

## TABLE OF CONTENTS

- Table of Contents
- Project Personnel
- Notice to Bidders
- Instructions to Bidders (AIA A701-2018)
- Supplementary Instructions to Bidders
- General Conditions (AIA A201-2017)
- Supplemental General Conditions
- Geotechnical Report – 11/07/2022
- Geotechnical Addendum – 04/19/2024
- Geotechnical Addendum – 06/26/2024
- Geotechnical Report II – 08/27/2025
- Form of Proposal
- Minority Business Participation Forms
- Form of Bid Bond (AIA A310-2010)
- Construction Agreement (AIA A101-2017)
- Form of Performance Bond (AIA A312-2010)
- Form of Payment Bond (AIA A312-2010)
- Certificate of Substantial Completion (AIA G704-2017)
- Index of Drawings

### **DIVISION 1 – GENERAL REQUIREMENTS**

- 01 10 00 - Summary
- 01 20 00 - Price and Payment Procedures
- 01 21 00 – Allowances
- 01 22 00 – Unit Prices
- 01 23 00 – Alternates
- 01 25 00 – Substitution Procedures
- 01 30 00 - Administrative Requirements
- 01 32 16 - Construction Progress Schedule
- 01 33 00 - Submittal Procedures
- 01 40 00 - Quality Requirements
- 01 41 00 – Structural Testing Laboratory Services
- 01 50 00 - Temporary Facilities and Controls
- 01 51 00 - Temporary Utilities
- 01 52 13 – Field Offices and Sheds
- 01 57 13 – Temporary Erosion and Sediment Control
- 01 58 13 - Temporary Project Signage
- 01 60 00 - Product Requirements
- 01 70 00 - Execution and Closeout Requirements
- 01 74 19 - Construction Waste Management and Disposal

01 78 00 - Closeout Submittals

01 79 00 – Demonstration and Training

## **DIVISION 2 – EXISTING CONDITIONS**

02 41 00 – Demolition

02 41 00 – Minor Demolition

## **DIVISION 3 – CONCRETE**

03 15 00 – Concrete Accessories

03 20 00 – Mild Reinforcing for Concrete

03 30 00 – Cast-In-Place Concrete

03 30 05 – MVRA for Cast-In-Place Concrete

03 45 00 – Precast Architectural Concrete

03 49 00 – Glass-Fiber Reinforced Concrete

## **DIVISION 4 – MASONRY**

04 05 11 – Masonry Mortaring and Grouting

04 20 00 – Unit Masonry

04 22 00 – Concrete Unit Masonry

## **DIVISION 5 – METALS**

05 12 00 – Structural Steel Framing

05 21 00 – Steel Joist Framing

05 31 00 – Steel Decking

05 40 00 – Cold-Formed Metal Framing

05 50 00 – Metal Fabrications

05 51 00 – Metal Stairs

05 51 33 – Metal Ladders

05 52 13 – Pipe and Tube Railing

## **DIVISION 6 – WOOD, PLASTICS AND COMPOSITES**

06 10 00 – Rough Carpentry

06 10 01 – Rough Carpentry

06 16 00 – Sheathing

06 20 00 – Finish Carpentry

06 41 00 – Architectural Wood Casework

06 65 10 – Solid Surface Fabrications

## **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

07 01 50.19 – Preparation for Re-Roofing

07 11 13 – Bituminous Damproofing  
07 13 00 – Sheet Waterproofing  
07 21 00 – Thermal Insulation  
07 24 00 – Exterior Insulation and Finish Systems  
07 26 00 – Underslab Vapor Retarder  
07 27 26 – Fluid-Applied Membrane Air Barriers  
07 54 00 – Thermoplastic Membrane Roofing  
07 62 00 – Sheet Metal Flashing and Trim  
07 65 23 – EPDM Through-Wall Flashing  
07 71 00 – Roof Specialties  
07 72 00 – Roof Accessories  
07 84 00 – Firestopping  
07 91 00 – Preformed Joint Sealants  
07 92 00 – Joint Sealants  
07 95 13 – Expansion Joint Cover Assemblies

#### **DIVISION 8 – OPENINGS**

08 11 13 – Hollow Metal Doors and Frames  
08 14 16 – Flush Wood Doors  
08 31 00 – Access Doors and Panels  
08 33 23 – Overhead Coiling Doors  
08 34 61 – Bullet Resistant Wood Doors  
08 34 63 – Detention Doors and Frames  
08 43 13 – Aluminum-Framed Entrances and Storefronts  
08 43 33 – Bullet Resistant Aluminum-Framing System  
08 56 53 – Security Windows  
08 71 00 – Door Hardware  
08 80 00 – Glazing  
08 88 00 – Special Function Glazing  
08 88 13 – Fire-Rated Glazing

#### **DIVISION 9 – FINISHES**

09 05 61 – Common Work Results for Flooring Preparation  
09 21 16 – Gypsum Board Assemblies  
09 22 16 – Non-Structural Metal Framing  
09 22 40 – Security Mesh  
09 24 00 – Cement Plastering  
09 30 00 – Tiling  
09 51 00 – Acoustical Ceilings

09 66 23 – Resinous Matrix Terrazzo Flooring  
09 67 00 – Fluid-Applied Flooring  
09 68 13 – Tile Carpeting  
09 69 33 – Low-Profile Fixed Height Access Flooring  
09 70 00 – Aluminum Millwork Trim  
09 81 00 – Acoustic Insulation  
09 84 30 – Sound-Absorbing Wall and Ceiling Units  
09 91 13 – Exterior Painting  
09 91 23 – Interior Painting  
09 93 00 – Staining and Transparent Finishing

**DIVISION 10 – SPECIALTIES**

10 14 00 – Signage  
10 14 16 – Plaques  
10 14 19 – Dimensional Letter Signage  
10 21 13.17 – Phenolic Toilet Compartments  
10 22 13 – Wire Mesh Partitions  
10 26 41 – Ballistic Resistant Panels  
10 28 00 – Toilet, Bath, and Laundry Accessories  
10 44 00 – Fire Protection Specialties  
10 75 00 – Flagpoles  
10 82 13 – Exterior Grilles and Screens

**DIVISION 11 – EQUIPMENT**

Not Used

**DIVISION 12 – FURNISHINGS**

12 21 13 – Horizontal Louver Blinds  
12 24 00 – Window Shades  
12 36 00 – Countertops  
12 48 13 – Entrance Floor mats and Frames  
12 55 00 – Detention Furnishings and Accessories  
12 67 00 – Pews and Benches

**DIVISION 13 – SPECIAL CONSTRUCTION**

Not Used

**DIVISION 14 – CONVEYING EQUIPMENT**

14 21 00 – Electric Traction Elevators

**DIVISION 21 –FIRE SUPPRESSION**

- 21 05 00 – General Fire Sprinkler Requirements
- 21 05 13 – Electrical Work in Sprinkler Contract
- 21 05 23 – Fire Sprinkler System Piping
- 21 05 29 – Pipe Supports

**DIVISION 22 –PLUMBING**

- 22 05 00 – Basic Plumbing Requirements
- 22 05 03 – Through Penetration Firestopping
- 22 05 29 – Plumbing Supports and Anchors
- 22 05 50 – Seismic Requirements for Equipment and Supports
- 22 05 53 – Plumbing Identification
- 22 07 19 – Plumbing Piping Insulation
- 22 10 00 – Plumbing Piping
- 22 10 30 – Plumbing Specialties
- 22 11 33 – Domestic Water Pumps
- 22 14 29 – Sump Pumps
- 22 30 00 – Plumbing Equipment
- 22 40 00 – Plumbing Fixtures

**DIVISION 23 –MECHANICAL**

- 23 05 00 – Common Work Results for HVAC
- 23 05 13 – Electrical Work (Mechanical)
- 23 05 29 – Mechanical Hangers and Supports
- 23 05 48 – Vibration Isolation
- 23 05 53 – Identification of HVAC Components
- 23 05 93 – Testing and Balancing
- 23 07 00 – Insulation
- 23 08 00 – Mechanical Commissioning Requirements
- 23 09 00 – Building Automation System Requirements
- 23 29 23 – Variable Frequency Drives
- 23 31 00 – Ductwork
- 23 33 13 – Fire Dampers
- 23 34 00 – Fans
- 23 36 00 – Air Terminal Units
- 23 37 00 – Air Distribution
- 23 81 13 – Outdoor Packaged Unit
- 23 81 43 – Split System Heat Pump

23 82 39 – Electric Resistance Heating Unit

**DIVISION 26 –ELECTRICAL**

26 00 00 – General Provisions (Electrical) Contract  
26 05 20 – Wires and Cables  
26 05 33 – Boxes and Cabinets  
26 05 45 – Conduit and Conduit Fittings  
26 05 53 – Electrical Identification  
26 08 00 – Electrical Commissioning Requirements  
26 22 13 – Dry Type Transformers  
26 24 13 – Service Entrance Switchboard  
26 24 16 – Panel Boards and Circuit Breakers  
26 27 26 – Wiring Devices  
26 27 27 – Disconnects  
26 32 13 – Spark Ignited Engine-Driven Generator Sets  
26 33 05 – Battery Emergency Supply (EI1)  
26 36 23 – Automatic Transfer Switches (ATS)  
26 51 00 – Lighting Fixtures

**DIVISION 27 – COMMUNICATIONS**

27 10 00 – Telecommunication Distribution System

**DIVISION 28 –ELECTRONIC SAFETY AND SECURITY**

28 18 00 – Security Access Detection Equipment  
28 31 00 – Addressable Fire Alarm System  
28 50 00 – Bi-Directional Antenna System (BDA)  
28 55 00 – RF Survey for Emergency Responder Radio Antenna/Repeater System (ERRRS)

**DIVISION 31 – EARTHWORK**

31 20 00 – Earth Moving  
31 23 33 – Trenching & backfilling for Utilities  
31 25 00 – Erosion and Sedimentation Control  
31 31 16 – Termite Control  
32 12 12 – Pavement and Appurtenances  
32 92 00 – Lawns and Grasses  
33 14 13 – Water Distribution System  
33 31 11 – Sanitary Sewer System  
33 40 00 – Storm Drainage System  
33 40 01 – Aluminized TYPE II (ALT2) Corrugated Metal Pipe Underground Detention

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

31 31 16 – Termite

32 31 36 – Security Gate and Barriers

32 35 00 – Screening Devices

**DIVISION 33 – UTILITIES**

Not Used

**END OF TABLE OF CONTENTS**

## GEOTECHNICAL ADDENDUM NO. 3

June 26, 2024

Oakley Collier Architects  
109 Candlewood Road  
Rocky Mount, NC 27804

Re: **Franklin County Judicial Center**  
111 W. Nash Street  
Louisburg, NC  
Ground Improvement – Aggregate Piers

Based on information provided by EM Structural, Southern Engineering understands that the design team is considering the use of a ground improvement system for this project consisting of aggregate piers. The intent of the ground improvement is to achieve a higher bearing capacity for foundation design, which would equate to smaller footings and hopefully lower construction costs. Southern Engineering has been asked to comment on the suitability of aggregate piers for this project.

Based on our knowledge of the subsurface conditions at this site, and past experience with aggregate piers, it is our opinion that they are a viable alternative and will provide an increased bearing capacity for foundation design. Aggregate piers are a delegated design item; therefore, their design bearing capacity will be provided by others. However, we anticipate that the bearing capacity will likely be on the order for 5 ksf to 7 ksf given the soil profile at this site, building loads, and typical settlement tolerances. Please note that installation of aggregate piers will cause moderate to high ground vibrations. While not typically harmful to newer construction, the vibrations need to be considered for the old, adjacent masonry structures.

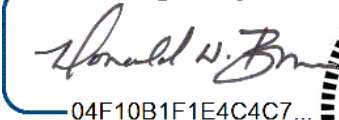
We appreciate being of continued service to you, the County, and the rest of the design team on this project. If you have any questions, please feel free to contact me at your convenience.

Sincerely,

**SOUTHERN ENGINEERING AND TESTING, P.C.**

NC License No. C-4167; SC Certificate of Authority 5297

DocuSigned by:



04F10B1F1E4C4C7...

Donald W. Brown Jr, PE  
Vice President | Principal



6/26/2024



FORM OF SINGLE PRIME GENERAL CONTRACTOR PROPOSAL

New Judicial Center & Annex Renovations  
Franklin County  
Architect's Project #21054

Bidder: \_\_\_\_\_  
Date: \_\_\_\_\_

The undersigned, as Bidder, hereby declares that the only person or persons interested in the Proposal as principal of principals is or are named herein and that no other person than herein mentioned has any interest in this Proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The Bidder further declares that he has examined the site of the Work and the Contract Documents relative thereto and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed.

The bidder proposes and agrees if this Proposal is accepted to contract with Franklin County in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation, and labor necessary to complete the new construction & renovations for the New Franklin County Judicial Center & Courthouse Annex Renovations in full accordance with the plans, specifications, and contract documents, to the full and entire satisfaction of Franklin County with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and Contract Documents for the sum of:

**SINGLE PRIME CONTRACT:** \_\_\_\_\_

**BASE BID** \_\_\_\_\_

\_\_\_\_\_ Dollars(\$)

Subcontractors:	License No.	Dollars(\$)
Civil:	_____	_____
Plumbing:	_____	_____
Mechanical:	_____	_____
Electrical:	_____	_____
Fire Sprinkler:	_____	_____

The Bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the Architect and shall fully complete all work within **540** consecutive calendar days from date of commencement established in a Notice to Proceed.

BIDDER further agrees to pay substantial completion liquidated damages, the sum of \$500 for each consecutive calendar, and this amount shall be assessed in accordance with Subparagraph 8.5.1 of the General Conditions.

#### **ALTERNATES**

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" or "deducted from" the base bid. (Strike out "Add" or "Deduct" as appropriate.)

#### **GENERAL CONTRACT:**

##### **Alternate No. 1: Two-Ply Roofing:**

(Add)(Deduct) \_\_\_\_\_ Dollars (\$) \_\_\_\_\_

#### **UNIT PRICES**

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid quantity of the work all in accordance with the contract documents.

