SECTION 02227

AGGREGATE MATERIAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate Materials

1.2 RELATED SECTIONS

A. Section 02100 - Site Preparation

B. Section 02200 - Earthwork

C. Section 02220 - Excavation, Backfill and Compaction

D. Section 02511 – Asphaltic Concrete Paving

E. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM): latest edition ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

ANSI/ASTM D1157 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lbs (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

ASTM D2487 - Classification of Soils for Engineering Purposes.

ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

ASTM D4318 - Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition. AASHTO T180 - Moisture-Density Relations of Soils Using A 10 lb (4.54 Kg) Rammer and an 18 inch (457 mm) Drop.

AASHTO M147 - Materials for Aggregate and Soil Aggregate.

1.4 QUALITY ASSURANCE

Test and analysis of aggregate material will be preformed in accordance with standard ASTM and AASHTO procedures listed herein.

1.5 SUBMITTALS

A. Submit in air tight containers a 10 pound sample of each aggregate or mixture that is to be incorporated into the project to the independent testing laboratory.

B. Submit the names of each material supplier and specific type and source of each material. Any changes in source throughout the job require approval of the Owner or Engineer.

C. Submit materials certificate to on-site Independent Testing Laboratory which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All construction and materials shall meet or exceed the requirements of this section and the MDOT highway department specification section referred to or noted on the drawings which pertain to paving base course design, materials, preparation, and/or execution. All materials shall be as indicated on Drawings and shall comply with applicable state highway specification regarding source, quality, gradation, liquid, limit, plasticity index, and mix proportioning.

B. The following tables serve as guidance for the gradation of the various aggregate materials. Local availability and variances with each States requirements may change the gradations and parameters of these materials. The Contractor shall indicate when submitting materials to be tested what the various applications will be.

Material Description	2”	1"	3/4"	1/2"	3/8"	1/4"	4	10	40	200
Select Backfill	--	--	--	--	--	--	85-100	--	10-30	0-5
3/4 Inch Crushed Stone	--	100	90-100	--	20-50	--	0-10	--	--	--
Riprap Bedding Material	--	--	--	--	--	25-70	--	--	0-30	0-7
Pipe Bedding	--	100	90-100	--	20-55	--	0-10	0-5	--	--
Base Course Crushed Gravel**	100	--	--	45-70	--	30-55	--	--	0-20	0-5
Subbase Course Gravel***	--	--	--	--	--	25-70	--	--	0-30	0-7

* Aggregate base course shall not contain particles of rock which will not pass the 2 inch square mesh sieve.

** Aggregate subbase course shall not contain particles of rock which are larger than 4 inches.

PART 3 - EXECUTION

3.1 STOCKPILING

Stockpile on-site at locations indicated by the owner in such a manner that there will be no standing water or mixing with other materials.

3.2 BORROW SITES

Upon completion of borrow operations, clean up borrow areas as indicated on the plans and in neat and reasonable manner to the satisfaction of the property Owner or the Engineer.

3.3 TRANSPORTATION

Off-site materials shall be transported to the project using well maintained and operating vehicles. Once on the job site, all transporting vehicles shall stay on designated haul roads and shall at no time endanger any of the improvements by rutting, overloading or pumping the haul road.

END OF SECTION 02227

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED CUSTOM HOUSE SQUARE BUILDING
(W. L. BLAKE ADDITION #2)
CUSTOM HOUSE AND FORE STREETS
PORTLAND, MAINE

05-0079 February 1, 2006

Prepared for:
OEI IVb, LLC
Olympia Equity Investors
Attn: Mr. Tim Levine
280 Fore Street, Suite 202
Portland, Maine 04101

Prepared by:

S.W.COLE ENGINEERING, INC.
286 Portland Road
Gray, Maine 04039

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S.W.COLE ENGINEERING, INC. • Geotechnical Engineering • Field & Lab Testing • Scientific & Environmental Consulting

05-0079

February 1, 2006

OEI IVb, LLC
Olympia Equity Investors
Attention: Mr. Tim Levine
280 Fore Street, Suite 202
Portland, Maine 04101

Subject: Geotechnical Engineering Services
Proposed Custom House Square Building
(W.L. Blake Building Addition #2)
Custom House and Fore Streets
Portland, Maine

Dear Mr. Levine:

In accordance with our Proposal dated January 28, 2005, we have made a subsurface investigation and geotechnical evaluation at the above referenced site. We received authorization to proceed on September 12, 2005. A draft report was provided for your review and comment on November 4, 2005. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Attachment A.

1.0 INTRODUCTION

1.1 Scope of Work

The purpose of our work was to obtain subsurface information in order to develop geotechnical recommendations for foundations associated with the proposed construction. Our scope included interior and exterior test boring explorations, a review of subsurface information obtained during a previous building addition, a geotechnical evaluation of the subsurface findings relative to the proposed construction and preparation of this report.

1.2 Proposed Construction

As discussed, we understand development plans call for construction of a new five-story office building on the site. We understand the building will be steel-framed with a

basement floor elevation 11.5 feet (project datum). As discussed, we anticipate the building will be founded on pile-supported foundations. Detailed structural loading information is not available at the time of this report.

2.0 EXPLORATION AND TESTING

2.1 Exploration

Five test borings (B-201 through B-205) were made at the site on October 25 and 26, 2005. The test borings were made by Northern Test Boring of Gorham, Maine working under subcontract to S. W. COLE ENGINEERING, INC. The exploration locations were selected and established by S. W. COLE ENGINEERING, INC. based upon site access limitations, underground utility constraints and our understanding of the proposed construction. The approximate exploration locations are shown on the "Exploration Location Plan" attached as Sheet 1. Logs of explorations are attached at Sheets 2 through 6. Rock cores were obtained at test borings B-201 and B-202. Rock core logs are attached as Sheets 7 and 8. A key to the notes and symbols used on the logs is attached as Sheet 9.

Five test borings (B-1 through B-5) were made by S. W. COLE ENGINEERING, INC. for the first addition to the Blake Building in February 2000. A plan showing the locations of these test boring, as well as the logs of these test borings, are attached as Appendix A.

2.2 Testing

The soils were sampled using a split spoon sampler and Standard Penetration Test (SPT) methods. SPT results are shown on the logs. Soil samples obtained from the test borings were returned to our laboratory for further visual classification.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The site is bounded by Fore Street (at about elevation 22) to the west, Custom House Street (elevation varies adjacent to the proposed construction from about 22 feet to 18 feet) to the south, the W.L.Blake Building to the east and the Fore Street Restaurant and a paved parking lot (at about elevation 13) to the north. Elevations are based on the project datum, as shown on the boundary and topographic survey prepared by Owen Haskell Inc.

The area proposed for the new office building is currently occupied by a one and two story masonry structure and paved loading ramp. The masonry structure has visible signs of step-cracking associated with structural distress caused by foundation settlement. The existing interior concrete slab is uneven, in relatively poor condition and shows signs of settlement related distress. The existing concrete floor is at an elevation of about 13 feet. The west wall of the existing masonry structure along Fore Street is a massive concrete retaining wall about 9 feet high.

3.2 Subsurface Conditions

Borings B-201 through B-203 were conducted adjacent to the large retaining wall at the edge of Fore Street. Below about 5 inches of concrete, these borings encountered 6 to 8 feet of loose dark brown to black silty sand with various amounts of brick and gravel (fill) overlying dense brown gravelly sand with some silt (native) overlying probable bedrock surfaces at about 9 to 9 ½ feet below the existing ground surface. It should be noted that an approximate 6-inch void was encountered directly below the concrete slab in boring B-202. Rock cores were obtained at borings B-201 and B-202. The rock cores indicate that the upper 3 feet of the bedrock is highly weathered and fractured with an RQD of 0%. An approximate 8-inch void was encountered within the upper 3-foot weathered zone of the bedrock at boring B-201. Below the 3-foot weathered zone, the bedrock core encountered gray Carbonaceous Pelite with an RQD of 91%.

Borings B-204 and B-205 were conducted between proposed column lines D and E (see Sheet 1), about 50 and 70 feet from the edge of Fore Street, respectively. Boring B-204 was conducted in an existing paved access drive area and B-205 was conducted inside the existing building adjacent to the northerly wall line. Boring B-204 encountered about 4.5 inches of asphalt overlying about 3 feet of medium dense base gravel overlying 2 feet of medium dense subbase gravel overlying loose dark brown to black silt and fine sand with varying amounts of brick and gravel. Boring B-205 encountered about 6 inches of concrete overlying the loose dark brown to black silty sand (fill) soils. Underlying the dark brown to black silty sand (fill), at depths of about 9 feet from the ground surface, borings B-204 and B-205 encountered very loose black silt and wood to depths of about 22 and 16 feet from the ground surface, respectively. Several buried wooden logs were encountered in these test borings with diameters estimated to range from 12 and 18 inches. The buried wood may be relic wood cribbing

or relic timber piles. The layer or buried wood and silt overlies light brown gravelly silt and sand (likely native soils) overlying refusal surfaces at depths of about 21 to 25 feet.

S. W. COLE ENGINEERING, INC. performed geotechnical explorations for the recent building addition on easterly side of the proposed construction. Borings B-3 through B-5 encountered similar conditions as B-204 and B-205. These borings encountered loose to very loose dark brown to black silty fill soils with wood and bricks to depths of 14 to 19 feet below the ground surface overlying medium dense to dense native brown silty sand with some gravel overlying refusal surfaces at depths of about 23 to 31 feet below the ground surface. Buried wood was also encountered at boring B-4.

Refer to the boring and rock core logs, attached as Sheets 2 through 8 and in Appendix A for more detailed descriptions of the subsurface findings at the exploration locations.

3.3 Groundwater Conditions

At the time of drilling, groundwater was observed at depths of about 9 feet below the ground surface. After removing the casing from the explorations, the holes generally caved at about 5 to 6 feet from the ground surface with no free water within the hole. It should be noted that groundwater levels likely fluctuate in response to nearby tidal water levels.

3.4 Seismic and Frost Conditions

According to IBC 2003, we interpret the subsurface conditions to correspond to a Seismic Site Class E. The design freezing index for the Portland, Maine area is approximately 1250 Fahrenheit-Degree-Days, which corresponds to a frost penetration on the order of 4.5 feet.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the findings at the exploration locations and our understanding of the proposed project, it is our opinion the proposed construction appears feasible from a geotechnical standpoint provided the proposed building addition is founded on pile-supported foundations. As discussed, it may be feasible to support the foundations along Fore Street on spread footing bearing on clean, sound intact bedrock provided excavations can be successfully completed to fully penetrate the upper 3-foot

weathered zone of bedrock. As discussed, the top 3 feet of bedrock encountered adjacent to Fore Street is very poor quality and voids were encountered within the bedrock. The rock in this area will need to be improved by either 1) pressure grouting (pile supported foundations) or 2) excavation and removal of unsuitable rock (spread footing foundations). Alternatively, a drilled pipe pile set at least 5 feet into the rock and filled with high strength concrete could be used to support the foundations adjacent to Fore Street.

It should be noted that the spoils generated from excavation of existing soils will not be suitable for reuse on site with the exception of the gravels found beneath the existing paved loading dock ramp area. In addition, based on our experience in the area and the results from our recent and previous exploration work, the excavated soils may have some level of contamination requiring special disposal at an approved disposal facility.

4.2 Foundations

4.2.1 Pile Foundations

Considering the subsurface conditions encountered and our understanding of the proposed construction, we recommend foundation support of the proposed building be derived from steel H-Piles with cast driving tips driven to end-bearing on bedrock. Grade beams, pile caps and foundations exposed to freezing temperatures should extend at least 4.5 feet below exterior finished grade for frost protection or be insulated with foundation insulation to provide adequate frost protection. Since large wooden obstructions were observed in the test borings, piles must be designed to withstand the driving forces. Additionally, it should be anticipated that some piles will shift laterally during driving or may need to be relocated to overcome below grade obstructions.

Considering the voids encountered within upper 3 feet of the bedrock adjacent to Fore Street, the bedrock in this area will need to be improved if driven piles are utilized. In general, a grout subcontractor could place a high strength epoxy grout within the top 3 feet of bedrock at proposed pile cap locations adjacent to Fore Street to fill any voids or fractures that may exist. The grout should have a minimum compressive strength of 10,000 psi. In general, placing epoxy grout to improve subsurface bedrock is costly; therefore, we recommend that consideration be given to installing concrete filled steel pipe pile adjacent to Fore Street, drilled at least 5 feet into bedrock.

Based on our understanding of the project, we offer the following pile sections and allowable axial compressive capacities for design consideration. The allowable axial capacities have been reduced to allow for 1/8-inch corrosion of the pile section.

PILE SECTION ASTM A572 Grade 50	**ALLOWABLE AXIAL COMPRESSIVE PILE CAPACITY (1/8" Corrosion Allowance)**
HP10 x 57	80 kips
HP12 x 53	80 kips
5-inch diameter concrete filled pipe pile	40 kips
NOTE 1: Axial capacity based up 1/8" corrosion reduction in steel and working stress not exceeding 16.7 ksi. NOTE 2: Pipe piles should be filled with concrete with a minimum compressive strength of 5,000 psi.	

Post-construction settlement of piles driven to practical refusal on sound bedrock or drilled and socketed into sound bedrock should not exceed ½-inch; elastic shortening of the pile should be evaluated on a pile cap by pile cap basis, as deemed necessary by the structural engineer. Considering the depth to bedrock, our experience on the site and a bottom of pile cap elevation of 4.5 feet below exterior grades, we anticipate pile lengths could likely vary from about 5 to 35 feet. Piles should be spaced a minimum of two pile diameters, center-to-center, but not less than 24 inches. We recommend that pile caps and grade beams be underlain with 8 inches of compacted crushed stone to help provide a stable working surface during construction.

For pile caps backfilled with properly compacted Structural Fill (clean, free-draining sand and gravel), we recommend a passive earth pressure of 325 pcf (equivalent fluid) for design consideration. Additional lateral resistance can be provided by grade beams between the pile caps, as deemed necessary by the structural engineer.

The pile-driving contractor should submit information on the pile driving equipment and proposed 'set' or stop driving criteria to S. W. COLE ENGINEERING, INC. prior to the start of pile driving activities. S. W. COLE ENGINEERING, INC. should be on-site during the driving of piles to maintain pile-driving records and to monitor vibrations due to driving.

Vibrations from pile driving activities can adversely affect adjacent structures. We recommend that a pre-driving survey be done on structures adjacent to the proposed project. The pre-driving survey should include photographs and the installation of crack monitors as appropriate to establish a baseline prior to the start of pile driving activities.

The IBC 2003 requires that pile load tests be performed on piles with design capacities over 40 tons (80 kips). Considering the recommended pile capacities are 80 kips or less, pile load testing will not be required. However, based on our experience in the City of Portland, we recommend that a pile driving summary plan and letter, stamped by a Maine Professional Engineer, stating that the piles were installed according to the recommendations in the geotechnical report, be prepared to meet the Special Inspections requirements of the City.

4.2.2 Spread Footing Foundations

Based on the subsurface findings and our understanding of the proposed construction, spread footing foundations bearing on sound bedrock may be considered adjacent to the existing retaining wall supporting Fore Street. As discussed, excavation of the existing soils has certain limitations including: possible undermining of the existing Fore Street retaining wall foundation, unearthing potentially contaminated soils and excavating below the groundwater table. If this option is considered, we recommend the contractor conduct several test pit exploration adjacent to the existing retaining wall to assess subsurface and foundation conditions after the existing building has been demolished.

If spread footings are utilized, excavation of all soils and weathered bedrock to expose clean, sound, intact bedrock will be required (likely about 12 feet below existing grade). The excavations will likely need shoring and the existing retaining wall may need bracing or require underpinning. For spread footing foundations bearing on clean, sound, intact bedrock, we recommend a net allowable bearing capacity of 10 ksf. S. W. COLE ENGINEERING, INC. should be retained to observe subgrades prior to placing new concrete or fill.

4.3 Excavation Work

An erosion control system should be instituted prior to any construction activity at the site to help protect adjacent drainage ways.

Wet to saturated soil conditions will likely be encountered in the foundation excavations. In our opinion, ditching with sump and pump dewatering techniques should be adequate to control groundwater in excavations less than about 6 feet deep. We recommend placing at least 8 inches of crushed stone at the base of pile cap and grade beam excavations to act as a drainage media and working mat.

Deeper excavations, such as for utilities or for spread footing foundations (if utilized), will likely require braced sheeting for groundwater cutoff and excavation stability. A crushed stone working mat will likely also be needed at the base of utility excavations to provide a stable working surface. A geotextile fabric should be used below the crushed stone to help separate the stone and subgrade soils and help stabilize the subgrade.

In any case, all excavations must be properly shored and/or sloped in accordance with OSHA trenching regulations to prevent sloughing and caving of the sidewalls during construction. Excavations adjacent to existing buildings must be properly shored and underpinned as necessary to prevent undermining of the existing structures.

4.4 Foundation Drainage

We recommend that a perimeter foundation drainage system be provided near pile cap subgrade around the exterior side of the proposed building. The underdrain pipe may consist of 4-inch diameter perforated foundation drain with a filter sock bedded in free-draining sand meeting the requirements of MDOT 703.22 Type B Underdrain Sand. The underdrain must be placed at least 4.5 feet below exterior finish grades to provide frost protection and have a positive gravity outlet protected from freezing temperatures and backflow.

4.5 Slab-On-Grade Floors

Based on our observations of the existing concrete floor, the presence of voids below the slab and our understanding of the proposed construction, we recommend that the existing floor be completely removed. The underlying soils are not suitable for direct support of slab-on-grade floors, therefore we recommend that the existing soils be overexcavated to a depth of least 18 inches below proposed floor slabs and replaced with compacted Structural Fill overlying a woven geotextile fabric, such as Mirafi 500X, placed on exposed subgrades. It should be noted that the subsurface soils have a high organic content and may continue to settle after construction is complete resulting in unlevel floors and possibly voids below the slab. If post construction settlement of the

on-grade floor slabs is not tolerable, we recommend the on-grade floor slabs be pile supported.

We recommend that a 15-mil vapor retarder be placed directly below concrete slab-on-grade floors. The vapor retarder should have a permeance that is less than the floor covering being applied on the slab and should be installed according to the manufacturer's recommended methods including taping all joints and wall connections. Flooring suppliers should be consulted relative to acceptable vapor barrier systems for use with their products. The vapor barrier must have sufficient durability to withstand direct contact with the subslab fill and construction activity.

We recommend that control joints be installed within slabs-on-grade to accommodate shrinkage in the concrete as it cures. In general, control joints are usually installed at 10 to 15 foot spacing; however, the actual spacing of control joints should be determined by the structural engineer. We recommend that all slabs be wet-cured for a period of at least 7 days after casting as a measure to reduce the potential for curling of the concrete and excessive drying/shrinkage. We further recommend that consideration be given to using a curing paper or curing compound after the wet-cure period to improve the quality of the completed floor.

4.6 Backfill and Compaction

The existing fill soils are unsuitable for backfill against foundations or for reuse below slab and paved areas. The existing pavement gravels may be reused as compacted fills below on-grade floor slabs to form a casting bed for construction of the floor slabs and as backfill for interior foundations not exposed to freezing temperatures.

Crushed stone placed as a working mat below pile caps, grade beams at utility trenches should be clean, washed ¾-inch minus Crushed Stone Drainage Aggregate meeting the gradation requirements for MDOT 703.23 Underdrain Type C.

We recommend backfill of foundation exposed to freezing, interior foundation backfill and fill below on-grade floor slabs consist of clean, free-draining, sand and gravel meeting the gradation requirements for Structural Fill, as given below:

Structural Fill	
Sieve Size	Percent Finer by Weight
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30
No. 200	0 to 5

Fill should be placed in horizontal lifts and be compacted. Lift thickness should be generally limited to between 6 to 12 inches, as appropriate for the compaction equipment being used, such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Foundation backfill and fills placed beneath slabs, paved areas and walkways should be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557 (Modified Proctor). Crushed stone below pile-supported foundations should be compacted to provide stable access for foundation construction crews and stable subgrades for concrete placement.

4.7 Entrance Slabs

Entrance slabs at door openings should be designed to reduce the effects of differential frost action. We recommend that exterior entrance slabs be underlain with a minimum of 4.5 feet of Structural Fill extending beneath the entire width and length of entrance slab. The thickness of Structural Fill below the entrance slab should transition up to adjacent pavement subbase at a 3H:1V slope or flatter. This is to help avoid abrupt, differential heaving. All adjacent paved and grassed areas should be sloped to promote drainage away from the building periphery.

