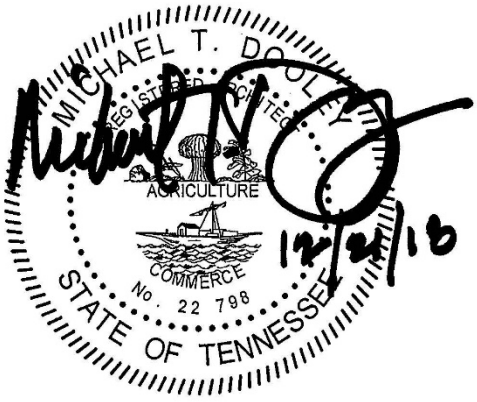
DOCUMENT 00 91 13.01 – ADDENDUM 1

1.01 PROJECT INFORMATION



A. Project Identification: Five Points Phase 4.
   1. Project Location: 400 McConnell Street, Knoxville, Tennessee 37915.

B. Owner: Knoxville Community Development Corporation, 901 Broadway, N.E., Knoxville, Tennessee 37917-6699.

C. Architect: BarberMcMurry architects, 505 Market Street, Suite 300, Knoxville, TN 37902-2175. Phone: 865-934-1915. Fax: 865-546-0242.

D. Architect Project Number: 177700

E. Date of Addendum: 21 December 2018.

1.02 NOTICE TO BIDDERS

A. This Addendum is issued to all registered plan holders pursuant to the Instructions to Bidders. This Addendum serves to clarify, revise, and supersede information in the Project Manual, Drawings, and previously issued Addenda. Portions of the Addendum affecting the Contract Documents will be incorporated into the Contract by enumeration of the Addendum in the Owner/Contractor Agreement.

B. The Bidder shall acknowledge receipt of this Addendum in the appropriate space on the Bid Form.

C. The date for receipt of bids is unchanged by this Addendum, at same time and location.
   1. Bid Date: 2:00 PM on 15 January 2018.

1.03 ATTACHMENTS

A. This Addendum includes the following attached Documents and Specification Sections:
   1. Section 00 01 15 – List of Drawing Sheets, revised 21 December 2018, reissued.
   2. Section 31 00 00 – Earthwork, dated 7 December 2018, new.
   3. Section 31 10 00 – Site Clearing, dated 7 December 2018, new.
   4. Section 32 16 16 – Asphalt Paving, dated 7 December 2018, new.
   5. Section 32 13 13 – Concrete Paving, dated 7 December 2018, new.
   6. Section 32 13 73 – Concrete Paving Joint Sealants, dated 7 December 2018, new.
   7. Section 32 17 23 – Pavement Markings, dated 7 December 2018, new.
   8. Section 33 11 00 – Water Distribution, dated 7 December 2018, new.
   9. Section 33 13 00 – Disinfection of Water Distribution, dated 7 December 2018, new
   10. Section 33 31 00 – Sanitary Sewerage, dated 7 December 2018, new.

11. Section 33 41 00 – Storm Sewer System, dated 7 December 2018, new.

B. This Addendum includes the following attached Sheets:
1. Cover Sheet A000, revised 21 December 2018, reissued.
2. Civil Sheet C001, revised 21 December 2018, reissued.
3. Civil Sheet C100, revised 21 December 2018, reissued.
4. Civil Sheet C200, revised 21 December 2018, reissued.
5. Civil Sheet C201, revised 21 December 2018, reissued.
6. Civil Sheet C202, revised 21 December 2018, reissued.
7. Civil Sheet C203, revised 21 December 2018, reissued.
8. Civil Sheet C204, revised 21 December 2018, reissued.
9. Civil Sheet C300, revised 21 December 2018, reissued.
10. Civil Sheet C301, revised 21 December 2018, reissued.
11. Civil Sheet C302, revised 21 December 2018, reissued.
12. Civil Sheet C303, revised 21 December 2018, reissued.
13. Civil Sheet C304, revised 21 December 2018, reissued.
14. Civil Sheet C400, revised 21 December 2018, reissued.
15. Civil Sheet C401, revised 21 December 2018, reissued.
16. Civil Sheet C402, revised 21 December 2018, reissued.
17. Civil Sheet C403, revised 21 December 2018, reissued.
18. Civil Sheet C500, revised 21 December 2018, reissued.
19. Civil Sheet C501, revised 21 December 2018, reissued.
20. Civil Sheet C502, revised 21 December 2018, reissued.
21. Civil Sheet C503, revised 21 December 2018, reissued.
22. Civil Sheet C900, revised 21 December 2018, reissued.
23. Civil Sheet C901, revised 21 December 2018, reissued.
24. Civil Sheet C902, revised 21 December 2018, reissued.
25. Architectural Sheet A030, revised 21 December 2018, reissued.
26. Architectural Sheet A050, revised 21 December 2018, reissued.
27. Architectural Sheet A-A101, revised 21 December 2018, reissued.
28. Architectural Sheet B-A101, revised 21 December 2018, reissued.
29. Architectural Sheet C-A101, revised 21 December 2018, reissued.
30. Architectural Sheet D1-A101, revised 21 December 2018, reissued.
31. Architectural Sheet D2-A101, revised 21 December 2018, reissued.
32. Architectural Sheet E-A101, revised 21 December 2018, reissued.
33. Architectural Sheet F-A101, revised 21 December 2018, reissued.
34. Architectural Sheet G1-A101, revised 21 December 2018, reissued.
35. Architectural Sheet G2-A101, revised 21 December 2018, reissued.
36. Architectural Sheet H1-A101, revised 21 December 2018, reissued.
37. Architectural Sheet H2-A101, revised 21 December 2018, reissued.
38. Architectural Sheet A401, revised 21 December 2018, reissued.
39. Architectural Sheet A505, revised 21 December 2018, reissued.
40. Structural Sheet S004, revised 21 December 2018, reissued.

END OF DOCUMENT 00 91 13.01

SECTION 00 01 15 - LIST OF DRAWING SHEETS

1.01 LIST OF DRAWINGS

A. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

SHEET NUMBER	SHEET NAME
GENERAL:	
A000	COVER SHEET
CIVIL:	
C001	GENERAL NOTES
C-100	DEMOLITION PLAN
C-200	OVERALL SITE LAYOUT
C-201	SOUTHWEST LAYOUT PLAN
C-202	NORTHWEST LAYOUT PLAN
C-203	NORTHEAST LAYOUT PLAN
C-204	ROADWAY GEOMETRY PLAN
C-300	OVERALL GRADING PLAN
C-301	SOUTHWEST GRADING PLAN
C-302	NORTHWEST GRADING PLAN
C-303	NORTHEAST GRADING PLAN
C-304	ROADWAY PROFILES
C-400	OVERALL DRAINAGE PLAN
C-401	SOUTHWEST DRAINAGE PLAN
C-402	NORTHWEST DRAINAGE PLAN
C-403	NORTHEAST DRAINAGE PLAN
C-404	STORM SEWER PROFILES
C-405	STORM SEWER PROFILES
C-500	OVERALL UTILITY PLAN
C-501	SOUTHWEST UTILITIES PLAN
C-502	NORTHWEST UTILITIES PLAN
C-503	NORTHEAST UTILITIES PLAN
C-504	SANITARY SEWER PROFILES
C-505	UTILITIES PLAN - KUB RIGHT-OF-WAY
C-506	UTILITIES PLAN - KUB RIGHT-OF-WAY
C-507	UTILITIES PLAN - KUB RIGHT-OF-WAY
C-508	UTILITIES PLAN - KUB RIGHT-OF-WAY
C-800	DETAILS
C-801	DETAILS
C-802	DETAILS
C-803	DETAILS
C-804	DETAILS
C-805	DETAILS
C-900	INITIAL EROSION & SEDIMENTATION CONTROL PLAN
C-901	INTERIM EROSION & SEDIMENTATION CONTROL PLAN
C-902	FINAL EROSION & SEDIMENTATION CONTROL PLAN
C-903	EROSION & SEDIMENTATION CONTROL PLAN DETAILS
C-904	EROSION & SEDIMENTATION CONTROL PLAN DETAILS