#### **GENERAL CONTRACT:**

Unit Price No. 1: Undercut of Unsuitable Material (Open Excavations) Per 1 CY Unit Price (\$) \_\_\_\_\_

Unit Price No. 2: Undercut of Unsuitable Material (Trenches) Per 1 CY Unit Price (\$) \_\_\_\_\_

Unit Price No. 3: Rock Excavation (Trenches): Per 1 CY Unit Price (\$) \_\_\_\_\_

Unit Price No. 4: Data Outlet & Conduit Per 1 outlet Unit Price (\$) \_\_\_\_\_

Unit Price No. 5: Duplex Receptacle & Circuit Per 1 outlet Unit Price (\$) \_\_\_\_\_

Unit Price No. 6: Structural Fabric Per 1 SY Unit Price (\$) \_\_\_\_\_

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bond within ten (10) consecutive calendar days after written notice being given on the award contract, the check, cash or bid bond accompanying this bid shall be paid into the funds of the Owner's account set aside for the project, as liquidated damages for such failure; otherwise the check, cash or bid bond accompanying this proposal shall be returned to the undersigned.  
Attach certified check, cash or bid bond to this proposal.

Respectfully submitted this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

Name of firm or corporation making bid

\_\_\_\_\_

WITNESS:

By: \_\_\_\_\_

\_\_\_\_\_

Title: \_\_\_\_\_

Proprietorship or Partnership

(Owner, Partner, Pres., V. Pres.)

Address: \_\_\_\_\_

\_\_\_\_\_

License No: \_\_\_\_\_

Federal ID No: \_\_\_\_\_

(Corporate Seal)

ATTEST:

By: \_\_\_\_\_

Title: \_\_\_\_\_

(Corp. Sec. or Asst. Sec. Only)

Addenda received and used in computing bid:

Addendum No. 1 \_\_\_\_\_ Addendum No. 3 \_\_\_\_\_

Addendum No. 2 \_\_\_\_\_ Addendum No. 4 \_\_\_\_\_

**For All Official Notices:**

\_\_\_\_\_

Name and Title

\_\_\_\_\_

Name of Firm/Corporation

\_\_\_\_\_

Street Address, City, State and Zip

\_\_\_\_\_

Telephone and Fax Numbers

## INDEX OF DRAWINGS

### **GENERAL**

G0.10	COVERSHEET
G0.20	BUILDING CODE SUMMARY
G0.31	LIFE SAFETY- LEVEL 01
G0.32	LIFE SAFETY- LEVEL 02
G0.33	LIFE SAFETY- LEVEL 03
G0.40	RATED ASSEMBLIES
G0.41	RATED ASSEMBLIES
G0.42	RATED ASSEMBLIES
G0.50	CONSTRUCTION PHASING

### **CIVIL**

C-0.01	NOTES & LEGENDS
C-1.00	EXISTING CONDITIONS
C-1.01	EXISTING CONDITIONS
C-1.02	DEMOLITION PLAN
C-2.00	SITE PLAN
C-2.01	PLAZA DESIGN PLAN
C-2.02	VEHICLE MOVEMENT ANALYSIS
C-3.00	GRADING & DRAINAGE PLAN
C-3.10	STORM DRAINAGE PROFILES
C-3.11	STORM DRAINAGE PROFILES
C-3.12	STORM DRAINAGE PROFILES
C-3.13	STORM DRAINAGE PROFILES
C-3.14	SWIM MANAGEMENT
C-4.00	UTILITY PLAN
C-5.00	EROSION CONTROL PLAN- PHASE 1A
C-5.01	EROSION CONTROL PLAN- PHASE 1B
C-5.02	EROSION CONTROL PLAN-PHASE 2A
C-5.03	EROSION CONTROL PLAN- PHASE 2B
C-5.04	EROSION CONTROL PLAN- PHASE 3
C-6.00	EROSION CONTROL DETAILS
C-6.01	EROSION CONTROL DETAILS
C-6.02	EROSION CONTROL DETAILS
C-6.03	DETAILS
C-6.04	DETAILS
C-6.05	DETAILS
C-6.06	DETAILS
L-1.0	LANDSCAPE PLAN
L-2.0	LANDSCAPE DETAILS

### **STRUCTURAL**

S0.00	COVERSHEET
S0.01	GENERAL NOTES

S0.02	GENERAL NOTES
S0.03	GENERAL NOTES
S0.04	GENERAL NOTES
S0.05	MASTER SUBMITTAL
S0.06	SPECIAL INSPECTIONS
S0.10	STRUCTURAL LOADING
S1.0D1	DEMOLITION PLAN – FOUNDATION
S1.0D2	DEMOLITION PLAN – SLAB ON GRADE
S1.0D3	DEMOLITION PLAN – WALLS
S1.0D4	DEMOLITION PLAN- MEZZANINE
S1.0D5	DEMOLITION PLAN – ANNEX ROOF
S1.10A	FOUNDATION PLAN (NEW BUILDING)- AREA A
S1.10B	FOUNDATION PLAN (NEW BUILDING)- AREA B
S1.11A	SLAB ON GRADE PLAN- AREA A
S1.11B	SLAB ON GRADE PLAN- AREA B
S1.15A	LEVEL 1 WALL / GIRT FRAMING- AREA A
S1.15B	LEVEL 1 WALL FRAMING- AREA B
S1.20A	SECOND FLOOR FRAMING PLAN- AREA A
S1.21A	SECOND FLOOR FRAMING PLAN- AREA A- ENLARGED STAIRS
S1.22A	SECOND FLOOR FRAMING PLAN-AREA A- ENLARGED CONNECTOR
S1.23B	ANNEX ROOF FRAMING- AREA B
S1.25A	LEVEL 2 GIRT FRAMING- AREA B
S1.30A	THIRD FLOOR FRAMING PLAN- AREA A
S1.31A	THIRD FLOOR FRAMING PLAN-AREA A ENLARGED STAIRS
S1.35A	LEVEL 3 GIRT FRAMING PLAN- AREA A
S1.40A	ROOF FRAMING PLAN- AREA A
S1.41A	HIGH ROOF FRAMING PLAN- AREA A
S2.01	JUDICIAL BUILDING FULL SECTIONS
S2.02	JUDICIAL BUILDING FULL SECTIONS
S2.03	JUDICIAL BUILDING FULL SECTIONS
S2.04	JUDICIAL BUILDING FULL SECTIONS
S2.05	JUDICIAL BUILDING FULL SECTIONS
S2.06	JUDICIAL BUILDING FULL SECTIONS
S2.07	JUDICIAL BUILDING FULL SECTIONS
S2.08	JUDICIAL BUILDING FULL SECTIONS
S2.10	JUDICIAL BUILDING PARTIAL SECTIONS
S2.11	JUDICIAL BUILDING PARTIAL SECTIONS
S2.12	JUDICIAL BUILDING PARTIAL SECTIONS
S2.13	JUDICIAL BUILDING PARTIAL SECTIONS
S2.14	JUDICIAL BUILDING PARTIAL SECTIONS
S2.20	ANNEX BUILDING SECTIONS
S2.21	ANNEX BUILDING SECTIONS (SHEAR WALLS)
S2.44	ELEVATOR 1 SECTIONS
S2.45	ELEVATOR 2 WALL SECTIONS
S2.46	STAIR 2 & 3 SECTIONS
S2.50	BRACED FRAME ELEVATIONS
S2.51	BRACED FRAME ELEVATIONS
S2.52	BRACED FRAME ELEVATIONS
S3.01	TYPICAL SLAB ON GRADE DETAILS
S3.02	TYPICAL SLAB ON GRADE DETAILS
S3.03	ELEVATOR PIT DETAILS

S3.04	SHALLOW FOUNDATION DETAILS
S3.05	FOUNDATION WALL DETAILS
S3.06	CONCRETE PEDESTAL DETAILS
S3.07	CONCRETE PEDESTAL DETAILS
S4.20	CMU FRAMING SECTIONS AND DETAILS
S4.21	CMU FRAMING SECTIONS AND DETAILS
S4.22	CMU FRAMING SECTIONS AND DETAILS
S5.01	STEEL COLUMN BASEPLATE DETAILS
S5.03	STEEL COLUMN SPLICE DETAILS
S5.10	TYPICAL STRUCTURAL STEEL CONNECTIONS
S5.11	TYPICAL STRUCTURAL STEEL MOMENT CONNECTIONS
S5.12	TYPICAL STRUCTURAL STEEL BRACED FRAME CONNECTIONS
S5.25	STEEL GIRT DETAILS
S5.30	COMPOSITE STEEL DECK DETAILS
S5.31	COMPOSITE STEEL DETAILS
S5.32	COMPOSITE STEEL DETAILS
S5.33	COMPOSITE STEEL DETAILS
S5.40	STEEL ROOF FRAMING DETAILS
S5.41	STEEL ROOF FRAMING DETAILS
S5.42	STEEL ROOF FRAMING DETAILS
S5.43	STEEL ROOF FRAMING DETAILS
S6.01	TYPICAL LIGHT GAGE METAL STUD DETAILS
S6.02	LIGHT GAGE METAL STUD SHEAR WALL DETAILS

## **ARCHITECTURAL**

D1.01	DEMOLITION PLANS
A0.01	WALL LEGEND
A1.01	SLAB / MASONRY PLAN- LEVEL 1
A1.02	SLAB / MASONRY PLANS- LEVEL 2+3
A1.11	PLAN- LEVEL 1 (OVERALL)
A1.11A	PLAN- LEVEL 1 (AREA A)
A1.11B	PLAN- LEVEL 1 (AREA B)
A1.12	PLAN- LEVEL 2
A1.13	PLAN- LEVEL 3
A1.14	ROOF PLAN
A1.21	REFLECTED CEILING PLAN- LEVEL 1 (OVERALL)
A1.21A	RCP- LEVEL 1 (AREA A)
A1.21B	RCP- LEVEL 1 (AREA B)
A1.22	RCP- LEVEL 2
A1.23	RCP- LEVEL 3
A1.31	FINISH PLANS- LEVEL 01 (AREA A)
A1.31C	FINISH PLANS- LEVEL 01 (AREA B)
A1.32	FINISH PLANS- LEVEL 02
A1.33	FINISH PLANS- LEVEL 03
A2.01	OVERALL BUILDING ELEVATIONS
A2.02	OVERALL BUILDING ELEVATIONS
A2.03	OVERALL BUILDING ELEVATIONS
A3.01	BUILDING SECTIONS
A3.02	BUILDING SECTIONS
A3.11	WALL SECTIONS- EXTERIOR

A3.12	WALL SECTIONS- EXTERIOR
A3.13	WALL SECTIONS- EXTERIOR
A3.14	WALL SECTIONS- EXTERIOR
A3.31	VERTICAL CIRCULATION- STAIR #1
A3.32	VERTICAL CIRCULATION- STAIR #2
A3.33	VERTICAL CIRCULATION- STAIR # 3
A3.34	VERTICAL CIRCULATION- ELEV #3/4
A4.01	ENLARGED PLANS
A4.02	ENLARGED PLANS- CLERK COURTROOM
A4.03	ENLARGED PLANS- DISTRICT COURT 1
A4.04	ENLARGED PLANS- DISTRICT COURT 2
A4.05	ENLARGED PLAN
A4.10	ENLARGED PLANS- RESTROOMS
A4.11	ENLARGED PLANS- RESTROOMS
A4.12	ENLARGED PLANS- RESTROOMS
A5.01	EXTERIOR DETAILS
A5.02	EXTERIOR DETAILS
A5.03	EXTERIOR DETAILS
A5.04	EXTERIOR DETAILS
A5.05	EXTERIOR DETAILS
A5.11	INTERIOR DETAILS
A5.12	INTERIOR DETAILS
A5.13	INTERIOR DETAILS
A6.01	DOOR SCHEDULE
A6.02	ASSEMBLED GLAZING

## **FIRE PROTECTION**

FP0.00	FIRE PROTECTION NOTES, LEGEND, AND FIXTURE SCHEDULES
FP1.10	OVERALL LEVEL 1 FIRE PROTECTION PLAN
FP1.11	OVERALL FIRE PROTECTION PLAN- LEVEL 2+3
FP2.01	FIRE PROTECTION SECTION VIEW
FP3.01	FIRE PROTECTION SITE PLAN

## **PLUMBING**

P0.00	PLUMBING NOTES LEGEND AND FIXTURE SCHEDULE
P0.01	PLUMBING FIXTURE SCHEDULE
P1.11	PLUMBING PLAN- LEVEL 1 (OVERALL)
P1.11A	LEVEL 1- ENLARGED WASTE PIPING PLAN (AREA A)
P1.11B	LEVEL 1- ENLARGED WASTE PIPING PLAN (AREA B)
P1.11C	LEVEL 1- ENLARGED WASTE PIPING PLAN (AREA C)
P1.12	OVERALL LEVEL 2+3 WASTE PIPING PLAN
P1.12A	LEVEL 2- ENLARGED WASTE PIPING PLAN (AREA A)
P1.12B	LEVEL 2- ENLARGED WASTE PIPING PLAN (AREA B)
P1.13A	LEVEL 3- ENLARGED WASTE PIPING PLAN (AREA A)
P1.13B	LEVEL 3- ENLARGED WASTE PIPING PLAN (AREA B)
P1.14	PLUMBING PLAN – ROOF
P1.21A	LEVEL 1- ENLARGED WATER PIPING PLAN (AREA A)
P1.21B	LEVEL 1- ENLARGED WATER PIPING PLAN (AREA B)
P1.21C	LEVEL 1- ENLARGED WATER PIPING PLAN (AREA C)

P1.22A	LEVEL 2- ENLARGED WATER PIPING PLAN (AREA A)
P1.22B	LEVEL 2- ENLARGED WATER PIPING PLAN (AREA B)
P1.23A	LEVEL 3- ENLARGED WATER PIPING PLAN (AREA A)
P1.23B	LEVEL 3- ENLARGED WATER PIPING PLAN (AREA B)
P2.01	WATER PIPING RISER
P3.01	PLUMBING DETAILS

## **MECHANICAL**

M0.00	MECHANICAL NOTES LEGEND AND DETAILS
M0.01	MECHANICAL SCHEDULES
M0.02	VENTILATION SUMMARY
M0.03	VENTILATION SUMMARY
M1.10	OVERALL LEVEL 1 MECHANICAL PLAN
M1.10A	LEVEL 1- ENLARGED MECHANICAL PLAN (AREA A)
M1.10B	LEVEL 1- ENLARGED MECHANICAL PLAN (AREA B)
M1.10C	LEVEL 1- ENLARGED MECHANICAL PLAN (AREA C)
M1.11	OVERALL LEVEL 2 MECHANICAL PLAN
M1.11A	OVERALL LEVEL 2 MECHANICAL PLAN (AREA A)
M1.11B	OVERALL LEVEL 2 MECHANICAL PLAN (AREA B)
M1.12A	OVERALL LEVEL 3 MECHANICAL PLAN (AREA A)
M1.12B	OVERALL LEVEL 3 MECHANICAL PLAN (AREA B)
M1.13	MECHANICAL PLAN – ROOF
M2.1	MECHANICAL DETAILS
M2.2	MECHANICAL DETAILS
M2.3	CONTROLS DETAILS