4.8 Weather Considerations

If foundation construction takes place during cold weather, subgrades, foundations, and concrete must be protected during freezing conditions. Concrete must not be placed on frozen soil and once placed, the soil and concrete must be protected from freezing. Further, the on-site fills are moisture sensitive and as such exposed soil surfaces will be susceptible to disturbance during wet conditions. Consequently, sitework and construction activities should take appropriate measures to protect exposed soils, particularly when wet.

4.9 Construction Testing

S. W. COLE ENGINEERING, INC. should be retained to provide testing and observation services during the excavation, pile driving and foundation phases of construction. This is to observe compliance with the design recommendations, drawings and specifications and to allow design changes in the event that subsurface conditions are found to differ from those anticipated prior to the start of construction.

S. W. COLE ENGINEERING, INC. is available to assist in conducting a pre-pile driving survey, provide pile driving vibration monitoring, observe pile installation, and to test soil, concrete, asphalt, steel, spray-applied fireproofing and masonry construction materials.

5.0 CLOSURE

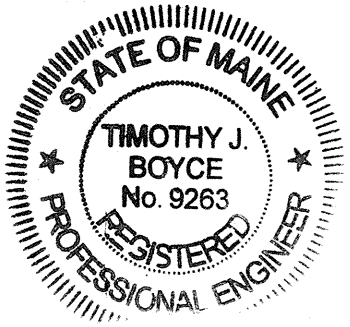
S. W. COLE ENGINEERING, INC. should be engaged to review the sitework and foundation design drawings to confirm that our recommendations have been appropriately interpreted and implemented. We look forward to working with you as the design progresses and during the construction phase.

Sincerely,

S. W.COLE ENGINEERING, INC.

Andrew R. Simmons, P.E.
Geotechnical Engineer

Timothy J. Boyce, P.E.
Senior Geotechnical Engineer



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Attachment A - Limitations

This report has been prepared for the exclusive use of OEI IVb, LLC for specific application to the proposed Custom House Square Building (W.L. Blake Building Addition #2) located at Custom House and Fore Streets in Portland, Maine. S. W. COLE ENGINEERING, INC. has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

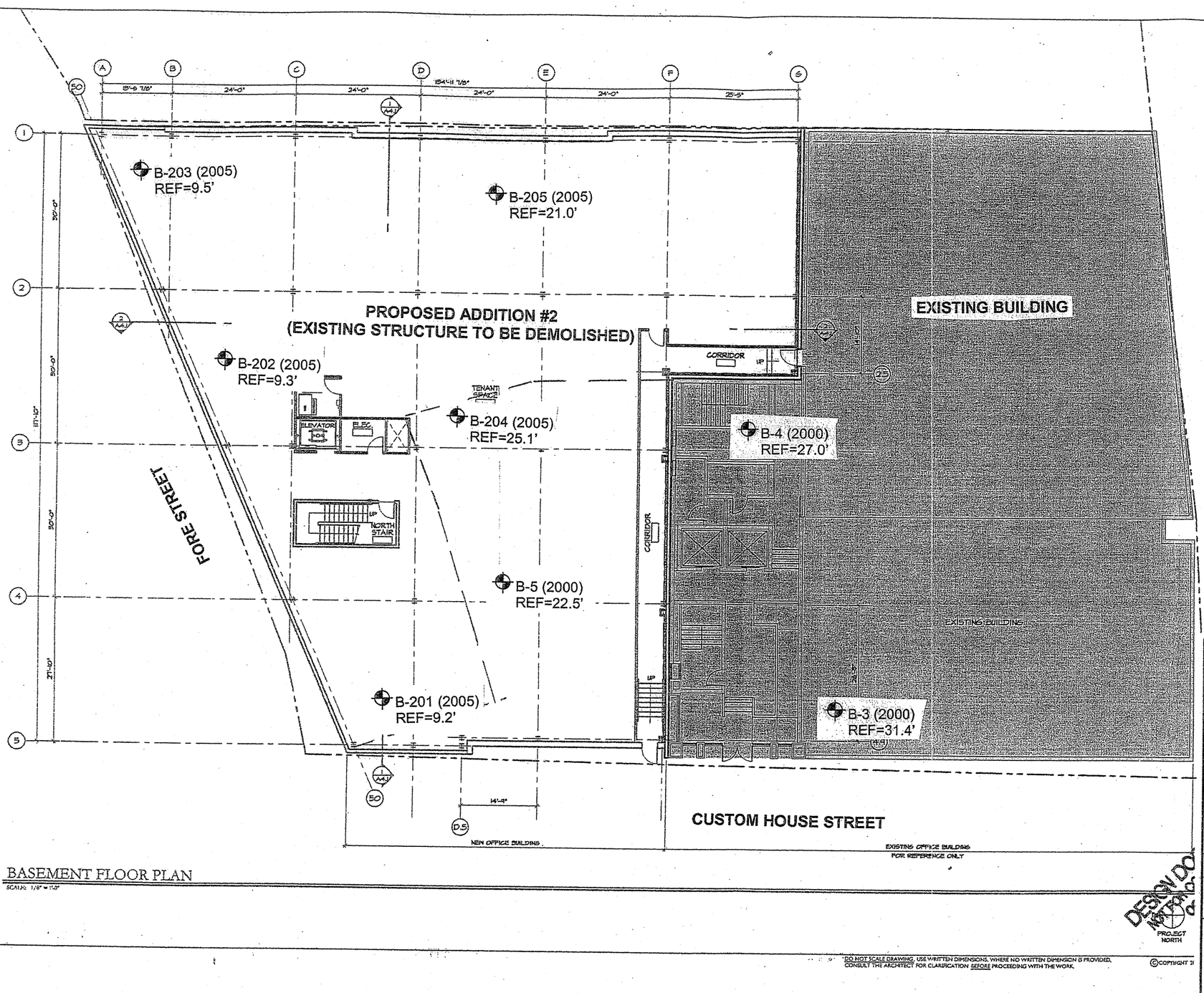
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S. W. COLE ENGINEERING, INC.'s scope of work has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S. W. COLE ENGINEERING, INC. should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S. W. COLE ENGINEERING, INC.



BASEMENT FLOOR PLAN

SCALE: 1/8" = 1'-0"

PCI
ARCHITECTURE
A DIVISION OF PHO CONI INCORPORATED
PO BOX 4170, MANCHESTER, NH 03130
TEL: 603-623-8811 FAX: 603-623-7230

ISSUE

SE SQUARE

LEGEND

Approximate Test Boring Location

NOTES

1. Exploration locations determined in the field by measurements from existing site features.
2. Base plan prepared by PCI Architecture

S.W.COLE ENGINEERING, INC.

OLYMPIA EQUITY INVESTORS

EXPLORATION LOCATION PLAN

PROPOSED W.L. BLAKE ADDITION #2
CUSTOM HOUSE AND FORE STREETS
PORTLAND, MAINE

PROJECT NO. 05-0079	SCALE: 1IN = 20FT
DATE: NOV. 2, 2005	SHEET: 1

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-201**
SHEET: 1 OF 1
PROJECT NO.: 05-0079
DATE START: 10/26/05
DATE FINISH: 10/26/05
ELEVATION: 13' +/-
SWC REP.: A. SIMMONS

PROJECT / CLIENT: PROPOSED W.L. BLAKE BUILDING ADDITION #2 / OLYMPIA EQUITY INVESTORS
LOCATION: FORE STREET, PORTLAND, MAINE
DRILLING CO. : NORTHERN TEST BORINGS, INC. DRILLER: MIKE NADEAU

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4 IN.	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
FREE WATER NOT ENCOUNTERED
SOILS APPEARED MOIST TO WET

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									5"	CONCRETE
										PROBABLE DARK BROWN FILL WITH BRICKS (NO SAMPLING - OBSERVED DRILL CUTTINGS)
									7.2'	
									9.2'	WEATHERED BEDROCK FROM 7.2 TO 8.5 FEET - VOID FROM 8.5 TO 9.2 FEET
					RQD=0%					
	1R	72"	61"	14.0'	RQD=91%					GRAY CARBONACEOUS PELITE (BEDROCK) SLIGHTLY WEATHERED, MODERATELY HARD
									14.0'	
										BOTTOM OF EXPLORATION AT 14.0 FEET

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-201**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-202**
SHEET: 1 OF 1
PROJECT NO.: 05-0079
DATE START: 10/25/05
DATE FINISH: 10/25/05
ELEVATION: 13' +/-
SWC REP.: A. SIMMONS

PROJECT / CLIENT: PROPOSED W.L. BLAKE BUILDING ADDITION #2 / OLYMPIA EQUITY INVESTORS
LOCATION: FORE STREET, PORTLAND, MAINE
DRILLING CO. : NORTHERN TEST BORINGS, INC. DRILLER: MIKE NADEAU

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4 IN.	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
HOLE CAVED AT 5.5 FEET
SOILS APPEAR SATURATED @ 9 FEET

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									4.5"	CONCRETE (3/4" REBAR AT 3" DEPTH)
	1D	24"	1"	2.5'	WOH/24"				1.0'	VOID
	2D	24"	6"	7.0'	1	1	4	5	6.5'	DARK BROWN SANDY SILT (SILT) ~ LOOSE ~
	3D	24"	8"	9.0'	26	24	19	11	9.3'	BROWN GRAVELLY SAND SOME SILT ~ DENSE ~
	1R	36"	36"	12.3'	RQD = 17%				12.3'	GRAY CARBONACEOUS PELITE (BEDROCK) HIGHLY WEATHERED, MODERATELY HARD
										BOTTOM OF EXPLORATION AT 12.3 FEET

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-202**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-203
SHEET: 1 OF 1
PROJECT NO.: 05-0079
DATE START: 10/26/05
DATE FINISH: 10/26/05
ELEVATION: 13' +/-
SWC REP.: A. SIMMONS

PROJECT / CLIENT: PROPOSED W.L. BLAKE BUILDING ADDITION #2 / OLYMPIA EQUITY INVESTORS
LOCATION: FORE STREET, PORTLAND, MAINE
DRILLING CO. : NORTHERN TEST BORINGS, INC. DRILLER: MIKE NADEAU

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4 IN.	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
HOLE CAVED AT 6.5 FEET
SOILS APPEAR SATURATED @ 9 FEET

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									5.5"	CONCRETE
	1D	24"	2"	2.5'	1	2	2	2		BLACK GRAVELLY SAND AND SILT WITH BRICK (FILL)
	2D	24"	2"	4.5'	3	8	14	8		~ LOOSE TO MEDIUM DENSE ~
	3D	24"	8"	7.0'	5	9	7	8	8.0'	
	4D	20"	6"	8.7'	4	6	28	50/2"	9.5'	BROWN GRAVELLY SILT AND SAND ~DENSE ~
										REFUSAL AT 9.5 FEET NOTE: UNABLE TO ADVANCE RODS PAST 9.5 FEET, AND UNABLE TO RE-CIRCULATE WATER. REFUSAL SURFACE LIKELY BEDROCK, BOULDER OR HARD OBSTRUCTION

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-203

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-204**
SHEET: 1 OF 1
PROJECT NO.: 05-0079
DATE START: 10/25/05
DATE FINISH: 10/25/05
ELEVATION: 13' +/-
SWC REP.: A. SIMMONS

PROJECT / CLIENT: PROPOSED W.L. BLAKE BUILDING ADDITION #2 / OLYMPIA EQUITY INVESTORS
LOCATION: FORE STREET, PORTLAND, MAINE
DRILLING CO. : NORTHERN TEST BORINGS, INC. DRILLER: MIKE NADEAU

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4 IN.	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
HOLE CAVED AT 5 FEET
SOILS APPEAR SATURATED @ 9 FEET

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									4.5"	ASPHALT
	1D	24"	12"	2.5'	7	12	11	15	3.0'	DARK BROWN GRAVELLY SAND SOME SILT (FILL) ~ MEDIUM DENSE ~
	2D	24"	12"	4.5'	12	15	14	9	5.0'	BROWN GRAVELLY SAND TRACE SILT (FILL) ~ MEDIUM DENSE ~
	3D	24"	10"	7.0'	2	3	3	3		DARK BROWN SILT AND FINE SAND TO GRAVELLY SANDY SILT WITH BRICKS (FILL) ~ LOOSE ~
	4D	24"	10"	9.0'	3	2	2	8	9.5'	
	5D	24"	8"	12.0'	3	8	10	6		BLACK SILT AND WOOD (FILL) (LIKELY RELIC WOOD CRIBBING OR RELIC TIMBER PILES) ~ LOOSE ~ DRILLED THROUGH 18" DIAMETER LOG FROM 13 TO 14.5'
	6D	24"	12"	14.0'	3	1	14	25		
	7D	24"	5"	17.0'	8	6	7	7		
	8D	24"	4"	19.0'	3	3	7	6		~ LOOSE ~
	9D	24"	2"	22.0'	5	2	6	10	22.0'	
	10D	24"	10"	24.0'	5	6	6	9	25.1'	LIGHT BROWN GRAVELLY SANDY SILT TRACE ORGANICS (NATIVE) ~ MEDIUM DENSE ~
	11D	1"	1"	25.1'	25/1"					REFUSAL AT 25.1 FEET (PROBABLE BEDROCK)

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-204**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-205**
SHEET: 1 OF 1
PROJECT NO.: 05-0079
DATE START: 10/26/05
DATE FINISH: 10/26/05
ELEVATION: 13' +/-
SWC REP.: A. SIMMONS

PROJECT / CLIENT: PROPOSED W.L. BLAKE BUILDING ADDITION #2 / OLYMPIA EQUITY INVESTORS
LOCATION: FORE STREET, PORTLAND, MAINE
DRILLING CO. : NORTHERN TEST BORINGS, INC. DRILLER: MIKE NADEAU

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4 IN.	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
HOLE CAVED AT 5 FEET
SOILS APPEAR SATURATED @ 9 FEET

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									6"	CONCRETE
	1D	24"	6"	2.5'	5	5	4	5	1.5'	DARK BROWN SILTY GRAVELLY SAND (FILL) ~ LOOSE ~
	2D	24"	10"	4.5'	5	5	6	4		BLACK SILT SOME SAND AND GRAVEL WITH BRICKS (FILL) ~.LOOSE ~
	3D	24"	12"	7.0'	3	2	2	2	8.0'	
	4D	24"	9"	9.0'	2	4	3	2	9.0'	BROWN SILT AND FINE SAND (FILL)
	5D	24"	12"	12.0'	1	1	1	16		BLACK SILT AND WOOD SOME GRAVEL (FILLS) DRILLED THROUGH EDGE OF 12" DIAMETER PAPER BIRCH LOG FROM 10 TO 11' ~ LOOSE ~ DRILLED THROUGH 12" DIAMETER LOG FROM 12.5 TO 13.5'
	6D	8"	8"	12.7'	16	50/2"			15.5'	(LIKELY RELIC WOOD CRIBBING OR RELIC TIMBER PILES)
	7D	24"	12"	17.0'	9	18	20	29		BROWN GRAVELLY SILT AND SAND (NATIVE) ~ DENSE ~
	8D	12"	1"	21.0'	10	50			21.0'	
									22.5'	ROLLER CONE (PROBABLE BEDROCK)
										REFUSAL AT 22.5 FEET (PROBABLE BEDROCK)

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-205**

S.W.COLE ENGINEERING, INC.

ROCK CORE LOG

BORING NO. B-201
PROJECT NO. 05-0079
SHEET 1 OF 1
CORE SIZE NQ

PROJECT NAME / LOCATION: PROPOSED W.L. BLAKE BUILDING ADDITION # 2 / PORTLAND, MAINE
LOGGED BY ARS DATE 10/28/05
CHECKED BY GWB DATE 10/31/05

DEPTH BELOW SURFACE (ft)	CORE RUN	CORE INTERVAL (in)	CORE RECOVERY (in)	RQD%	ROCK QUALITY	GRAPHIC LOG	ROCK DESCRIPTION AND IDENTIFICATION
8.0'							WEATHERED BEDROCK
8.5'							(16 INCH THICK)
							VOID
9.2'							
			12"	0%	VERY POOR		GRAY CARBONACEOUS PELITE HIGHLY WEATHERED - MODERATELY HARD FRACTURES @ 90 DEGREES TO HORIZONTAL
10.2'							
	1R	58"		42"/46"	EXCELLENT		GRAY CARBONACEOUS PELITE SLIGHTLY WEATHERED MODERATELY HARD FRACTURES @ 45 DEGREES TO HORIZONTAL
			42"	91%			
							ZONE OF CORE LOSS
14.0'							

S.W.COLE ENGINEERING, INC.

ROCK CORE LOG

BORING NO. B-202
PROJECT NO. 05-0079
SHEET 1 OF 1
CORE SIZE NQ

PROJECT NAME / LOCATION: PROPOSED W.L. BLAKE BUILDING ADDITION # 2 / PORTLAND, MAINE
LOGGED BY ARS DATE 10/28/05
CHECKED BY GWB DATE 10/31/05

DEPTH BELOW SURFACE (ft)	CORE RUN	CORE INTERVAL (in)	CORE RECOVERY (in)	RQD%	ROCK QUALITY	GRAPHIC LOG	ROCK DESCRIPTION AND IDENTIFICATION
9.3'	1R	36"	36"	6"/36" 17%	VERY POOR		GRAY CARBONACEOUS PELITE HIGHLY WEATHERED MODERATELY HARD FRACTURES @ 90 DEGREES TO HORIZONTAL
12.3'							

KEY TO THE NOTES & SYMBOLS
Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - based on laboratory unconfined compressive test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. based on pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass. RQD is computed from recovered core samples.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

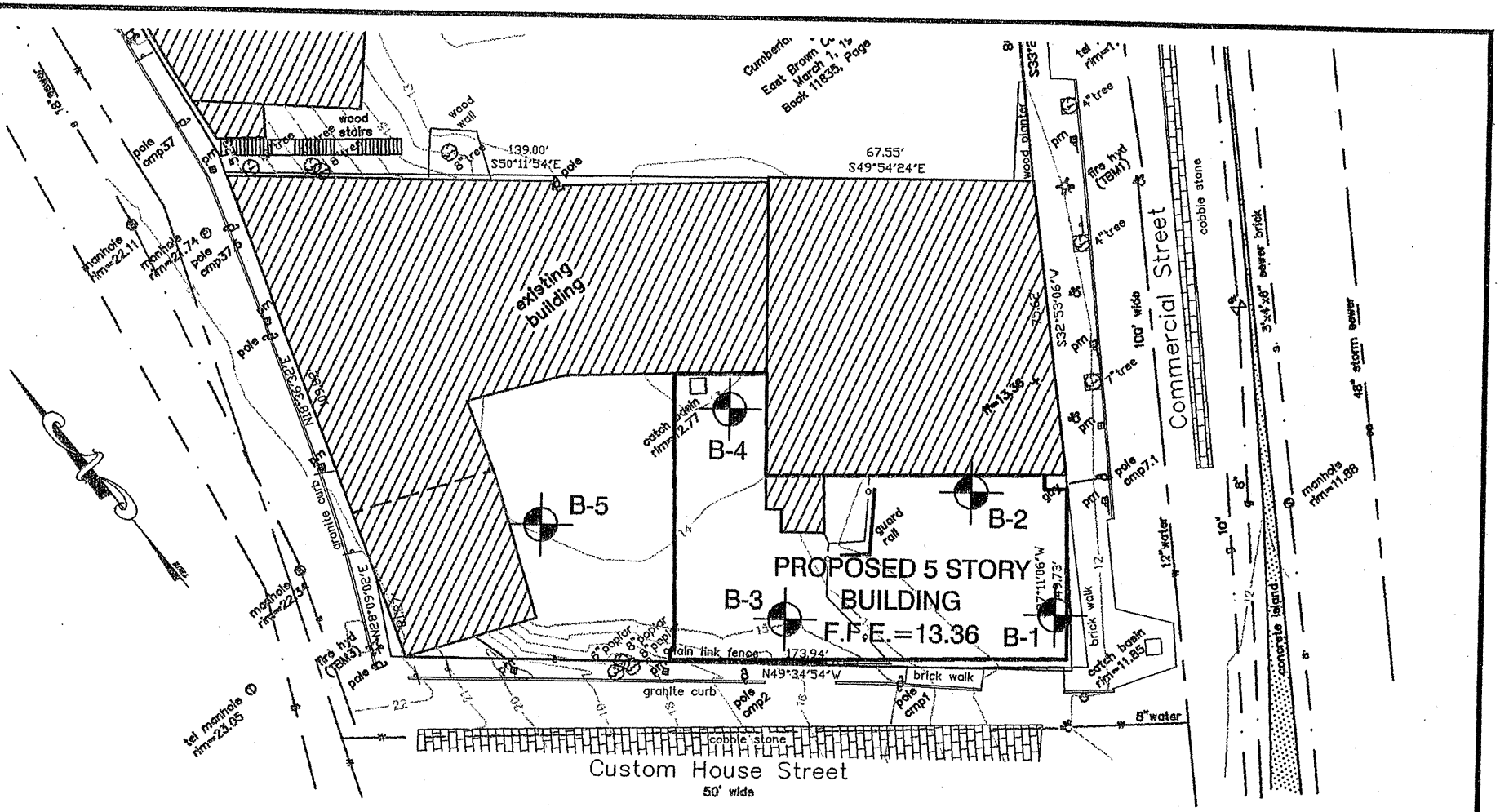
0 to 5% TRACE
5 to 12% SOME
12 to 35% "Y"
35+% AND

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

APPENDIX A



NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=20' SCALE PLAN OF THE SITE ENTITLED "STANDARD BOUNDRY SURVEY AND TOPOGRAPHIC PLAN," PREPARED BY A.R.C.C. LAND SURVEYORS INC., DATED 2/11/2000, AND A 1"=20' SCALE PLAN OF THE SITE ENTITLED "SITE PLAN," PREPARED BY ARCHETYPE, P.A. ARCHITECTS, DATED 2/15/2000.