LANDSCAPE:

L1.0	OVERALL LANDSCAPE PLAN
L1.1	DETAILED LANDSCAPE PLAN
L1.2	DETAILED LANDSCAPE PLAN
L1.3	DETAILED LANDSCAPE PLAN
L1.4	DETAILED LANDSCAPE PLAN
L1.5	DETAILED LANDSCAPE PLAN
L1.6	DETAILED LANDSCAPE PLAN
L1.7	DETAILED LANDSCAPE PLAN
L1.8	DETAILED LANDSCAPE PLAN
L1.9	DETAILED LANDSCAPE PLAN
L2.0	LANDSCAPE DETAILS & NOTES
IR1.0	IRRIGATION SCOPE PLAN

ARCHITECTURAL:

A010	LIFE SAFETY PLANS
A011	LIFE SAFETY PLANS
A012	LIFE SAFETY PLANS
A020	ARCHITECTURAL OVERALL SITE PLAN
A021	ARCHITECTURAL SITE PLAN (NORTHWEST)
A022	ARCHITECTURAL SITE PLAN (SOUTHWEST)
A023	ARCHITECTURAL SITE PLAN (NORTHEAST)
A024	ARCHITECTURAL SITE PLAN (SOUTHEAST)
A030	SITE DETAILS
A050	STANDARD MOUNTING HEIGHTS, PARTITION TYPES & UL RATED ASSEMBLIES
A051	UL RATED ASSEMBLIES
A-A101	TYPE A - FIRST FLOOR PLANS & SCHEDULES (VICTORIAN)
A-A102	TYPE A - SECOND FLOOR PLANS (VICTORIAN)
A-A103	TYPE A - ENLARGED PLANS & INTERIOR ELEVATIONS (VICTORIAN)
A-A301	TYPE A - BUILDING ELEVATIONS (VICTORIAN)
A-A302	TYPE A - BUILDING SECTIONS (VICTORIAN)
B-A101	TYPE B - FIRST FLOOR PLANS & SCHEDULES (COLONIAL REV.)
B-A102	TYPE B - SECOND FLOOR PLANS (COLONIAL REV.)
B-A103	TYPE B - ENLARGED PLANS & INTERIOR ELEVATION (COLONIAL REV.)
B-A104	TYPE B - INTERIOR ELEVATIONS (COLONIAL REV.)
B-A301	TYPE B - BUILDING ELEVATIONS (COLONIAL REV.)
B-A302	TYPE B - BUILDING SECTIONS (COLONIAL REV.)
C-A101	TYPE C - FIRST FLOOR PLANS & SCHEDULES (CRAFTSMAN)
C-A102	TYPE C - SECOND FLOOR PLANS (CRAFTSMAN)
C-A103	TYPE C - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
C-A301	TYPE C - BUILDING ELEVATIONS (CRAFTSMAN)
C-A302	TYPE C - BUILDING SECTIONS (CRAFTSMAN)
D1-A101	TYPE D1 - FIRST FLOOR PLANS & SCHEDULES (CRAFTSMAN)
D1-A102	TYPE D1 - SECOND FLOOR PLANS (CRAFTSMAN)
D1-A103	TYPE D1 - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
D1-A104	TYPE D1 - INTERIOR ELEVATIONS (CRAFTSMAN)
D1-A301	TYPE D1 - BUILDING ELEVATIONS (CRAFTSMAN)
D1-A302	TYPE D1 - BUILDING SECTIONS (CRAFTSMAN)

D2-A101	TYPE D2 - COMMUNITY ROOM ADDITION PLANS AND ELEVATIONS
E-A101	TYPE E - BUILDING PLANS & SCHEDULES (CRAFTSMAN)
E-A102	TYPE E - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
E-A301	TYPE E - BUILDING ELEVATIONS (CRAFTSMAN)
E-A302	TYPE E - BUILDING SECTIONS (CRAFTSMAN)
F-A101	TYPE F - FIRST FLOOR PLANS & SCHEDULES (COLONIAL REV.)
F-A102	TYPE F - SECOND FLOOR PLANS (COLONIAL REV.)
F-A103	TYPE F - ENLARGED PLANS & INTERIOR ELEVATIONS (COLONIAL REV.)
F-A104	TYPE F - INTERIOR ELEVATIONS (COLONIAL REV.)
F-A301	TYPE F - BUILDING ELEVATIONS (COLONIAL REV.)
F-A302	TYPE F - BUILDING SECTIONS (COLONIAL REV.)
G1-A101	TYPE G1 - FIRST FLOOR PLANS & SCHEDULES (CRAFTSMAN)
G1-A102	TYPE G1 - SECOND FLOOR PLANS (CRAFTSMAN)
G1-A103	TYPE G1 - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
G1-A104	TYPE G1 - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
G1-A301	TYPE G1 - BUILDING ELEVATIONS (CRAFTSMAN)
G1-A302	TYPE G1 - BUILDING SECTIONS (CRAFTSMAN)
G2-A101	TYPE G2 - FIRST FLOOR PLANS & SCHEDULES (VICTORIAN)
G2-A102	TYPE G2 - SECOND FLOOR PLANS (VICTORIAN)
G2-A103	TYPE G2 - ENLARGED INTERIOR ELEVATIONS (VICTORIAN)
G2-A104	TYPE G2 - ENLARGED PLANS & INTERIOR ELEVATIONS (VICTORIAN)
G2-A301	TYPE G2 - BUILDING ELEVATIONS (VICTORIAN)
G2-A302	TYPE G2 - BUILDING SECTIONS (VICTORIAN)
H1-A101	TYPE H1 - BUILDING PLANS & SCHEDULES (COLONIAL REV.)
H1-A102	TYPE H1 - ENLARGED PLANS & INTERIOR ELEVATIONS (COLONIAL REV.)
H1-A301	TYPE H1 - BUILDING ELEVATIONS (COLONIAL REV.)
H1-A302	TYPE H1 - BUILDING SECTIONS (COLONIAL REV.)
H2-A101	TYPE H2 - BUILDING PLANS & SCHEDULES (VICTORIAN)
H2-A102	TYPE H2 - ENLARGED PLANS & INTERIOR ELEVATIONS (VICTORIAN
H2-A301	TYPE H2 - BUILDING ELEVATIONS (VICTORIAN)
H2-A302	TYPE H2 - BUILDING SECTIONS (VICTORIAN)
A401	SECTION DETAILS
A402	SECTION DETAILS
A403	SECTION DETAILS
A501	PLAN DETAILS
A502	ENLARGED STAIR PLANS & SECTIONS
A503	ENLARGED STAIR PLANS & SECTIONS
A504	ENLARGED STAIR PLANS & SECTIONS
A505	ENLARGED STAIR PLANS, SECTIONS & DETAILS
A601	CASEWORK DETAILS
A701	DOOR AND FRAME TYPES, DOOR AND FRAME DETAILS
A702	WINDOW ELEVATIONS AND DETAILS

STRUCTURAL:

S001	ABBREVIATIONS, SYMBOLS AND LEGENDS
S002	GENERAL NOTES
S003	SPECIAL INSPECTIONS
S004	TYPICAL DETAILS
S005	TYPICAL DETAILS
S006	TYPICAL DETAILS

