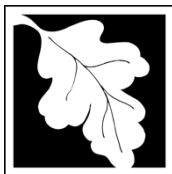
a. number of new stream crossings

b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
 - a. The work is a maintenance dredging project as provided for in the Act; or
 - b. The time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
 - c. If the work is for a Test Project, this Order of Conditions shall be valid for no more than one year.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order. An Order of Conditions for a Test Project may be extended for one additional year only upon written application by the applicant, subject to the provisions of 310 CMR 10.05(11)(f).
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on _____ unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

349-1405

MassDEP File #

eDEP Transaction #

Worcester

City/Town

C. General Conditions Under Massachusetts Wetlands Protection Act

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.
9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.
10. A sign shall be displayed at the site not less than two square feet or more than three square feet in size bearing the words,

"Massachusetts Department of Environmental Protection" [or, "MassDEP"]

"File Number 349-1405 "
11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.
12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.
13. The work shall conform to the plans and special conditions referenced in this order.
14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.
15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.
16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

349-1405

MassDEP File #

eDEP Transaction #

Worcester

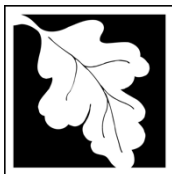
City/Town

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.
18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.
19. The work associated with this Order (the "Project")
 - (1) ☒ is subject to the Massachusetts Stormwater Standards
 - (2) ☐ is NOT subject to the Massachusetts Stormwater Standards

If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:

- a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.
- b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:
 - i. all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;
 - ii. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;
 - iii. any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

349-1405

MassDEP File #

eDEP Transaction #

Worcester

City/Town

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;

v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement") for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following:

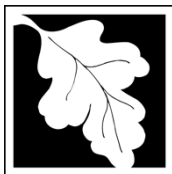
i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and

ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

349-1405

MassDEP File #

eDEP Transaction #

Worcester

City/Town

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

- g) The responsible party shall:
1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
 2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
 3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.
- h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.
- i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.
- j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.
- k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.
- l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):

See Attachment A.

20. For Test Projects subject to 310 CMR 10.05(11), the applicant shall also implement the monitoring plan and the restoration plan submitted with the Notice of Intent. If the conservation commission or Department determines that the Test Project threatens the public health, safety or the environment, the applicant shall implement the removal plan submitted with the Notice of Intent or modify the project as directed by the conservation commission or the Department.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

349-1405

MassDEP File #

eDEP Transaction #

Worcester

City/Town

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☒ Yes ☐ No
2. The City of Worcester hereby finds (check one that applies):
Conservation Commission

- a. ☐ that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:

City of Worcester Wetlands Protection Ordinance & Regulations

1. Municipal Ordinance or Bylaw

COW GRO

Part 1. Ch. 6.

2. Citation

Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.

- b. ☒ that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:

City of Worcester Wetlands Protection Ordinance & Regulations

1. Municipal Ordinance or Bylaw

COW GRO

Part 1. Ch. 6.

2. Citation

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.

The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):

See Attachment A.

ATTACHMENT A
Worcester Conservation Commission
Special Order of Conditions

City of Worcester Wetlands Protection Ordinance & City of Worcester Wetlands Protection Regulations
(City of Worcester Revised Ordinance Part I, Chapter 6)
And
Massachusetts General Laws, Chapter 131, §40 - Massachusetts Wetlands Protection Act

Endicott Street & Bigelow Street Rights-of-Way (CC-2024-053 & DEP#349-1405)

Project Description: To enhance the roadways along Endicott Street and Bigelow Street by expanding sidewalks, redesigning parking, adding a two-way cycle lane, improving stormwater management, and related sitework.

Findings/Waivers: This work is approved as a limited project pursuant to 310 CM 10.53(3)(f). The Commission notes that while compensatory storage is not provided in accordance with 310 CMR 10.57(4), 2,862 CF of new subsurface storage is proposed. The Commission also notes that the calculations provided by the applicant indicate that the loss in flood storage would result in a 0.002' increase in the base flood elevation of this floodplain, which represents a minimal increase to the horizontal extent and level of flood waters.