2. THE LOCATIONS OF BORINGS HAVE BEEN DETERMINED IN THE FIELD BY TAPE MEASUREMENTS FROM EXISTING SITE FEATURES.

LEGEND

BORING LOCATION

S.W.COLE ENGINEERING, INC. GEOTECHNICAL CONSULTANTS

ALLIANCE CONSTRUCTION, INC.

EXPLORATION LOCATION PLAN

PROPOSED BLAKE BUILDING ADDITIONS
COMMERCIAL STREET
PORTLAND, MAINE

Job No.	00-0067	Scale	1"=40'
Date :	02/18/00	Sheet	1

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

BORING LOG

BORING NO.: B-1
SHEET: 1 OF 1
PROJECT NO.: 00-0067
DATE START: 2/9/00
DATE FINISH: 2/9/00
ELEVATION: 12.5 +/- ft
SWC REP.: TJB

PROJECT / CLIENT: BLAKE BUILDING ADDITIONS / ALLIANCE CONSTRUCTION
LOCATION: COMMERCIAL STREET / PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA			
SAMPLER:	S.S.	1 3/8"	140 lb	30"
CORE BARREL:				

WATER LEVEL INFORMATION
WATER @ 6.8'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.6'	BITUMENOUS PAVEMENT
	S1	24"	12"	4.0'	14	15	17	7	6.2'	BLACK-BROWN SAND AND SILT WITH BRICKS, ASH AND WOOD (FILL) ~MEDIUM DENSE~
	S2	24"	18"	7.0'	5	4	4	2	6.8'	TAN-OXIDE STAINED SAND TRACE GRAVEL TRACE SILT (FILL) ~MEDIUM DENSE~
	S3	24"	12"	12.0'	WOH	5	6	7		OLIVE-GRAY SILTY CLAY AND BLUE-GRAY SANDY SILT WITH BRICK FRAGMENTS (FILL) ~MEDIUM DENSE~
	S4	24"		17.0'	3	17	13	10	19.9'	
	R1	60"		25.0'					25.0'	QUARTZITE-BEDROCK (SEE CORE LOG, SHEET 7) RQD = 42%
										BOTTOM OF EXPLORATION @ 25.0'

SAMPLES:
D=SPLIT SPOON
C=3" SHELBY TUBE
U=3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH.-VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-1

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

BORING LOG

BORING NO.: B-2
SHEET: 1 OF 1
PROJECT NO.: 00-0067
DATE START: 2/9/00
DATE FINISH: 2/9/00
ELEVATION: 12.5 +/- ft
SWC REP.: TJB

PROJECT / CLIENT: BLAKE BUILDING ADDITIONS / ALLIANCE CONSTRUCTION
LOCATION: COMMERCIAL STREET / PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA			
SAMPLER:	S.S.	1 3/8"	140 lb	30"
CORE BARREL:				

WATER LEVEL INFORMATION

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.3'	BITUMENOUS PAVEMENT
										PROBABLE FILL - NO SAMPLING
									17.5'	REFUSAL @ 17.5' (PROBABLE BEDROCK)

SAMPLES:
D=SPLIT SPOON
C=3" SHELBY TUBE
U=3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH.-VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-2

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

BORING LOG

BORING NO.: B-3
SHEET: 1 OF 1
PROJECT NO.: 00-0067
DATE START: 2/9/00
DATE FINISH: 2/9/00
ELEVATION: 15 +/- ft
SWC REP.: TJB

PROJECT / CLIENT: BLAKE BUILDING ADDITIONS / ALLIANCE CONSTRUCTION
LOCATION: COMMERCIAL STREET / PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA			
SAMPLER:	S.S.	1 3/8"	140 lb	30"
CORE BARREL:				

WATER LEVEL INFORMATION

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.5'	BITUMENOUS PAVEMENT
	S1	24"	20"	4.0'	7	8	8	6		BLACK-BROWN SAND AND SILT WITH BRICKS AND WOOD (FILL)
	S2	24"	12"	7.0'	2	2	2	8		~MEDIUM DENSE TO LOOSE~
	S3	24"	6"	12.0'	3	2	2	3		PETROLEUM ODOR
	S4	24"	10"	17.0'	3	8	10	18		PETROLEUM ODOR
									19.0'	
	S5	24"	12"	22.0'	5	6	12	13		GRAY-BROWN SILTY SAND TRACE GRAVEL (GLACIAL TILL)
	S6	24'	20"	27.0'	4	14	15	11		~MEDIUM DENSE~
16	ROD PROBE									
13										
58										
110									31.4'	
										REFUSAL @ 31.4' (PROBABLE BEDROCK)

SAMPLES:
D=SPLIT SPOON
C=3" SHELBY TUBE
U=3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH.-VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-3

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

BORING LOG

BORING NO.: B-4
SHEET: 1 OF 1
PROJECT NO.: 00-0067
DATE START: 2/9/00
DATE FINISH: 2/9/00
ELEVATION: 13.5 +/- ft
SWC REP.: TJB

PROJECT / CLIENT: BLAKE BUILDING ADDITIONS / ALLIANCE CONSTRUCTION
LOCATION: COMMERCIAL STREET / PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA			
SAMPLER:	S.S.	1 3/8"	140 lb	30"
CORE BARREL:				

WATER LEVEL INFORMATION

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.4'	BITUMENOUS PAVEMENT
	S1	24"	22"	7.0'	7	9	14	16	9.0'	BLACK-BROWN SAND AND SILT WITH GRAVEL, BRICKS AND WOOD (FILL) ~MEDIUM DENSE~
	S2	7"	7"	14.6'	25	33/1			17.0'	WOOD FROM 9 TO 10 FT SAMPLER DROPPED TO 14 FT (PROBABLE VOID) WOOD AND VOIDS WOOD IN SAMPLER 14.0 TO 14.6 FT
	S3	24"	12"	22.0'	30	33	16	16	24.0'	GRAY SILTY SAND TRACE GRAVEL (GLACIAL TILL) ~DENSE~
	S4	24"	24"	27.0'	19	33	16	16	27.0'	BROWN SILTY GRAVELLY SAND WITH ROCK FRAGMENTS (TILL) ~DENSE~
										BOTTOM OF EXPLORATION @ 27.0'

SAMPLES:
D=SPLIT SPOON
C=3" SHELBY TUBE
U=3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH.-VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-4

S.W.COLE ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

BORING LOG

BORING NO.: B-5
SHEET: 1 OF 1
PROJECT NO.: 00-0067
DATE START: 2/9/00
DATE FINISH: 2/9/00
ELEVATION: 14 +/- ft
SWC REP.: TJB

PROJECT / CLIENT: BLAKE BUILDING ADDITIONS / ALLIANCE CONSTRUCTION
LOCATION: COMMERCIAL STREET / PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:				
SAMPLER:	S.S.	1 3/8"	140 lb	30"
CORE BARREL:				

WATER LEVEL INFORMATION

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.4'	BITUMENOUS PAVEMENT
	S1	24"	14"	7.0'	6	9	5	4		BLACK-BROWN SAND AND SILT WITH BRICK FRAGMENTS AND WOOD (FILL) ~MEDIUM DENSE~
	S2	24"	9"	12.0'	WOH	WOH	4	6	14.0'	
	S3	24"		17.0'	1	2	2	2		GRAY SILTY SAND TRACE GRAVEL (FILL) ~LOOSE~
	S4	24"		22.0'	1	1	WOH	WOH	22.5'	REFUSAL @ 22.5' (PROBABLE BEDROCK)

SAMPLES:
D=SPLIT SPOON
C=3" SHELBY TUBE
U=3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH.-VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-5

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

ROCK CORE LOG

BORING NO. B-1
PROJECT NO. 00-0067
SHEET 1 OF 1
CORE SIZE NQ2

PROJECT NAME / LOCATION: BLAKE BUILDING / PORTLAND, MAINE
LOGGED BY MTT DATE 2/15/00
CHECKED BY GWB DATE 2/18/00

DEPTH BELOW SURFACE (ft)	CORE RUN	CORE INTERVAL (in)	CORE RECOVERY (in)	RQD%	ROCK QUALITY	GRAPHIC LOG	ROCK DESCRIPTION AND IDENTIFICATION
20.0'							HIGHLY FRACTURED ZONE, PIECES LESS THEN 1"
	R1	60"	56"	42%	POOR		GRAY TO GREENISH QUARTZITE - VERY FRACTURED, FRACTURES AT 30 TO 50 DEGREES FROM HORIZONTAL, MODERATLEY HARD AND SLIGHTLY WEATHERED
25.0'							ZONE OF CORE LOSS
							BOTTOM OF EXPLORATION @ 25.0'

SECTION 02230

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants and grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, abandoning site utilities in place and removing site utilities.
7. Temporary erosion and sedimentation control measures.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 1 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.

2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.

3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.

4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.

2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.4 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in Division 2 Sections covering site utilities.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.

4. Use only hand methods for grubbing within tree protection zone.

5. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches.

2. Do not stockpile topsoil within tree protection zones.

3. Dispose of excess topsoil as specified for waste material disposal.

4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 02230

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes construction dewatering.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
2. Division 2 Section "Excavation Support and Protection."
3. Division 2 Section "Earthwork" for excavating, backfilling, site grading and for site utilities.
4. Division 2 Section "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
4. Remove dewatering system if no longer needed.

1.4 SUBMITTALS

A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written report outlining control procedures to be adopted if dewatering problems arise.
3. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

D. Record drawings at Project closeout identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions performed during dewatering.

1. Note locations and capping depth of wells and well points.

E. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: A geotechnical report has not been prepared for this Project.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 OBSERVATION WELLS

A. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated and additional observation wells as may be required by authorities having jurisdiction.

B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

1. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

END OF SECTION 02240

SECTION 02260

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes temporary excavation support and protection systems.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.

2. Division 2 Section "Dewatering" for dewatering excavations.

3. Division 2 Section "Earthwork" for excavating and backfilling and for existing utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.

2. Prevent surface water from entering excavations by grading, dikes, or other means.

3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: A geotechnical report has not been prepared for this Project.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches.

E. Shotcrete: Comply with Division 3 Section "Shotcrete" for shotcrete materials and mixes, reinforcing, and shotcrete application.

F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER BEAMS AND LAGGING

A. Install steel soldier beams before starting excavation. Space soldier beams at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier beams as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at centers indicated and secure to soldier beams.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Tiebacks: Drill for, install, grout, and tension tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.

2. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Architect.

2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.

2. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 02260

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. State of Maine Department of Transportation Standard Specifications.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling for utility trenches.
8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 2 Section "Dewatering" for lowering and disposing of ground water during construction.
2. Division 2 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
3. Division 2 Section "Subdrainage" for drainage of foundations, slabs-on-grade, walls and landscaped areas.

1.3 UNIT PRICES (NOT USED)

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 2 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.

2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 2 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.

2. Geotextile.

3. Controlled low-strength material, including design mixture.

B. Samples: 12-by-12-inch Sample of subdrainage and separation geotextile.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.

2. Laboratory compaction curve according to ASTM D 698 and ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.

D. Blasting Plan: For record purposes and approval by authorities having jurisdiction.

E. Seismic Survey Report: For record purposes; from seismic survey agency.

F. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.

2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:

1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.

2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

D. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand. Subbase material shall conform to Section 703 – AGGREGATES, 703.06 Aggregates for Base and Subbase of the State of Maine Department of Transportation (MDOT) Standard Specifications.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand. Base material shall conform to Section 703 – AGGREGATES, 703.06 Aggregates for Base and Subbase of the State of Maine Department of Transportation (MDOT) Standard Specifications.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand. Engineered Fill material shall conform to Section 703 – AGGREGATES, 703.19 Granular Borrow of the State of Maine Department of Transportation (MDOT) Standard Specifications.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; Bedding course material shall conform to Section 703 – AGGREGATES, 703.31 Crushed Stone of the State of Maine Department of Transportation (MDOT) Standard Specifications.

H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.

2. Grab Tensile Strength: 157 lbf; ASTM D 4632.

3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: 0.43 mm maximum; ASTM D 4751.
7. Permittivity: 0.05 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:

1. Portland Cement: AASHTO M85, Type II or III.
2. Fly Ash: AASHTO M295, Class F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 80 psi, when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495.

2.4 GEOFOAM (NOT USED)

2.5 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

1. Perform blasting without damaging adjacent structures, property, or site improvements.
2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil

materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches beneath bottom of concrete slabs on grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches beneath bottom of concrete slabs on grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.

3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.

G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 GEOFOAM FILL (NOT USED)

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.

3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.

2. Walks: Plus or minus 1/8 inch.

3. Pavements: Plus or minus 3/16 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.19 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase and base course to required crown elevations and cross-slope grades.

4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.

5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 and ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 and ASTM D 1557.

3.20 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place drainage course 6 inches or less in compacted thickness in a single layer.

3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02510

WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water-distribution piping and specialties outside the building for the following:

1. Water services.
2. Fire-service mains.
3. Combined water service and fire-service mains.
4. Aboveground water piping for applications other than water-service piping.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

C. All water materials shall meet the requirements of the Portland Water District.

1.3 DEFINITIONS

A. Combined Water Service and Fire-Service Main: Exterior water piping for both domestic-water and fire-suppression piping.

B. Fire-Service Main: Exterior fire-suppression-water piping.

C. Fire-Suppression-Water Piping: Interior fire-suppression-water piping.

D. Water-Distribution Piping: Interior domestic-water piping.

E. Water Service: Exterior domestic-water piping.

F. The following are industry abbreviations for plastic materials:

1. PA: Polyamide (nylon) plastic.
2. PE: Polyethylene plastic.
3. PEX: Cross linked polyethylene plastic.
4. PP: Polypropylene plastic.
5. PVC: Polyvinyl chloride plastic.
6. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
7. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Piping specialties.
2. Valves and accessories.
3. Water meters and accessories.
4. Backflow preventers and assemblies.

5. Protective enclosures.
6. Fire hydrants.
7. Flushing hydrants.
8. Fire department connections.
9. Alarm devices.
10. Post hydrants.
11. Drinking fountains.

B. Shop Drawings: For the following:

1. Precast concrete vaults, including frames and covers, ladders, and drains.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: For piping and specialties including relation to other services in same area. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field Quality-Control Test Reports: From Contractor.

E. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:

1. Water meters.
2. Valves.
3. Backflow preventers.
4. Protective enclosures.
5. Fire hydrants.
6. Flushing hydrants.
7. Post hydrants.
8. Drinking fountains.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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

E. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

F. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

G. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

H. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.

2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with Portland Water District requirements, provide products by the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

C. Grooved-End, Ductile-Iron Pipe: AWWA C151, with one or both ends with cut rounded grooves according to AWWA C606.

1. Ductile-Iron, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
2. Ductile-Iron-Piping Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Ductile-Iron Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

E. Ductile-Iron Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

F. Ductile-Iron Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

2.4 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B 88, Type K, ASTM B 88, Type L, and ASTM B 88, Type M, water tube, drawn temper.

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.5 PE PIPE AND FITTINGS

A. PE, ASTM Pipe: ASTM D 2239, SIDR Numbers 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 160 psig.

1. Insert Fittings for PE Pipe: ASTM D 2609 made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.

2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

B. PE, AWWA Pipe: AWWA C906, DR Numbers 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 160 psig.

1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 160 psig.

C. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe and also FM approved, with minimum thickness equivalent to FM Class 150 and Class 200.

1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

2.6 PEX TUBE AND FITTINGS

A. PEX Tube: ASTM F 876, SDR 9.

1. Brass Fittings for PEX Tube: Insert type with corrosion-resistant metal bands.

2.7 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, Schedule 80 Pipe: ASTM D 1785.

1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.

2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

C. PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.

2. PVC Fabricated Fittings: AWWA C900, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.8 FIBERGLASS PIPE AND FITTINGS (NOT USED)

2.9 JOINING MATERIALS

A. Transition Couplings:

1. Underground Piping, NPS 1-1/2 and Smaller: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2. Underground Piping, NPS 2 and Larger: AWWA C219, metal, sleeve-type coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

3. Aboveground or Vault Piping: Pipe fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Soldering Flux: ASTM B 813, water-flushable type.

D. Solder Filler Metal: ASTM B 32, lead-free type with 0.20 percent maximum lead content.

E. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

F. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.10 PIPING SPECIALTIES

A. Flexible Connectors:

1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.

2. Ferrous Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

B. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.

1. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.

2. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure to suit system pressures.

3. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

    a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.

4. Dielectric Couplings: Galvanized-steel couplings with inert and non-corrosive thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 deg F.

5. Dielectric Nipples: Electroplated steel nipples with inert and non-corrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig minimum working pressure at 225 deg F.

2.11 CORROSION-PROTECTION ENCASEMENT FOR PIPING

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.12 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers:

a. U.S.P. Metroseal.

b. AFC Series 2500.

c. Mueller A-2360.

d. Clow Series F6100.

2. Nonrising-Stem, Metal-Seated Gate Valves: AWWA C500, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

a. Minimum Working Pressure: 200 psig.

b. End Connections: Mechanical joint.

c. Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Minimum Working Pressure: 200 psig.

b. End Connections: Mechanical joint.

c. Interior Coating: Complying with AWWA C550.

4. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves: AWWA C509, ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Minimum Working Pressure: 250 psig.

b. End Connections: Push-on or mechanical joint.

c. Interior Coating: Complying with AWWA C550.

5. OS&Y, Rising-Stem, Metal-Seated Gate Valves: AWWA C500, cast-iron or ductile-iron body and bonnet, outside screw and yoke, cast-iron double disc, bronze disc and seat rings, and bronze stem.

a. Minimum Working Pressure: 200 psig.

b. End Connections: Flanged.

6. OS&Y, Rising-Stem, Resilient-Seated Gate Valves: AWWA C509, cast-iron or ductile-iron body and bonnet, outside screw and yoke; with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

a. Minimum Working Pressure: 200 psig.

b. End Connections: Flanged.

2.13 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.

1. Available Manufacturers:

a. U.S.P. Metroseal.

b. AFC Series 2500.

c. Mueller A-2360.

d. Clow Series F6100.

2. Tapping Sleeve: Cast- or ductile-iron or stainless steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.

3. Valve: AWWA, cast-iron, nonrising-stem, metal resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5-inch- diameter barrel.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FM-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

D. Indicator Posts: UL 789, FM-approved, horizontal, wall-type, cast-iron body with operating wrench, extension rod, and cast-iron barrel.

2.14 CHECK VALVES (NOT USED)

2.15 CORPORATION VALVES AND CURB VALVES

A. Available Manufacturers:

1. Amcast Industrial Corporation; Lee Brass Co.

2. Ford Meter Box Company, Inc. (The).

3. Grinnell Corporation; Mueller Co.; Water Products Div.

4. Jones, James Company.

5. Master Meter, Inc.

6. McDonald, A. Y. Mfg. Co.

7. Red Hed Manufacturing Co.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.

2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over curb valve, and approximately 3-inch- diameter barrel.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.16 WATER-REGULATING VALVES

A. Available Manufacturers:

1. Ames Co., Inc.
2. BERMAD.
3. Cla-Val Co.
4. GA Industries, Inc.
5. IMI Cash Valve, Inc.
6. OCV Control Valves.
7. Watts Industries, Inc.; Water Products Div.

B. Pressure-Regulating Valves: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. Include 250-psig working-pressure design, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment.

C. Flow-Regulating Valves: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. Include 250-psig working-pressure design, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment.