A-S101	FOUNDATION PLAN
A-S102	SECOND FLOOR FRAMING PLAN
A-S103	ROOF FRAMING PLAN
B-S101	FOUNDATION PLAN
B-S102	SECOND FLOOR FRAMING PLAN
B-S103	ROOF FRAMING PLAN
C-S101	FOUNDATION PLAN
C-S102	SECOND FLOOR FRAMING PLAN
C-S103	ROOF FRAMING PLAN
D1-S101	FOUNDATION PLAN
D1-S102	SECOND FLOOR FRAMING PLAN
D1-S103	ROOF FRAMING PLAN
D2-S101	FOUNDATION PLAN
D2-S102	SECOND FLOOR FRAMING PLAN
D2-S103	ROOF FRAMING PLAN
E-S101	FOUNDATION & ROOF FRAMING PLAN
F-S101	FOUNDATION PLAN
F-S102	SECOND FLOOR FRAMING PLAN
F-S103	ROOF FRAMING PLAN
G1-S101	FOUNDATION & SECOND FLOOR FRAMING PLAN
G1-S102	ROOF FRAMING PLAN
G2-S101	FOUNDATION & SECOND FLOOR FRAMING PLAN
G2-S102	ROOF FRAMING PLAN
H1-S101	FOUNDATION & SECOND FLOOR FRAMING PLAN
H1-S102	ROOF FRAMING PLAN
H2-S101	FOUNDATION & SECOND FLOOR FRAMING PLAN
H2-S102	ROOF FRAMING PLAN
S201	SECTIONS & DETAILS
S301	SECTIONS & DETAILS
S401	SECTIONS & DETAILS
S402	SECTIONS & DETAILS

MECHANICAL:

M001	HVAC NOTES, LEGENDS AND SCHEDULES
M002	HVAC DETAILS
A-M101	BUILDING A - FIRST AND SECOND FLOOR HVAC PLANS
B-M101	BUILDING B - FIRST AND SECOND FLOOR HVAC PLANS
C-M101	BUILDING C - FIRST AND SECOND FLOOR HVAC PLANS
D1-M101	BUILDING D1 - FIRST AND SECOND FLOOR HVAC PLANS
D2-M101	BUILDING D2 - FIRST AND SECOND FLOOR HVAC PLANS
E-M101	BUILDING E - FIRST FLOOR HVAC PLAN
F-M101	BUILDING F - FIRST AND SECOND FLOOR HVAC PLANS
G1-M101	BUILDING G1 - FIRST AND SECOND FLOOR HVAC PLANS
G2-M101	BUILDING G2 - FIRST AND SECOND FLOOR HVAC PLANS
H1-M101	BUILDING H1 - FIRST AND SECOND FLOOR HVAC PLANS
H2-M101	BUILDING H2 - FIRST AND SECOND FLOOR HVAC PLANS

PLUMBING:

P0.0	PLUMBING NOTES, LEGENDS AND SCHEDULES
A-P101	BUILDING A - FIRST AND SECOND FLOOR SANITARY PLANS

A-P102	BUILDING A - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
B-P101	BUILDING B - FIRST AND SECOND FLOOR SANITARY PLANS
B-P102	BUILDING B - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
C-P101	BUILDING C - FIRST AND SECOND FLOOR SANITARY PLANS
C-P102	BUILDING C - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
D1-P101	BUILDING D1 - FIRST AND SECOND FLOOR SANITARY PLANS
D1-P102	BUILDING D1 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
D2-P101	BUILDING D2 - FIRST AND SECOND FLOOR SANITARY PLANS
D2-P102	BUILDING D2 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
E-P101	BUILDING E - FIRST FLOOR SANITARY PLAN
E-P102	BUILDING E- FIRST FLOOR DOMESTIC WATER PLAN
F-P101	BUILDING F - FIRST AND SECOND FLOOR SANITARY PLANS
F-P102	BUILDING F - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
G1-P101	BUILDING G1 - FIRST AND SECOND FLOOR SANITARY PLANS
G1-P102	BUILDING G1 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
G2-P101	BUILDING G2 - FIRST AND SECOND FLOOR SANITARY PLANS
G2-P102	BUILDING G2 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
H1-P101	BUILDING H1 - FIRST AND SECOND FLOOR SANITARY PLANS
H1-P102	BUILDING H1 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
H2-P101	BUILDING H2 - FIRST AND SECOND FLOOR SANITARY PLANS
H2-P102	BUILDING H2 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS

FIRE PROTECTION:

FP001	FIRE PROTECTION NOTES, LEGENDS, SCHEDULES, AND DETAILS
A-FP101	BUILDING A - FIRST AND SECOND FLOOR FIRE PROTECTION PLANS
B-FP101	BUILDING B - FIRST AND SECOND FLOOR FIRE PROTECTION PLANS
C-FP101	BUILDING C - FIRST AND SECOND FLOOR FIRE PROTECTION PLANS

ELECTRICAL:

ES1.1	ELECTRICAL SITE LIGHTING PLAN
ES2.1	ELECTRICAL SITE POWER PLAN
ES3.1	ELECTRICAL SITE COMMUNICATIONS PLAN
E001	ELECTRICAL LEGENDS, DETAILS, NOTES, AND SCHEDULES
A-E101	BUILDING A - ELECTRICAL COMPOSITE PLAN
B-E101	BUILDING B - FIRST FLOOR COMPOSITE ELECTRICAL PLAN
B-E102	BUILDING B - SECOND FLOOR COMPOSITE ELECTRICAL PLAN
C-E101	BUILDING C - ELECTRICAL COMPOSITE PLAN
D1-E101	BUILDING D1 - FIRST AND SECOND FLOOR LIGHTING PLANS
D1-E201	BUILDING D1 - FIRST AND SECOND FLOOR POWER AND COMM. PLAN
D2-E101	BUILDING D2 - FIRST AND SECOND FLOOR LIGHTING PLANS
D2-E102	BUILDING D2 - FIRST AND SECOND FLOOR POWER AND COMM. PLAN
E-E101	BUILDING E - COMPOSITE ELECTRICAL PLANS
F-E101	BUILDING F - FIRST AND SECOND FLOOR LIGHTING PLANS
F-E102	BUILDING F - FIRST AND SECOND FLOOR POWER AND COMM PLAN
G1-E101	BUILDING G1 - COMPOSITE PLAN
G2-E101	BUILDING G2 - COMPOSITE PLANS
H1-E101	BUILDING H1 - ELECTRICAL COMPOSITE PLANS
H2-E101	BUILDING H2 - ELECTRICAL COMPOSITE PLAN

DRAWINGS ARE BOUND WITH PROJECT MANUAL

END OF SECTION 00 01 15

SECTION 310000 - EARTHWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Protection, modification, or installation of utilities as sitework progresses with particular attention to grade changes and necessary staging or phasing of work.

B. Cutting, filling, and grading to required lines, dimensions, contours, and elevations for proposed improvements.

C. Scarifying, compacting, drying, dewatering and removal of unsuitable material to ensure proper preparation of areas for fills or proposed improvements.

1.2 RELATED SECTIONS

A. Section 312300 – Excavation, Backfill, and Compaction for Structures.

B. Section 312313 – Excavation, Backfill, and Compaction for Pavement.

C. Section 321123 – Aggregate Materials

D. Section 312513 – Slope Protection and Erosion Control

E. The “Foundation Subsurface Preparation” as shown on the Construction Drawings and/or the Architectural-Structural drawings and/or the “Report of Subsurface Exploration”, whichever is more stringent if a conflict exists.