## **ELECTRICAL**

E0.00	ELECTRICAL LEGEND, NOTES, DETAILS
E0.01	ELECTRICAL DETAILS
E0.02	LIGHT FIXTURE SCHEDULE, LIGHTING DETAILS
E1.00	ELECTRICAL SITE PLAN
E1.10	OVERALL LEVEL 1 LIGHTING PLAN
E1.10A	LEVEL 1- ENLARGED LIGHTING PLAN
E1.10B	LEVEL 1- ENLARGED LIGHTING PLAN
E1.10C	LEVEL 1- ENLARGED LIGHTING PLAN
E1.11	OVERALL LEVEL 2 & 3 LIGHTING PLAN
E1.11A	LEVEL 2- ENLARGED LIGHTING PLAN
E1.11B	LEVEL 2- ENLARGED LIGHTING PLAN
E1.12A	LEVEL 3- ENLARGED LIGHTING PLAN
E1.12B	LEVEL 3- ENLARGED LIGHTING PLAN
E1.20A	LEVEL 1- ENLARGED POWER PLAN
E1.20B	LEVEL 1- ENLARGED POWER PLAN
E1.20C	LEVEL 1- ENLARGED POWER PLAN
E1.21A	LEVEL 2- ENLARGED POWER PLAN
E1.21B	LEVEL 2- ENLARGED POWER PLAN
E1.22A	LEVEL 3- ENLARGED POWER PLAN
E1.22B	LEVEL 3- ENLARGED POWER PLAN
E1.23	POWER PLAN- ROOF
E1.30A	LEVEL 1- ENLARGED HVAC POWER PLAN



E1.30B	LEVEL 1- ENLARGED HVAC POWER PLAN
E1.30C	LEVEL 1- ENLARGED HVAC POWER PLAN
E1.31A	LEVEL 2- ENLARGED HVAC POWER PLAN
E1.31B	LEVEL 2- ENLARGED HVAC POWER PLAN
E1.32A	LEVEL 3- ENLARGED HVAC POWER PLAN
E1.32B	LEVEL 3- ENLARGED HVAC POWER PLAN
E1.33	HVAC POWER PLAN- ROOF
E2.00	POWER RISER- PHASE 1
E2.01	DEMOLITION POWER RISER- PHASE 2
E2.02	POWER RISER- PHASE 2
E2.03	COMMUNICATION RISER, SECURITY RISER
E2.04	PANEL SCHEDULES
E2.05	PANEL SCHEDULES
E2.06	PANEL SCHEDULES
E2.07	PANEL SCHEDULES

### **FIRE ALARM**

FA0.00	FIRE ALARM, LEGEND, NOTES, DETAILS
FA1.10	LEVEL 1- OVERALL FIRE ALARM PLAN
FA1.10A	LEVEL 1- ENLARGED FIRE ALARM PLAN- A
FA1.10B	LEVEL 1- ENLARGED FIRE ALARM PLAN- B
FA1.10C	LEVEL 1- ENLARGED FIRE ALARM PLAN- C
FA1.11	LEVEL 2 & 3- OVERALL FIRE ALARM PLAN
FA1.11A	LEVEL 2- ENLARGED FIRE ALARM PLAN- A
FA1.11B	LEVEL 2- ENLARGED FIRE ALARM PLAN- B
FA1.12A	LEVEL 3- ENLARGED FIRE ALARM PLAN- A
FA1.12B	LEVEL 3- ENLARGED FIRE ALARM PLAN- B

**SECTION 01 21 00  
ALLOWANCES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Cash/Unit Price allowances.
- B. Contingency allowance.
- C. Payment and modification procedures relating to allowances.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

**1.03 CASH/UNIT PRICE ALLOWANCES**

- A. Costs Included in Cash/Unit Price Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts
- B. Architect Responsibilities:
  - 1. Consult with Contractor for consideration and selection of products .
  - 2. Select products in consultation with Owner and transmit decision to Contractor.
- C. Contractor Responsibilities:
  - 1. Assist Architect in selection of products .
  - 2. Obtain proposals from suppliers and installers and offer recommendations.
  - 3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
  - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
  - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

**1.04 CONTINGENCY ALLOWANCE**

- A. All expenditures from Contingency Allowance shall be approved by Architect prior to ordering, purchasing or committing to expenditure.
- B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
- C. Funds will be drawn from the Contingency Allowance only by Contingency Disbursement or Change Order. The Architect shall provide a Contingency Disbursement form for use and shall keep account of all funds approved/used.
- D. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

**1.05 ALLOWANCES SCHEDULE**

- A. **Unit Price Allowance No. 1 - Undercut of Unsuitable Material (Open Excavations)**
  - 1. The contractor shall stipulate the allowance amount to be included in the Base Bid for 6,000 cubic yards based on the description of work and unit of measurement cost provided for in Section 01 22 00 - Unit Prices, Unit Price No. 1.
- B. **Unit Price Allowance No.2 - Undercut of Unsuitable Material (Trenches)**
  - 1. The contractor shall stipulate the allowance amount to be included in the Base Bid for 1,000 cubic yards based on the description of work and unit of measurement cost provided for in Section 01 22 00 - Unit Prices, Unit Price No. 2.
- C. **Unit Price Allowance No. 3 - Rock Excavation (Trenches)**

1. The contractor shall stipulate an amount to be included in the Base Bid to provide 1,750 cubic yards rock excavation based on the description of work and unit of measurement cost provided in Section 01 22 00 - Unit Prices, Unit Price No. 3.
- D. **Unit Price Allowance No. 4 - Data Outlet and Conduit.**
  1. The contractor shall stipulate the allowance amount to be included in the Base Bid for 50 occurrences based on the description of work and unit of measurement cost provided for in Section 01 22 00 - Unit Prices, Unit Price No. 4.
- E. **Unit Price Allowance No. 5 - Duplex Receptacle and Circuit.**
  1. The contractor shall stipulate the allowance amount to be included in the Base Bid for 50 occurrences based on the description of work and unit of measurement cost provided for in Section 01 22 00 - Unit Prices, Unit Price No. 5.
- F. **Unit Price Allowance No. 6 - Structural Fabric**
  1. The contractor shall stipulate an amount to be included in the Base Bid to provide 8,000 square yards of structural fabric based on the description of work and unit of measurement cost provided in Section 01 22 00 - Unit Prices, Unit Price No. 6.
- G. **Contingency Allowance No. 7 - Owner's Contingency.**
  1. Include in the base bid amount an allowance of \$200,000 for Owner's Contingency. Contingency items shall be as determined and approved by the Architect and include all materials, labor, profit, and overhead associated with the approved contingency item.
- H. **Cash Allowance No. 8 - Brick.**
  1. Include in the base bid amount an allowance of \$700 per 1000 brick for purchase and delivery of Brick Veneer. See Section Unit Masonry
- I. **Cash Allowance No. 9 - Design, Testing and Installation of Bi-Directional Amplifier (BDA) System.**
  1. The contractor include in the Base Bid a cash allowance amount of \$150,000 for the design, testing, purchase, delivery & installation of the BDA system required for the building.
- J. **Cash Allowance No. 10 - Pedestrian Traffic Control**
  1. Include in base bid amount an allowance of \$50,000 to provide pedestrian traffic barricades to channel pedestrians to a safe walking path during construction.
- K. **Cash Allowance No. 11 - Legally Dispose Contaminated Soils**
  1. Include in base bid amount an allowance of \$25,000 to properly dispose of contaminated soils found during excavation.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION - NOT USED****END OF SECTION**

**SECTION 01 22 00  
UNIT PRICES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
- C. Defect assessment and non-payment for rejected work.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

**1.03 COSTS INCLUDED**

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

**1.04 UNIT QUANTITIES SPECIFIED**

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

**1.05 MEASUREMENT OF QUANTITIES**

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Testing agency will take all measurements and compute quantities accordingly.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement Devices:
  - 1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
  - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
  - 3. Metering Devices: Inspected, tested and certified by the applicable state department within the past year.
- E. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- F. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- G. Measurement by Area: Measured by square dimension using mean length and width or radius.
- H. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- I. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
- J. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.

**1.06 PAYMENT**

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Payment will not be made for any of the following:
  - 1. Products wasted or disposed of in a manner that is not acceptable.

2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected Products.

#### **1.07 DEFECT ASSESSMENT**

- A. Replace Work, or portions of the Work, not complying with specified requirements.
- B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, Architect will direct one of the following remedies:
  1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Architect, or:
  2. The defective Work will be partially repaired to the instructions of the Architect, and the unit price will be adjusted to a new unit price at the discretion of Architect.
- C. The authority of the Architect to assess the defect and identify payment adjustment is final.

#### **1.08 SCHEDULE OF UNIT PRICES**

- A. Item: Unit Price No. 1 - Undercut of Unsuitable Material (Open Excavations).
  1. Description: Complete removal and disposal of unsuitable soils encountered in open excavations and replacement with satisfactory soils, and as further defined in Division 31 20 00 - Earth Moving. This work includes, but is not limited to, excavating, loading, hauling, properly disposing and backfilling.
  2. Unit of Measurement: per (1) Cubic Yard Excavated
    - a. Description of Measurement: Measurement shall be in cubic yards (CY) of soil excavated below proposed subgrade. Measurement of undercut shall be in the presence of the engineer and must be approved. Maintain daily log sheets of measured quantities. Log sheets must be signed by Engineer and submitted with pay request. Payment shall not be made for quantities that have not been field verified by engineer.
- B. Item: Unit Price No. 2 - Undercut of Unsuitable Material (Trenches).
  1. Description: Complete removal and disposal of unsuitable soils encountered in trench excavation and replacement with satisfactory soils or Class I stone, and as further defined in Division 31 23 33 - Trenching & Backfilling for Utilities. This work includes, but is not limited to, excavating, loading, hauling, properly disposing and backfilling.
  2. Unit of Measurement: per (1) Cubic Yard Excavated
    - a. Description of Measurement: Measurement shall be in cubic yards (CY) of soil excavated below pipe bedding. Measure along the centerline of the trench times the undercut depth below the pipe bedding as approved by the Engineer times the O.D. plus four feet. Measure unstable soils at manholes on the max basis of one foot greater than the outside diameter of the manhole and a depth approved by the Engineer. Measurement shall be based on actual quantities removed but not exceeding the maximum specified trench dimensions. Measurement of undercut shall be in the presence of the engineer and must be approved. Maintain daily log sheets of measured quantities. Log sheets must be signed by Engineer and submitted with pay request. Payment shall not be made for quantities that have not been field verified by engineer.
- C. Item: Unit Price No. 3 -Rock Excavation (Trenches).
  1. Description: Complete removal and disposal of excavated rock material including, but not limited to, drilling, blasting, monitoring, excavating, loading, hauling, and properly disposing of excavated material. Providing specified material for backfilling shall include, but not be limited to, material, loading, hauling, placing and compacting and as further defined in Division 31 23 33 - Trenching & Backfilling for Utilities.
  2. Unit of Measurement: per (1) Cubic Yard Excavated.
    - a. Description of Measurement: Measurements for all rock excavation shall be per cubic yards (CY) of rock removed.

- 1) Pipe: Measure along the centerline of the trench, times the depth from the top of rock profile to the specified depth below the pipe, times the pipe OD plus five feet.
  - 2) Structure: Measure one foot beyond the outside of the structure (excluding extended base) and to a depth of one foot greater than the bottom of the structure.
  - 3) General: Take measurements in the presence of the Engineer. Maintain daily log sheets of measured quantities. Log sheets must be signed by the Engineer and submitted with payment request. Payment shall not be made for quantities that have not been field verified by the Engineer.
- D. Item: Unit Price No. 4 - Data Outlet and Conduit.
1. Description: Furnish and install data outlet and conduit to above ceiling in same configuration as delineated in the plans.
  2. Unit of Measurement: Per single outlet.
- E. Item: Unit Price No. 5 - Duplex Receptacle and Circuit.
1. Description: Furnish and install duplex receptacle and circuit to panel in same configuration as delineated in the plans.
  2. Unit of Measurement: Per single outlet.
- F. Item: Unit Price No. 6 - Structural Fabric.
1. Description: Structural fabric used to reinforce soil that includes material and placing of material, according to Division 31 20 00 - Earth Moving.
  2. Unit of Measurement: per (1) Square Yard of Material.
    - a. Description of Measurement: Measurement shall be in square yards (SY) of material, based on quantities verified by Engineer.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION - NOT USED****END OF SECTION**

This page intentionally left blank

**SECTION 02 41 00**  
**MINOR DEMOLITION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Removal of designated equipment and structures.
- B. Identification of existing utilities.

**1.02 RELATED SECTIONS**

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
  - 1. Summary of Work

**1.03 SUBMITTALS**

- A. Submit the following in accordance with Section, Submittal Procedures:
  - 1. Schedule
    - a. Indicate demolition and removal sequence.
  - 2. Record Drawings
    - a. Accurately record locations of capped utilities, subsurface obstructions, and other pertinent items uncovered during demolition.

**1.04 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for demolition work, safety of structure, dust control and work safety requirements.
- B. Obtain required permits from authorities.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Do not close or obstruct egress width to exits.
- E. Do not disable or disrupt building fire or life safety systems without 3 day prior written notice to the Owner.
- F. Conform to procedures applicable when discovering hazardous or contaminated materials.

**1.05 SCHEDULING**

- A. Schedule Work and notify Owner in accordance with Section, Summary of Work.
- B. Scheduling of work shall be done with the approval of Owner.



## **PART 2 PRODUCTS**

### **2.01 NOT USED**

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Provide, erect, and maintain temporary barriers as required for demolition and as indicated on the Drawings.
- B. Erect and maintain weatherproof closures for exterior openings.
- C. Erect and maintain temporary partitions to prevent spread of dust, odors and noise to permit continued Owner occupancy of the facility.
- D. Protect existing materials and areas which are not to be demolished.
- E. Prevent movement of structure; provide required bracing and shoring.
- F. Mark location of utilities.