2.17 RELIEF VALVES

A. Available Manufacturers:

1. BERMAD.
2. GA Industries, Inc.
3. MULTIPLEX Manufacturing Co.
4. OCECO, Inc.
5. Val-Matic Valve & Mfg. Corp.

B. Air-Release Valves: AWWA C512, hydro-mechanical device to automatically release accumulated air. Include 300-psig working-pressure design.

C. Air/Vacuum Valves: AWWA C512, direct-acting, float-operated, hydro-mechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping. Include 300-psig working-pressure design.

D. Combination Air Valves: AWWA C512, float-operated, hydro-mechanical device to automatically release accumulated air or to admit air. Include 300-psig working-pressure design.

2.18 DETECTOR CHECK VALVES

A. Available Manufacturers:

1. Ames Co., Inc.
2. Badger Meter, Inc.
3. CMB Industries, Inc.; Febco Div.
4. Firematic Sprinkler Devices, Inc.
5. Globe Fire Sprinkler Corporation.
6. Grinnell Corporation; Mueller Co.; Hersey Meters.
7. McWane, Inc.; Kennedy Valve Div.
8. Smith-Blair, Inc.
9. Victaulic Co. of America.
10. Viking Corporation.
11. Watts Industries, Inc.; Water Products Div.

B. Detector Check Valves: UL 312, galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends; designed for 175-psig working pressure. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

1. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

C. Detector Check Valves: UL 312, FM-approved detector check, iron body, corrosion-resistant clapper ring and seat ring material, 175-psig working pressure, flanged ends, with connections for bypass and installation of water meter.

2.19 WATER METERS

A. Water meters will be furnished by utility company. Refer to Mechanical Specifications.

2.20 DETECTOR-TYPE WATER METERS

A. Available Manufacturers:

1. Badger Meter, Inc.
2. Grinnell Corporation.
3. Grinnell Corporation; Mueller Co.; Hersey Meters.
4. Schlumberger Limited; Water Div.
5. Sensus Technologies, Inc.

B. Description: AWWA C703, UL-listed, FM-approved, main line, proportional, detector type, 150-psig working pressure, with meter on bypass. Register flow in gallons unless cubic feet are indicated.

1. Bypass Meter: AWWA C702, compound-type, bronze case; at least one-half nominal size of main-line meter.

C. Remote Registration System: Utility company standard; direct-reading type complying with AWWA C706. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

2.21 WATER-METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter with lettering "WATER METER" in cover; and slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter with lettering "WATER METER" in top cover; separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Description: Polymer-concrete body and cover for disc-type water meter with lettering "WATER" in cover; and slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square.

2.22 HOSE-CONNECTION, BACKFLOW-PREVENTION DEVICES

A. General: ASSE standard, non-removable type, backflow-prevention devices with ASME B1.20.7, garden-hose threads on outlet.

B. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with manual drain feature. Units attached to rough-bronze-finish hose connections may be rough bronze.

C. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves and intermediate atmospheric vent.

2.23 BACKFLOW PREVENTERS

A. Refer to Mechanical Specifications and local utility company requirements.

2.24 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.

B. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.

C. Manhole: ASTM A 48, Class No. 35 minimum tensile strength, gray-iron traffic frame and cover.

1. Dimensions: Not smaller than 24-inch diameter, unless otherwise indicated.

D. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron, 24-inch- minimum-diameter traffic frame and cover.

E. Drain: ASME A112.21.1M, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.25 PROTECTIVE ENCLOSURES (NOT USED)

2.26 FREESTANDING FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants: UL 246, FM-approved, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

B. Dry-Barrel, High-Pressure Fire Hydrants: UL 246, FM-approved, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall

have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 250-psig minimum working-pressure design.

C. Dry-Barrel Fire Hydrants: AWWA C502, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

D. Dry-Barrel, High-Pressure Fire Hydrants: AWWA C502, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 250-psig minimum working-pressure design.

1. Available Manufacturers:
    a. American AVK Co.; Valves & Fittings Div.
    b. American Cast Iron Pipe Co.; American Flow Control Div.
    c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    d. American Foundry Group, Inc.
    e. East Jordan Iron Works, Inc.
    f. Grinnell Corporation; Mueller Co.; Water Products Div.
    g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    h. McWane, Inc.; Kennedy Valve Div.
    i. McWane, Inc.; M & H Valve Company Div.
    j. Troy Valve.
    k. United States Pipe and Foundry Company.
2. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
3. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
4. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
5. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.27 WALL FIRE HYDRANTS (NOT USED)

2.28 FLUSHING HYDRANTS (NOT USED)

2.29 FIRE DEPARTMENT CONNECTIONS (NOT USED)

2.30 ALARM DEVICES (NOT USED)

2.31 POST HYDRANTS (NOT USED)

2.32 DRINKING FOUNTAINS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

C. Do not use flanges, unions, or keyed couplings for underground piping.

D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground Water-Service Piping: Use the following piping materials for each size range:

1. NPS ¾" – 2": PVC, C-900; SDR-21; Gaskets per ASTM F477.

2. NPS 4" and larger: Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

F. Aboveground and Vault Water-Service Piping: (NOT USED)

G. Aboveground Water Piping: (NOT USED)

H. Underground Fire-Service-Main Piping: (NOT USED)

I. Aboveground and Vault Fire-Service-Main Piping: Ductile-iron pipe with grooved ends; ductile-iron, grooved-end fittings; ductile-iron keyed couplings; and grooved joints.

J. Underground Combined Water-Service and Fire-Service-Main Piping: Use the following:

1. NPS 6 to NPS 12: Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

2. NPS 6 to NPS 12: PVC, AWWA Class 200 pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.

3. NPS 6 to NPS 12: Fiberglass, AWWA, FM-approved RTRP, Class 200; RTRF; and gasketed joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3" and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient -seated gate valves with valve box.

2. Use the following for valves in vaults and aboveground:

a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.

b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.

c. Check Valves: AWWA C508, swing-check valves.

3. Water-Regulating Valves: Use for water-service piping in vaults and aboveground.

a. Pressure-Regulating Valves: To control water pressure.

b. Flow-Regulating Valves: To control water flow.

4. Relief Valves: Use for water-service piping in vaults and aboveground.

a. Air-Release Valves: To release accumulated air.

b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.

c. Combination Air Valves: To release or admit air.

5. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.

2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

3. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.

4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.

5. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Utility Materials" for joining piping of dissimilar metals.

3.5 PIPING SYSTEMS - COMMON REQUIREMENTS (NOT USED)

3.6 PIPING INSTALLATION

A. Water-Main Connection: Arrange with Portland Water District for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of Portland Water District and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.

2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.

3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.

4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.

2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.

3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.

4. Install corporation valves into service-saddle assemblies.

5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

G. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

H. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.

I. Install PE pipe according to ASTM D 2774 and ASTM F 645.

J. Install PEX tubing according to ASTM D 2774 and ASTM F 645.

K. Bury piping with depth of cover over top at least 66 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
1. Under Driveways: With at least 36 inches cover over top.
2. Under Railroad Tracks: With at least 48 inches cover over top.
3. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

L. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

M. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.

N. Sleeves are specified in Division 15.

O. Mechanical sleeve seals per Portland Water District requirements.

P. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

Q. Anchor service-entry piping to building wall.

R. See Division 15 for potable-water piping inside the building.

S. See Division 13 Sections for fire-suppression water piping inside the building.

T. Install water-supply piping with shutoff valve in water supply to each post hydrant. Use curb valve and service box.

U. Install trap below frost line on drain outlet of each drinking fountain.

3.7 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

B. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

D. Water-Regulating Valves: Install in vault or aboveground between shutoff valves.

E. Relief Valves: Install aboveground with shutoff valve on inlet.

F. Detector Check Valves: Install in vault or aboveground.

3.9 DETECTOR CHECK VALVE INSTALLATION

A. Install detector check valves for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

B. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 WATER-METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written requirements.

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water-meter installation according to utility company's written instructions and requirements.

3.12 BACKFLOW-PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.13 VAULT CONSTRUCTION INSTALLATION

A. See Division 3 Section "Cast-in-Place Concrete" for concrete vaults.

B. Install precast concrete vaults according to ASTM C 891.

C. Connect drain outlet to storm drainage piping.

3.14 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.15 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA-Type Fire Hydrants: Comply with AWWA M17.

D. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.16 FLUSHING HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.

C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.17 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connections of types and features indicated.

B. Install ball drip valves at each check valve for fire department connection to mains.

C. Install protective pipe bollards on three sides of each freestanding fire department connection. Refer to Division 5 for pipe bollards.

3.18 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.

2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:

1. Valves: Install chain and padlock on open OS&Y gate valve.

2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Division 13 Section "Fire Alarm."

3.19 POST HYDRANT INSTALLATION

A. Install post hydrants in pavement or with concrete anchor.

3.20 DRINKING FOUNTAIN INSTALLATION

A. Install drinking fountains anchored to concrete pavement or to concrete block.

3.21 CONNECTIONS

A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping and specialties.

B. See Division 2 Section "Utility Materials" for piping connections to valves and equipment.

C. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

D. Connect water-distribution piping to post hydrants and drinking fountains.

E. Connect water-distribution piping to interior domestic-water and fire-suppression piping.

F. Connect waste piping from drinking fountains to sanitary sewerage system. See Division 2 Section "Sanitary Sewerage" for connection to sanitary-sewer piping.

G. Ground equipment according to Division 16.

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

3.22 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.23 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.

B. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Utility Materials" for identifying devices.

3.24 ADJUSTING

A. Adjust drinking fountain flow regulators for proper flow and stream height.

3.25 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.

c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

C. After completing drinking fountain installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

D. Clean drinking fountains, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 02510

SECTION 02511

ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide all material and labor for the placement of surface course and binder course on roads, access drives, parking lots, sidewalks, and walkways. Reference MDOT Standard Specifications for Highways & Bridges, Section 401 for Hot Mix Asphalt.

1.2 REFERENCES

A. December 2002 MDOT Standard Specifications, Highways & Bridges, including relevant updates, except as modified herein.

B. December 2002 MDOT Standard Details, Highways & Bridges.

C. MS-2 - Mix design methods for asphalt concrete and other hot mix types - The Asphalt Institute (AI).

D. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).

E. Hot Mix. Asphalt Paving Handbook - US Army Corp of Engineers, UN-13 (CE MP-ET).

F. MS-19 - Basic Asphalt Emulsion Manual - The Asphaltic Institute (AI).

G. ASTM D946 - Penetration - Graded Asphalt Cement for use in Pavement Construction.

H. AASHTO M-226/ASTM D3381 Asphalt Cement

I. AASHTO M-140/ASTM D997 or AASHTO M-208/ASTM D-2397 Tack Coat

J. AASHTO M-117/ASTM D242 Mineral Filler

K. AASHTO T-245/ASTM D1559 Marshall Mix Design

L. Approved and released for construction plans.

1.3 RELATED SECTIONS

A. Section 02220 - Excavation, Backfilling and Compaction

B. Section 02227 - Aggregate Material

C. Section 02520 - Portland Cement Concrete Paving

D. Section 02525 - Curbs and Sidewalks

E. Section 02584 - Pavement Markings

1.4 SUBMITTALS

A. Design Mix: Before any asphaltic concrete paving is constructed, the Contractor shall submit the proposed actual design mix to the Owner for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, asphalt cement grade used, Marshall Stability (lbs), flow, effective asphalt content (percent), and direct references to the applicable highway department specifications sections for each material. Design shall be for a mixture listed in the most recent edition of roadway specifications of the state in which the project is to be constructed. In no case shall a mix design over three years old be submitted.

B. Material Certificates: Submit materials certificate to an independent testing laboratory retained by the Owner. The certificates shall be signed by the material producer and contractor, certifying that materials comply with, or exceed, the requirements herein.

C. Field density test results, minimum 1 per 100 tons of bituminous pavement placed including sta/offset of test.

D. Plant inspection reports to verify pavement batch plant and paving equipment meets or exceeds MDOT Specification 401. The inspections shall be conducted by an independent testing firm retained by the Owner.

1.5 JOB CONDITIONS

A. Weather Limitations:

1. Apply tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application.

2. Construct asphaltic concrete paving when atmospheric temperature is above 40 degrees F base, 50 degrees F surface.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide asphaltic concrete mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet State Department of Transportation specifications and exhibit satisfactory record on previous installations.

B. Asphalt Cement: Comply with AASHTO M-226/ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, AR-80, viscosity grade, depending on local mean annual air temperature. (See following chart):

Temperature Condition	Asphalt Grades
Cold, mean annual air temperature < 7° C (45° F)	AC-10 85/100 pen.
Warm, mean annual air temperature between 7° C (45° F) and 24° C (75° F)	AC-20 60/70 pen.
Hot, mean annual air temperature > 24° C (57° F)	AC-30

Final acceptance of the proper grade of A.C. shall be made by the Owner's Engineer.

C. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.

D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D242, if recommended by applicable state highway standards.

E. Asphalt-Aggregate Mixture: Unless otherwise noted on the Drawings, the Design Mix shall have a minimum stability based on a 50-blow Marshall complying with ASTM D 1559 of 1000 lbs. with a flow between 8 and 16. The Design Mix shall be within sieve analysis and bitumen ranges below:

SIEVE ANALYSIS OF MIX

Square Sieve	Total Percent Passing	Percent Tolerance
3/4"	100	
1/2"	80-100%	5%
3/8"	65-93%	4%
#8	40-55%	4%
#50	12-27%	2%
#200	0-10%	0%

Percent bitumen by weight of total mix: 5.0 - 8.5.

Air voids: 3-6%

Percent aggregate voids filled with asphalt cement: 70-82%

Allowable variance of percent bitumen by weight of total mix=0.4

2.2 EQUIPMENT

Maintain all batch plant and paving equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose material from compacted base material surface immediately before applying prime coat.

B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.

C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

3.2 APPLICATIONS

A. Tack Coat:

1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.

2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat on the surface of all such bases where asphaltic concrete paving will be constructed.

3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and applicable state highway specifications.

4. Apply at minimum rate of 0.05 gallon per square yard of surface.

5. Allow to dry until at proper condition to receive paving.

3.3 ASPHALTIC CONCRETE PLACEMENT

A. Place asphalt concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:

1. When ambient temperature is between 40 degrees F and 50 degrees F: 285 degrees F.

2. When ambient temperature is between 50 degrees F and 60 degrees F: 280 degrees F.

3. When ambient temperature is higher than 60 degrees F: 275 degrees F.

B. Whenever possible, all pavement shall be spread by a finishing machine. Inaccessible or irregular areas, pavement may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.4 WEATHER AND SEASONAL LIMITATIONS

For weather limitations the State of Maine will be considered to be divided into two paving zones:

(a) Zone 1: All area north of US Route 2 from Gilead to Brewer and north of Route 9 from Brewer to Calais.

(b) Zone 2: All area south of Zone 1 including the US Route 2 and Route 9 boundaries.

Bituminous plant mix for use other than traveled way wearing course may be placed in either zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer placed in the shade at the paving location is 35 degrees F or higher and the area to be paved is not frozen. Plant mix to be placed as traveled way wearing course may be placed in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th provided the air temperature determined above is 50 degrees F or higher.

Any hot bituminous base or binder course that is to be subject to traffic during the winter months shall have its gradation densified or asphalt content (percent of mix) adjusted through a change in the job mix formula as submitted by the Contractor and approved by the Owner.

3.5 ROLLING AND COMPACTION

A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. Mixture shall be compacted to a minimum, of 92% theoretical maximum density. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 FIELD QUALITY CONTROL

A. An Independent Testing Laboratory, selected and paid by Owner, shall be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, density, composition and surface smoothness. Asphaltic surface and asphaltic base/binder courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. In no event shall less than three cores in light duty areas and three cores in heavy duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design.

B. Grade Control: Establish and maintain required lines and elevations.

C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner's; until specified thickness of the course is met or exceeded at no additional expense to the Owner.

D. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to the owner upon request. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface: 1/4"

Wearing Course Surface: 3/16"

E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.

F. Compaction: Field density tests for in-place materials shall be performed by examination of field cores in accordance with one of the following standards:

1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.

2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

G. Pavement Plant Inspection: The paving plant shall be inspected a minimum of one week prior to pavement placement to verify the plant meets the requirements outlined in Section 401. Random inspection and sampling during pavement placement shall be conducted and documented by a testing firm hired and paid for by the Owner.

END OF SECTION 02511

SECTION 02525

CURB AND SIDEWALKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Bituminous Curb

B. Granite Curb

C. Bituminous Sidewalk

D. Brick Sidewalk

1.2 RELATED SECTIONS

A. Section 02100 - Site Preparation

B. Section 02227 - Aggregate Materials

C. Section 02505 - Paving Base and Subbase Course

D. Section 02511 – Asphaltic Concrete Paving

E. MDOT Standard Specifications, Latest Revision

F. Construction Documents.

1.3 PERFORMANCE REQUIREMENTS

A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

1.4 SUBMITTALS

A. Submittals for New Bricks:

1. Samples:

a. Furnish five individual samples of brick showing extreme variations in color and texture.

b. Furnish five individual samples of brick showing “nominal” color and texture.

2. Certificates:

a. Prior to delivery, submit to the Owner certificates attesting compliance with the applicable specifications for grades, types or classes included in these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Granite Curb

1. Stone for curbing and edging shall be approved granite from acceptable sources. The stone shall be hard and durable, predominantly gray in color, free from seams which impair its structural integrity and of smooth splitting character. Natural grain size and color variations characteristic of the source deposit will be permitted. Such natural variations may include bands of clusters of mineral or both of mineral crystallization that do not impair the structural integrity of the curb stone. The dimensions, shape and other details shall be as shown on the plans.

The exposed face of stone curb shall be free from indications of drill holes. Half drill holes not larger than 20 mm [¾ inch] diameter will be permitted in the arris line in the plane of the back.

2. Vertical curb shall have a thermal finish top surface to an approximate true plane with no depression or projection on that surface of over 3 mm [1/8 inch]. The top front arris line shall be pitched straight and true with no variations from a straight line greater than 6 mm [¼ inch]. The top back arris line shall meet the same requirement except that indentations of a maximum of 9 mm [3/8 inch] will be allowed. There shall be no projection or depression on the back face which would exceed a batter of 1 horizontal on 3 vertical for a distance from the top of 75 mm [3 inches].

   The front face shall be at right angles to the top and shall be smooth split and have no projections greater than 25 mm [1 inch] or depressions greater than 13 mm [1/2 inch], measured from the vertical plane of the face through the top arris line for a distance down from the top of 200 mm [8 inches]. The remainder of the face shall have no projections or depressions greater than 25 mm [1 inch] from the plane of the face.

   The ends of the curb shall be approximately square with the planes of the top, back and face and so finished that when the sections are placed end to end with the required minimum spacing of 6 mm [1/4 inch] no more than 16 mm [5/8 inch] space shall show in the joint for the full width of the top surface and for the entire exposed front face. The remainder of the end may extend back no more than 200 mm [8 inches] from the plane of the joint.

   Drill holes through the curb will be allowed providing they are at least 225 mm [9 inches] below the top and are mortared full with Portland Cement Mortar before placing the stone.

3. Miscellaneous Stone Curb: When a depressed or modified section of curb is called for on the plans or ordered by the Engineer, for driveways, crossings, closures, transitions or for other reasons, the Contractor shall furnish curbing with the required modifications.

4. Curb Inlets: Inlets used at catch basins shall conform to the applicable requirements of Vertical Curb, Type 1 and to the shape, dimensions and details as shown on the Standard Detail plans.

5. Dimensions: The stone curb units shall be of the dimensions indicated on the plans and shall be cut in lengths of not less than 1.2 mm [four feet] nor greater than 3 m [ten feet]. Random lengths of curb less than 1.2 m (four feet) in length may be obtained if the Engineer determines it necessary to meet field conditions. All curb to set on a radius of 20 m (60 feet) or less shall be cut to fit the curve as required.

6. Curb Type 5: The exposed face shall be smooth split to an approximate true plane having no projections or depressions which will allow over 25 mm [1 inch] to show between a 600 mm [2 foot] straightedge and the face when the straightedge is placed as closely as possible on any part of the face. Half drill holes not more than 75 mm [3 inches] in length and 20 mm [3/4 inch] in diameter will be permitted along the bottom. The arris line, top front shall be straight and true with no variation from a straight line greater than 3 mm [1/8 inch]. The arris lines at the bottom of the face shall be straight and true so that not over 25 mm [1 inch] shall show between the stone and a straightedge for the full length of the stone. The ends shall be square to the length at the face and so finished that when the stones are placed end to end, no space more than 40 mm [1 ½ inches] will show in the joint for the width of the face.

When Curbing Type 5 is required on a curve, the pieces shall be shaped.