Table of Contents:

I. Conditions to Meet Prior to and During Construction 2

II. Conditions to Meet Before the Start of Any Activity 2

III. Stormwater Management System..... 2

IV. Conditions to Meet During Construction 3

V. Conditions to Meet at Completion of Project..... 4

VI. General Conditions..... 5

Notes:

- **Office of the Commission** is located at the Division of Planning and Regulatory Services (455 Main Street 4th floor, Worcester, MA), which can be contacted by e-mailing planning@worcesterma.gov or calling 508-799-1400 ext. 31440.
- **Asterisked (*) conditions** are standard conditions of approval for all projects.

I. Conditions to Meet Prior to and During Construction

21. Person Responsible for Compliance with the Order of Conditions* – A person shall be designated to be responsible to monitor compliance with the Order of Conditions. Their name and contact information (24/7) shall be provided to the Office of the Commission prior to start of any activity. This person shall conduct:
- a) periodic inspections to assure the adequacy and continued effectiveness of erosion and sediment controls;
 - b) inspections of said controls following 0.5-inch or greater rain events, or after a heavy snow melt.
22. Contract* - This Order of Conditions and all approved plans shall be included as part of any contract and subcontract and shall be posted in a prominently displayed location in the supervisory office on site during all phases of construction.
23. Notification* - The applicant shall notify the Office of the Commission a minimum of 48 hours prior to the start of any activity.

II. Conditions to Meet Before the Start of Any Activity

24. Pre-Construction Conference* -
- a) The Conservation Commission or its Agents shall conduct a pre-construction conference prior to commencement of activities in each phase of the project. Phasing, if any, shall conform to the approved plans.
 - b) The property owner / applicant and any person performing work that is subject to this Order are responsible for understanding and complying with the requirements of this Order, the Wetlands Protection Act, 310 CMR 10.00 and City of Worcester Wetlands Protection Ordinance and Regulations. Said persons shall acknowledge such in writing prior to commencement of activities.
25. Inspections Prior to Site Preparation and Site Work* - Erosion and sediment controls shall be installed and verified, in compliance with final approved plans, by the Commission or its Agents prior to the commencement of any excavation, grubbing and/or stumping of vegetation, grading, construction, or other site preparation.
26. Construction Schedule* - Submit a Construction Schedule consistent with Work Sequencing plans provided to the Office of the Commission prior to the start of any activities.

III. Stormwater Management System

27. Catch Basins* –
- a) The paved roadways and parking lots shall be bermed and shall be installed with standard City of Worcester catch basins.
 - b) Prior to start of activity on site that causes soil erosion and sedimentation, catch basin filter traps shall be installed in the existing and new catch basins.
 - c) Catch basins shall be cleaned as warranted during construction to keep them clear of sediment, and minimum twice a year thereafter.
28. Stormwater Management System Maintenance* – The stormwater management system shall be maintained in accordance with the approved design plans and Operation and Maintenance Plan on file with the Office of the Commission. The system shall be maintained in good hydraulic condition (e.g. any accumulated silt/sediment shall be removed; the system shall be kept free of any litter, refuse, or other extraneous matter, etc.). **This condition shall extend in perpetuity beyond the issuance of the Certificate of Compliance.**