### **3.02 DEMOLITION**

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Identify, disconnect, remove and cap designated utilities within demolition areas.
- C. Demolition of structures shall include the complete removal of the structure foundation.
- D. Demolish in an orderly and careful manner. Protect existing supporting structural members and equipment. Cease operations immediately if structure appears to be in danger. Notify Engineer. Do not resume operations until directed.
- E. Except where noted otherwise, remove demolished materials from site as work progresses. Do not burn or bury materials on site.
- F. Upon completion of work, leave areas in clean condition.
- G. Remove temporary Work.

### **3.03 EQUIPMENT TO OWNER**

- A. The following equipment shall be turned over to the Owner after removal from the existing facility. The equipment shall be stored at a location on the site as designated by the Owner.

END OF SECTION

**SECTION 06 10 01  
ROUGH CARPENTRY****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Nonstructural dimension lumber framing.
- B. Rough opening framing for doors, windows, and roof openings.
- C. Roofing nailers.
- D. Preservative treated wood materials.
- E. Fire retardant treated wood materials.
- F. Communications and electrical room mounting boards.
- G. Concealed wood blocking, nailers, and supports.
- H. Miscellaneous wood nailers, furring, and grounds.

**1.02 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- D. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- F. AWWA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2023.
- G. AWWA U1 - Use Category System: User Specification for Treated Wood; 2025.
- H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. ITS (DIR) - Directory of Listed Products; Current Edition.
- J. PS 1 - Structural Plywood; 2023.
- K. PS 20 - American Softwood Lumber Standard; 2025.
- L. SPIB (GR) - Standard Grading Rules; 2021.
- M. UL (DIR) - Online Certifications Directory; Current Edition.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing and application instructions.
- C. Product Data: Submit technical data on wood treatment.
- D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. Species: Southern Pine, unless otherwise indicated.
  - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
  - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at [www.alsc.org](http://www.alsc.org), and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
  - 4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

### **2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

### **2.03 CONSTRUCTION PANELS**

- A. Wall Sheathing, For all new and renovated exterior walls: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant (16 mm Type X fire resistant).
  - 1. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. Edges: Square.
  - 4. Products:
    - a. CertainTeed Corporation; GlasRoc Brand: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Georgia-Pacific Gypsum; DensGlass Sheathing: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - c. Gold Bond Building Products, LLC provided by National Gypsum Company; \_\_\_\_: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - d. USG Corporation; Securock Brand Glass-Mat Sheathing: [www.usg.com/#sle](http://www.usg.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

### **2.04 FIRE-RETARDANT TREATMENT (FRT)**

- A. Factory-treat wood members in accordance with AWWA U1 and use category indicated.
- A. Kiln-dry after treatment (KDAT) to maximum moisture content of 19 percent for sawn material and 15 percent for plywood.
- A. Fabrication of FRT Wood:
  - 1. Ripping or milling of boards, lumber, and timber after treatment is not permitted.
  - 1. Field cutting to length and drilling of holes in boards, lumber, and timber are permitted without additional treatment.
  - 1. Field cutting and drilling of holes in plywood are permitted.

- A. Label or brand FRT wood with classification mark of UL (DIR) or ITS (DIR) or other approved inspection agency, the treatment plant, name of treatment, species of wood, flame spread and smoke developed index, method of drying after treatment, and treating standard.

## **2.05 PRESSURE-PRESERVATIVE TREATMENT (PPT)**

- A. Factory-treat wood members in accordance with AWPA U1 and use category indicated.
- A. Kiln-dry wood after treatment with waterborne preservative to maximum moisture content of 19 percent for lumber and 15 percent for plywood.
- A. Fabricate to maximum extent possible before treatment.
- A. Label preservative-treated wood with marking as required by AWPA U1 and ICC (IBC). Unless otherwise permitted by standard U1 and building code, include the following markings: AWPA U1, accredited inspection agency mark, treating plant identification, type of preservative, preservative retention, and permitted end use.
- A. Field Treatment for Cuts and Holes in Preservative-Treated Wood: Comply with AWPA M4.
- B. Metal and Finish of Fasteners:
  - 1. Fire-Retardant-Treated Wood:
    - a. Nails, timber rivets, wood screws, and lag screws: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
  - 1. Preservative-Treated Wood:
    - a. Nails, timber rivets, wood screws, and lag screws - general use: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
  - 1. Untreated Wood: Unfinished steel.

## **2.06 ACCESSORIES**

- A. Subfloor Adhesives: Gap-filling construction adhesive for bonding wood structural panels to wood-based floor system framing; complying with ASTM D3498.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Coordinate installation of rough carpentry members specified in other sections.

### **3.02 INSTALLATION - GENERAL**

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

### **3.03 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- D. Specifically, provide blocking and framing for the proper installation of the following:
  - 1. Cabinets and shelf supports.
  - 2. Wall brackets.
  - 3. Handrails.
  - 4. Grab bars.
  - 5. Towel and bath accessories.
  - 6. Wall-mounted door stops.

7. Other wall- or ceiling-mounted items indicated on drawings.
  8. Televisions.
- E. Provide wood ground along base of wall at floor, 1 1/2 inches tall by thickness of wallboard, continuous behind all rubber base.
1. Finish face of ground shall be flush with finish face of wallboard.
  2. Set wallboard tight to top of ground.

### **3.04 ROOF-RELATED CARPENTRY**

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

### **3.05 INSTALLATION OF CONSTRUCTION PANELS**

- A. Subflooring: Screw to framing; staples are not permitted.
- B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
- C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
  2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
  3. Install adjacent boards without gaps.
  4. Size and Location: As indicated on drawings.

### **3.06 TOLERANCES**

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

### **3.07 CLEANING**

- A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
1. Comply with applicable regulations.
  2. Do not burn scrap on project site.
  3. Do not burn scraps that have been pressure treated.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

### **END OF SECTION**

**SECTION 07 01 50.19  
PREPARATION FOR RE-ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Replacement of existing roofing system in preparation for entire new roofing system.
- B. Temporary roofing protection.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 54 00 - Thermoplastic Membrane Roofing.

**1.03 REFERENCE STANDARDS**

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with affected mechanical and electrical work associated with roof penetrations.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
  - 1. Attendees:
    - a. Architect.
    - b. Contractor.
    - c. Owner.
  - 2. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:
    - a. Removal and installation schedule.
    - b. Necessary preparatory work.
    - c. Protection before, during, and after roofing system installation.
    - d. Removal of existing roofing system.
    - e. Installation of new roofing system.
    - f. Temporary roofing and daily terminations.
    - g. Transitions and connection to and with other work.
    - h. Inspections and testing of installed systems.
    - i. Inspection of existing roof decking..
- C. Schedule work to coincide with commencement of installation of new roofing system.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Materials Removal Company Qualification Statement.
- C. Installer's Qualification Statement.
- D. Preconstruction Testing Agency Qualification Statement.

**1.06 QUALITY ASSURANCE**

- A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
  - 1. When same installer as new roofing system, comply with related requirements of section indicated for new roofing system.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

**1.08 FIELD CONDITIONS**

- A. Existing Roofing System: Single Ply Membrane roofing.
- B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.
- C. Maintain continuous temporary protection prior to and during installation of new roofing system.

**1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Existing Warranties: Perform this work using methods and materials that will maintain existing roof system warranties.
  - 1. Notify existing roof system warrantor prior to starting this work and obtain written instructions for procedures necessary to maintain this existing warranty.
  - 2. Upon completion of this work, notify warrantor of reroofing completion and obtain documentation to verify that existing roofing system has been inspected and warranty is still in effect.
    - a. Submit documentation upon project closeout.

**PART 2 PRODUCTS****2.01 COMPONENTS**

- A. See the following sections for additional information on components relating to this work:

**2.02 MATERIALS****PART 3 EXECUTION****3.01 EXAMINATION**

- A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

**3.02 PREPARATION**

- A. Sweep roof surface clean of loose matter.
- B. Remove loose refuse and dispose of properly off-site.

**3.03 MATERIAL REMOVAL**

- A. Remove roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets, insulation vents, and \_\_\_\_\_.
- B. Remove insulation and fasteners, cant strips, and blocking.
- C. Remove vapor retarder, sheathing paper, underlay, and \_\_\_\_\_.
- D. Repair existing wood deck surface to provide smooth working surface for new roof system.

**3.04 INSTALLATION**

- A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 07 54 00 for additional requirements.

**3.05 FIELD QUALITY CONTROL**

- A. Independent agency inspection and testing will be provided under provisions of Section 01 40 00.

**3.06 PROTECTION**

- A. Provide temporary protective sheeting over uncovered deck surfaces.
- B. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.
- C. Provide for surface drainage from sheeting to existing drainage facilities.

**END OF SECTION**

**SECTION 07 54 00  
THERMOPLASTIC MEMBRANE ROOFING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Adhered system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered.
- C. Cover boards.
- D. Flashings.
- E. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

**1.02 REFERENCE STANDARDS**

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- C. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2021.
- D. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2024.
- E. FM (AG) - FM Approval Guide; Current Edition.
- F. NRCA (RM) - The NRCA Roofing Manual; 2025.
- G. NRCA (WM) - The NRCA Waterproofing Manual; 2005.
- H. UL (FRD) - Fire Resistance Directory; Current Edition.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.
  - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, surfacing, and fasteners.
- C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and walkway pad layout.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Warranty Documentation:
  - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
  - 2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.



- B. Installer Qualifications: Company specializing in performing work of this section with at least five years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

#### **1.07 FIELD CONDITIONS**

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.
- C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
  - 1. Warranty Term: 20 years.
  - 2. For repair and replacement include costs of both material and labor in warranty.
  - 3. Exceptions are not Permitted:
    - a. Damage due to roof traffic.
    - b. Damage due to wind speed greater than 56 miles per hour (90 km/h) but less than 90 miles per hour (145 km/h).
- D. The Contractor (Roofing System Installer) shall warrant the materials and workmanship of the roofing system against leakage and defects due to faulty materials, workmanship and contract negligence for a period of two (2) years following acceptance of the project by the Owner.
- E. The Roofing System Manufacturer shall inspect the installation and warrant the materials and workmanship of the roofing system against leakage for a minimum period of twenty (20) years following acceptance of the project by the Owner.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:
  - 1. Carlisle SynTec Systems; Sure-Flex PVC: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 2. GAF; EverGuard PVC \_\_\_\_: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - 3. The Garland Company; <https://www.garlandco.com/#sle..>
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation:
  - 1. Carlisle SynTec: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 2. GAF: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - 3. Versico Roofing Systems: [www.versico.com/#sle](http://www.versico.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

**2.02 ROOFING - UNBALLASTED APPLICATIONS**

- A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered.
- B. Roofing Assembly Requirements:
  - 1. Solar Reflectance Index (SRI): 78, minimum, calculated in accordance with ASTM E1980.
    - a. Field applied coating may not be used to achieve specified SRI.
  - 2. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.
  - 3. Insulation Thermal Resistance (R-Value): 5 per inch, minimum; provide insulation of thickness required.
- C. Acceptable Insulation Types - Constant Thickness Application:
  - 1. Minimum 2 layers of polyisocyanurate board.
- D. Acceptable Insulation Types - Tapered Application:
  - 1. Tapered polyisocyanurate board.

**2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS**

- A. Membrane Roofing Materials:
  - 1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, Type II, sheet contains reinforcing fibers or reinforcing fabrics.
    - a. Thickness: 60 mil, 0.060 inch (1.5 mm), minimum.
  - 2. Sheet Width:
    - a. Adhered Application: Limit width to 120 inches (3,048 mm), maximum, when ambient temperatures are less than 40 degrees F (4.4 degrees C) for extended period of time during installation.
  - 3. Color: White.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Membrane Fasteners: As recommended and approved by membrane manufacturer.
- D. Flexible Flashing Material: Same material as membrane.

**2.04 DECK SHEATHING**

- A. Parapet sheathing (roof side): Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 5/8 inch (16 mm) thick.
  - 1. Products:
    - a. Georgia-Pacific; DensDeck: [www.densdeck.com/#sle](http://www.densdeck.com/#sle).
      - 1) Basis of Design or approved substitution.
    - b. USG Corporation; : [www.usg.com/#sle](http://www.usg.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

**2.05 COVER BOARDS**

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
  - 1. Thickness: 1/2 inch (12.7 mm), fire-resistant.
  - 2. Products:
    - a. Georgia-Pacific; DensDeck: [www.densdeck.com/#sle](http://www.densdeck.com/#sle).
    - b. Gold Bond Building Products, LLC provided by National Gypsum Company; DEXcell Glass Mat Roof Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

**2.06 INSULATION**

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
  - 1. Classifications:
    - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
      - 2) Compressive Strength: Classes 1-2-3, Grade 2, 20 psi (138 kPa), minimum.

2. Board Size: 48 by 96 inches (1220 by 2440 mm).
3. Board Thickness: As required to achieve R30.
4. Tapered Board: Slope as indicated; minimum thickness 1/2 inch (13 mm); fabricate of fewest layers possible.
5. Products:
  - a. DuPont de Nemours, Inc; \_\_\_\_\_: [building.dupont.com/#sle](http://building.dupont.com/#sle).
  - b. GAF; EnergyGuard Polyiso Insulation: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - c. Johns Manville; ENRGY 3 - Flat and Tapered: [www.jm.com/#sle](http://www.jm.com/#sle).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.07 ACCESSORIES**

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- B. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; other configurations as detailed.
- C. Sheathing Adhesive: Noncombustible type, for adhering gypsum sheathing to metal deck.
- D. Sheathing Joint Tape: Paper type, 6 inch (150 mm) wide, self adhering.
- E. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
- F. Membrane Adhesive: As recommended by membrane manufacturer.
- G. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- H. Insulation Adhesive: As recommended by insulation manufacturer.
- I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
  1. Composition: Roofing membrane manufacturer's standard.
  2. Size: Manufacturer's standard size.
  3. Surface Color: White.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

### **3.02 PREPARATION - WOOD DECK**

- A. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.

### **3.03 PREPARATION - METAL DECK**

- A. Install deck sheathing on metal deck:
  1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
  2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
  3. Tape joints.

### **3.04 INSTALLATION, GENERAL**

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.

- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

### **3.05 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE**

- A. Attachment of Insulation:
  - 1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions.
- B. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
- C. Lay subsequent layers of insulation with joints staggered minimum 6 inches (152 mm) from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
- F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches (457 mm).
- H. Do not install more insulation than can be covered with membrane in same day.