B. Bricks

New bricks shall conform to requirements of A.S.T.M. Standard Specifications for Building Brick (made of clay or shale) Designation C62-66 for Grade SW with the following modifications.

1. The absorption limits shall be from 8 to 12 percent for the average of five bricks.
2. The compressive strength shall not be less than 8,000 pounds per square inch (psi).
3. The moduls of rupture shall not be less than 1,000 pounds per square inch (psi).
4. The bricks shall be No. 1, wire cut type for paving.

Bricks shall be of standard size (2-1/4" x 3-3/4"x8") with permissible variations not to exceed 1 1/16" in depth, 1/8" in width or ¼" in length.

C. Bituminous Curb

1. The asphalt cement for bituminous curb shall be of the grade required for the wearing course, or shall be Viscosity Grade AC-20 meeting the current requirements of Asphalt Cement. The aggregate shall conform to the requirements of Section 02511 – Asphaltic Concrete Paving. The course aggregate portion retained on the 2.36 mm [No. 8] sieve may be either crushed rock or crushed gravel.

   The mineral constituents of the bituminous mixture shall be sized and graded and combined in a composite blend that will produce a stable durable curbing with an acceptable texture.

   Bituminous material for curb shall be the requirements of Section 02511 – Asphaltic Concrete Paving and Impregnated with Fibers.

D. Concrete Pavers

1. Concrete Pavers shall conform to the style and dimension contained in the construction drawings.
2. Concrete Pavers shall be made of no slump concrete and shall conform to ASTM C-936 and have a maximum absorption of 5%.
3. Concrete Pavers shall have a compressive strength of 8000 psi.

E. Detectable Warning Pavers

1. Detectable warning pavers shall meet all the requirements of Concrete Pavers.

PART 3 - EXECUTION

3.1 EXECUTION

A. Granite Curb

1. Installation: The curb stone shall be set on a compacted foundation so that the front top arris line conforms to the lines and grades required. The foundation shall be prepared in advance of setting the stone by grading the proper elevation and shaping to conform as closely as possible to the shape of the bottom of the stone. The required spacing between stones shall be assured by the use of an approved spacing device to provide an open joint between stones of at least 6 mm [1/4 inch] and no greater than 15 mm [5/8 inch].
2. Backfilling: All remaining spaces under the curb shall be filled with approved material and thoroughly had tamped so the stones will have a firm uniform bearing on the foundation for the entire length and width. Any remaining excavated areas surrounding the curb shall be filled to the required grade with approved materials. This material shall be placed in layers not exceeding 200 mm [8 inches] in depth, loose measure and thoroughly tamped.

3. Protection: The curb shall be protected and kept in good condition. All exposed surfaces smeared or discolored shall be cleaned and restored to a satisfactory condition or the curb stone removed and replaced.

4. Curb Inlets: Curb placed adjacent to curb inlets shall be installed with steel dowels cemented into each stone with epoxy grout as shown on the Standard Detail sheets.

   The epoxy grout shall be used in accordance with the manufacturer's instructions. The grout shall be forced into the hole, after which the dowel shall be coated with grout for one-half its length and inserted into the grout filled hole. The hole shall be completely filled with grout around the dowel. All tools and containers must be clean before using.

B. Bituminous Curb

1. Preparation of Base: Prior to placing the curb, the foundation course shall be thoroughly cleaned of all foreign and objectionable material. String or chalk lines shall be positioned on the prepared base to provide guide lines. The foundation shall be uniformly painted with tack coat.

2. Placing: The curb shall be placed by an approved power operated extruding type machine using the shape mold called for. A tight bond shall be obtained between the base and the curb. The Engineer may permit the placing of curbing by other than mechanical curb placing machines when short sections or sections with short radii are required. The resulting curbing shall conform in all respects to the curbing produced by the machine.

3. Sealing: The curb shall be sealed with bituminous sealing compound, when directed. The emulsified bituminous sealing compound shall be an approved commercially prepared product manufactured for specific protective coating, colored as required. It shall contain fillers, pigments and sand or fibrous materials suspended in a suitable emulsified asphalt or tar. It shall be of such consistency that it can be applied at atmospheric temperatures and capable of being easily diluted with the addition of water and mixed by hand stirring at the site of application. Before sealing, the curb shall be clean, dry and shall have reached the ambient temperature.

4. Acceptance: Curb may be accepted or rejected on the basis of appearance in regard to texture, alignment or both. All damaged curb shall be removed and replaced at the Contractor's expense.

5. Polyester fibers shall be uniformly incorporated into the dry mix at a rate of 0.25 percent of the total batch weight. Certification shall be provided from the supplier with each shipment meeting the following requirements:

Average Length	6.35 mm $\pm$0.127 [0.25 inch $\pm$ 0.005]
Average Diameter	20 um$\pm$ 2.5 [0.0008 inch $\pm$0.0001]
Specific Gravity	1.32-1.40
Melting Temperature	250 º C [480 º F] Minimum
Color	Natural (White)

C. Brick Sidewalk

1. Preparation: Provide and compact base gravel where required as surface to place stone dust.

2. Stone Dust: A layer of stone dust material one (1") inch thick shall be spread upon the properly base course. This course shall be firm but not compacted.

3. Brick Placement: Perform all masonry work with skilled workmen under adequate supervision. A journeyman brick mason shall supervise all brick placement. Lay all masonry true to lines and grade with all surfaces true, and corners straight and plumb. Lay exposed-to-view bricks smooth side up, with an individual unit-to-unit level tolerance not to exceed 1/8-inch and an overall tolerance from the grade not to exceed ¼-inch in 10 feet in any direction. Lay no unit having chipped edges of face, in exposed-to-view locations. Remove any such unit, if installed and replace with a new undamaged unit.

   a. Brick Laying:

      The brick shall be laid in patterns shown on the drawings. The joints shall be hand tight, leaving only as much space between bricks as occurs naturally from rough surface or slight irregularities. A piece of paper shall not be able to slide between the bricks. When necessary, the brick will be struck and broken. The City will require replacement of improperly broken bricks. No spaces shall be larger than 1/8-inch left at broken brick areas. No struck brick shall be less than two (2') inches in length.

4. Compaction: After the bricks are carefully laid upon the properly prepared stone dust base, a 2" x 4" board shall be placed upon the bricks and shall be tapped with a hammer until the bricks reach a firm, unyielding bed and present a surface of the proper grade and slope. Any divergence from line and grade is to be corrected by taking up and relaying the bricks. After setting the bricks, a sufficient amount of stone dust shall be spread over the surface and thoroughly swept or raked so as to fill the joints. All surplus stone dust remaining on the brick paved areas after the joints have been properly filled shall be removed by sweeping. Avoid raking out the joints during the removal of excess stone dust.

END OF SECTION 02525

SECTION 02530

SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections and City of Portland Technical Design Standards and details apply to this Section.

1.2 SUMMARY

A. This Section includes gravity-flow, non-pressure and force-main, pressure sanitary sewerage outside the building, with the following components:

1. Special fittings for expansion and deflection.
2. Backwater valves.
3. Cleanouts.
4. Corrosion-protection piping encasement.
5. Precast concrete manholes.

B. All sanitary sewer materials shall meet the requirements of the City of Portland Public Works Department.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene-monomer rubber.

C. FRP: Fiberglass-reinforced plastic.

D. LLDPE: Linear low-density, polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

H. RTRF: Glass-fiber-reinforced, thermosetting-resin fitting.

I. RTRP: Glass-fiber-reinforced, thermosetting-resin pipe.

J. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Non-pressure, Drainage-Piping Pressure Rating: 10-foot head of water.

B. Force-Main, Pressure-Piping Pressure Rating: At least equal to 1.5 times the system operating pressure but not less than 100 psig.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Special pipe fittings.
2. Backwater valves.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Architect's permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS (NOT USED)

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS (NOT USED)

2.5 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS (NOT USED)

2.6 DUCTILE-IRON PRESSURE PIPE AND FITTINGS (NOT USED)

2.7 STAINLESS-STEEL PIPE AND FITTINGS (NOT USED)

2.8 ABS PIPE AND FITTINGS (NOT USED)

2.9 PVC PIPE AND FITTINGS

A. PVC Pressure Pipe: AWWA C900, Class 150, for gasketed joints and using ASTM F 477, elastomeric seals.

1. Fittings NPS 4 to NPS 8: PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.
2. Fittings NPS 10 and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.

B. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 80 pipe, with plain ends for solvent-cemented joints with ASTM D 2467, Schedule 80, socket-type fittings.

C. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness pipe with ASTM D 3034, SDR 35, socket-type fittings for solvent-cemented joints.

D. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

E. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-1 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

F. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.10 FIBERGLASS PIPE AND FITTINGS (NOT USED)

2.11 CONCRETE PIPE AND FITTINGS (NOT USED)

2.12 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, rubber.
2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:
   a. Fernco Inc.
   b. NDS Inc.

D. Shielded, Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:
   a. Cascade Waterworks Mfg.
   b. Dallas Specialty & Mfg. Co.
   c. Mission Rubber Company; a division of MCP Industries, Inc.

E. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

1. Available Manufacturers:
    a. Fernco Inc.
    b. Logan Clay Products Company (The).
    c. Mission Rubber Company; a division of MCP Industries, Inc.

F. Non-pressure-Type, Rigid Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:
    a. ANACO.

2.13 PRESSURE-TYPE PIPE COUPLINGS

A. Reducing or transition, metal, bolted sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psig minimum pressure rating and ends of same sizes as piping to be joined.

B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

1. Available Manufacturers:
    a. Cascade Waterworks Mfg.
    b. Dresser, Inc.; DMD Div.
    c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    d. JCM Industries.
    e. Romac Industries, Inc.
    f. Smith-Blair, Inc.
    g. Viking Johnson.
2. Center-Sleeve Material: Stainless steel.
3. Gasket Material: Natural or synthetic rubber.
4. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Couplings: With split sleeve with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

1. Available Manufacturers:
    a. Brico Industries.
2. Sleeve Material: Carbon steel.
3. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
4. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
5. Metal Component Finish: Corrosion-resistant coating or material.

2.14 SPECIAL PIPE FITTINGS

A. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

1. Available Manufacturers:
    a. EBAA Iron Sales, Inc.
    b. Romac Industries, Inc.
    c. Star Pipe Products.

B. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

1. Available Manufacturers:
    a. EBAA Iron Sales, Inc.

C. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

1. Available Manufacturers:
    a. Dresser, Inc.; DMD Div.
    b. EBAA Iron Sales, Inc.
    c. JCM Industries.
    d. Smith-Blair, Inc.

2.15 BACKWATER VALVES

A. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

1. Available Manufacturers:
    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.
    c. Wade Div.; Tyler Pipe.
    d. Watts Industries, Inc.
    e. Watts Industries, Inc.; Enpoco, Inc. Div.
    f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
2. Horizontal Type: With swing check valve and hub-and-spigot ends.
3. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.
4. Terminal Type: With bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

1. Available Manufacturers:
    a. Canplas Inc.
    b. IPS Corporation.
    c. NDS Inc.
    d. Plastic Oddities, Inc.

e. Sioux Chief Manufacturing Company, Inc.

f. Zurn Light Commercial Specialty Plumbing Products; Zurn Plumbing Products Group.

2.16 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Available Manufacturers:

a. Josam Company.

b. MIFAB Manufacturing Inc.

c. Smith, Jay R. Mfg. Co.

d. Wade Div.; Tyler Pipe.

e. Watts Industries, Inc.

f. Watts Industries, Inc.; Enpoco, Inc. Div.

g. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Top-Loading Classification: Heavy duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

1. Available Manufacturers:

a. Canplas Inc.

b. IPS Corporation.

c. NDS Inc.

d. Plastic Oddities, Inc.

e. Sioux Chief Manufacturing Company, Inc.

f. Zurn Light Commercial Specialty Plumbing Products; Zurn Plumbing Products Group.

2.17 CORROSION-PROTECTION PIPING ENCASEMENT NOT USED)

2.18 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.

5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

7. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.

8. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.

9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

10. Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to exterior surfaces.

11. Manhole Frames and Covers: Refer to City of Portland Type A detail for specified casting model. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

    a. Material: ASTM A 48/A 48M, Class 35 gray iron, unless otherwise indicated.

    b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

B. Designed Precast Concrete Manholes: (NOT USED)

C. Cast-in-Place-Concrete Manholes: (NOT USED)

D. Fiberglass Manholes: (NOT USED)

E. Manhole Cover Inserts: Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.

1. Available Manufacturers:

    a. FRW Industries; a Syneco Systems, Inc. company.

    b. Knutson Enterprises.

    c. L.F. Manufacturing, Inc.

    d. Parson Environmental Products, Inc.

2. Type: Solid With drainage and vent holes.

2.19 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: 2 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.20 MISCELLANEOUS MATERIALS

A. Paint: SSPC-Paint 16.

B. PE Sheeting: ASTM D 4397, with at least 8-mil thickness.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use non-pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping, unless otherwise indicated.

a. Shielded flexible couplings for same or minor difference OD pipes.

b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.

c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Non-pressure Sewer Piping: Use the following pipe materials for each size range:

1. Use PVC SDR 35.

D. Force-Main, Pressure Piping: (NOT USED)

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

F. Install gravity-flow, non-pressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, as indicated on the plans.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install piping below frost line.
5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
7. Install ductile-iron, gravity sewer piping according to ASTM A 746.
8. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.
9. Install stainless-steel drainage piping according to ASME A112.3.1.
10. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
11. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
12. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
13. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
14. Install fiberglass sewer piping according to ASTM D 3839 and ASTM F 1668.
15. Install non-reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
16. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. (NOT USED)

H. (NOT USED)

I. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.4 PIPE JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, non-pressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
5. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.
6. Join stainless-steel drainage piping according to ASME A112.3.1.
7. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
8. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
9. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
10. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
11. Join fiberglass sewer piping according to ASTM D 4161 for elastomeric-seal joints.
12. Join non-reinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
13. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
14. Join dissimilar pipe materials with non-pressure-type, flexible couplings.

3.5 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

E. Install manhole cover inserts in frame and immediately below cover.

3.6 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.7 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.

B. Install combination horizontal and manual gate valve type in piping and in manholes where indicated.

C. Install terminal-type backwater valves on end of piping and in manholes where indicated. Secure units to sidewalls.

3.8 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

4. Use extra-heavy-duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops at surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.9 CONNECTIONS

A. Connect non-pressure, gravity-flow drainage piping to building's sanitary building drains.

B. Connect pressure, force-main piping to building's sanitary force mains where indicated.

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Connect to interceptors specified in Division 2 Section "Interceptors."

3.10 CLOSING ABANDONED SANITARY SEWERAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch-thick, brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

1. Remove manhole and close open ends of remaining piping.

2. Remove top of manhole down to at least 36 inches below final grade. Fill to top with stone, rubble, gravel, or compacted dirt.

C. Backfill to grade according to Division 2 Section "Earthwork."

3.11 PAINTING (NOT USED)

3.12 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.13 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

a. Allowable leakage is a maximum of 50 gal. /inch of nominal pipe size per mile of pipe, during 24-hour period.

b. Close openings in system and fill with water.

c. Purge air and refill with water.

d. Disconnect water supply.

e. Test and inspect joints for leaks.

f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

b. Option: Test concrete gravity sewer piping according to ASTM C 924.

7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.

a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.

b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

8. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.14 CLEANING

A. Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION 02530

SECTION 02584

UNDERGROUND DUCTS AND UTILITY STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Ducts in direct-buried duct banks.
2. Ducts in concrete-encased duct banks.
3. Handholes and handhole accessories.
4. Manholes and manhole accessories.

B. Related Sections include the following:

1. Division 16 Section "Grounding and Bonding" for grounding electrodes, counterpoise conductors, clamps and connectors for grounding metallic manhole and handhole accessories, and testing of grounds.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Manhole and handhole hardware.
2. Conduit and ducts, including elbows, bell ends, bends, fittings, and solvent cement.
3. Duct-bank materials, including spacers and miscellaneous components.
4. Warning tape and warning planks.

B. Shop Drawings: Show fabrication and installation details for underground ducts and utility structures and include the following:

1. For manholes:
   a. Duct sizes and locations of duct entries.
   b. Reinforcement details.
   c. Manhole cover design.
   d. Step details.
   e. Grounding details.
   f. Dimensioned locations of cable rack inserts, pulling-in irons, and sumps.
2. For precast manholes and handholes, Shop Drawings shall be signed and sealed by a qualified professional engineer, and shall show the following:
   a. Construction of individual segments.
   b. Joint details.
   c. Design calculations.

C. Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures. Include plans and sections drawn to scale, and show all bends and location of expansion fittings.

D. Product Certificates: For concrete and steel used in underground precast manholes, according to ASTM C 858.

E. Product Test Reports: Indicate compliance of manholes with ASTM C 857 and ASTM C 858, based on factory inspection.

1.4 QUALITY ASSURANCE

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

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete units at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect at least two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

1.7 COORDINATION

A. Coordinate layout and installation of ducts, manholes, and handholes with final arrangement of other utilities and site grading, as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes and handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure duct runs drain to manholes and handholes, and as approved by Architect.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, of Attachment A and CMP Handbook

2.2 CONDUIT

A. Conduit and fittings are specified in Division 16.

2.3 DUCTS

A. Rigid Nonmetallic Conduit: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

B. Rigid Nonmetallic Conduit: NEMA TC 2, Type EPC-80-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

C. Plastic Utilities Duct: NEMA TC 6, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 9.

D. Plastic Utilities Duct: NEMA TC 6, Type DB-60-PVC, ASTM F 512, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 9.

E. Plastic Utilities Duct: NEMA TC 8, Type EB-35-PVC, ASTM F 512, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 9.

F. Plastic Utilities Duct: NEMA TC 8, Type DB-120-PVC, ASTM F 512, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 9.

2.4 HANDHOLES

A. Cast-Metal Boxes: Cast aluminum, with outside flanges and recessed, gasketed cover for flush mounting and with nonskid finish and legend on cover. Unit, when buried, shall be designed to support AASHTO H10 loading.

B. Precast Handholes: Reinforced concrete, monolithically poured walls and bottom, with cast-aluminum frame and access door assembly as the top of handhole. Duct entrances and windows shall be located near corners to facilitate racking. Pulling-in irons and other built-in items shall be installed before pouring concrete. Cover shall have nonskid finish and legend. Unit, when buried, shall be designed to support AASHTO H10 loading.

C. Fiberglass Handholes: Molded fiberglass, with 6-inch- square cable entrance at each side and weatherproof cover with nonskid finish and legend. Unit, when buried, shall be designed to support AASHTO H10 loading.

D. Cover Legend: "ELECTRIC."

2.5 PRECAST MANHOLES

A. Precast Units: ASTM 478, with interlocking mating sections, complete with accessories, hardware, and features as indicated. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

B. Design and fabricate structure according to ASTM C 858.

C. Design structure according to details on Drawings.

D. Structural Design Loading: ASTM C 857, Class A-16.

E. Joint Sealant: Continuous extrusion of asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

F. Source Quality Control: Inspect structures according to ASTM C 1037.

2.6 CAST-IN-PLACE MANHOLES

A. Loading: AASHTO HS20.

2.7 ACCESSORIES

A. Refer to Attachment A.

B. (NOT USED)

C. Sump Frame and Grate: ASTM A 48, Class 30B gray cast iron.

D. Pulling Eyes in Walls: Eyebolt with reinforcing-bar fastening insert 2-inch- diameter eye and 1-by-4-inch bolt.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

E. Pulling and Lifting Irons in Floor: 7/8-inch- diameter, hot-dip-galvanized, bent steel rod; stress relieved after forming; and fastened to reinforced rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

F. Bolting Inserts for Cable Stanchions: Flared, threaded inserts of non-corrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

G. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

H. Cable Stanchions: Hot-rolled, hot-dip-galvanized, T-section steel; 2-1/4-inch size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.

I. Cable Arms: 3/16-inch- thick, hot-rolled, hot-dip-galvanized, steel sheet pressed to channel shape; 12 inches wide by 14 inches long and arranged for secure mounting in horizontal position at any location on cable stanchions.

J. Cable-Support Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

K. Grounding Materials: Comply with Division 16 Section "Grounding and Bonding."

L. Ladder: UL-listed, heavy-duty wood specifically designed for electrical manhole use. Minimum length equal to distance from deepest manhole floor to grade plus 36 inches.

M. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and of adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

N. Warning Tape: Underground-line warning tape specified in Division 16 Section "Electrical Identification."

O. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.