IV. Conditions to Meet During Construction

29. Limit of Work* – No removal, filling, dredging or altering of jurisdictional areas shall take place outside the approved work under this Order of Condition.
30. Work Sequencing* – Activities shall take place in accordance with all phasing and sequencing shown on the plan and/or provided in the application materials on file with the Office of the Commission and shall follow any lot opening restrictions otherwise provided herein.
31. Certification of Stormwater Management Infrastructure - A registered Professional Engineer, currently licensed to practice within the Commonwealth of Massachusetts, shall provide a written certification that all stormwater management infrastructure has been installed in substantial compliance with the approved plans and that the systems function as designed.
32. Erosion Stabilization -
 - a) Erosion and Sediment Controls* - All erosion and sediment controls shall be monitored, maintained, and adjusted for the duration of the project to prevent adverse impacts to jurisdictional areas. Additional erosion and sediment controls may be utilized on site as needed.
 - b) Off Site Impacts* - There shall be no off-site erosion, flooding, ponding, or flood-related damage from runoff caused by the project activities.
 - c) Unanticipated Drainage or Erosion* - The applicant shall control any unanticipated drainage and/or erosion conditions that may cause damage to jurisdictional areas and/or abutting or downstream properties. Said control measures shall be implemented immediately upon need. The Office of the Conservation Commission shall be notified if such conditions arise and of the measures utilized.
 - d) Soil Stabilization due to Delay in Work* - If there is an interruption of more than 10, but less than 60 days between completion of grading and revegetation, the applicant shall sow all disturbed areas with annual rye grass to prevent erosion. If soils are to be exposed for longer than 60 days, a temporary cover of rye or other grass should be established following US Soil Conservation Services procedures, as recently amended, to prevent erosion and sedimentation. Once final grading is complete, loaming and seeding of final cover should be completed promptly.
 - e) Grading of Slopes*-
 - i. >40% Slope – Slopes shall not exceed those specified in the plans approved by the Conservation Commission. Any slope equal to or greater than 40% (1 vertical to 2 1/2 horizontal) shall be stabilized with erosion control matting.
 - ii. <40% Slope – Final grades of vegetated areas shall not exceed a slope of 1 vertical to 2 1/2 horizontal (40%) and shall be stabilized to prevent erosion, particularly during the construction period.
 - f) Stockpile Maintenance* - Any stockpiling of loose materials shall be properly stabilized to prevent erosion into and sedimentation of jurisdictional areas. Preventative controls such as strawbales or erosion control matting shall be implemented to prevent such an occurrence.
 - g) Stockpile Location – In no case shall any soil or excavated material be stockpiled within 50 feet of any wetland, floodplain, or storm drain inlet.
 - h) Site Stabilization Prior to Winter* - Prior to winter, exposed soils shall be stabilized (e.g. with demonstrated vegetative growth, impermeable barriers, erosion control blankets, etc.).
33. Invasive Insects* -
 - a) Plantings – No trees to be planted shall be species susceptible to the Asian Longhorned Beetle or Emerald Ash Borer.

- b) *Wood Removal* – All tree, brush & wood removal shall adhere to the most recently amended requirements set forth by the Massachusetts Department of Conservation & Recreation for any project located in the Asian Longhorned Beetle Quarantine Zone.
34. Dust Control* - Provisions for dust control shall be provided during all construction and demolition activities. Such provisions shall be conducted in compliance with all City of Worcester Water Use Restrictions, if in effect, during such activities.
35. Dewatering* – If dewatering is required,
- a) Notice of such activities shall be given to the Office of the Commission within 24 hours of commencement;
 - b) There shall be no discharge of untreated dewatered stormwater or groundwater to jurisdictional areas either by direct or indirect discharge to existing drainage systems;
 - c) Any discharge to surface waters or drainage structures must be visibly free of sediment;
 - d) To the maximum extent practicable, proposed dewatering activities should be located outside of the 100' buffer. If such activities must be located within the 100' buffer, they shall be monitored at all times when the pumps are running;
 - e) Dewatering activities shall be confined within an area of secondary containment at all times.
36. Cement Truck Washing - Cement trucks shall not discharge washout effluent directly to any resource area, the 30' buffer thereto, or into any drainage system. Designated washout areas shall be located out of the 100 buffer zone to any wetland.
37. Spill Prevention* -
- a) No fuel, oil, or other pollutants shall be stored in any resource area or the buffer zone thereto, unless specified in this Order;
 - b) No refueling shall take place within resource areas or 100-ft to a resource area;
 - c) The applicant shall take all necessary precautions to prevent discharge or spillage of fuel, oil or other pollutants onto any part of the site;
 - d) A spill kit shall be present on site at all times.