### **3.06 INSTALLATION - MEMBRANE**

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate per manufacturer's recommendations. Fully embed membrane in adhesive except in areas directly over or within 3 inches (75 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (76 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
  - 1. Extend membrane over cant strips and up a minimum of 4 inches (102 mm) onto vertical surfaces.
  - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
  - 3. Secure flashing to nailing strips at 4 inches (102 mm) on center.
  - 4. Insert flashing into reglets and secure.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
- G. Install roofing expansion joints where indicated. Make joints watertight.
  - 1. Install prefabricated joint components in accordance with manufacturer's instructions.
- H. Coordinate installation of roof drains and sumps and related flashings.

### **3.07 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

### **3.08 CLEANING**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.

- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

**3.09 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**END OF SECTION**

**SECTION 08 31 00  
ACCESS DOORS AND PANELS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Wall- and ceiling-mounted access units.

**1.02 REFERENCE STANDARDS****1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

**PART 2 PRODUCTS****2.01 ACCESS DOORS AND PANELS ASSEMBLIES**

- A. Ceiling-Mounted Units \_\_\_\_\_:
  - 1. Location: As indicated on drawings.
  - 2. Panel Material: Concealed Aluminum extrusion with gypsum board inlay.
  - 3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
  - 4. Size - Other Ceilings: As indicated on Drawings.
  - 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- B. Wall-Mounted Security Units:
  - 1. Location: As indicated on drawings.
  - 2. Panel Material: Steel.
  - 3. Size: 24 by 48 inches (610 by 1219 mm).
  - 4. Door/Panel and Frame: Heavy duty.
  - 5. Security type lock as indicated.

**2.02 WALL AND CEILING MOUNTED ACCESS UNITS**

- A. Manufacturers:
  - 1. ACUDOR Products Inc; FW-5050-ACF: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  - 2. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 3. **BASIS OF DESIGN:** BAUCO Access Panel Solutions Inc: [www.bauco.com/#sle](http://www.bauco.com/#sle).
    - a. Concealed Hardware and Gypsum Board Inlay - Regular Size: BAUCO Plus II - Access Panels.
    - a. Concealed Hardware and Gypsum Board Inlay - Large Size: BAUCO XL - Access Panels.
  - 4. Karp Associates, Inc: [www.karpinc.com/#sle](http://www.karpinc.com/#sle).
  - 5. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  - 1. Material: Aluminum extrusions with gypsum board inlay.
  - 2. Style: Frame concealed by door panel.

- a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
- 3. Frames: 2.8mm thick aluminum 6063-T6 inner and outer frames w/ galvanized steel reinforcing at internal corners.
- 4. Heavy-Duty Single Steel Sheet Door Panels: 14-gauge, 0.0747-inch (1.89 mm) minimum thickness.
- 5. Door Panels to Receive Wall/Ceiling Finish: Surface recessed 5/8 inch (15.9 mm) back from wall face.
- 6. Steel Finish: Primed.
- 7. Aluminum Finish: Natural brushed.
- 8. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
- 9. Door/Panel Size: As indicated on the drawings.
- 10. Hardware:
  - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
  - b. Latch/Lock: Tamperproof tool-operated cam latch.
  - c. Inside Latch Release: Mechanism that allows door/panel to be opened from inside.
  - d. Gasketing: Extruded neoprene, around perimeter of door panel.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

#### **3.03 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

#### **END OF SECTION**

**SECTION 08 80 00  
GLAZING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds.

**1.02 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024.
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- L. ASTM F1233 - Standard Test Method for Security Glazing Materials And Systems; 2008 (Reapproved 2019).
- M. GANA (SM) - GANA Sealant Manual; 2008.
- N. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.
- O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).
- P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 24 by 24 inch (\_\_\_ by \_\_\_ mm) in size of glass units.
- E. Samples: Submit 12 inch (\_\_\_ mm) long bead of glazing sealant, color as selected.
- F. Certificate: Certify that products of this section meet or exceed specified requirements.



- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Insulating Glass Units: One of each glass size and each glass type.

### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
  - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
    - a. Insulating Glass Certification Council (IGCC).
    - b. Safety Glazing Certification Council (SGCC).
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
  - 1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.

### 1.06 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

### 1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

### 1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
  - 1. Cardinal Glass Industries; \_\_\_\_: [www.cardinalcorp.com/#sle](http://www.cardinalcorp.com/#sle).
  - 2. Guardian Glass, LLC; \_\_\_\_: [www.guardianglass.com/#sle](http://www.guardianglass.com/#sle).
  - 3. Pilkington North America Inc; \_\_\_\_: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle).
  - 4. Saint Gobain North America; \_\_\_\_: [www.saint-gobain.com/#sle](http://www.saint-gobain.com/#sle).
  - 5. Vitro Architectural Glass (formerly PPG Glass); \_\_\_\_: [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Laminated Glass Manufacturers:
  - 1. Cardinal Glass Industries; \_\_\_\_: [www.cardinalcorp.com/#sle](http://www.cardinalcorp.com/#sle).
  - 2. Trulite Glass & Aluminum Solutions, LLC: [www.trulite.com/#sle](http://www.trulite.com/#sle).
  - 3. Viracon, Architectural Glass segment of Apogee Enterprises, Inc; \_\_\_\_: [www.viracon.com/#sle](http://www.viracon.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Mirrored Glass Manufacturers:
  - 1. Glasswerks; Mirrored Glass: [glasswerks.com/#sle](http://glasswerks.com/#sle).

2. Pilkington North America Inc; \_\_\_\_\_: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle).
  3. Saint Gobain North America; Saint Gobain Miralite Revolution: [www.saint-gobain.com/#sle](http://www.saint-gobain.com/#sle).
- D. Plastic Films Manufacturers:
1. 3M Window Film; \_\_\_\_\_:  
[solutions.3m.com/wps/portal/3M/en\\_US/Window\\_Film/Solutions/#sle](http://solutions.3m.com/wps/portal/3M/en_US/Window_Film/Solutions/#sle).
  2. Avery Dennison; Decorative Plastic Films: [www.averydennison.com/#sle](http://www.averydennison.com/#sle).
  3. Flexvue Films; \_\_\_\_\_: [www.flexvuefilms.com/#sle](http://www.flexvuefilms.com/#sle).
  4. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  3. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
1. In conjunction with weather barrier related materials described in other sections, as follows:
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
  2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
  3. Solar Optical Properties: Comply with NFRC 300 test method.

## 2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
  2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
  3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
  4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
  5. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria.
  6. Patterned Glass Type: ASTM C1036, Type II - Patterned Flat Glass, Quality - Q5, Form 3 - Patterned glass, with color and performance characteristics as indicated.
  7. Safety Wired Glass Type: ASTM C1036, Type II - Wired Flat Glass, Quality - Q5, complying with ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II impact test requirements, and with color and performance characteristics as indicated.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

## 2.04 INSULATING GLASS UNITS

- A. Manufacturers:
1. Guardian Glass, LLC; \_\_\_\_\_: [www.guardianglass.com/#sle](http://www.guardianglass.com/#sle).
  2. Pilkington North America Inc; \_\_\_\_\_: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle). Pilkington North America Inc; \_\_\_\_\_: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle).
  3. Vitro Architectural Glass (formerly PPG Glass); \_\_\_\_\_: [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).

- B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
- C. Insulating Glass Units: Types as indicated.
  - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  - 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  - 3. Warm-Edge Spacers: Low-conductivity thermoplastic with desiccant warm-edge technology design.
    - a. Spacer Width: As required for specified insulating glass unit.
    - b. Spacer Height: Manufacturer's standard.
  - 4. Spacer Color: Black.
  - 5. Edge Seal:
    - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
    - b. Color: Black.
  - 6. Purge interpane space with dry air, hermetically sealed.
  - 7. Pre-Equalized Insulated Glazing Units: Provide glazing units sealed at manufacturing plant with internal pressure matching pressure of the installation location.
- D. Type IGU-01 - Insulating Glass Units: Vision glass, double glazed.
  - 1. Applications: Exterior glazing unless otherwise indicated.
  - 2. Space between lites filled with air.
  - 3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    - a. Tint: Gray.
    - b. Coating: Self-cleaning type, on #1 surface.
    - c. Coating: Low-E (passive type), on #2 surface.
  - 4. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    - a. Tint: Clear.
  - 5. Total Thickness: 1 inch (25.4 mm).
  - 6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.28, nominal.
  - 7. Visible Light Transmittance (VLT): 32 percent, nominal.
  - 8. Solar Heat Gain Coefficient (SHGC): 0.19, nominal.
  - 9. Visible Light Reflectance, Outside: 7 percent, nominal.
- E. Type IGU-02 - Insulating Glass Units: Spandrel glazing.
  - 1. Applications: Exterior spandrel glazing unless otherwise indicated.
  - 2. Space between lites filled with air.
  - 3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    - a. Tint: Clear.
    - b. Coating: Same as on vision units, on #2 surface.
  - 4. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick.
    - a. Tint: Clear.
  - 5. Total Thickness: 1 inch (25.4 mm).
  - 6. Thermal Transmittance (U-Value), Summer - Center of Glass: \_\_\_\_\_, nominal.
  - 7. Visible Light Reflectance, Outside: \_\_\_\_\_ percent, \_\_\_\_\_.
- F. Type IGU-01\* - Insulating Glass Units: Safety glazing.
  - 1. Applications:
    - a. Glazed lites in exterior doors.
    - b. Glazed sidelights and panels next to doors.
    - c. Other locations required by applicable federal, state, and local codes and regulations.
    - d. Other locations indicated on drawings.
  - 2. Space between lites filled with air.

3. Glass Type: Same as Type IGU-01 except use fully tempered float glass for both outboard and inboard lites.
- G. Type TGU-1 - Translucent Glazing Units:
1. Applications: As indicated on drawings..
  2. Space between lites filled with honeycomb transparent insulation core aligned perpendicular to glazing, filled with Aerogel..
  3. Outboard Lite: Fully tempered float glass, 0.23622 inch (\_\_\_\_ mm) thick, minimum.
    - a. Tint: To Match IGU-01.
  4. Metal edge spacer; Continuous perimeter bar separated from glass surfaces with foam thermal break; Glass connected to spacers using structural silicon.
  5. Inboard Lite: Fully tempered float glass, 0.23622 inch (\_\_\_\_ mm) thick, minimum.
    - a. Tint: Clear.
  6. Sound Transmission Class (STC) rating of 35, with special acoustical spacer and edge seal.
  7. Total Thickness: 1 inch (25.4 mm).
  8. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.20, nominal.
  9. Visible Light Transmittance (VLT): 32 percent, nominal.
  10. Solar Heat Gain Coefficient (SHGC): 0.26, nominal.
  11. OMIT (ADD.1): Visible Light Reflectance, Outside: 31 percent, nominal.
  12. Glazing Method: Wet glazing method, sealant and sealant.
  13. Manufacturers:
    - a. Advanced Glazings, LTD: Solera; S-R5+Aerogel: <https://advancedglazings.com/#sle>.
    - b. Okalux; <https://www.glastroesch.com/#sle>.
    - c. GlasPro Inc.; <https://glas-pro.com/#sle>.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Type TGU-2 - Translucent Glazing Units:
1. Applications: As indicated on drawings..
  2. Space between lites filled with honeycomb transparent insulation core aligned perpendicular to glazing, filled with Aerogel..
  3. Outboard Lite: Fully tempered float glass, 0.23622 inch (\_\_\_\_ mm) thick, minimum.
    - a. Tint: Clear.
  4. Metal edge spacer; Continuous perimeter bar separated from glass surfaces with foam thermal break; Glass connected to spacers using structural silicon.
  5. Inboard Lite: Fully tempered float glass, 0.23622 inch (\_\_\_\_ mm) thick, minimum.
    - a. Tint: Clear.
  6. Sound Transmission Class (STC) rating of 35, with special acoustical spacer and edge seal.
  7. Total Thickness: 1 inch (25.4 mm).
  8. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.20, nominal.
  9. Visible Light Transmittance (VLT): 42 percent, nominal.
  10. Solar Heat Gain Coefficient (SHGC): 0.39, nominal.
  11. Glazing Method: Wet glazing method, sealant and sealant.
  12. Manufacturers:
    - a. Advanced Glazings, LTD: Solera; S-R5+Aerogel: <https://advancedglazings.com/#sle>.
    - b. Okalux; <https://www.glastroesch.com/#sle>.
    - c. GlasPro Inc.; <https://glas-pro.com/#sle>.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.05 GLAZING UNITS

- A. Type FG-1 - Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
  2. Glass Type: Heat-strengthened float glass.
  3. Tint: Clear.
  4. Thickness: 1/4 inch (6.4 mm), nominal.

- B. Type FG-1\* - Monolithic Safety Glazing: Non-fire-rated.
  - 1. Applications:
    - a. Glazed lites in doors, except fire doors.
    - b. Sliding glass doors.
    - c. Glazed sidelights to doors, except in fire-rated walls and partitions.
    - d. Other locations required by applicable federal, state, and local codes and regulations.
    - e. Other locations indicated on drawings.
  - 2. Glass Type: Fully tempered safety glass as specified.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch (6.4 mm), nominal.
- C. Type SG-1 - Security Glazing: Laminated glass, 2-Ply.
  - 1. Applications: Locations as indicated on drawings.
  - 2. Tint: Mirrored..
  - 3. Tint: Clear.
  - 4. Thickness: As required to meet performance criteria.
  - 5. Outer Lite: Tempered glass.
  - 6. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
  - 7. Inside Lite: Heat-strengthened glass.
  - 8. Performance Criteria:
    - a. Bullet Resistance: Pass ASTM F1233 tests in compliance with ballistic criteria class and weapon description indicated; Class HG4 - Handgun-High.
- D. Type SG-2 - Security Glazing: Laminated glass, 2-Ply.
  - 1. Applications: All Doors located in sally port and inmate secure areas.
  - 2. Thickness: As required to meet performance criteria.
  - 3. Outer Lite: Tempered glass.
  - 4. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
  - 5. Interlayer, Inboard Side : Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
  - 6. Inside Lite: Tempered glass.
  - 7. Performance Criteria:
    - a. Forced Entry Resistance: Pass ASTM F1233 tests in compliance with Forced Entry Sequence of Testing, Class Achieved 1.2: 1-1/2 inch (4 cm) Diameter Pipe/Sledge, 25 impacts.
- E. Type SG-WT - Safety Wired Glass: Flat glass with embedded wire mesh.
  - 1. Applications: Locations as indicated on drawings.
  - 2. Form: Form 1 - Wired glass, polished both sides; ASTM C1036.
  - 3. Mesh: M1 - Diamond; ASTM C1036.
  - 4. Tint: Clear, Class 1.
  - 5. Glass Type: Laminated annealed.
  - 6. Thickness: 1/4 inch (6.4 mm), nominal.
- F. Type M-1 - Transparent One-Way Mirror: Mirror quality float glass with pyrolytic (hard coat) type coating located on high light level surface of glass; ASTM C1376.
  - 1. Applications: Locations as indicated on drawings.
  - 2. Thickness: 1/4 inch (6 mm).
  - 3. Glass Tint: Grey.
  - 4. Glass Type: Insulating glass unit.
  - 5. Lighting Ratio: Maintain at least 8:1 lighting level ratio between coated side (bright-observed side) and uncoated side (dim-observer side).
  - 6. Glazing Method: Gasket glazing.
  - 7. Manufacturers:
    - a. Pilkington North America Inc; \_\_\_\_\_: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

**2.06 GLAZING COMPOUNDS**

- A. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; \_\_\_\_\_ color.