1. Color: Red dye added to concrete during batching.

2. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

2.8 CONSTRUCTION MATERIALS

A. Waterproofing: Comply with Division 7 Section "Composite Sheet Waterproofing."

B. Dampproofing: Comply with Division 7 Section "Bituminous Dampproofing."

C. Mortar: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.

D. Brick for Manhole Chimney: Sewer and manhole brick, ASTM C 32, Grade MS.

E. Concrete: Use 3000-psi- minimum, 28-day compressive strength and 3/8-inch maximum aggregate size. Concrete and reinforcement are specified in Division 3 Section "Cast-in-Place Concrete."

PART 3 - EXECUTION

3.1 APPLICATION

A. Underground Ducts for Electrical Cables Higher Than 600 V: Type EPC-40-PVC, concrete-encased duct bank.

B. Underground Ducts for Electrical Feeders: Type EB-20-PVC, concrete-encased duct bank.

C. Underground Ducts for Electrical Branch Circuits: Type DB-60-PVC, direct-buried duct bank.

D. Underground Ducts for Telephone Utility Service: Type EPC-40-PVC, direct-buried duct bank, except use Type EPC-80-PVC when crossing roads and railroads.

E. Underground Ducts for Communication Circuits: Type EPC-40-PVC, direct-buried duct bank.

F. Manholes: Underground precast concrete utility structures.

G. Manholes: Cast-in-place concrete.

3.2 EARTHWORK

A. Excavation and Backfill: Comply with Division 2 Section "Earthwork" but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoil, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Section "Landscaping."

D. Restore disturbed pavement. Refer to Division 1 Section "Cutting and Patching."

3.3 CONDUIT AND DUCT INSTALLATION (REFER TO CMP REQUIREMENTS)

3.4 MANHOLE AND HANDHOLE INSTALLATION

A. Elevation: Install manholes with rooftop at least 15 inches below finished grade. Install handholes with depth as indicated. Where indicated, cast handhole cover frame directly into roof of handhole and set roof surface 1 inch above grade.

B. Drainage: Install drains in bottom of units where indicated. Coordinate with drainage provisions indicated.

C. Access: Install cast-iron frame and cover.

1. Install brick chimney to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

2. Install precast collars and rings to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

3. Set frames in paved areas and traffic ways flush with finished grade. Set other frames 1 inch above finished grade.

D. Waterproofing: Apply waterproofing to exterior surfaces of units after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole and handhole chimneys after brick mortar has cured at least three days.

E. Dampproofing: Apply dampproofing to exterior surfaces of units after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole and handhole chimneys after brick mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

G. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

H. Grounding: Install ground rod through floor in each structure with top protruding 4 inches above floor. Seal floor opening against water penetration with waterproof non-shrink grout. Ground exposed metal components and hardware with bare-copper ground conductors. Train conductors neatly around corners. Use cable clamps secured with expansion anchors to attach ground conductors.

I. Cast-in-Place Manhole Installation: Comply with applicable requirements in Division 3 Section "Cast-in-Place Concrete."

1. Finish interior surfaces with a smooth-troweled finish.

2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.

J. Precast Concrete Manhole Installation: Unless otherwise indicated, comply with ASTM C 891.

1. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

3.5 FIELD QUALITY CONTROL

A. Testing: Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

B. Grounding: Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 16 Section "Grounding and Bonding."

C. Duct Integrity: Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of the duct. If obstructions are indicated, remove obstructions and retest.

D. Correct installations if possible and retest to demonstrate compliance. Remove and replace defective products and retest.

3.6 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 02584

WORK SCOPE AND SPECIFICATIONS FOR CONDUIT AND MANHOLE CONSTRUCTION

Fore & Franklin Streets, Portland, Maine

I. PROJECT DISCUSSION

These specifications are for installation of a manhole and conduit system to accommodate the installation of underground primary voltage cables transformers, and switchgear along Fore and Franklin Streets in Portland.

II. GENERAL REQUIREMENTS

A. Work Scope

Contractor shall furnish all labor, materials, equipment, supplies, and other facilities, except as noted in this specification, and shall perform all work necessary or incidental to the construction of the manholes, conduit lines, transformer vaults and other items specified herein. The Contractor shall perform the work in strict accordance with the applicable sections of these Specifications which form a part of this Contract, and to the satisfaction and approval of Central Maine Power (CMP), and shall perform all other obligations and assume all liability imposed upon him by the Contract and Specifications.

B. Contract Drawings

The following drawings are included and made part of these Specifications:

Title	Drawing No.
6’ x 12’ Sidewalk Vault	905A-18
4’ x 4’ Hand-hole with 32” Cover	905A-7
S&C Vista Switchgear Vault	
Bilco Doors	
300 Fore Street Underground Electrical Layout	905-????
Fore Street, Portland	905-2208
Franklin Street Arterial, Portland	905-2196

C. Site Conditions and Representation

It shall be the sole responsibility of the Contractor to satisfy himself as to the nature and location of the work to be done, the general and local conditions, the physical conditions of the site, the condition of the ground and all other matters which can in any way affect the work or cost thereof. It shall further be the sole responsibility of the Contractor to satisfy himself, as necessary, and to assume all risk with respect to the character, quality, and quantity of any and all surface and subsurface materials, including groundwater, to be encountered. Any failure of the contractor to acquaint himself with the available information will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.

Central Maine Power Company assumes no responsibility for information or opinions concerning soils and subsurface conditions unless such responsibility is assumed in writing by Central Maine Power Company.

D. Permits

The contractor shall obtain the necessary street opening permits and pay all charges required by the City, State, and other duly authorized authorities. Permits required for disposing of surplus topsoil, excavated material, hauling, etc. shall be obtained by the contractor.

E. Work Layout

The conduit and manholes shall be located per the Contract Drawings.

The Contractor, immediately upon entering the project site for the purposes of beginning work, shall locate all general reference points and take action as is necessary to prevent their destruction, lay out his own work and be responsible for all lines, elevations, control points and other work executed by him under the Contract.

F. Backfill and Road and Sidewalk Repair

All backfill shall meet, be installed and compacted as specified by the State, Municipality or other authority having jurisdiction.

The Contractor shall be responsible for restoring the paving of sidewalks and roads as specified by the State, Municipality or other authority having jurisdiction. The Contractor shall be responsible for the grading with loam and seeding of grassed areas as specified by the State, Municipality or other authority having jurisdiction.

G. Existing Underground Utilities

The Contractor shall be responsible for confirming the location of utilities along the proposed route. Inaccurate locations or omissions on Central Maine Power Company plans shall not relieve the Contractor of this responsibility. Any required exploratory digging shall be at the Contractors expense. Contact **Dig-Safe** before any excavation by dialing 1-800-225-4977.

H. Safety

The Contractor shall use due care in protecting the work area and the public and shall provide for such traffic control as is necessary to complete the work in a safe manner or as may be required by Federal, State, Municipal or other authorities. All work shall be performed in a safe manner and in compliance with the applicable OSHA and other codes, including the Maine Overhead High-Voltage Line Safety Act.

I. Additional Information

Requests for additional information should be directed to:

Brian Conroy

Central Maine Power

162 Canco Road

Portland, Me. 04103

Tel: (207) 791-1023

III. Technical Requirements

A. Vault Construction

1. Vaults shall be located and constructed per the Contract Drawings.
2. Vaults shall be pre-cast, reinforced for H-20 wheel loading and have the dimensions specified. There shall be a 3-inch set-back at the conduit openings, with a 45 degree wall bevel to meet the set-back conduit. Cable pulling eyes shall be installed in the walls opposite conduit entrances.
3. Vaults shall be located and constructed per the Contract Drawings

B. Conduit Construction

1. Conduit shall be located and constructed per the Contract Drawings.
2. The conduit formation shall be spaced with plastic spacers at intervals of 5 foot or less. An intermediate spacer shall be placed over the top ducts of each conduit formation to hold them in place and support the neutral conductor. Care shall be taken to ensure that the joints will present a smooth surface to the cable when it is installed. All trench bottoms to be power tamped before placing of ducts.
3. No bends with a bending radius of less than 4 feet shall be installed in the conduit line. All bends or sweeps shall be of galvanized steel.
4. The conduit formation shall be encased with a minimum 3 inches and maximum 6 inches concrete on top, **bottom**, and sides. Substantial forms shall be used unless the trench sides are stable, vertical, smooth and within 6 inches of the ducts. The aggregate shall not exceed ¾ inch in diameter. The concrete shall be agitated sufficiently to eliminate voids. Reinforcing rods are not required. No wood blocking or form materials shall be left in the concrete envelope or trench. A Central Maine Power Company supplied marker tape shall be placed on the concrete envelope as soon as the concrete is placed.
5. A ¼ inch polyethylene pulling rope shall be left in each conduit.
6. Conduit runs shall have a minimum pitch for drainage of 3 inches per 100 feet toward one or both manholes. A minimum of 30 inches of cover shall be provided from finish grade to the conduit envelope.
7. A bare 4/0 copper neutral conductor shall be embedded in the conduit envelope per the contract drawings. The neutral conductor shall be brought into all manholes. Precautions shall be taken to prevent damage to the neutral conductor where it enters the manholes. A sufficient length of neutral from each conduit line shall be left in each manhole such that the neutral can be trained along the walls and bonded to all other neutrals entering the manhole. The training and bonding of the neutral will be done by CMP personnel.

IV. Material Specifications

A. Bilco Doors

www.bilco.com

Type JD-ALH20; W=8', L=4'; type 316 stainless steel hardware.

(I might use Syracuse Castings equivalent)

B. ***Grates***

www.ikgindustries.com

Heavyweld type HB; xx" W x yy" L; 3½" deep; steel; hot dip galvanized; H20 load rated.

C. ***Pre-cast Transformer Vault***

www.superiorconcrete.com

Type 38Y; per CMP Drawing 905A-18

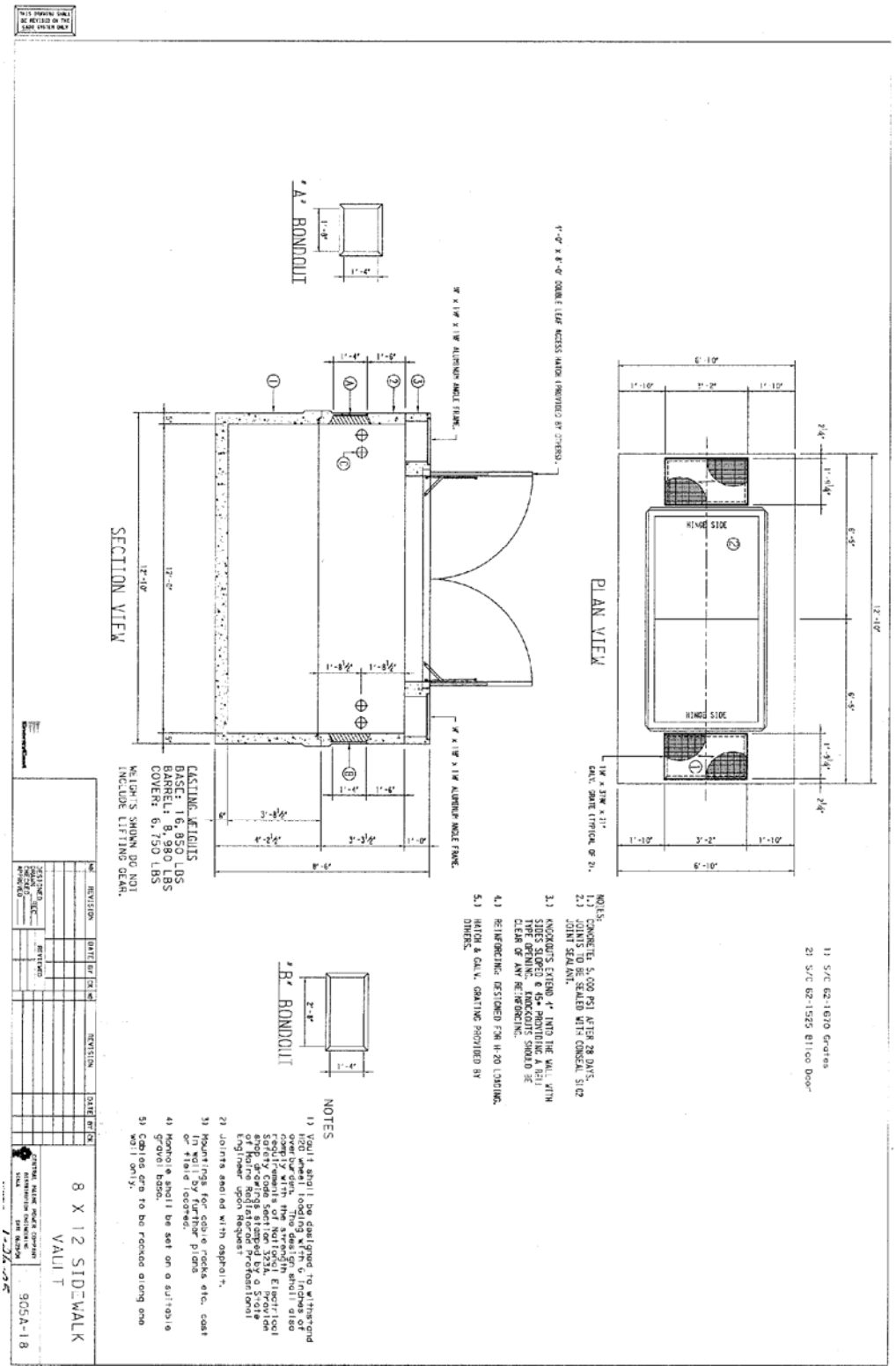
D. ***Trenwa Vault***

www.trenwa.com

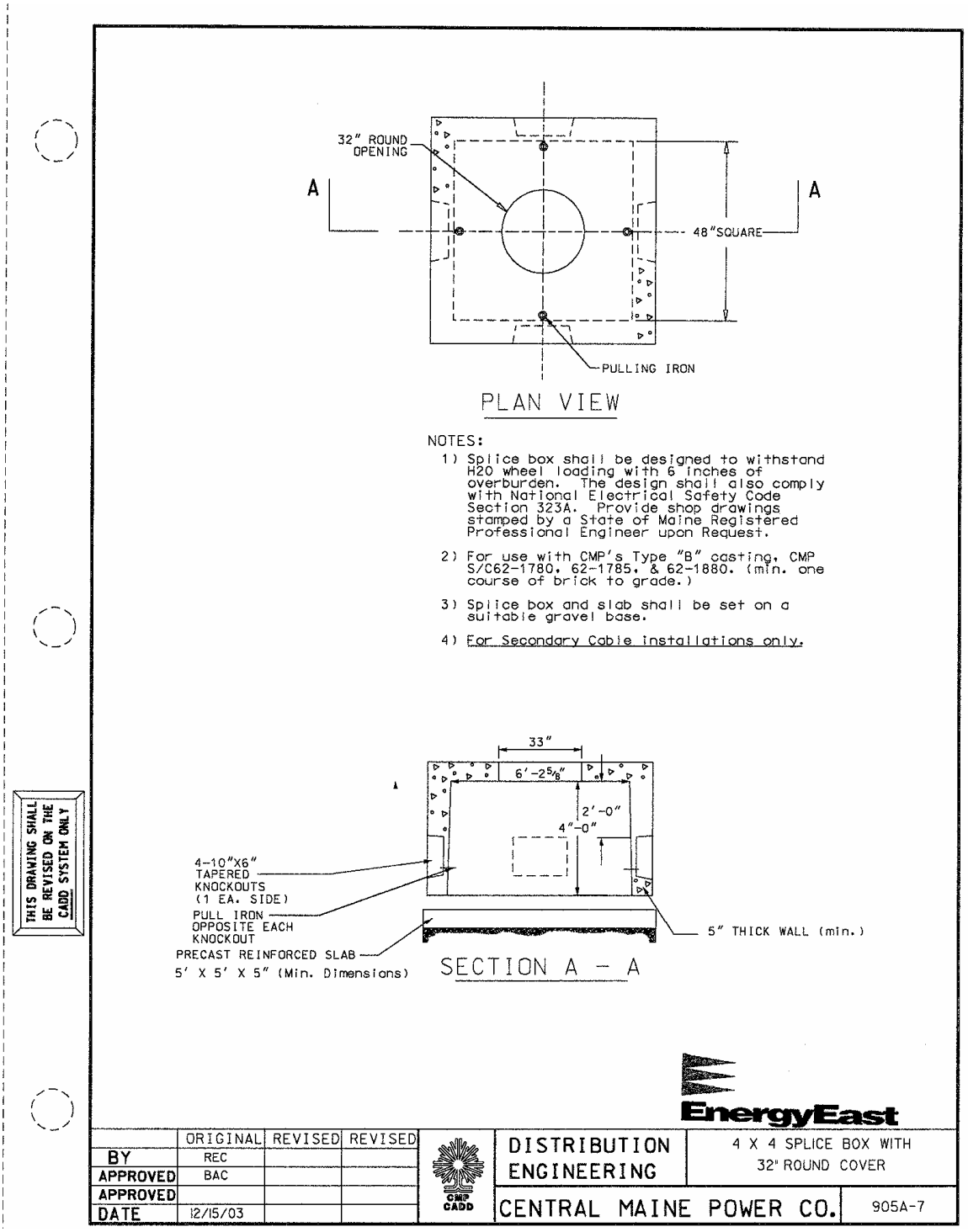
S&C Vista Switchgear Vault; 4 Way Heavy Duty Concrete Lid

V. Drawings

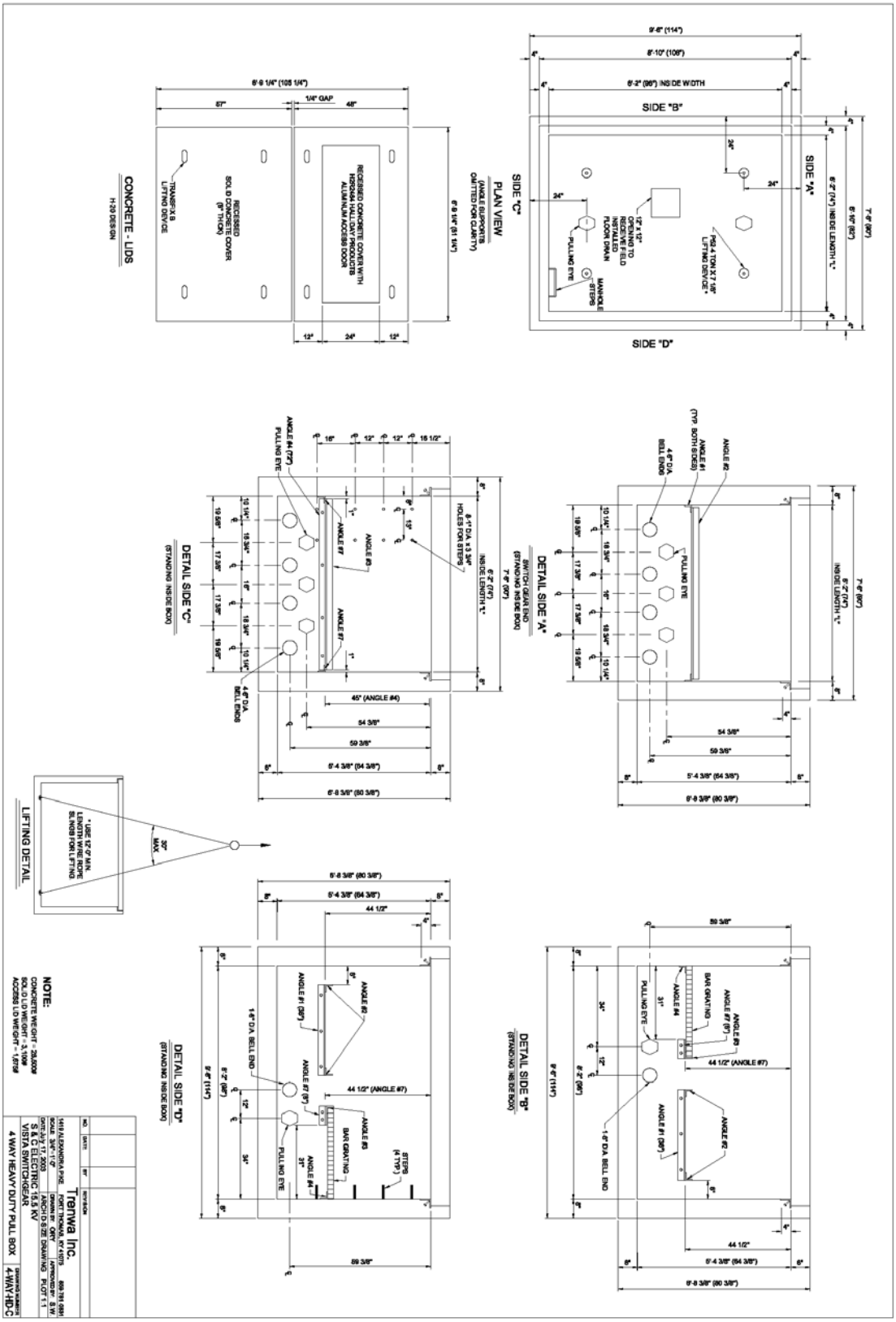
A. 6' x 12' Sidewalk Transformer Vault (905A-18)