V. Conditions to Meet at Completion of Project

38. Site Stabilization* - All disturbed areas shall be properly stabilized with well-established perennial vegetation or other approved methods before the project is considered complete.
39. Erosion and Sediment Controls* - Erosion and sediment controls shall not be removed from the site until all disturbed areas have been stabilized with final vegetative cover and approval has been received from the Commission or its Agents to do so. The controls must then be removed within two weeks of receipt of that certification.
40. Certificate of Compliance* - Upon completion of the project, the applicant shall request in writing a Certificate of Compliance from the Commission. If the project has been completed in accordance with plans stamped by a registered professional engineer, architect, landscape architect, or land surveyor, certification must include a written statement by such professional certifying the same.
- a) A certified as-built plan-of-land shall be provided showing final grades, resource areas, and all constructed improvements;
 - b) Certification shall be provided from a professional engineer documenting the total net change to flood storage capacity to ensure it does not exceed the approved amount.

41. Pesticides, Etc. – No pesticides, herbicides, or fertilizers, with the exception of lime, shall be used on lawn(s) within the buffer zone to bordering vegetated wetland or bank after completion of the project.
42. Sand/Salt – The use of sand and salt on paved surfaces shall be kept to an absolute minimum during the winter months.
43. Deed Condition – Conditions numbered **28, 41, & 42** shall extend beyond the Certificate of Compliance, in perpetuity, and shall be referred to in all future deeds to this property.

VI. General Conditions

44. Change in Ownership* - If a change in ownership takes place while this Order is still in effect, it is the responsibility of the new owner to notify the Commission of the change and to provide the name of the person responsible for compliance with the Order.
45. Conservation Agent's Power to Act* - With respect to all conditions, the Conservation Commission designates the Conservation Agent, as its Agent with full powers to act on its behalf in administering and enforcing this Order, unless the Agent determines approval from the Commission is appropriate.
46. Right to Inspect* - A member of the Conservation Commission or its Agent may enter and inspect the property and the activity that are the subjects of this Order at all reasonable times, with or without probable cause or prior notice, and until a Certificate of Compliance is issued, for the purpose of evaluating compliance with this Order (and other applicable laws and regulations).
47. Changes to the Plan or Errors & Omissions* -
 - (a) If any plan, calculation, or other data presented to the Office of the Commission is in error or have omissions, and are deemed significant by the Commissioners or their Agents, all work will stop at the discretion of the Commission, until the discrepancies have been rectified to the Commission's satisfaction.
 - (b) The applicant must notify the Commission in writing of any changes in the plans or implementation of the proposed activity where mandated by any local, state, or federal agencies having jurisdiction over the proposed activity. If, in the opinion of the Commission, any changes in the plans or implementation of the proposed activity so require, then the Commission may modify, amend or rescind this Order in a way consistent with:
 - M.G.L. Chapter 131, Section 40,
 - 310 CMR 10.00, *Wetlands Protection*,
 - the City of Worcester's *Wetlands Protection Ordinance*, and
 - the Commission's *Wetlands Protection Regulations*

If any provisions of any conditions, or application thereof is held to be invalid, such invalidity shall not affect any other provisions of this Order. If the Commission deems that a proposed change is major or substantial, a new hearing may be required.

48. Liability* - The applicant shall indemnify and save harmless the Commonwealth, the City of Worcester, the Conservation Commission, and its Agents against all sites, claims or liabilities of every name and nature arising at any time out of or in consequence of the acts of the Commission or its Agents in the performance of the work covered by this Order and/or failure to comply with the terms and conditions of this Order whether by itself or its employees or subcontractors.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 – Order of Conditions
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
 349-1405
 MassDEP File #

eDEP Transaction #
 Worcester
 City/Town

E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

Please indicate the number of members who will sign this form.

This Order must be signed by a majority of the Conservation Commission.