**2.07 ACCESSORIES**

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

**PART 3 EXECUTION****3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

**3.02 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

**3.03 INSTALLATION, GENERAL**

- A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

**3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)**

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

**3.05 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)**

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Place setting blocks at 1/4 points and install glazing pane or unit.
- C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch (610 mm) intervals, 1/4 inch (6.4 mm) below sight line.
- D. Fill gaps between glazing and stops with \_\_\_\_\_ type sealant to depth of bite on glazing, but not more than 3/8 inch (9 mm) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

**3.06 INSTALLATION - STRUCTURAL SILICONE GLAZING**

- A. Application - Factory (Shop) Glazed: Follow basic guidelines of structural silicone glazing for glazing application.

- B. Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.
- C. Provide only structural silicone sealant, tested and manufactured for structural glazing.

**3.07 INSTALLATION - PLASTIC FILM**

- A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.
- B. Place without air bubbles, creases or visible distortion.
- C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

**3.08 FIELD QUALITY CONTROL**

- A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

**3.09 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

**3.10 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

**SECTION 12 48 13  
ENTRANCE FLOOR MATS AND FRAMES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Modular entrance mat.
- B. Recessed mat frames.

**1.02 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.
- C. Shop Drawings: Indicate dimensions and details for recessed frame.
- D. Maintenance Data: Include cleaning instructions, \_\_\_\_\_, and stain removal procedures.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Floor Mats:
  - 1. Construction Specialties, Inc; Entrance Mats: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  - 2. Kadee Industries; KDCM Carpet Rollout Mat: [www.kadeeindustries.com/#sle](http://www.kadeeindustries.com/#sle).
  - 3. Nystrom, Inc; \_\_\_\_\_: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

**2.02 FLOOR MATS**

- A. Modular Entrance Mat w/ Frame: Extruded aluminum planks with polyethylene foam backing, carpet tread inlays running perpendicular to traffic flow, and perimeter trim for surface-mounted installation.
  - 1. Thickness: 7/16 inches (\_\_\_\_ mm).
  - 2. \_\_\_\_\_ Size: as indicated on drawings.
  - 3. Tread Surfaces: high-impact Regrind PET-G.
  - 4. Colors: As selected by Architect from manufacturer's full selection.
- B. Recessed Frame: 3/4" inch (\_\_\_\_ mm) thick recessed frame in 6063-T5 aluminum alloy w/ 1/4" wide exposed surface. Black TPE trim fillers as required. Anodized finish to match adjacent curtainwall assemblies.

**2.03 FABRICATION**

- A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.
- B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

**PART 3 EXECUTION****3.01 EXAMINATION****3.02 PREPARATION**

- A. Mats: Verify size of floor recess before fabricating mats.
- B. Vacuum clean floor recess.

**3.03 INSTALLATION**

- A. Install frames to achieve flush plane with finished floor surface.
- B. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

**3.04 TOLERANCES**

- A. Maximum Gap Formed at Recessed Frame From Mat Size: 1/4 inch (6 mm).

**END OF SECTION**



## SECTION 28 31 00 – ADDRESSABLE FIRE ALARM SYSTEM

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. The fire alarm and detection system shall be included as a deferred submittal package.
- B. Performance-based designs shall be submitted to the Authority Having Jurisdiction (AHJ) for review and approval in a format acceptable to the approving authority. The submittal shall include documentation for each system function, performance objective, integration with other system(s), and design configuration. Documentation shall also include design calculations for system batteries, voltage drop, and other AHJ-requested items. The AHJ shall act as the sole authority for approval and shall approve all applicable modifications/variations to the design prior to installation.
- C. The fire alarm and automatic detection systems shall be designed, stamped, programmed, submitted for approval, installed, tested, and commissioned as a turnkey solution by the Contractor. Contractor shall be responsible for the coordination and interface of other systems.
- D. The contract documents define the minimum fire alarm system requirements. The most stringent requirement/interpretation shall apply when there is a discrepancy among the contract documents, code-minimum requirements, and the interpretation of the AHJ.
- E. The scope of the fire alarm and automatic detection system includes interface and integration with the following systems. The following list is provided as a courtesy. Contractor shall review the entire set of contract documents to identify the project-specific conditions and third-party systems requiring fire alarm interface and integration. Contractor shall visit the project site to review the existing conditions prior to submitting pricing.
  - 1. Fire Protection (Sprinkler): Monitor modules, flow switches, post indicator valves, sprinkler system, fire alarm cabinets, electric bells.
  - 2. Double Interlocked Preaction Sprinkler Systems.
  - 3. Fire Door Control: Door hold opens, power-operated fire rated doors, coiling door systems.
  - 4. Elevator Control: Machine room (or roomless) / lobby / shaft detection, elevator recall operation, hoistway damper control, fire fighter operation.
  - 5. Building Automation System: Report alarm, supervisory, trouble status.
- F. One-way emergency communications system with voice notification within-building.

#### 1.02 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

#### 1.03 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years' experience.

- B. Installer: A factory-authorized electrical or security contractor licensed with the State and local jurisdiction with five years' experience in the design, installation and maintenance of fire alarm systems by that manufacturer.
- C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 3. This person's name and certification number shall appear on the start-up and testing reports.

#### 1.04 REFERENCES

- A. ASME A17.1 - Safety Code for Elevators and Escalators
- B. 2020 NFPA 70 - National Electrical Code (NEC) with NC amendments
- C. 2013 NFPA 72 - National Fire Alarm and Signaling Code
- D. NFPA 101 - Life Safety Code
- E. UL 2017 - General Purpose Signaling Devices and Systems
- F. UL 217 / 268 - Standard for Smoke Alarms / Smoke Detectors for Fire Alarm Systems
- G. UL 2572 - Control and Communication Units for Mass Notification Systems
- H. 2018 NC Fire Code with NC amendments

#### 1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 00 00 and as noted below.
  - 1. Failure to comply with all the following and all the provisions in 26 00 00 will result in the shop drawing submittal being rejected without review.
  - 2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.
- B. Provide product catalog data sheets as shop drawings.
  - 1. Provide a product catalog data sheet for each item shown on the Fire Alarm Symbol Legend and for each piece of equipment that is not shown on the drawings but required for the operation of the system.
  - 2. Where a particular Fire Alarm Symbol Legend item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Legend symbol shall be shown on the top of each sheet.
  - 3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.
- C. Submit CAD Floor Plans as Shop Drawings:
  - 1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.

2. Indicate the precise routing of notification appliance circuits under the provisions of circuit survivability. Refer to "Wiring" under Part 3 - Execution of this specification section for requirements.
  3. A legend or key shall be provided to show which symbols shown on the submittal floor plans correspond with symbols shown on the Contract Documents.
- D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.
- E. Provide installation and maintenance manuals under provisions of Section 26 00 00.
- F. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.
- G. Voice Alarm Communication System: Submit equipment rack or console layout, grounding schematic, amplifier power calculations, and wiring diagram.
- H. Emergency Communication System: Submit equipment rack or console layout, grounding schematic, amplifier power calculations, and wiring diagram. Submit plot (minimum 1"=30') of area-wide notification sound pressure levels.
- I. Submit photocopy proof of NICET certification of the person overseeing the preparation of drawings and installation/testing.
- J. When required to comply with local or state regulatory reviews, the fire alarm submittal shall have a[ Professional Engineer's stamp and signature NICET Certification] of the state in which the project is completed.

#### 1.06 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Provide quantity equal to 2 percent (2%) of amount of each type installed, but no less than two (2) units of each type.
    - a. Smoke and heat detectors, manual pull stations, duct smoke detectors, monitor modules, control modules and relays.
    - b. Notification Appliances: Speakers, speaker strobes, and strobes.
  2. Keys: The installing contractor shall collect all equipment spare keys provided with each lockable or resettable device/cabinet[ minimum of one (1) set each] and shall turn over to the Owner upon completion.
  3. All spare parts shall be housed in metal cabinet labeled "Fire Alarm Spare Parts."

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 00 00.
- B. Store and protect products under provisions of Section 26 00 00.

#### 1.08 REGULATORY REQUIREMENTS

- A. System: UL listed.

- B. Conform to requirements of NFPA 101.
- C. Conform to requirements of Americans with Disabilities Act (ADA).
- D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

#### 1.09 CODES, LAWS, AND ORDINANCES

- A. The fire alarm design shall comply with the following applicable codes, laws, and standards:

1. ASME A17.1 Safety Code for Elevators and Escalators
2. North Carolina Building Code NCBC 2018
3. NCFC 2018 North Carolina Fire Code[ with amendments]
4. NFPA 72 National Fire Alarm & Signaling Code 2013
5. NFPA 70 National Electrical Code 2020
6. NFPA 101 Life Safety Code
7. NFPA 13 Installation of Sprinkler Systems
8. NFPA 80 Fire Door and other Opening Protectives
9. NFPA 101 Life Safety Code
10. Conform to all requirements of State of <North Carolina> codes, laws, ordinances and other regulations having jurisdiction.

#### 1.10 SYSTEM DESCRIPTION

- A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, voice evacuation equipment, emergency communication systems, control panels, auxiliary control devices, annunciators, power supplies, and wiring as indicated on the drawings and specified herein.
- C. Maintain the Existing <Notifier SFP-400B> Fire Alarm System: The existing control panel shall remain and shall be operational throughout construction. The system shall only be disabled after the addition has been completed. A fire watch shall be provided for all areas affected during outages. All system outages must be scheduled with the Owner at least one week prior. Individual devices may be disabled as needed based on construction activities to reduce the potential for false alarms, but all devices must be operational when the Contractor is not physically on site.
- D. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.

- E. In-Building Network: A complete fire alarm system network shall be provided. Provide quantity of control panels as indicated on the drawings. The network shall be a Style 7 token ring, peer-to-peer network. The network shall be characterized by simultaneous or sequential transmission, or both, and reception of multiple signals on a signaling line circuit or communication channel. The distributed intelligent characteristic of the network shall provide for all nodes independently making pertinent system decisions with no need for a central controller. Each node shall be capable of independent operation should loss of network communications occur. In no case shall read-only network annunciation be acceptable as the only networking function.
- F. Voice Communication: The facility shall have an emergency voice alarm communication system. The digitized recorded voice message shall notify occupants that a fire condition has been reported. Emergency manual voice override shall be provided.
- G. Emergency Communication System (ECS): A system capable of reproduction of prerecorded, synthesized, or live messages with voice intelligibility to indicate the existence of an emergency situation and communicating information necessary to facilitate an appropriate response and action. The system shall provide alerting in the building.
- H. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.
- I. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.
- J. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panels.
- K. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

#### 1.11 SYSTEM DESIGN CRITERIA

- A. Audio Notification: Voice based; full coverage
- B. Visual Notification: Full coverage
- C. Automatic Fire/Smoke/Heat Detection: Partial coverage
- D. Full coverage is defined as all occupiable interior spaces.
- E. Partial coverage is defined as all commonly occupied spaces including corridors, lobbies/waiting, toilets/restrooms, open office areas, meeting rooms, common work spaces, storage, mechanical/electrical spaces, and stairways.

#### 1.12 AUTOMATIC DETECTION DESIGN CRITERIA

- A. Addressable Smoke Detectors: Environmentally conditioned spaces not susceptible to dirt and dusty conditions.
- B. Conventional Smoke Detectors: Permitted for areas that are not environmentally suitable for addressable smoke detectors.

- C. Air Sampling Smoke Detectors: Where indicated on mechanical plans.

#### 1.13 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 26 00 00.
- B. Include location of end-of-line devices.
- C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.
- D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

#### 1.14 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 26 00 00.
- B. Include operating instructions, and maintenance and repair procedures.
- C. Include results of testing of all devices and functions.
- D. Include manufacturer's representative's letter stating that system is operational.
- E. Include the CAD floor plan drawings.
- F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

#### 1.15 DOCUMENT STORAGE CABINET

- A. The cabinet shall have all fire alarm system documents, including record drawings, wiring diagrams, operation manuals, etc. A legend sheet permanently attached to the door shall contain system passwords and inspection logs. The enclosure shall also provide two (2) key ring holders for system keys and a location for a standard size business card with service contact information.
- B. The cabinet will have, permanently and securely mounted inside, a digital flash memory device with a minimum of 4 GB of storage capacity and a standard USB B connector for uploading and downloading electronic versions of record documents and system programming information.
- C. The cabinet shall be red in color with an identification label reading "FIRE ALARM DOCUMENTS". Refer to Identification Section 26 05 53. The cabinet shall be lockable.
- D. The final version of the system database program shall be stored within the cabinet.
- E. Locate cabinet in the Command Center Adjacent to the Fire Command Center.

#### 1.16 WARRANTY

- A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.