F. Construction Drawings and Report of Subsurface Exploration.

1.3 REFERENCE STANDARDS

A. American Society for testing and Materials (ASTM) latest edition.

1. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft2)
2. (600 kN.m/m2).
3. D 1556 Density and Unit Weight of Soil In Place by the Sand-Cone Method.
4. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft2) (2,700 Kn.m/m^2).
5. D 2167 Density and Unit Weight of Soil In Place by the Rubber Balloon Method.
6. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
7. D 2487 Classification of Soils for Engineering Purposes.
8. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).
9. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
10. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.
1. T 88 Particle Size Analysis of Soils.

1.4 QUALITY ASSURANCE

A. An independent testing laboratory, selected and paid for by Contractor, shall be retained to perform construction testing on site.

1. The independent testing laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Civil Engineering Consultant, and Contractor shall be provided with copies of reports within 96 hours of time that test was performed. In event that test performed fails to meet Specifications, Owner and Contractor shall be notified immediately by the independent testing laboratory.
2. Costs related to retesting due to failures shall be paid for by the Contractor at no additional expense to Owner. Contractor shall provide free access to site for testing activities.

1.5 SUBMITTALS

A. Submit 100-pound sample of each type of off-site fill material that is to be used at the site in air tight container(s) for the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.

B. Submit name of each material supplier and specific type and source of each material. Change in source throughout project requires approval of Engineer

C. If fabrics or geogrids are to be used, design shall be submitted for approval to Engineer

D. Submit Dewatering Plans upon request by Owner.

PART 2 - PART 2 – PRODUCTS

2.1 MATERIALS

A. Excavated and re-used material for subsoil fill as specified herein.

B. Aggregate fill as specified in Section 321100.

C. Imported fill material approved by Geotechnical Engineer and specified herein.

2.2 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.3 SOURCE QUALITY CONTROL

A. In areas to receive pavement, California Bearing Ratio (CBR) or Limerock Bearing Ratio (LBR) test shall be performed for each type of material that is imported from off-site.

B. Following tests shall be performed as part of construction testing requirements on each type of on-site or imported soil material used as compacted fill:
1. Moisture and Density Relationship: ASTM D 698 (or ASTM D 1557).
2. Mechanical Analysis: AASHTO T 88.

3. Plasticity Index: ASTM D 4318.

PART 3 - PART 3 – EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Locate and identify existing utilities that are to remain and protect from damage.

C. Notify utility companies to remove or relocate utilities that are in conflict with proposed improvements.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect bechmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

F. Remove from site, material encountered in grading operations that, in opinion of the Geotechnical Engineer, is unsuitable or undesirable for backfilling, subgrade, or foundation purposes. Dispose of in a legal manner and a manner. Backfill areas with layers of suitable material and compact as specified herein.

G. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:

1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.
2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low areas dry and undisturbed.
3. If proposed for fill, muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation by Geotechnical Engineer. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building subgrade or within 10’-0” of perimeter of building subgrade, retaining wall subgrade or paving subgrade. If, after observation by Geotechnical Engineer, material is found to be unsuitable, unsuitable material shall be removed from site.

H. Dewatering:

1. General:
   a. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom and/or sides. Design system to prevent differential hydrostatic head which would result in floating out soil particles in a manner termed as a “quick” or “boiling” condition. System shall not be dependent solely upon sumps and/or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation’s stability.

b. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow all Work to be installed in a dry condition.
c. Control, by acceptable means, all water regardless of source and be fully responsible for disposal of the water.
d. Confine discharge piping and/or ditches to available easement or to additional easement obtained by Contractor. Provide necessary permits and/or additional easement at no additional cost to Owner.
e. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary to these purposes, lover water level in advance of excavation, utilizing wells, wellpoints, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.
f. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.
g. Open pumping with sumps and ditches shall be allowed, provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.
h. Install wells and/or wellpoints, if required, with suitable screens and filters, so that continuous pumping of fines does not occur. Arrange discharge to facilitate collection of samples by the Owner. During normal pumping, and upon development of well(s), levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.
i. Control grading around excavations to prevent surface water from flowing into excavation areas.
j. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

2. Design:
   a. Contractor shall designate and obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work.
   b. Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required.
   c. Contractor shall be solely responsible for the design, installation, operation, maintenance, and any failure of any component of the system.
3. Damages:
   a. Contractor shall be responsible for and shall repair without cost to the Owner any damage to work in place, or other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation, including, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
   b. Remove subgrade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the Owner.
4. Maintaining Excavation in Dewatering Condition:
   a. Dewatering shall be a continuous operation. Interruptions due to power outages or any other reason will not be permitted.
   b. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.

c. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.

d. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components and any other work required to maintain excavation in dewatered condition.

5. System Removal:

a. Remove dewatering equipment from the site, including related temporary electrical service.

b. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

3.2 EXCAVATION FOR FILLING AND GRADING

A. Classification of Excavation: Contractor acknowledges that site has been investigated to determine type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.

B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.

C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.

D. Excavated material containing rock or stone greater that 6-inches in largest dimension is unacceptable as fill within proposed building subgrade and paving subgrade.

E. Rock or stone less than 6-inches in largest dimension is acceptable as fill to within 24-inches of surface of proposed subgrade when mixed with suitable material.

F. Rock or stone less than 2-inches in largest dimension and mixed with suitable material is acceptable as fill within the upper 24-inches of proposed subgrade.

3.3 FILLING AND SUBGRADE PREPARATION

A. Fill areas to contours and elevations shown on Construction Drawings with unfrozen materials.

B. Place fill in continuous lifts specified in Geotechnical Report.

C. Refer to Section 312300 and Geotechnical Report for filling requirements for structures.

D. Refer to Section 312313 and Geotechnical Report for filling requirements for pavements.

E. Areas exposed by excavation or stripping and on which subgrade preparations are to be performed shall be scarified to minimum depth of 8-inches and compacted as per the geotechnical report included herein.

F. Fill materials used in preparation of subgrade shall be placed as per the geotechnical report included herein.

G. Material imported from off-site shall have CBR value equal to or above pavement design subgrade CBR value indicated in the geotechnical report.

3.4 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.5 BORROW AND SPOIL SITES

A. Contractor shall be responsible for compliance with NPDES and local erosion control permitting requirements for any and all off-site, disturbed spoil and borrow areas. Upon completion of spoil and/or borrow operations, clean up spoil and/or borrow areas in a neat and reasonable manner to the satisfaction of property owner, Owner, and Civil Engineering Consultant.

3.6 RIP-RAP

A. This work shall consist of furnishing and setting or placing rubble stone, crushed stone, concrete blocks, sacked sand-cement or machined rip-rap. Slope pavement shall consist of the construction of a reinforced concrete mat on prepared slopes. Construction shall be in reasonable close conformity to the lines, grades, dimensions, typical details and sizes shown on the drawings or as directed by the Engineer.

B. All materials used in this construction, in addition to the general requirements of these Specifications, unless otherwise stipulated, shall conform to the following:

C. Rip-rap and slope pavement shall conform to Subsection 709 of the Tennessee Department of Transportation, Standard Specifications for Road and Bridge Construction, 1981 or latest revisions.

3.7 FINISH GRADING

A. Grade areas where finish grade elevations or contours are indicated on Construction Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from

rock, debris, or irregular surface changes. Finished subgrade surface shall not be more than 0.10-feet above or below established finished subgrade elevation. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential.

B. Correct settled and eroded areas within 1 year after date of completion at no additional expense to Owner. Bring grades to proper elevation. Replant or replace grass, shrubs, bushes, or other vegetation that appears dead, dying, or disturbed by construction activities. Refer to Section 312513 for slope protection and erosion control.

3.8 FIELD QUALITY CONTROL

A. Field density tests for in-place materials shall be performed as part of construction testing requirements according to one of the following standards:
1. Sand-Cone Method: ASTM D 1556.
2. Balloon Method: ASTM D 2167.
3. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission).