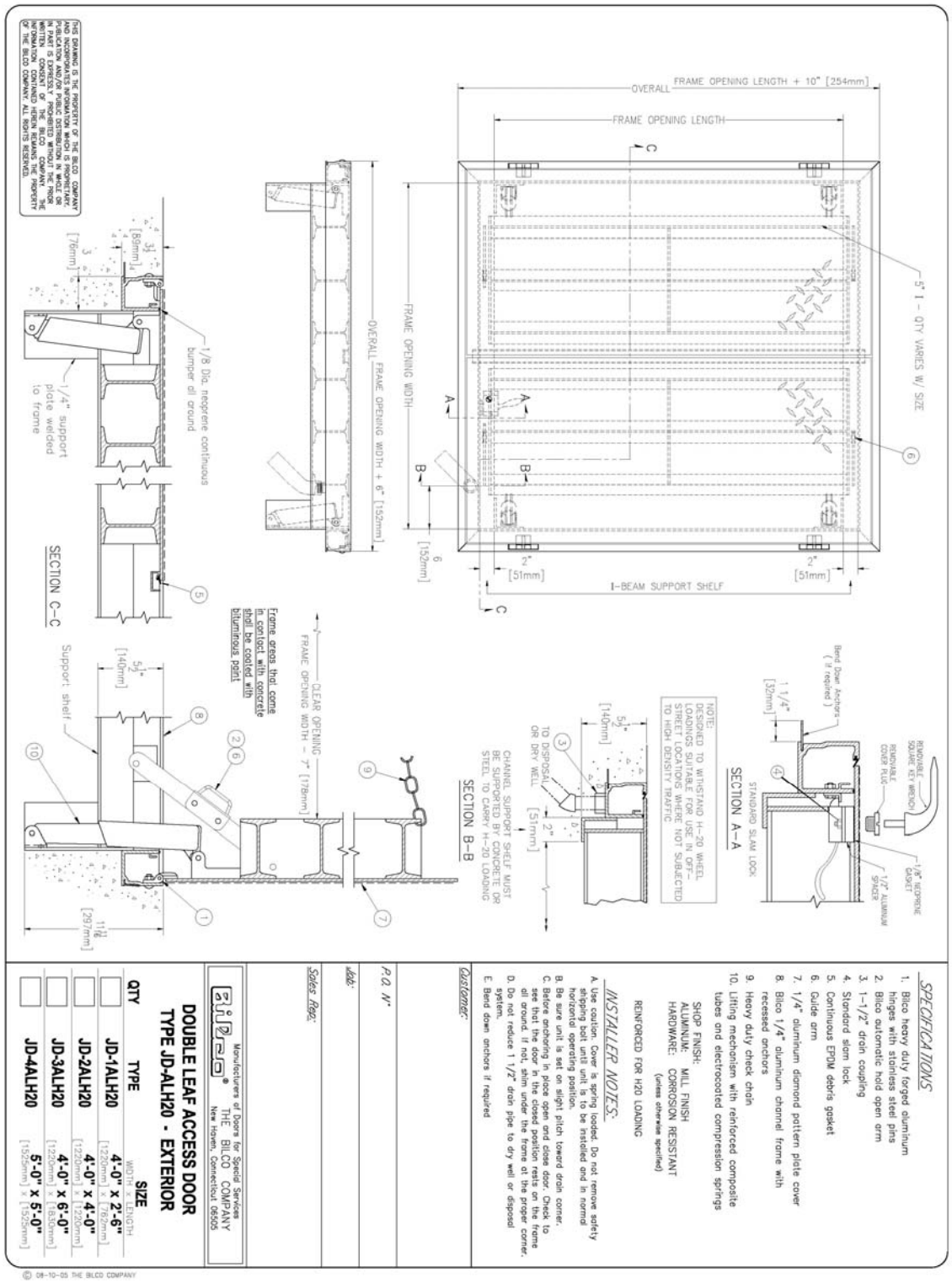
B. 4' x 4' Hand-hole with 32" Cover (905-A7)



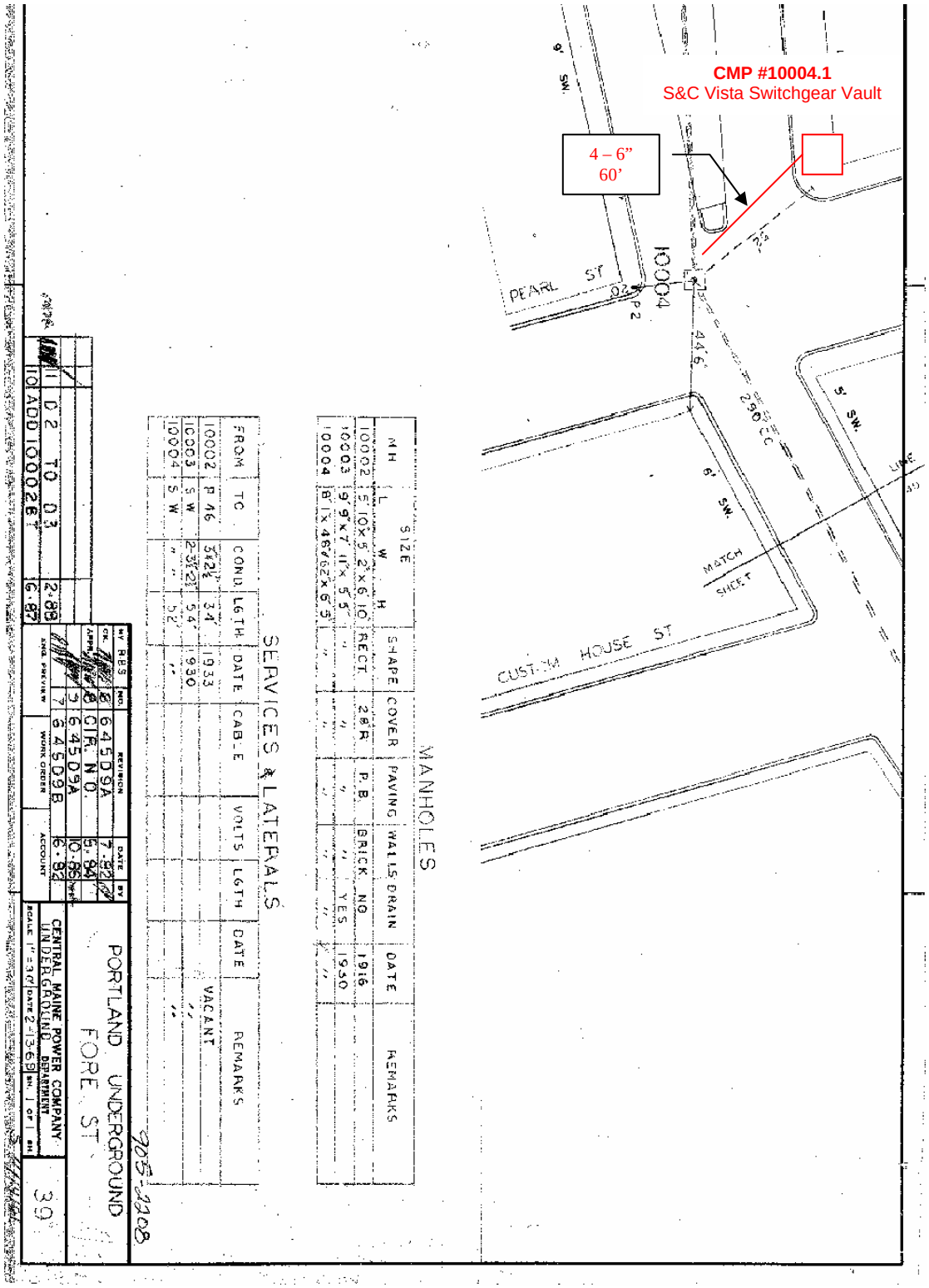
C. S&C Vista Switchgear Vault



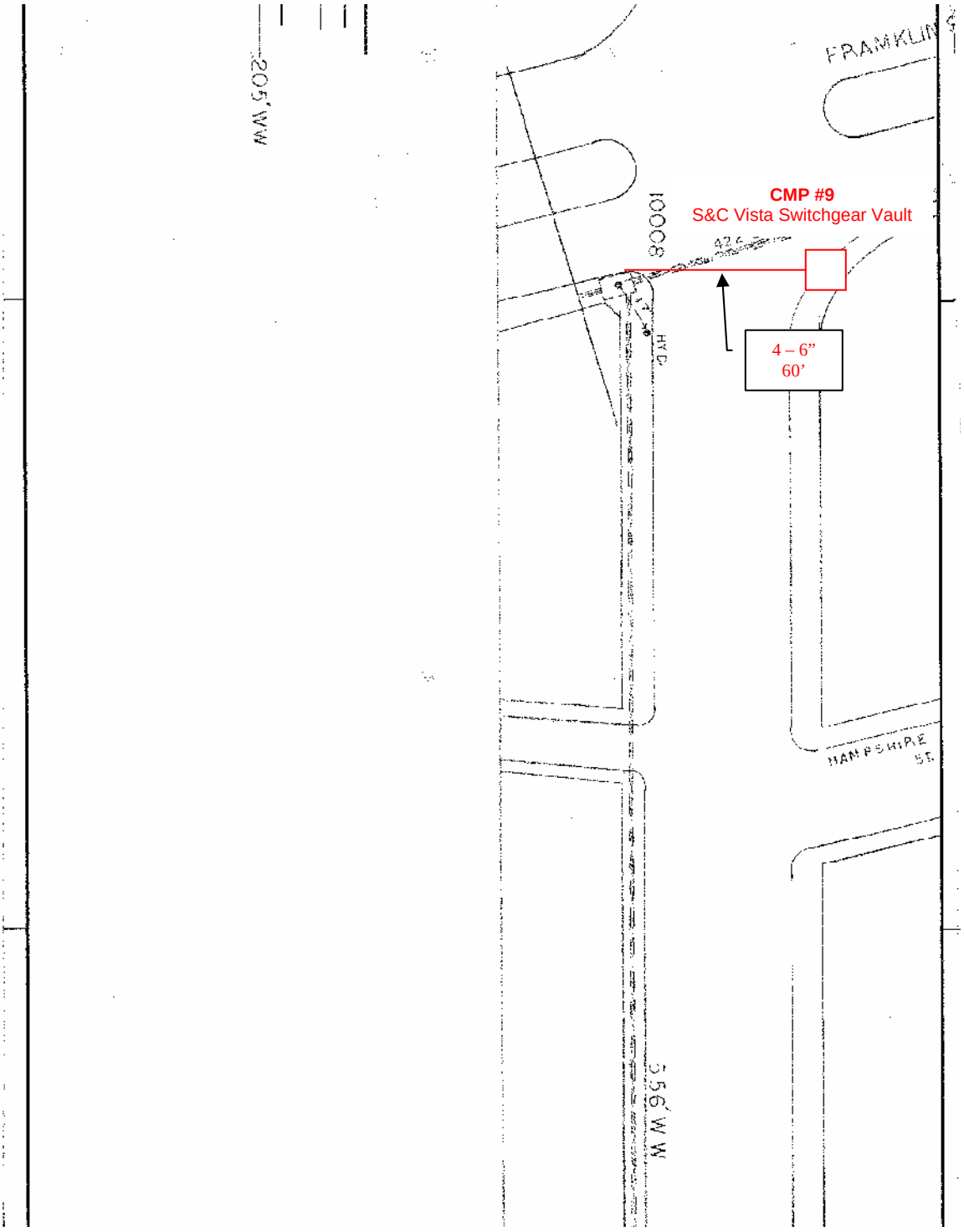
D. Bilco Doors



E. Fore Street, Portland (905-2208)



F. Franklin Street Arterial, Portland (905-2196)



SECTION 02620

SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes subdrainage systems for the following:

1. Foundations.
2. Underslab areas.
3. Plaza decks.
4. Retaining walls.
5. Landscaped areas.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. HDPE: High-density polyethylene.

C. PE: Polyethylene.

D. PP: Polypropylene.

E. PS: Polystyrene.

F. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

A. Product Data: For drainage conduit, drainage panels, and geotextile fabrics.

1. Perforated pipe.
2. Solid pipe.
3. Pipe with open joints.
4. Drainage conduits.
5. Drainage panels.
6. Geotextile fabrics.

1.5 COORDINATION

A. Drainage panel materials and installation shall be compatible with dampproofing of walls below grade.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to various application articles in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.3 UNDERSLAB HEADERS

A. ABS Sewer Pipe and Fittings: ASTM D 2751.
   1. Solvent Cement: ASTM D 2235.
   2. Gaskets: ASTM F 477, elastomeric seal.

B. Cast-Iron Soil Pipe and Fittings: ASTM A 74, Service and Extra-Heavy classes, hub-and-spigot ends, gray, for gasketed joints.
   1. Gaskets: ASTM C 564, rubber, of thickness matching class of pipe.

C. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
   1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

D. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.
   1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.

E. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
   1. Gaskets: ASTM F 477, elastomeric seal.

2.4 DRAINAGE PIPES AND FITTINGS

A. Perforated, PE Pipe and Fittings: ASTM F 405, corrugated, for coupled joints.
   1. Couplings: Manufacturer's standard, band type.

B. Perforated, PE Pipe and Fittings: ASTM F 667, corrugated, for coupled joints.
   1. Couplings: Manufacturer's standard, band type.

C. Perforated, PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.5 SPECIAL PIPE COUPLINGS

A. Description: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.6 CLEANOUTS

A. Cast-Iron Pipe: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

B. PVC Pipe: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.7 DRAINAGE CONDUIT

A. Pipe and Fittings: Perforated and corrugated, molded from HDPE complying with ASTM D 3350, with fittings and geotextile filter fabric jacket.

1. Size: 12 inches high by approximately 3/4 inch thick with a minimum flow rate of 30 gpm per foot.

2. Size: 18 inches high by approximately 3/4 inch thick with a minimum flow rate of 45 gpm per foot when tested according to ASTM D 4716.

3. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.

4. Couplings: Corrugated HDPE band.

B. Pipe and Fittings: Perforated, molded from HDPE complying with ASTM D 1248 into shape of interconnected corrugated pipes, with fittings and geotextile filter fabric jacket.

1. Size: 6 inches high by approximately 1-1/4 inches thick with a flow rate of 15 gpm per foot when tested according to ASTM D 4716.

2. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.

3. Couplings: HDPE.

C. Pipe and Fittings: Perforated, smooth PVC complying with ASTM D 4216 and ASTM D 2729.

1. Size: 4 inches high by approximately 1/4 inches thick with a minimum flow rate equal to NPS 4 pipe.

2. Fittings: PVC with NPS 4 outlet connection.

3. Couplings: PVC.

2.9 FABRIC DRAINAGE PANELS (NOT USED)

2.10 INSULATION DRAINAGE PANELS (NOT USED)

2.11 SOIL MATERIALS

A. Impervious Fill: Clay, gravel, and sand mixture.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Size No. 57, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 8 sieve.

2.12 ROOFING FELTS

A. ASTM D 226, Type I, asphalt-saturated roofing felt.

B. ASTM D 227, coal-tar-saturated roofing felt.

2.13 GEOTEXTILE FILTER FABRICS

A. Woven or nonwoven geotextile filter fabric of PP or polyester fibers, or combination of both. Flow rates range from 110 to 330 gpm per sq. ft. when tested according to ASTM D 4491. Available styles are flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

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

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.3 SUBDRAINAGE SYSTEM APPLICATIONS

A. NPS 4 Piping:

1. Perforated, PE pipe and fittings, couplings, and coupled joints.
2. Perforated, PVC sewer pipe and fittings for loose, bell-and-spigot joints.
3. Perforated, clay pipe and fittings, Standard-Strength class; gaskets; and gasketed joints.
4. Concrete drain tile, Standard-Quality class; and open joints.

B. NPS 6 Piping:

1. Perforated, PE pipe and fittings, couplings, and coupled joints.
2. Concrete drain tile, Standard-Quality class; and open joints.

3.4 UNDERSLAB DRAINAGE SYSTEM APPLICATIONS

A. NPS 4 Piping:

1. Perforated, PE pipe and fittings, couplings, and coupled joints.
2. Perforated, PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. NPS 6 Piping:

1. Perforated, PE pipe and fittings, couplings, and coupled joints.
2. Perforated, PVC sewer pipe and fittings for loose, bell-and-spigot joints.

3.5 UNDERSLAB DRAINAGE SYSTEM HEADER APPLICATIONS

A. NPS 4 and NPS 6 Piping:

1. ABS pipe and fittings, couplings, and coupled joints.
2. Cast-iron soil pipe and fittings, Extra-Heavy class; gaskets; and gasketed joints.
3. PE drainage tubing and fittings, couplings, and coupled joints.
4. PVC sewer pipe and fittings, couplings, and coupled joints.

3.6 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tapes directly over piping.

1. Install warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.7 FOUNDATION DRAINAGE INSTALLATION

A. Bottom Impervious Fill: Place impervious fill material on subgrade adjacent to bottom of footing after concrete footings have been cured and forms removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Drainage Fill: Place supporting layer of drainage fill over compacted subgrade to compacted depth of not less than 4 inches. After installing drainage piping, add drainage fill to width of at least 6 inches on side away from wall and to top of pipe to perform tests. After satisfactory testing, cover piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade. Place drainage fill in layers not exceeding 3 inches in loose depth; compact each layer placed.

1. Before installing drainage fill, lay flat-style geotextile filter fabric in trench and overlap trench sides. After installing drainage fill, wrap top of drainage fill with flat-style geotextile filter fabric.

2. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with electrical tape.

3. After installing drainage fill, place one layer of flat-style geotextile filter fabric over top of drainage fill, overlapping edges at least 4 inches.

C. Install vertical drainage panel as follows:

1. Coordinate placement with other drainage materials.

2. Lay perforated, PE or PVC drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.

3. Mark horizontal calk line on wall at a point 6 inches less than panel width above footing bottom. Before marking wall, subtract footing width.

4. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.

5. Wrap bottom of panel around drainage pipe.

6. Attach panel to wall at horizontal mark and at beginning of pipe. Place core side of panel against wall. Use concrete nails with washers through product cylinders to attach panel to wall. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Some manufacturers use construction adhesives, metal stick pins, or double-sided tape. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.

7. If another panel is required on the same row, cut away 4 inches of installed panel core and wrap fabric over new panel.

8. If additional rows of panel are required, overlap lower panel with 4 inches of fabric.

9. Cut panel as necessary to keep top 12 inches below finish grade.

10. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.

11. Do not use drainage panels as protection over waterproof membrane, unless otherwise approved by waterproofing membrane manufacturer.

D. Fill to Grade: Place native fill material over compacted drainage fill. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish elevations and slope away from building.

3.8 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted, but before drainage fill has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope and compact to firm, solid bed for drainage system.

B. Drainage Fill: Place supporting layer of drainage fill over compacted subgrade to compacted depth of not less than 4 inches. After installing drainage piping, add drainage fill to top of pipe to perform tests. After satisfactory testing, cover piping with drainage fill to elevation of bottom of slab and compact drainage material.

1. Before installing drainage fill, lay flat-style geotextile filter fabric in trench and overlap trench sides. After installing drainage fill, wrap top of drainage fill with flat-style geotextile filter fabric.

2. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with electrical tape.

C. Install horizontal drainage panels as follows:

1. Coordinate placement with other drainage materials.

2. Lay perforated, PE or PVC drainage pipe at inside edge of footings.

3. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.

4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.

3.9 PLAZA DECK DRAINAGE INSTALLATION (NOT USED)

3.10 RETAINING-WALL DRAINAGE INSTALLATION (NOT USED)

3.11 LANDSCAPING DRAINAGE INSTALLATION (NOT USED)

3.12 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.

2. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.

3. Plaza Deck Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 1.0 percent.

4. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.

5. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.

6. Lay perforated pipe with perforations down.

7. Lay open-joint pipe spaced as indicated on Drawings or, if not indicated, with 1/4-inch space between ends. Cover top two-thirds of joint opening with open-joint screening material and tie with corrosion-resistant wire.

8. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping according to ASTM D 2321.