- B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

#### 1.17 ANNUAL INSPECTION/TESTING AND SERVICE CONTRACT

- A. Provide cost to furnish service, inspect, and test all devices of the fire alarm system per the requirement of NFPA for one (1) year, starting one year after the Date of Substantial Completion. Submit written reports of inspection testing per NFPA 72, Chapter 14.
- B. The Owner may enter into a contract directly with the vendor after shop drawing submittals. This specification is not a contract between the Owner and the vendor to perform these services.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Johnson Controls - Simplex
- B. Notifier by Honeywell
- C. Edwards - EST
- D. Siemens Fire Safety

#### 2.02 FIRE ALARM COMMAND CENTER (FCC)

- A. Control Panel: Modular, power-limited electronic design. Provide[ flush][ surface] wall-mounted enclosure as shown on plans. Enclosure shall be minimum 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- B. Each Signaling Line Circuit (SLC loop) shall not be loaded over 80% of the maximum device capacity. For example, in the minimum system capacity column listed below, if the fire alarm manufacturer's system capacity of analog sensors per loop is 99 devices, then no more than 79 devices shall be wired on that loop. The minimum system capacity shall be as follows:
  - 1. Minimum Total Addressable Points: 250
- C. Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC) Boards:
  - 1. Each board shall communicate directly with each addressable analog sensor and binary input to determine normal, alarm, or trouble conditions. Analog signals would be used for automatic test and determination of maintenance requirements.
  - 2. Each board shall contain its own microprocessor and shall be provided to monitor addressable inputs and to control addressable outputs (addressable relays). The board shall communicate and provide power to all devices on its loop over a single pair of wires, except where 4-wire devices require a separate power circuit.
- D. Central Processing Unit:
  - 1. The central processing unit (CPU) shall communicate with the monitor and control all other modules in the panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the CPU.

2. The CPU shall execute all control-by-event programs for specific action to be taken if a designated situation is detected in the system. A real-time system clock for time annotations on the display and printer shall be included.
  3. All power for the unit shall be supervised and supplied by the FCC.
- E. Display:
1. The board shall provide all controls and indicators used by the system operator and may also be used to program all control panel parameters.
  2. The board shall provide an alphanumeric array for display of custom alphanumeric labels for all addressable points. It shall also provide indicators for AC Power, System Alarm, System Trouble, Display Trouble and Signal Silence.
  3. Displayed descriptions of addressable points shall include actual room names/numbers selected by the Owner. This information shall be obtained prior to programming. Room names/numbers shown on floor plans shall not be used.
  4. The board shall provide a touch key-pad with control capability to command all system functions and entry of any alphanumeric information. Twenty different passwords with four levels of security shall be supported to prevent unauthorized manual control or programming.
- F. Memory: The CPU and display interface board shall be augmented by non-volatile field programmable memory. EPROM memory will also be allowed provided the memory is burned in with minimum expansion capability equal to the total system capacity of the panel. Memory shall not be lost upon primary and secondary power failure.
- G. Power Supply:
1. Input power shall be 120 VAC, 60 Hertz. Output power shall be as noted on the device specifications and drawings. Each component of the fire alarm system requiring 120 VAC input power shall be served from a dedicated[ emergency][ life safety] branch circuit. Provide two #12 conductors and one #12 ground in 3/4" conduit to a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Identify/label breaker and branch circuit in accordance with NFPA requirements and Specification Section 26 05 53.
  2. Adequate to supply 125% of all control panel and peripheral power needs as well as 125% of power required for all external audio-visual devices. The power supply may be increased as needed by adding additional modular expansion power supplies. Over-current protections shall be provided on all power outputs.
  3. All power supplies shall be designed and installed to meet UL and NFPA requirements for power-limited operation on all external initiating and indicating circuits.
  4. The power supply shall provide integral charger for use with internal batteries. Battery capacity shall be sufficient for operation of the entire system for 60 hours in a non-alarm state followed by alarm mode for 15 minutes, plus 25% spare capacity for future devices.
- H. Surge Protection:
1. All fire alarm control panels, NAC panels, etc. shall be provided with a surge protection device (SPD). The SPD shall be UL listed to Standard 1449 Rev 3. The unit should be clearly labeled in accordance with Identification Section 26 05 53. The SPD shall have thermal fuses to protect against fire in short circuit conditions. The unit shall provide visual indication that the unit is protecting and functioning.
  2. Any communications or signaling circuits associated with the fire alarm system, which leave or enter a facility, shall be provided with a surge protection device. The devices shall be as recommended by the fire alarm system manufacturer.
- I. IP-GSM Digital Cellular Fire Communicator:



1. [Provide digital internet / cellular phone interface capable of fire alarm notification to the local fire department, fire protection agency, or monitoring service.][ Monitoring fees and initial connection charges are not part of this project.]
2. Communication shall include system status including individual addressable device status, power loss, low battery and earth fault, and 24-hour test signal.

J. Digitized Voice Command Center (VCC): Include integral with fire alarm system.

1. The Digitized Voice Command Center (VCC) shall contain all equipment required for all audio control, signaling, and supervisory functions. This shall include digital voice units, speaker zone indication, microphones,[ and main firefighter phone handset].
2. Function: The Voice Command Center equipment shall perform the following functions:
  - a. Operate as a supervised multi-channel automatic digitized voice evacuation system with manual emergency voice communication system.
  - b. Dual channel speaker circuits shall be arranged such that there is a minimum of one (1) speaker circuit per paging zone as indicated on the Fire Alarm Riser and plans.
  - c. Audibly and visually annunciate the active or trouble condition of every signal circuit.
  - d. Audibly and visually annunciate any trouble condition of tone generators and digital voice units required for normal operation of the system.
  - e. Provide all-call activities through activation of a single control switch.
  - f. Provide automatic, digitally recorded voice messages and tones.

3. Audio Amplifiers (AMP): Include integral with fire alarm system:

- a. The audio amplifiers will provide multi-channel audio power at 25-volt or 70-volt RMS for distribution to speaker circuits.
- b. The audio amplifier shall include an integral power supply, and shall provide the following controls and indicators:
  - 1) Normal Audio Level LED
  - 2) Incorrect Audio Level LED
  - 3) Battery Trouble LED
  - 4) Amplifier Trouble LED
  - 5) Audio Amplifier Gain Adjust
- c. Includes audio input and amplified output supervision backup input.
- d. Amplifier shall be backed up in groups (one amplifier backs up several). Failure of any one amplifier in the system shall not degrade system performance in any way.

4. Audio Message Generator (Digitized Voice):

- a. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a digitized voice message to all speakers in the building.
- b. Actuation of any alarm initiating device shall cause a digitized message to sound over the speakers. The message shall be repeated four (4) times.
- c. A built-in microphone shall be provided to allow paging through speaker circuits.
- d. The audio message generator shall have the following controls and indicators to allow for proper operator understanding and control:
  - 1) All Call LED
  - 2) On-Line LED

3) All Call Switch

5. Voice Messages:

- a. A pre-programmed custom digital voice message shall be used for notification appliance speaker circuits. The messages shall be approved by the Authority Having Jurisdiction (AHJ). Voice messages shall be from a female voice. The messages shall be provided in the multi-lingual language of the predominant building population.
- b. Message shall be preceded by a tone and message shall be repeated four times until silenced.
- c. Fire emergency messages shall be annunciated in all evacuation signal zones throughout the building.
- d. Emergency communication messages shall be annunciated in the zone(s) selected by the operator.
- e. Fire Alarm Pre-Recorded Messages: Refer to drawings for fire alarm pre-recorded message schedule.

6. Speaker Circuit Control Switches/Indicators:

- a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
- b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
- c. Buttons shall be provided on the voice command center to manually activate all auxiliary messages. (i.e. all clear, active shooter, custom message.)

2.03 FIRE ALARM PATHWAY CLASS AND SURVIVABILITY LEVEL

A. Pathway Class:

1. Pathway Class A: Circuits capable of transmitting an alarm signal during an open or a non-simultaneous single ground fault on a circuit conductor wiring system. Wiring of outgoing and return conductors shall be physically separated by a minimum of 50 feet or by a 2-hour rated enclosure.
2. Pathway Class B: Circuits NOT capable of transmitting an alarm beyond the location of the fault condition. Wiring of outgoing and return conductors is permitted to be run in the same conduit or cable.

B. Pathway Survivability Level:

1. Pathway Survivability Level 1: Circuits are protected by an automatic sprinkler system and installed in metal raceways.
2. Shared Pathway Designation Level 1: Physical segregation of life safety and non-life safety data is not required. Life safety data shall be the priority.

2.04 EMERGENCY COMMUNICATION CONTROL UNIT (ECCU)

- A. The ECCU shall be a listed combination system with the fire alarm system as described in NFPA 72 and meeting UL Standard 864.
- B. Microphone for delivering live voice messages. Ability to interrupt public address system announcements and to silence building background music while delivering voice messages.

- C. Available for use for general paging or other non-emergency messages without the activation of strobes.
- D. ECCU shall be able to activate strobes and discrete output for text signs.
- E. Capacity for multiple prerecorded messages. Prerecorded messages shall be passed in the English language and also in the predominant language(s) used. Messages should address at least the following:
  - 1. Intruder/hostile person sighted within/around the building.
  - 2. "All Clear" message.
  - 3. A test message intended for verifying functionality of the system.
- F. Ability to automatically repeat prerecorded messages until terminated.
- G. Allows the ECS to temporarily override fire alarm audible messages and provide intelligible voice commands during simultaneous fire and terrorist events. All other features of the fire alarm system, including the transmission of signals to the fire department, shall function properly.
- H. Provide a supervisory signal if the ECS is used to override fire alarm audible messages during simultaneous fire and terrorist events. The supervisory signal shall be annunciated at the FCC and any remote fire alarm annunciators, and be transmitted to the fire department. The visual annunciation of the separate supervisory signal shall be distinctly labeled or otherwise clearly identified.
- I. Provide a 3-position switch to allow manual control on/off of strobes; center return to automatic mode.
- J. Provide a single switch or operating mechanism capable of defeating the shutdown of all heating, ventilating, and air conditioning (HVAC) equipment in the facility.
- K. Complete set of self-diagnostics for the controller and appliance network. Local diagnostic information display, information, and system event log file.
- L. Establishes priority for passing messages to prevent interference between the ECCU and LOC.

## 2.05 SIGNALING LINE CIRCUIT DEVICES

- A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.
- B. Signal Line Device(s):
  - 1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
    - a. Device types as follows:
      - 1) WP - Weather Proof
      - 2) TR = Wire guard is required
      - 3) Candela Ratings:
        - a) ## = 15 Candela; 30 Candela; 75 Candela; 95 Candela; 110 Candela

C. FA-120; Smoke Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. Device types as follows:
    - 1) Blank = Photoelectric
    - 2) C = Conventional
    - 3) TR = Wire guard is required
2. (BLANK) Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.

D. FA-122; Duct Smoke Detectors, Sampling Tube Type:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. Duct-type smoke detectors shall use the same analog photoelectric sensor technology, with the same features specified for standard smoke detectors, except with additional features as specified below.
  - b. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Where the detector housing is larger than the duct height, Contractor shall fabricate a mounting bracket for the detector and attach according to the fire alarm manufacturer's recommendations.
  - c. Provide a remote alarm LED indicator device (FA-241 or FA-242) if detector is not visible from a floor-standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate labeled: Duct Smoke Detector.

E. FA-130; Manual Pull Stations:

1. Manual pull station, addressable, single action[ with plastic breakrod], reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering. Provided with all necessary mounting hardware. Use surface mount only on precast concrete or structure.
2. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.
3. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location, with maintained temperatures between 32°F and 120°F.

F. FA-160; Monitor Modules:

1. Monitor Module shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit. It shall interface initiating devices with the control panel using Style D or Style B circuits. Contractor option: Use an interface module (2-wire operation) for Style B circuits connected to normally-open dry contacts, such as a flow switch.
2. The module shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being monitored, or where shown on the drawings. All mounting hardware shall be provided.
3. The module shall supply the required power to operate the monitored device(s).
4. The module shall provide address setting means using rotary decimal or DIP switches.

G. FA-161; Addressable Control Module:

1. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional child relay(s), as required, rated for the electrical load being controlled (Contractor to match voltage, amps, etc.).
2. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
3. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
4. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

2.06 NOTIFICATION APPLIANCE DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Notification Appliance Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. Device types as follows:
    - 1) WP = Weather Proof
    - 2) TR = Wire guard is required
    - 3) Candela Ratings:
      - a) ## = 15 Candela; 30 Candela; 75 Candela; 95 Candela; 110 Candela.

C. Notification Device(s):

1. Wall Mounted: White housing with red lettering or pictogram. Confirm with architect prior to purchase. Lettering to read "ALERT" in lieu of "FIRE".
2. Ceiling Mounted: White housing with red lettering or pictogram. Confirm with architect prior to purchase. Lettering to read "ALERT" in lieu of "FIRE".

D. FA-200; Visual Alarm Devices:

1. Wall or ceiling mounted, refer to plans.
2. High intensity (Candela rating as scheduled on the drawings) xenon strobe or equivalent under a lens. Candela rating shall be visible from exterior of the device.
3. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
4. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
5. (WP) Weatherproof Visual Notification Device: High intensity strobe, square housing, 75 Candela rating, suitable for wet locations. Provide with weatherproof back box.
  - a. Mounting: Semi-flush wall.
  - b. Conduit shall not be exposed.

E. FA-220; Audio (Speaker) Alarm Devices:

1. Wall or ceiling mounted, refer to plans.
2. Sound rating shall be dependent on the tap (wattage) setting. Tap settings shall be available in 3 dBA increments. A minimum of four (4) tap settings should be available to allow field adjustment of the sound output across a minimum range of 78 to 87 dBA, 400Hz to 4KHz (6 dBA cutoff) frequency range. Speakers shall operate on a 25-volt or 70-volt RMS system, unless otherwise noted on drawings.
3. Speakers shall clearly reproduce a signal consisting of a live or prerecorded human voice with voice intelligibility.
4. Speaker, housing, and backbox shall be UL listed for fire alarm/emergency applications.
5. Wall Mounted: Speaker, square housing, flush or semi flush mounted.
6. Ceiling Mounted: 4" speaker, round housing, flush mounted (provide tile bridge where applicable).

F. FA-221; Combination Audio (Voice) and Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. Combine speaker and visual components into a single device. Refer to the corresponding paragraphs above for requirements of each component.
3. (WP) Weatherproof Voice/Visual Notification Device: Speaker with high intensity 75 Candela rated strobe. 25-volt or 70-volt VRMS with a minimum of four (4) tap settings which shall allow field adjustment of the sound output across a minimum range of 78 to 87 dBA (UL 1480), 400 Hz to 4 KHz (6 dBA cutoff) frequency range.
  - a. Mounting: Semi-flush wall.
  - b. Conduit shall not be exposed.