B. Perform density test as follows:
1. Building Subgrade Areas, Including 10'-0" Outside of Exterior Building Lines: In cut areas, not less than 1 compaction test for every 2,500 sq. ft. In fill areas, same rate of testing for each 6-inch lift, measured loose.
2. Areas of Construction Exclusive of Building Subgrade Areas: In cut areas, not less than 1 compaction test for every 10,000 sq. ft. In fill areas, same rate of testing for each 6-inch lift, measured loose.

C. Corrective measures for non-complying compaction:
1. Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing, and removing site utilities.
   7. Temporary erosion- and sedimentation-control measures.

1.02 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.03 MATERIAL OWNERSHIP

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

1.04 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.05 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. 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 were directed by Owner.

D. Utility Locator Service: Notify Tennessee One Call at 811 before site clearing.

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

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.01 PREPARATION

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

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 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 erosion- and sedimentation-control shown on the Drawings.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

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

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

E. The Contractor shall follow the latest edition of the Tennessee Erosion and Sedimentation Control handbook.

3.03 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.04 EXISTING 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 utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Do not shut off any utilities without coordinating with Architect. Utility interruption will only be allowed during time that the exiting school facilities are not in use.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

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

F. Removal of underground utilities is included in Division 33 Sections.

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, 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. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods for grubbing within protection zones.
   4. 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.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to a minimum depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil in location(s) indicated on the plans and away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Do not stockpile topsoil within protection zones.

3.07 SITE IMPROVEMENTS

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

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

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION 31 10 00

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt patching.
   2. Hot-mix asphalt paving.
   3. Pavement-marking paint.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
   1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
   2. Job-Mix Designs: For each job mix proposed for the Work.

B. Material Certificates: For each paving material, from manufacturer.

C. Material Test Reports: For each paving material.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the TDOT.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure. Follow requirements of the Tennessee Department of Transportation specified in “Standard Specifications for Road and Bridge Construction, March 1, 2006” for temperatures allowed for placement of asphalt materials.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F, and not exceeding 95 deg F.

PART 2 - PRODUCTS

A. Mineral Aggregate Base will follow the Specifications of the Tennessee Department of Transportation’s Section 303 – Mineral Aggregate Base; Mineral Aggregate Base Type A, Grading D.

B. Bituminous Plant Mix Base (Hot Mix) will follow the Specifications of the Tennessee Department of Transportation’s Section 307 – Bituminous Plant Mix Base (Hot Mix) for the mix indicated on the plans.

C. Prime Coat will follow the Specifications of the Tennessee Department of Transportation's Section 402 – Prime Coat.

D. Tack Coat will follow the Specifications of the Tennessee Department of Transportation's Section 403 – Tack Coat.

E. Asphaltic Concrete Surface (Hot Mix) will follow the Specifications of the Tennessee Department of Transportation's Section 411 – Asphaltic Concrete Surface (Hot Mix) for the mixes indicated on the plans.

F. Pavement Markings will follow the Specifications of the Tennessee Department of Transportation's Section 716 – Pavement markings for Painted Pavement Markings.

G. Signage will follow the Specifications of the Tennessee Department of Transportation's Section 713 – Highway Signage.

H. Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled plastic; UV stabilized; 4 inches high by 6 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
   1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.
   2. Adhesive: As recommended by wheel-stop manufacturer for application to asphalt pavement.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

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

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

3.02 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Follow City of Knoxville requirements for patching asphalt streets as shown in the detail on plan sheet C2.1.

3.03 INSTALLATION

A. Mineral Aggregate Base will follow the Specifications of the Tennessee Department of Transportation's Section 303 – Mineral Aggregate Base.

B. Bituminous Plant Mix Base (Hot Mix) will follow the Specifications of the Tennessee Department of Transportation's Section 307 – Bituminous Plant Mix Base (Hot Mix).

C. Prime Coat will follow the Specifications of the Tennessee Department of Transportation's Section 402 – Prime Coat.

D. Tack Coat will follow the Specifications of the Tennessee Department of Transportation's Section 403 – Tack Coat.

E. Asphaltic Concrete Surface (Hot Mix) will follow the Specifications of the Tennessee Department of Transportation's Section 411 – Asphaltic Concrete Surface (Hot Mix) for the mix indicated on the plans.

F. Pavement Markings will follow the Specifications of the Tennessee Department of Transportation's Section 716 – Pavement markings for Painted Pavement Markings.

G. Signage will follow the Specifications of the Tennessee Department of Transportation's Section 713 – Highway Signage.

3.04 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Sweep and clean surface to eliminate loose material and dust.

3.05 FIELD QUALITY CONTROL

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

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.06 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose them.

END OF SECTION 32 12 16

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Driveways.
   2. Curbs and gutters.
   3. Walks.
   4. Pads.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

D. Other Action Submittals:
   1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Qualification Data: For qualified Installer of detectable warnings, ready-mix concrete manufacturer and testing agency.

F. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent or epoxy adhesive.

8. Joint fillers.

G. Material Test Reports: For each of the following:
   1. Aggregates.

H. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
   2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches <Insert. Include full-size detectable warning.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Pre-installation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.
   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete paving subcontractor.

e. Manufacturer's representative of stamped concrete paving system used for detectable warnings.

1.06 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.02 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from steel wire into flat sheets.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

C. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

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

E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

H. Plain-Steel Wire: ASTM A 82/A 82M.

I. Deformed-Steel Wire: ASTM A 496/A 496M.

J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated.

K. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

L. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

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

N. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

O. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

P. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

Q. Zinc Repair Material: ASTM A 780.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, white portland cement Type I. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class C or Class F.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
   2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.

B. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: ¾-inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ChemMasters.
   b. Davis Colors.
   c. Dayton Superior Corporation.
   d. Elementis Pigments.
   e. Hoover Color Corporation.
   f. Lambert Corporation.
   g. LANXESS Corporation.
   h. QC Construction Products.
   i. Scofield, L. M. Company.
   j. Solomon Colors, Inc.
   k. Stampcrete International, Ltd.
   l. SureCrete Design Products.
2. Color: As selected by Architect from manufacturer's full range.

2.04 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Axim Italcementi Group, Inc.; Caltexol CIMFILM.
   b. BASF Construction Chemicals, LLC; Confilm.
   c. ChemMasters; Spray-Film.
   d. Conspec by Dayton Superior; Aquafilm.
   e. Dayton Superior Corporation; Sure Film (J-74).
   f. Edoco by Dayton Superior; BurkeFilm.
   g. Euclid Chemical Company (The), an RPM company; Eucobar.
   h. Kaufman Products, Inc.; VaporAid.
   i. Lambert Corporation; LAMBCO Skin.
   j. L&M Construction Chemicals, Inc.; E-CON.
   k. Meadows, W. R., Inc.; EVAPRE.

l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation, Inc.; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Anti-Hydro International, Inc.; A-H Curing Compound #2 DR WB.
b. ChemMasters; Safe-Cure Clear.
c. Conspec by Dayton Superior.
d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
e. Edoco by Dayton Superior;
f. Euclid Chemical Company (The), an RPM company; Kurez W VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; AQUA KURE - CLEAR.
i. L&M Construction Chemicals, Inc.; L&M CURE R.
j. Meadows, W. R., Inc.; 1100-CLEAR SERIES.
k. Nox-Crete Products Group; Resin Cure E.
l. SpecChem, LLC; PaveCure Rez.
m. Symons by Dayton Superior; Resi-Chem Clear.
n. Tamms Industries, Inc., Euclid Chemical Company (The); TAMMSCURE WB 30C.
o. TK Products, Division of Sierra Corporation.
p. Vexcon Chemicals Inc.; Certi-Vex Enviocure 100.