D. Install PVC piping according to ASTM D 2321.

E. Install clay piping according to ASTM C 12 and NCPI's "Clay Pipe Engineering Manual."

F. Install concrete piping according to ACPA's "Concrete Pipe Handbook."

3.13 PIPE JOINT CONSTRUCTION

A. Cast-Iron Soil Pipe and Fittings: Hub and spigot, with rubber compression gaskets according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook." Use gaskets that match class of pipe and fittings.

B. Join PE pipe, tubing, and fittings with couplings for soiltight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."

C. Join perforated, PE pipe and fittings with couplings for soiltight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.

D. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

E. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose, bell-and-spigot joints.

F. Join perforated clay pipe and fittings with gaskets according to ASTM C 425.

G. Lay clay pipe and fittings with open joints and open-joint screening material.

H. Join perforated, concrete pipe and fittings with gaskets according to ASTM C 443/C 443M.

I. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.14 SUBDRAINAGE CLEANOUT INSTALLATION (NOT USED)

3.15 UNDERSLAB SUBDRAINAGE CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from subdrainage piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

B. Use NPS 4 cast-iron soil pipe and fittings for subdrainage piping branch fittings and riser extensions to cleanout plug flush with top of slab.

3.16 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to solid building storm drainage system.

C. Where required, connect low elevations of foundation and underslab subdrainage to stormwater sump pumps.

3.17 FIELD QUALITY CONTROL

A. Testing: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.18 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 02620

SECTION 02630

STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes gravity-flow and non-pressure storm drainage outside the building, with the following components:

1. Special fittings for expansion and deflection.
2. Backwater valves.
3. Cleanouts.
4. Drains.
5. Corrosion-protection piping encasement.
6. Precast concrete manholes.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene-monomer rubber.

C. FRP: Fiberglass-reinforced plastic.

D. LLDPE: Linear low-density, polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

H. RTRF: Glass-fiber-reinforced, thermosetting-resin fitting.

I. RTRP: Glass-fiber-reinforced, thermosetting-resin pipe.

J. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Non-pressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

B. Force-Main, Pressure-Piping Pressure Rating: At least equal to system operating pressure but not less than 50 psig.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Special pipe fittings.
2. Backwater valves.
3. Drains.
4. Channel drainage systems.

5. Storage and leaching chambers.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers.

2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.

3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Architect's permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS (NOT USED)

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS (NOT USED)

2.5 DUCTILE-IRON CULVERT PIPE AND FITTINGS

A. Pipe: ASTM A 716, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.6 DUCTILE-IRON PRESSURE PIPE AND FITTINGS

A. Pipe: AWWA C151, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.7 STEEL PIPE AND FITTINGS (NOT USED)

2.8 ALUMINUM PIPE AND FITTINGS (NOT USED)

2.9 ABS PIPE AND FITTINGS (NOT USED)

2.10 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.

2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

3. Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

4. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

5. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

B. Corrugated PE Pipe and Fittings NPS 56 and NPS 60: AASHTO MP7, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2. Soiltight Couplings: AASHTO MP7, corrugated, matching pipe and fittings.

2.11 PVC PIPE AND FITTINGS

A. PVC Pressure Pipe: AWWA C900, Class 150, for gasketed joints and using ASTM F 477, elastomeric seals.

1. Fittings NPS 4 to NPS 8: PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.

2. Fittings NPS 10 and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.

B. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 40 pipe, with plain ends for solvent-cemented joints with ASTM D 2466, Schedule 40, socket-type fittings.

C. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness pipe with ASTM D 3034, SDR 35, socket-type fittings for solvent-cemented joints.

D. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

E. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-1 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

F. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.12 FIBERGLASS PIPE AND FITTINGS (NOT USED)

2.13 CONCRETE PIPE AND FITTINGS

A. Non-reinforced-Concrete Sewer Pipe and Fittings: ASTM C 14, Class 3, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.

B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.

1. Class I, Wall A.

2. Class III, Wall A.

2.14 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, rubber.

2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.

3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:

a. Dallas Specialty & Mfg. Co.

b. Fernco Inc.

c. Logan Clay Products Company (The).

d. Mission Rubber Company; a division of MCP Industries, Inc.

e. NDS Inc.

f. Plastic Oddities, Inc.

D. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:

a. Cascade Waterworks Mfg.

b. Dallas Specialty & Mfg. Co.

c. Mission Rubber Company; a division of MCP Industries, Inc.

E. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

1. Available Manufacturers:

a. Fernco Inc.

b. Logan Clay Products Company (The).

c. Mission Rubber Company; a division of MCP Industries, Inc.

F. Non-pressure-Type Rigid Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:

a. ANACO.

2.15 PRESSURE-TYPE PIPE COUPLINGS

A. Reducing or transition, metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psig minimum pressure rating and ends of same sizes as piping to be joined.

B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

1. Available Manufacturers:

a. Cascade Waterworks Mfg.

b. Dresser, Inc.; DMD Div.

c. Ford Meter Box Company, Inc. (The); Pipe Products Div.

d. JCM Industries.

e. Romac Industries, Inc.

f. Smith-Blair, Inc.

g. Viking Johnson.

2. Center-Sleeve Material: Stainless steel.

3. Gasket Material: Natural or synthetic rubber.

4. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Couplings: With split sleeve with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

1. Available Manufacturers:

a. Brico Industries.

2. Sleeve Material: Carbon steel.

3. Sleeve Dimensions: Of thickness and width required to provide pressure rating.

4. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.

5. Metal Component Finish: Corrosion-resistant coating or material.

2.16 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

1. Available Manufacturers:

a. EBAA Iron Sales, Inc.

b. Romac Industries, Inc.

c. Star Pipe Products.

B. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

1. Available Manufacturers:

a. EBAA Iron Sales, Inc.

C. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

1. Available Manufacturers:

a. Dresser, Inc.; DMD Div.

b. EBAA Iron Sales, Inc.

c. JCM Industries.

d. Smith-Blair, Inc.

2.17 BACKWATER VALVES

A. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

1. Available Manufacturers:

a. Josam Company.

b. Smith, Jay R. Mfg. Co.

c. Wade Div.; Tyler Pipe.

d. Watts Industries, Inc.

e. Watts Industries, Inc.; Enpoco, Inc. Div.

f. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Horizontal Type: With swing check valve and hub-and-spigot ends.

3. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.

4. Terminal Type: With bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

1. Available Manufacturers:

a. Canplas Inc.

b. IPS Corporation.

c. NDS Inc.

d. Plastic Oddities, Inc.

e. Sioux Chief Manufacturing Company, Inc.

f. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

2.18 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Available Manufacturers:

a. Josam Company.

b. MIFAB Manufacturing, Inc.

c. Smith, Jay R. Mfg. Co.

d. Wade Div.; Tyler Pipe.

e. Watts Industries, Inc.

f. Watts Industries, Inc.; Enpoco, Inc. Div.

g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Medium duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

1. Available Manufacturers:

a. Canplas Inc.

b. IPS Corporation.

c. NDS Inc.

d. Plastic Oddities, Inc.

e. Sioux Chief Manufacturing Company, Inc.

f. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

2.19 DRAINS

A. Gray-Iron Area Drains: ASME A112.21.1M, round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

1. Available Manufacturers:

a. Josam Company.

b. MIFAB Manufacturing, Inc.

c. Smith, Jay R. Mfg. Co.

d. Wade Div.; Tyler Pipe.

e. Watts Industries, Inc.

f. Watts Industries, Inc.; Enpoco, Inc. Div.

g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Medium duty.

B. Gray-Iron Trench Drains: ASME A112.21.1M, 6-inch- wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and number of bottom outlets with inside calk or spigot connections, of sizes indicated.

1. Available Manufacturers:

a. Josam Company.

b. Smith, Jay R. Mfg. Co.

c. Wade Div.; Tyler Pipe.

d. Watts Industries, Inc.

e. Watts Industries, Inc.; Enpoco, Inc. Div.

f. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Medium and heavy duty.

C. Steel Trench Drains: Factory fabricated from ASTM A 242/A 242M, welded steel plate to form rectangular body with uniform bottom slope of 2 percent down toward outlet, anchor flange, and grate. Include units of total length indicated, bottom outlet of size indicated, outlet strainer, acid-resistant enamel coating on inside and outside surfaces, and grate with openings of total free area at least two times cross-sectional area of outlet.

1. Available Manufacturers:

a. Rockford Sanitary Systems, Inc.

2. Plate Thickness: 1/8 inch.

3. Overall Width(s): 7-1/2 inches.

a. Grate Openings: 3/8-by-3-inch slots.

2.20 CORROSION-PROTECTION PIPING ENCASEMENT (NOT USED)

2.21 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

4. Riser Sections: 4-inch minimum thickness and lengths to provide depth indicated.

5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

7. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.

8. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.

9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

10. Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to exterior surfaces.

11. Manhole Frames and Covers: Refer to miscellaneous details for specified casting model. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

    b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

B. Designed Precast Concrete Manholes: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.

1. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole, as required to prevent flotation.

2. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

3. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.

4. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.

5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

6. Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to exterior surfaces.

7. Manhole Frames and Covers: Refer to miscellaneous details for specified casting model. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

    b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

C. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Ballast: Increase thickness of concrete, as required to prevent flotation.

2. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.

3. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.

4. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

5. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

   a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

   b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

D. Fiberglass Manholes: (NOT USED)

2.22 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.23 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS (NOT USED)

2.24 PLASTIC, CHANNEL DRAINAGE SYSTEMS

A. Description, General: Modular system of plastic channel sections, grates, and appurtenances; designed so grates fit into frames without rocking or rattling. Include number of units required to form total lengths indicated.

B. Available Manufacturers:

1. ACO Polymer Prod.

2. MultiDrain Corp.

3. NDS Inc.

4. Tuf-Tite, Inc.

5. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

C. Fiberglass Systems: (NOT USED)

D. PE Systems: (NOT USED)

E. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

F. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.25 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.

3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

5. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.

6. Steps: Not required.

7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.

1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.

2. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.

3. Steps: Not required.

4. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

C. Cast-in-Place Concrete, Catch Basins: Construct of reinforced concrete; designed according to ASTM C 890 for structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Bottom, Walls, and Top: Reinforced concrete.

2. Channels and Benches: Concrete.

3. Steps: Not required.

D. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum, unless otherwise indicated.

2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

E. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.26 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy-duty frames and grates according to utility standards.

E. Curb Inlets: Vertical curb opening, of materials and dimensions indicated.

F. Gutter Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavy-duty frames and grates.

G. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

H. Frames and Grates: Dimensions, opening pattern, free area, and other attributes indicated.

2.27 STORMWATER DETENTION STRUCTURES (NOT USED)

2.28 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-4, screen opening 3 inches.

C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size, graded stone.

D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

2.29 DRY WELLS (NOT USED)

2.30 STORMWATER DISPOSAL SYSTEMS (NOT USED)

2.31 MISCELLANEOUS MATERIALS

A. Paint: SSPC-Paint 16.

B. PE Sheeting: ASTM D 4397, with at least 8-mil thickness.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use non-pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping, unless otherwise indicated.

a. Shielded flexible couplings for same or minor difference OD pipes.

b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.

c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Non-pressure Sewer Piping: Use any of the following pipe materials for each size range:

0. NPS 3: Corrugated PE drainage pipe and fittings, silttight couplings, and coupled joints.
1. NPS 3: PVC water-service pipe; PVC Schedule 40, water-service-pipe fittings; and solvent-cemented joints.
2. NPS 3: NPS 4 PVC sewer pipe and fittings; gaskets; and gasketed joints.
3. NPS 4 and NPS 6: ABS, SDR 35, sewer pipe and fittings; gaskets; and gasketed joints.
4. NPS 4 and NPS 6: Corrugated PE drainage pipe and fittings, silttight couplings, and coupled joints.
5. NPS 4 and NPS 6: PVC sewer pipe and fittings, gaskets, and gasketed joints.
6. NPS 8 to NPS 12: NPS 14 ductile-iron culvert pipe, ductile-iron standard fittings, gaskets, and gasketed joints.
7. NPS 8 to NPS 12: ABS, SDR 42, sewer pipe and fittings; gaskets, and gasketed joints.
8. NPS 8 to NPS 12: Corrugated PE drainage pipe and fittings in NPS 8 and NPS 10 and corrugated PE pipe and fittings in NPS 12, silttight couplings, and coupled joints.
9. NPS 8 to NPS 12: Cellular-core PVC pipe, PVC sewer pipe fittings, and solvent-cemented joints.
10. NPS 8 to NPS 12: PVC profile gravity sewer pipe and fittings, gaskets, and gasketed joints.
11. NPS 8 to NPS 12: NPS 12 reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
12. NPS 15: NPS 16 ductile-iron culvert pipe, ductile-iron standard fittings, gaskets, and gasketed joints.
13. NPS 15: Corrugated PE pipe and fittings, silttight couplings, and coupled joints.
14. NPS 15: PVC sewer pipe and fittings, gaskets, and gasketed joints.
15. NPS 15: PVC profile gravity sewer pipe and fittings, gaskets, and gasketed joints.
16. NPS 15: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
17. NPS 18 to NPS 36: Ductile-iron culvert pipe, ductile-iron standard fittings, gaskets, and gasketed joints.
18. NPS 18 to NPS 36: Corrugated PE pipe and fittings, silttight couplings, and coupled joints.
19. NPS 18 to NPS 36: PVC sewer pipe and fittings, gaskets, and gasketed joints.
20. NPS 18 to NPS 36: PVC profile gravity sewer pipe and fittings, gaskets, and gasketed joints.
21. NPS 18 to NPS 36: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
22. NPS 42 to NPS 64: Ductile-iron culvert pipe, ductile-iron standard fittings, gaskets, and gasketed joints.
23. NPS 42 to NPS 64: Corrugated steel pipe and fittings, standard -joint bands, and banded joints.
24. NPS 42 to NPS 60: Corrugated PE pipe and fittings, silttight couplings, and coupled joints.

25. NPS 42 to NPS 60: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.

D. Force-Main Pressure Piping: Use the following pipe materials for each size range:

1. NPS 2: PVC Schedule 40, water-service pipe; PVC Schedule 40, water-service-pipe fittings; and solvent-cemented joints.

2. NPS 3: PVC Schedule 40, water-service pipe; PVC Schedule 40, water-service-pipe fittings; and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, non-pressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, as indicated on the plans.

2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.

3. Install piping with 36-inch minimum cover.

4. Install piping below frost line.

5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

6. Install hubless cast-iron soil piping according to CISPI C310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

7. Install ductile-iron culvert piping according to ASTM A 716.

8. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.

9. Install corrugated steel piping according to ASTM A 798/A 798M.

10. Install corrugated aluminum piping according to ASTM B 788/B 788M.

11. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.

12. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

13. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.

14. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

15. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
16. Install fiberglass sewer piping according to ASTM D 3839 and ASTM F 1668.
17. Install non-reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
18. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install force-main pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
2. Install piping with 36-inch minimum cover.
3. Install piping below frost line.
4. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
5. Install ductile-iron special fittings according to AWWA C600.
6. Install PVC pressure piping according to AWWA M23 or ASTM D 2774 and ASTM F 1668.
7. Install PVC water-service piping according to ASTM D 2774 and ASTM F 1668.

3.4 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 2 Section "Piped Utilities - Basic Materials and Methods." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, non-pressure drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping according to CISPI C310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
5. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.
6. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
7. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
8. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
9. Join corrugated PE piping according to CPPA 100 and the following:
    a. Use silttight couplings for Type 1, silttight joints.
    b. Use soiltight couplings for Type 2, soiltight joints.
10. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cement joints.
11. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.

12. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
13. Join fiberglass sewer piping according to ASTM D 3839 for elastomeric-seal joints.
14. Join non-reinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
15. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
16. Join dissimilar pipe materials with non-pressure-type flexible couplings.

C. Join force-main pressure piping according to the following:

1. Join ductile-iron pressure piping according to AWWA C660 or AWWA M41 for push-on joints.
2. Join ductile-iron special fittings according to AWWA C660 or AWWA M41 for push-on joints.
3. Join PVC pressure piping according to AWWA M23 for gasketed joints.
4. Join PVC water-service piping according to ASTM D 2855 for solvent-cemented joints.

D. Join dissimilar pipe materials with pressure-type couplings.

3.5 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.

B. Install combination horizontal and manual gate valve type in piping and in manholes where indicated.

C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use extra-heavy-duty, top-loading classification cleanouts in roads areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops at surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.7 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use light-duty, top-loading classification drains in earth or unpaved foot-traffic areas.
2. Use medium-duty, top-loading classification drains in paved foot-traffic areas.
3. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.
4. Use extra-heavy-duty, top-loading classification drains in roads areas.

B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.8 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections according to ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.

E. Install FRP manholes according to manufacturer's written instructions.

F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.9 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.10 STORMWATER INLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.11 DRY WELL INSTALLATION (NOT USED)

3.12 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.13 DRAINAGE SYSTEM INSTALLATION

A. Assemble and install components according to manufacturer's written instructions.

B. Install with top surfaces of components, except piping, flush with finished surface.

C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

D. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.

E. Fasten grates to channel sections if indicated.

F. Assemble channel sections with flanged or interlocking joints.

G. Embed channel sections in 4-inch minimum concrete around bottom and sides.

3.14 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill according to chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.

B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill according to piping manufacturer's written instructions.

3.15 CONNECTIONS

A. Connect non-pressure, gravity-flow drainage piping in building's storm building drains specified in Division 15 Section "Storm Drainage Piping."

B. Connect force-main pressure piping to building's storm drainage force mains specified in Division 15 Section "Storm Drainage Piping." Terminate piping where indicated.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Connect to sediment interceptors specified in Division 2 Section "Interceptors."

3.16 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch-thick, brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.

2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 2 Section "Earthwork."

3.17 PAINTING

A. Clean and prepare concrete manhole surfaces for field painting. Remove loose efflorescence, chalk, dust, grease, oils, and release agents. Roughen surface as required to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:

1. Cast-in-Place-Concrete Manholes: All exterior, except bottom.

2. Precast Concrete Manholes: All exterior.

B. Prepare ferrous frame and cover surfaces according to SSPC-PA 1 and paint according to SSPC-PA 1 and SSPC-Paint 16. Do not paint surfaces with foundry-applied, corrosion-resistant coating.

3.18 IDENTIFICATION

A. Materials and their installation are specified in division 2 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.19 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

   a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.

   b. Option: Test plastic piping according to ASTM F 1417.

   c. Option: Test concrete piping according to ASTM C 924.

6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.

   a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.

   b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.20 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 02630

SECTION 02764

PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 2 Section "Hot-Mix Asphalt Paving" for constructing joints between concrete and asphalt pavement.

2. Division 2 Section "Cement Concrete Pavement" for constructing joints in concrete pavement.

3. Division 7 Section "Joint Sealants" for sealing non-traffic and traffic joints in locations not specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For testing agency.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.

2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

3. When joint substrates are wet or covered with frost.

4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.

a. Available Products:

1) Pecora Corporation; Urexpan NR-300.

2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.

a. Available Products:

1) Meadows, W. R., Inc.; Sealtight Gardox.

3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

a. Available Products:

1) Tremco Sealant/Waterproofing Division; Vulkem 202.

B. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

1. Available Products:

a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.

C. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, and non-sag silicone sealant complying with ASTM D 5893 for Type NS.

1. Available Products:

a. Crafco Inc.; RoadSaver Silicone.

b. Dow Corning Corporation; 888.

D. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Available Products:

a. Crafco Inc.; RoadSaver Silicone SL.

b. Dow Corning Corporation; 890-SL.

E. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

1. Available Products:

a. Meadows, W. R., Inc.; Sof-Seal.

2.4 HOT-APPLIED JOINT SEALANTS

A. Jet-Fuel-Resistant Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3569.

1. Available Products:

a. Crafco Inc.; Superseal 444/777.

b. Meadows, W. R., Inc.; Poly-Jet 3569.

B. Jet-Fuel-Resistant Sealant for Concrete and Tar Concrete: Single-component formulation complying with ASTM D 3581.

1. Available Products:

a. Crafco Inc.; Superseal 1614A.

b. Meadows, W. R., Inc.; Poly-Jet 1614.

c. Meadows, W. R., Inc.; Poly-Jet 3406.

d. Meadows, W. R., Inc.; Poly-Jet 3569.

C. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Available Products:

a. Crafco Inc.; Superseal 444/777.

b. Meadows, W. R., Inc.; Poly-Jet 3406.

D. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Available Products:

a. Koch Materials Company; Product No. 9005.

b. Koch Materials Company; Product No. 9030.

c. Meadows, W. R., Inc.; Sealtight Hi-Spec.

2.5 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.

2. Do not stretch, twist, puncture, or tear backer materials.

3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construc tion operations or other causes so sealants are without

deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 02764