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

The names typed below represent the intent to sign the foregoing document in accordance with MGL Chapter 110G §9
 Duly authorized by Ch.110G and recorded at Worcester Registry of Deeds in Book 62537 Page 329.

10/07/2024

1. Date of Issuance
 3 of 5

2. Number of Signers

Signature

Signed by:

Diane Fratoni

Devin Canton

Printed Name

Signature

DocuSigned by:

Stuart Kirshner

ECA8503D0C3E4C8...

Diane Fratoni

Printed Name

Signature

71E1FDC8AF4E4BF...

Stuart Kirshner

Printed Name

Signature

DocuSigned by:

Lindsay Nystrom

Timothy Magliaro

Printed Name

Signature

1EC379ADB20C4D0...

Lindsay Nystrom

Printed Name

Signature

Printed Name

Signature

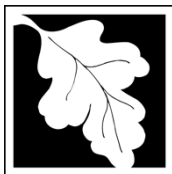
Printed Name

☐ by hand delivery on

☒ by certified mail, return receipt
 requested, on
 10/07/2024

Date

Date



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

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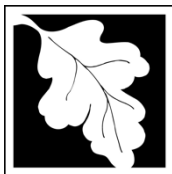
City/Town

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.



Massachusetts Department of Environmental Protection

Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

349-1405

MassDEP File #

eDEP Transaction #

Worcester

City/Town

G. Recording Information

Prior to commencement of work, this Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Conservation Commission

Please be advised that the Order of Conditions for the Project at:

Project Location

MassDEP File Number

Has been recorded at the Registry of Deeds of:

County

Book

Page

for:

Property Owner

and has been noted in the chain of title of the affected property in:

Book

Page

In accordance with the Order of Conditions issued on:

Date

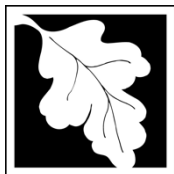
If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

DEP File Number: _____

**Request for Departmental Action Fee
Transmittal Form**

Provided by DEP _____

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

A. Request Information

1. Location of Project

a. Street Address _____

b. City/Town, Zip _____

c. Check number _____

d. Fee amount _____

2. Person or party making request (if appropriate, name the citizen group's representative):

Name _____

Mailing Address _____

City/Town _____

State _____

Zip Code _____

Phone Number _____

Fax Number (if applicable) _____

3. Applicant (as shown on Determination of Applicability (Form 2), Order of Resource Area Delineation (Form 4B), Order of Conditions (Form 5), Restoration Order of Conditions (Form 5A), or Notice of Non-Significance (Form 6)):

Name _____

Mailing Address _____

City/Town _____

State _____

Zip Code _____

Phone Number _____

Fax Number (if applicable) _____

4. DEP File Number: _____

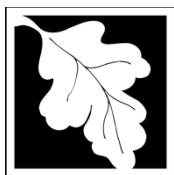
Important:
When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



B. Instructions

1. When the Departmental action request is for (check one):

- ☐ Superseding Order of Conditions – Fee: \$120.00 (single family house projects) or \$245 (all other projects)
- ☐ Superseding Determination of Applicability – Fee: \$120
- ☐ Superseding Order of Resource Area Delineation – Fee: \$120



Massachusetts Department of Environmental Protection

Bureau of Resource Protection - Wetlands

Request for Departmental Action Fee

Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

DEP File Number:

Provided by DEP

B. Instructions (cont.)

Send this form and check or money order, payable to the *Commonwealth of Massachusetts*, to:

Department of Environmental Protection
Box 4062
Boston, MA 02211

2. On a separate sheet attached to this form, state clearly and concisely the objections to the Determination or Order which is being appealed. To the extent that the Determination or Order is based on a municipal bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.
3. Send a **copy** of this form and a **copy** of the check or money order with the Request for a Superseding Determination or Order by certified mail or hand delivery to the appropriate DEP Regional Office (see <https://www.mass.gov/service-details/massdep-regional-offices-by-community>).
4. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.