2.05 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ChemMasters; Exposee.
      b. Conspec by Dayton Superior; Delay S.
      c. Dayton Superior Corporation; Sure Etch (J-73).
      d. Edoco by Dayton Superior; True Etch Surface Retarder.
      e. Euclid Chemical Company (The), an RPM company; Surface Retarder Formula S.
      f. Kaufman Products, Inc.; Expose.
      g. Meadows, W. R., Inc.; TOP-STOP.
      h. Metalcrete Industries; Surftard.
      i. Nox-Crete Products Group; CRETE-NOX TA.
      j. Scofield, L. M. Company; LITHOTEX Top Surface Retarder.
      k. Sika Corporation, Inc.; Rugasol-S.
      l. SpecChem, LLC; Spec Etch.
      m. TK Products, Division of Sierra Corporation; TK-6000 Concrete Surface Retarder.
      n. Unitex; TOP-ETCH Surface Retarder.
      o. Vexcon Chemicals Inc.; Certi-Vex Envioset.

F. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.06 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 4000 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
   3. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: 6 percent plus or minus 1 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 requirements as follows:
   1. Fly Ash or Pozzolan: 25 percent.
   2. Ground Granulated Blast-Furnace Slag: 50 percent.
   3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd..

H. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For concrete batches larger than 1 cu. yd. increase mixing time by 15 seconds for each additional 1 cu. yd.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
   2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
   3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."

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

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 20 feet unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
      a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
      a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
   3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 DETECTABLE WARNINGS

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Division 32 Section "Unit Paving".
1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

3.09 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 3/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch.
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   5. Lateral Alignment and Spacing of Dowels: 1 inch.
   6. Vertical Alignment of Dowels: 1/4 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
   8. Joint Spacing: 3 inches.
   9. Contraction Joint Depth: Plus 1/4 inch, no minus.
   10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

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

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 25 cu. yd. or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cold-applied joint sealants.
   2. Joint-sealant backer materials.
   3. Primers.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants 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. Paving-Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.04 FIELD 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 or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 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.

2.02 COLD-APPLIED JOINT SEALANTS

A. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Pecora Corporation; Urexpan NR-200.

2.03 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

2.04 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

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.

3.03 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint 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 joint-sealant backings.
   2. Do not stretch, twist, puncture, or tear joint-sealant backings.
   3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
   1. Place joint sealants so they fully contact joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
   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.

3.04 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction 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 in repaired areas are indistinguishable from the original work.

END OF SECTION 32 13 73

SECTION 32 17 23 - PAVEMENT MARKING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provision of traffic and symbol marking paint.

1.02 RELATED SECTIONS

A. Section 32 12 16 - ASPHALTIC CONCRETE PAVING WITH GRAVEL BASE

1.03 SUBMITTALS

A. Submit manufacturer's literature describing products.

B. Samples: Only as requested.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of use.

B. Store and mix all materials in ventilated areas as directed. Remove all empty containers, waste, and rags from premises overnight.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Traffic Marking Paint: Synthetic rubber type; white color. Same as Fuller-O'Brien Corporations 382-12; Glidden Company's Ultrihide Heavy Duty Chlorinated Rubber Traffic Paint White = 20630 Yellow = 20628; "Romark Traffic Paint"; Sinclair Paint Company's "60 Hiway Lac".

B. Handicapped Symbol Paint: White Color. Same as Glidden Company's Ultrihide Heavy Duty Chlorinated Rubber Traffic Paint White = 20630 Yellow = 20628.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine receiving surfaces and verify that surfaces are in proper condition to assure adhesion and functioning of coating specified.

B. Do not start work until unsatisfactory conditions have been corrected.

3.02 APPLICATION

A. Apply pavement marking paint in accordance with approved manufacturer's recommendations.

B. Insure dense coverage such that color and texture of substrate is not visible.

C. Parking Stripes: Paint four inches wide unless otherwise noted.

D. Symbol Marking: Paint as shown on drawings.

3.03 CLEANING

A. Upon completion of work, remove surplus materials and rubbish, and clean off spilled or splattered paint resulting form this work.

3.04 PROTECTION

A. Permit no surface traffic until pavement marking has dried thoroughly.

END OF SECTION 32 17 23

SECTION 33 11 00 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 LOCAL UTILITY SPECIFICATIONS

A. The Contractor shall contact the local authorities to determine if Standard Specifications for Water Distribution are available from the Local Utility District. If Local Utility District specifications are available, the Contractor shall utilize them in lieu of the following specification.

1.2 RELATED DOCUMENTS

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

1.3 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.

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

1.4 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. Water Service: Exterior domestic-water piping.

D. The following are industry abbreviations for plastic materials:
1. PVC: Polyvinyl chloride plastic.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Piping specialties.

2. Valves and accessories.
3. Water meters and accessories when not provided by the utility company.
4. Fire hydrants.

1.6 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.

1.7 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.

1.8 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.

1.9 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

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

2.2 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, 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. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

C. 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.

2.3 PVC PIPE AND FITTINGS

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

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.

2.4 JOINING MATERIALS

A. Refer to Division 2 Section "Utility Materials" for commonly used joining materials.

B. 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.

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

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

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

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

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

2.5 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. 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.

B. Bronze Gate Valves:

1. OS&Y, Rising-Stem Gate Valves: UL 262, FM-approved bronze body and bonnet, outside screw and yoke, and bronze stem.

a. Minimum Working Pressure: 200 psig.
b. End Connections: Threaded.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

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

1. 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.
2. Valve: AWWA, cast-iron, nonrising-stem, 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.

2.7 CHECK VALVES

A. AWWA Check Valves:

1. Check Valves: AWWA C508, swing-check type with 175-psig working-pressure rating and resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

2.8 CORPORATION VALVES AND CURB VALVES

A. 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.

B. 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.

C. 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.

2.9 WATER METERS

A. Provide water meters of the size and type required by utility company.

2.10 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.

2.11 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. 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.

2.12 FREESTANDING FIRE HYDRANTS

A. Fire hydrant type shall be as required by utility company.

B. 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.

1. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
2. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
3. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
4. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.13 GROUND HYDRANTS

A. Ground hydrants shall be Zurn Z1360 encased, flush type, non-freeze hydrants or approved equal.

2.14 PEDESTAL MOUNTED DRINKING FOUNTAINS

A. Pedestal mounted drinking fountains shall be Haws Corporation 3377FR with 6518FR valve assembly and 6625 valve box or approved equal.

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 3/4 to NPS 3: Soft copper tube, Type K; wrought-copper fittings; and brazed joints.
2. NPS 6 and NPS 8: AWWA C900 Class 200 PVC push-on-joint pipe; mechanical-joint, ductile-iron fittings; 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. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FM, cast-iron, nonrising-stem gate valves with indicator post.

3.4 JOINT CONSTRUCTION

A. See Division 2 Section "Utility Materials" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
2. 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.
3. 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

A. See Division 2 Section "Utility Materials" for piping-system common requirements.

3.6 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

B. 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.

C. 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 curb valve in water-service piping with head pointing up and with service box.

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

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

F. Bury piping with depth of cover over top at least 30 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.

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

H. 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.

I. See Division 15 Section "Domestic Water Piping" for potable-water piping inside the building.

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, PVC Water-Service Piping: According to AWWA M23.

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

3.9 WATER-METER INSTALLATION

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

B. Water Meters: Install displacement-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water-meter inlets. Include valves on water-meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Water Meters: Install compound-type water meters, NPS 3 and larger, in meter vaults. Include shutoff valves on water-meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

D. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water-meter inlets and outlets and full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.10 ROUGHING-IN FOR WATER METERS

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

3.11 VAULT INSTALLATION

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

B. Connect drain outlet to storm drainage piping. Refer to Division 2 Section "Storm Drainage."

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

3.13 GROUND HYDRANTS AND PEDESTAL DRINKING FOUNTAIN INSTALLATION

A. Install ground hydrants and pedestal drinking fountains per manufacturer's recommendations.

3.14 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.

3.15 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.

3.16 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.

a. 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 required by the local utility company.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 33 11 00

SECTION 33 13 00 - DISINFECTION OF WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Disinfection of potable water distribution and transmission system.

B. Testing and reporting results.

1.02 RELATED SECTIONS

A. Section 33 11 13 – Site Water Lines.

B. Section 33 11 19 – Fire Water System.

1.03 MEASUREMENT AND PAYMENT

A. Disinfection:
   1. Basis of Payment: no separate payment, included in the other items of work.

1.04 REFERENCES

A. ANSI/AWWA B300 - Standard for Hypochlorites.

B. ANSI/AWWA B301 - Standard for Liquid Chlorine.

C. ANSI/AWWA B303 - Standard for Sodium Chlorite.

D. ANSI/AWWA C651 - Standards for Disinfecting Water Mains.

1.05 SUBMITTALS

A. Test Reports: Indicate results comparative to specified requirements.

B. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

1.06 PROJECT RECORD DOCUMENTS

A. Provide the following:

B. Disinfection report; record:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   5. Date and time of flushing start and completion.
   6. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological report; record:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.

5. Initial and 24 hour disinfectant residuals in ppm for each outlet used.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards of the state.
8. Bacteriologist's signature and authority.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI/AWWA C651.

1.08 QUALIFICATIONS

A. Testing Firm: Group specializing in examining potable water systems, approved by the State of Tennessee.

1.09 REGULATORY REQUIREMENTS

A. Conform to applicable code or regulation for performing the work of this section.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of water system.

PART 2 - PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals: ANSI/AWWA B300, Hypochlorite, ANSI/AWWA B301, Liquid Chlorine, and ANSI/AWWA B303, Sodium Chlorite.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping system has been cleaned, inspected and pressure tested.

B. Perform scheduling and disinfection activity with startup, testing, adjusting and balancing, demonstrating procedures, including coordination with related systems.

3.02 EXECUTION

A. Provide and attach required equipment to perform the work of this Section.

B. Inject treatment disinfectant into piping system.

C. Maintain disinfectant in system for 24 hours.

D. Flush, circulate and clean until required cleanliness is achieved; use municipal domestic water.

3.03 QUALITY CONTROL

A. Provide analysis and testing of treated water under provisions of Section 01400.

B. Test samples in accordance with ANSI/AWWA C651.

END OF SECTION 33 13 00

SECTION 33 31 00

SANITARY SEWERAGE

PART 1 - GENERAL

1.1 LOCAL UTILITY SPECIFICATIONS

A. The Contractor shall contact the local authorities to determine if Standard Specifications for Sanitary Sewerage are available from the Local Utility District. If Local Utility District specifications are available, the Contractor shall utilize them in lieu of the following specification.

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. Cleanouts.
3. Precast concrete manholes.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Non-pressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic 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.

1.6 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 Engineer no fewer than five days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Engineer's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. 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 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Pipe and Fittings: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.4 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure 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 Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 CLEANOUTS

A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 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: Individual FRP steps, 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 60 inches.
9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
10. 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 "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; 15-mil minimum thickness applied to all surfaces, unless otherwise indicated.

2.7 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.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPING APPLICATIONS

A. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials:

1. PVC sewer pipe and fittings, gaskets, and gasketed joints conforming to ASTM D 3034 SDR 35.

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, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping below frost line.
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

G. 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. Basic piping 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, nonpressure, drainage piping according to the following:

1. 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.

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. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 2 inches above finished surface elsewhere, unless otherwise indicated.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC pipe fittings in sewer pipes at branches for cleanouts and PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use medium-duty, top-loading classification cleanouts in earth, unpaved foot-traffic and in paved foot-traffic areas.
2. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in asphalt pavement and earth in cast-in-place-concrete block, 24 by 24 by 6 inches deep. Set with tops flush with pavement and 1 inch above surrounding grade when in earth.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.7 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 15 Section "Sanitary Waste and Vent Piping."

B. 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.

2. Make branch connections into existing underground manholes by coring and installing a rubber boot as approved by the local utility provider.

3. 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.

3.8 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.

3.9 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. Reinspect 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 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. 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.

3.10 CLEANING

A. Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION

SECTION 33 41 00 - STORM SEWER SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provide storm sewer pipe.

B. Provide inlets.

C. Provide manholes and covers.

D. Provide Lines, Grades, Stakes, and Templates.

E. Make arrangements with the local governing agency for connections and charges and include the cost thereof in the contract price.

1.02 RELATED SECTIONS

A. Section 31 20 00 – Earthwork.

1.03 REFERENCES

A. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

C. ASTM C478 - Precast Concrete Manholes.

D. ASTM A48 - Gray Iron Castings.

1.04 DEFINITIONS

A. Bedding: fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.05 SUBMITTALS

A. Submit under provisions of General Conditions.

B. Product Data: provide data indicating pipe, pipe accessories, precast manholes, inlets, manhole rims and covers.

1.06 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe runs, connections, catch basins, inlets and invert elevations.

1.07 REGULATORY REQUIREMENTS

A. Requirements of Regulatory Agencies: All work shall comply with rules and regulations of local and state agencies having jurisdiction.

1.08 JOB CONDITIONS

A. Existing Conditions: Carefully maintain bench marks, monuments, and survey control references.

1.09 SEWER SERVICES AND FEES

A. Make arrangements with the Local Utility Governing Agency or Department for requirements and approval, and service connection. PAY ALL CHARGES THEREFOR, AND INCLUDE THE COST THEREOF IN THE CONTRACT PRICE.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Storm Sewer Pipe:
   1. Concrete Pipe: Meet the requirements of ASTM C76 Class III reinforced concrete culvert, storm drain, and culvert pipe with rubber gasket joints meeting requirements of ASTM C443.
   2. Polyethylene Pipe: Meet the requirements of ASTM F2648 for Annular Corrugated Profile Wall Polyethylene Pipe and Fittings for Land Drainage Applications.

B. Manhole Rims and Covers: Cast iron heavy traffic pattern with covers marked DRAIN, total weight at least 365 pounds, metal used in the manufacturer castings shall conform to minimum requirements of ASTM A48 Class 30B for Gray Iron; machine surfaces for the prevention of wabling; one of the following or approved equal:
   1. John Bouchard & Sons Company, Nashville, TN No. 1020.

C. Precast Manhole Sections: These shall conform to ASTM C478; straight sections shall be of the lengths required for each manhole assembly; top sections shall be 36 inches high and conical, either concentric or eccentric, tapering uniformly to 24 inch inside diameter at the top; each precast section shall have tongue and groove joints, and lifting holes to facilitate handling and laying. Embed manhole steps arranged on 16 inch uniform vertical centers in the completed manhole.

D. Manhole Steps: One of the following:
   1. John Bouchard & Sons Company, Nashville, TN, No. 1800, cast iron.

E. Standard Curb Inlets: Cast iron heavy traffic type inlet frame, metal used in the manufacturer castings shall conform to minimum requirements of ASTM A48 Class 30B for Gray Iron; machine surfaces for the prevention of wobbling; grate and non-skid diamond design surface floor plate cover; one of the following:
   1. Neenah Foundry Combination Inlet Frame, Grate, and Curb Box No. R-3067-L.

PART 3 - EXECUTION

3.01 TRENCHING AND EXCAVATING

A. Excavate trenches to depth indicated on drawings or required depth which will provide full length solid bearing for pipe barrels and sufficient depth for granular bedding materials for storm drain pipes. Provide 24 inches minimum earth cover over all pipes or as indicated.

B. Provide bell holes in trench bottoms to facilitate jointing and to prevent pipe hubs, couplings, and valves from bearing on ground before backfilling.

C. Sheet and brace excavations as required to prevent cave-ins and to protect personnel and adjacent structures.

D. Where pipelines are below footings, the horizontal distance between footings and pipelines shall be as required to provide a slope not steeper than 1:1 ratio between footing bottoms and the trench bottoms at any point.

E. Unsuitable Subsurface Conditions: Where excavation bottoms at required elevations are found to be unstable, or where rock, cinders, rubbish or other deleterious materials are encountered, extend excavations down to firm earth and at least six inches below deleterious materials. Then excavation bottoms shall be brought up to pipe laying elevation by backfilling with suitable material compacted in place. Suitable materials and compaction shall be as specified below. Dispose of excavated unsuitable materials in approved manner.

3.02 ROCK EXCAVATION AND BLASTING

A. Wherever used as the name of an excavated material, the term "rock" shall mean any one or more of the following materials which in the Engineer's opinion require for their removal drilling and blasting, wedging, sledging, or barring, or breaking up with power operated hand tools: boulders, pieces of concrete, and pieces of masonry, each weighing more than 250 pounds; and solid ledge rock, concrete, each with more than 1/2 cubic yard of volume. No measurement or allowance will be made for: soft or disintegrated rock or gravel which can be removed with a hand pick or power operated excavator or shovel; loose, shaped, or previously blasted rock or broken stone in rock fillings or elsewhere; rock exterior to the limits of measurement allowed which may fall into the excavation; and removal of existing pavement.

B. Where rock is encountered in pipe trenches, remove all rock from sides of trench to provide at least six inches horizontal clearance from the pipe bells on each side, and remove all rock from required subgrade down to at least four inches below the bottom of the pipe bells. Bring trench bottom up to required subgrade by backfilling with granular pipe embedment material as specified hereinafter, placed and compacted as required to provide uniform and continuous bearing of pipe barrels at every point between bell holes.

C. Where blasting is required, conduct all blasting operations only with properly qualified personnel in accordance with all applicable ordinances and regulations. Cover all blasts with suitable blasting mats, and use all other safety precautions as required to

prevent personal injury and property damage. Repair all damage caused by blasting operations.

3.03 BACKFILLING

A. After each pipe has been laid, thoroughly hand tamp backfill up to twelve inches above pipe top. Then place remaining backfill in maximum eight inch loose layers and compact each layer with pneumatic or other suitable power tamp to at least the density of the adjacent undisturbed soil. Backfill materials shall be of the following types.
   1. Up to twelve inches above pipe tops: selected earth or sand which is free of rocks, stones, bricks, cinders, broken concrete, rubbish, wood, vegetable matter, topsoil, and other unsuitable materials.
   2. From twelve inches above pipe tops to finished grade or subgrade: any materials removed from the excavation which are suitable for backfill. Do not use as backfill any pieces of rock, stone, concrete, asphalt paving, or masonry larger than six inches in their greatest dimensions.

3.04 INSTALLATION

A. Pipe Bedding: Lay gravity storm sewer lines with Class "C" bedding. This shall consist of granular bedding material of crushed rock, crushed stone, or washed gravel passing a 3/4 inch screen and 95 percent retained or a No. 4 sieve or sand may be used. Granular bedding material shall be placed on trench bottom four inch minimum depth and extending up the sides of the pipe to at least 1/6 pipe outside diameter; and initial backfill from the top of the granular bedding material up to 12 inches above pipe top consisting of select finely divided earth, hand placed and compacted before placing the remaining backfill.

B. Gravity Flow Sewer Pipe:
   1. General: Lay gravity flow sewer lines so that their inverts will conform accurately to the lines, grades, and elevations indicated and/or shown on previously approved cut sheets. Provide lasers, mason's lines, batter boards, and supports, and/or other suitable equipment as necessary to insure the installation of the sewer lines to the required lines, grades and elevations.
   2. Handling: Provide and use suitable equipment for the safe and convenient handling of piping materials. Unload all piping materials carefully, and lower them carefully into the trenches, piece by piece, in a manner that will prevent damage to the materials and trenches. Do not under any circumstances drop or dump piping materials, either from transportation vehicles, or into trenches. Before laying, inspect each length of pipe and each fitting for defects. Promptly remove all defective pipe and defective fittings from the pipe laying area.
   3. Laying: Begin laying pipe in finished trench at the lowest points, proceeding upgrade without breaks between manholes, with pipe spigots facing down grade. Lay pipe with the bedding method required to accommodate the conditions encountered, with full length support of the pipe barrel at every point between bell holes, without groove or bell ends bearing on trench bottom, and with water-tight joints. Dewater trenches during laying and jointing, as specified hereinbefore. Keep trenches water-free and as dry as practicable during bedding laying, and jointing, and until the work will not be adversely affected by submergence.

C. Jointing: Before jointing, all mating surfaces of each joint and all joint materials shall be clean and dry. Make up all joints in strict accordance with the pipe and gasket manufacturer's printed directions. Immediately after jointing, secure each previously laid length of pipe in place with tamped backfill on each side of pipe.
   1. Joints Between Different Types of Pipes: Encase each concrete or clay-to-cast iron pipe joint in a concrete collar at least three inches thick at all joints and extending at least six inches beyond each side of joint.

D. Manholes:
   1. Assemble each manhole with one or more straight vertical wall sections and one top taper section, to provide the required manhole depth. Seal all joints between precast section with the above specified gasket material, plug all lifting holes with non-shrinking mortar after laying sections, and seal around all pipe entrances with non-shrinking mortar, all to provide strictly water-tight construction. DO NOT USE MORTAR TO SEAL PRECAST SECTION JOINTS. Provide a 24 inch inside diameter brick, precast concrete, or cast-in-place concrete spacer rings between rim and precast taper section, as required to set rim at proper elevation. Securely grout spacers and rim to manhole structure with masonry mortar. Each finished manhole shall have permanently embedded-in manhole steps on 16 inch vertical centers.

E. Inverts: Provide an invert in each manhole bottom as required to accommodate the inflowing and outflowing pipes, constructed with concrete or brick and mortar, with full pipe size flow channels very carefully and smoothly shaped and finished to prevent splashing and turbulent flow. Make all changes of flow directions within manholes with the maximum practical radius curves. Where possible, lay pipe through manhole, and remove upper half of pipe to form invert. Manhole floor outside of invert shall be smooth and shall slope toward invert at least one inch per foot.
   1. Drop Construction: Provide drop connections where indicated, and in all cases where the drop through the manhole exceeds two feet with drop pipe and fittings arranged with the Local Utility standard details.
   2. Set manholes tops as follows, unless otherwise indicated or authorized:
      a. In streets, and other paved areas: flush with finished paving grade.
      b. Other areas: flush with finish grade.
   3. Connect new sewers to existing manholes where indicated. Rebuild existing inverts and provide new drop connections on existing manholes, in accordance with the requirements of this paragraph and as approved.
   4. Protect and maintain each manhole until it is accepted. The Engineer may inspect complete manholes singly or in groups. The Contractor will be relieved from further responsibility of protecting the top of each accepted manhole which is accepted in writing.

3.05 CLEANING UP SEWER SYSTEM

A. Clean up the sewer system as the work progresses. Negligence in proper cleaning up which causes undue inconvenience to the public or private citizens or presents an unsightly or dangerous condition, or causes embarrassment to civic officials shall be

sufficient reason for rejecting of construction estimates until the unsatisfactory conditions have been remedied.

B. After all work is complete, make a final cleanup of all areas where work has been done, and leave them in broom clean condition.

END OF SECTION 33 41 00