G. FA-230; Emergency Combination Audio (Voice) and Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. Combine speaker and visual components to have a clear lens for fire alarm annunciation strobe and an amber lens for the alert strobe into a single device. Refer to the corresponding paragraphs above for requirements of each component.
3. The contractor may provide separate devices side by side in lieu of a combination device.
4. (WP) Weatherproof Voice/Visual Notification Device: Speaker with high intensity 75 Candela rated strobe. 25-volt or 70-volt VRMS with a minimum of four (4) tap settings which shall allow field adjustment of the sound output across a minimum range of 78 to 87 dBA (UL 1480), 400 Hz to 4 KHz (6 dBA cutoff) frequency range.
  - a. Mounting: Semi-flush wall.
  - b. Conduit shall not be exposed.

2.07 DOOR HOLD-OPEN DEVICES

A. FA-270; Electromagnetic Door Holder Devices:

1. Flush wall mounted.
2. Voltage: 24VDC.
3. Holding force shall be 25 pounds minimum.
4. Provide fail-safe operation; power failure releases door.
5. Provide self-adjusting swivel catch plate with pivot points to adjust to door alignment changes.
6. Provide all hardware and wiring needed to accommodate the complete functioning door holder installation.

7. Ensure that the door hardware and trim projections are compatible with total projection of door release.
8. Provide firm anchoring for the electromagnet, such that the mounting box and device will not move independently from the wall or floor they are mounted to. This device and mounting will function as a doorstop and hold the force of the door closer mechanism.
9. Follow manufacturer's recommended installation and location instructions unless noted otherwise.
10. Electromagnetic door holder devices, housing, and back box shall be UL listed.

#### 2.08 NOTIFICATION APPLIANCE CIRCUIT PANEL (NAC)

- A. As shown on the plans or as a Contractor's option if not shown, furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NAC on the shop drawing submittals.
- B. Each NAC shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 60 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity for future devices. Each NAC provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.
- C. Power for each NAC shall be from a local 120 VAC circuit. Provide two #12 conductors and one #12 ground in 1/2" conduit to each NAC from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Coordinate panel and circuit number with the Architect/Engineer prior to installation.
- D. NAC extender panels may be installed only in locations coordinated with the Architect/Engineer.
- E. Mounting: Surface.

#### 2.09 ANNUNCIATION

- A. FAA; Remote LCD Annunciators:
  1. Auxiliary annunciators shall indicate alarm and trouble conditions visually and audibly as shown on the drawings. Provide local TROUBLE ACKNOWLEDGE, TEST, and ALARM SILENCE capability. Minimum 80-character display.
  2. Communications and power to the annunciators shall be supervised. The annunciator shall receive power from the fire alarm control panel.
  3. A single key switch shall enable all switches on the annunciator.
  4. Mounting: Flush.

#### 2.10 CONNECTIONS TO AUXILIARY DEVICES PROVIDED BY OTHERS

- A. FA-260; Flow Switch:
  1. (FA-260) Connection to flow switch to monitor fire protection flow switch or discharge output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed and MC; wired by EC.
  2. Provide a dedicated monitor switch for each sprinkler flow switch.
- B. FA-261; Tamper / Monitor Switch:

1. (FA-261) Connection to monitor switch to monitor fire protection system supervisory switches or output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
2. Tamper switches in the same room or system may be monitored by a single monitor switch when shown grouped on the plans.
3. (PIV) Post Indicator Valve. Connection to post indicator valve for sprinkler system supervisory notification. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC. Provide surge protection device as recommended by the fire alarm system manufacturer on line entering/leaving the facility.

C. FA-263; Electronic Bell:

1. Electronic bell for sprinkler alarm, electro-mechanical type, 120 VAC. Furnished and installed by MC. Fire alarm control and power connections by EC.

D. FA-271; Door Hold Device:

1. Integral with door hardware 24 VDC. Furnished and installed by GC. Fire alarm control and power connections by EC.

2.11 WIRE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

2.12 WIRING

A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with the Electrical Code for power-limited fire alarm signal service.

B. Fire Alarm Cable:

1. Manufacturers:
  - a. Comtran Corp.
  - b. Helix/HiTemp Cables, Inc.
  - c. Rockbestos-Suprenant Cable Corp.
  - d. West Penn Wire/CDT.
  - e. Radix.

PART 3 - EXECUTION

3.01 SEQUENCES OF FIRE ALARM OPERATION

A. General:

1. Refer to the Fire Alarm Operation Matrix on the drawings for basic requirements and system operation.



2. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
- B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:
1. Appropriate system Alarm, Trouble, or Supervisory LED shall flash at the control panel, transponder, and annunciator locations.
  2. A local signal in the control panel shall sound.
  3. The LCD display shall indicate all information associated with the condition, including the name of the item, type of device and its location within the protected premises.
  4. History storage equipment shall log the information associated with the fire alarm command center (FCC) condition, along with the time and date.
  5. Transmit the appropriate signal (supervisory, trouble, alarm) to the central station via the digital communicator.
- C. Audible Alarms Sequence:
1. Audible alarms throughout the building shall sound.
- D. Visual Alarms Sequence:
1. Visual alarms throughout the building shall flash.
- E. Fire Protection Electric Sprinkler Bell Sequence:
1. The fire alarm shall utilize an addressable relay to energize the electric sprinkler bell upon activation of the flow switch.
- F. Double Interlocked Preaction Sprinkler Activation Sequence:
1. The fire alarm system shall utilize an addressable relay to signal the double-interlock preaction sprinkler system to allow filling with water upon initiation of alarm in zone of sprinkler coverage.
  2. Where there are multiple zones to the preaction system, a separate addressable relay shall be provided for each zone and the system shall be programmed to signal only the zone that is in the area of the fire. Coordinate with the fire protection system installer.
  3. The fire alarm system shall utilize addressable monitor modules to monitor the control panel supervisory and trouble conditions.
- G. AHU and Mechanical Fan Shutdown Sequence:
1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers and mechanical fans. Coordinate other requirements with HVAC installer.
  2. The fire alarm system shall directly shut down the AHU or mechanical fan through the local HVAC control device (i.e., variable frequency drive or motor starter).
  3. Where a facility has more than one AHU or mechanical fan, each shall be shutdown individually based on input from initiation devices in the area served by the unit or designated for each air distribution system.
- H. Power-Operated Fire Doors Sequence:
1. The fire alarm system shall utilize an addressable relay to signal or disconnect power to the power-operated fire door, allowing automatic closing and latching of the door. Once the alarm is cleared, the addressable relay shall allow the door to open.

2. All door holders throughout the building shall release simultaneously.
  - I. Door Holder Release Sequence:
    1. The fire alarm system shall utilize an addressable relay to open the power connection to integral and magnetic door holders.
    2. All door holders throughout the building shall release simultaneously.
  - J. Elevator Recall Sequence:
    1. Elevator recall sequences shall meet the requirements of ASME/ANSI A17.1 and NFPA 72.
    2. Upon signal from a smoke detector in the machine room, hoistway, or any elevator lobby other than the "designated level" the fire alarm shall utilize an addressable relay to signal the elevator to recall to the designated level as determined by the Authority Having Jurisdiction.
    3. Upon signal from a smoke detector in the elevator lobby of the "designated level," the fire alarm system shall utilize an addressable relay to signal the elevator to recall to the "alternate level" as determined by the Authority Having Jurisdiction.
    4. All elevators that share the same hoistway, machine room or lobby shall be recalled simultaneously. Elevators served by different machine rooms, hoistways and lobbies shall continue to operate.
  - K. Firefighter's Cab Visual Alarm Sequence:
    1. Upon signal from a detector in the machine room or elevator hoistway, the fire alarm system shall utilize an addressable relay to signal the elevator controller to illuminate and flash the firefighters cab visual alarm.
  - L. Elevator Shutdown Sequence:
    1. Elevator shutdown shall meet the requirements of ASME/ANSI A17.1.
    2. All elevators that share the same hoistway, machine room, or lobby shall be shut down simultaneously. Elevators served by different machine rooms, hoistways, and lobbies shall continue to operate.
    3. The fire alarm system shall utilize an addressable relay to energize the shunt trip of the main elevator breaker, disconnecting power to the elevator.
  - M. Access Control Override Sequence:
    1. The fire alarm shall use addressable output relay(s) to signal the access control panel.
    2. Refer to the access control specifications for requirement upon fire alarm signal. The fire alarm shall initiate an override of delayed egress doors.
- 3.02 INSTALLATION
- A. Install system in accordance with manufacturer's instructions and referenced codes.
  - B. Fire Alarm Command Center:
    1. Install the control panel where shown on the drawings.
    2. All expansion compartments, if required, shall be located at the control panel.
    3. Install the voice command center and fire command center in the location as indicated on the drawings. This location should be primary fire department "attack" location. Coordinate with the local fire department prior to submitting shop drawings.

4. The fire alarm voice prerecorded messages shall be verified by the Contractor, as approved by the Owner, prior to the shop drawing submittal process.

C. Devices:

1. General:

- a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.
- b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
- c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.
- d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall notify the Architect/Engineer to coordinate a different acceptable location.

2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.

3. Protection of Fire Alarm System:

- a. A smoke detector shall be installed within the vicinity of the main fire alarm panel and every NAC extender panel per NFPA 72. A heat detector may be substituted when a smoke detector is not appropriate for the environment of installation.

4. Duct-type Analog Smoke Detectors:

- a. Duct-type analog smoke detectors shall be installed on the duct where shown on the drawings and details. The sampling tubes shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
- b. All detectors shall be accessible.
- c. Duct-type detectors shall be installed according to the manufacturer's instructions.

5. In-Duct Analog Smoke Detectors:

- a. In-duct analog smoke detectors shall be installed in the duct where shown on the drawings and details. The devices shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
- b. All detectors shall be accessible.

6. Heat Detector, Linear Wire Type:

- a. Install detection wire within 20 inches of the underside of building roof, floor, or as recommended by the manufacturer.
  - b. The protected area shall not exceed 4,000 square feet per zone. Provide a separate zone for areas divided by fire/smoke rated walls.
7. Manual Pull Stations:
  - a. Stations shall be located where shown and at the height noted on the drawings.
8. Addressable Relays and Monitor Modules:
  - a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.
  - b. All modules shall be mounted in or on a junction box in an accessible location.
  - c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.
9. SLC Loop Isolation Modules:
  - a. Isolation modules shall be installed to limit the number of addressable devices that are incapacitated by a circuit fault.
  - b. Refer to the fire alarm riser diagram for requirements.
10. Notification Appliance Devices:
  - a. Devices shall be located where shown on the drawings.
  - b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.
- D. Annunciators:
  1. Remote Annunciators: The annunciators shall be located where shown on the drawings and approved by the fire marshal.
- E. Wiring:
  1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
  2. Wiring shall be installed in conduit.
  3. All junction boxes with SLC and NAC circuits shall be identified on cover. Refer to Identification Section 26 05 13 for color and identification requirements.
  4. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 26 05 20.
  5. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.
    - a. Fire alarm temporal audible notification for all audio appliances.
    - b. Synchronization of all visual devices where two or more devices are visible from the same location.
    - c. Ability to silence audible alarm while maintaining visual device operation.
    - d. Emergency communication alert and textual visible appliance notification.
  6. Notification Appliance Circuits shall not span floors or smoke compartments. Refer to architectural drawings for smoke compartments.
  7. Signal line circuits connecting devices shall not span floors 2-hour smoke compartments.

8. Signal line circuits connecting devices shall be provided with an isolation module at each floor separation or as otherwise shown on the drawings.
  9. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.
- F. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows, or using colored tape at each conductor termination and in each junction box.
1. Power Branch Circuit Conductors: In accordance with Section 26 05 53.
  2. Signaling Line Circuit: Overall red jacket with black and red conductors.
  3. DC Power Supply Circuit: Overall red jacket with violet and brown conductors.
  4. Notification Appliance Circuit: Overall red jacket with blue and white conductors.
  5. Door Release Circuit: Gray conductors.
  6. Central Station Trip Circuit: Orange conductors.
  7. Central Station Fire Alarm Loop: Black and white conductors.
- G. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device, and shall not have visible knockouts.
- H. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.
- 3.03 FIELD QUALITY CONTROL
- A. Field inspection and testing will be performed under provisions of Section 26 00 00.
- B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.
- C. Contractor shall test and adjust the fire alarm system as follows:
1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:
    - a. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.
    - b. As specified on the drawings.
  2. Sound level measurement procedure shall meet the following requirements:
    - a. All measurements shall use the 'A' weighted, dBA, sound measurement scale.
    - b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
    - c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.

- d. All sound level measurements shall be taken at a height of 5' above the finished floor level.
- e. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of 2 rooms shall be tested. The results from the rooms tested shall be averaged and the remaining rooms may be adjusted per the average.
- f. Measurements shall be taken halfway between speakers or halfway between a speaker and the wall. No measurements shall be taken at the extreme edges of the room, nor directly under speakers.

D. Additionally, test the voice alarm communication system intelligibility per IEC 60849:

- 1. The following acoustically distinguishable spaces shall be tested: All unique rooms shall be tested.
- 2. Utilize equipment designed to test per IEC 60849 per the equipment manufacturer's instructions. This equipment includes a signal generator, which is input to the fire alarm system and a portable measurement device. This equipment is available from Simplex Grinnell or Gold Line.
- 3. Testing equipment that can simulate 'crowd babble' shall be used in rooms with occupancy of greater than 200.
- 4. When testing for intelligibility, the quantity and location of the measurement points shall be the same as the points used for measurement of dBA level.
- 5. Provide a room by room report, showing the average dBA level and STI for each room tested, the number and location of. The report shall be presented to the Architect/Engineer in an Excel .xls file.

#### 3.04 MANUFACTURER'S FIELD SERVICES

- A. Provide manufacturer's field services under provisions of Section 26 00 00.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.
- C. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. The Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.
- D. System Occupancy Adjustments: When requested by Owner within 12 months of date of Substantial Completion, provide on-site system adjustments to suit actual occupied conditions. For this purpose, provide up to two (2) site visits, 4 hours each visit, outside normal occupancy hours.

#### 3.05 SYSTEM TRAINING

- A. System training shall be performed under provisions of Section 26 00 00.
- B. Minimum on-site training times shall be:
  - 1. System Operators: One (1) day.
  - 2. Emergency Communication System: Four (4) hours.

END OF SECTION 283100

## **SECTION 31 20 00**

### **EARTH MOVING**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Provide labor, equipment, and material to perform site preparation and earthwork as specified herein and indicated on the Drawings. Work shall include, but is not limited to, the following:
  - 1. Survey staking as required for construction.
  - 2. Topsoil stripping and stockpiling.
  - 3. Dewatering.
  - 4. Protection of existing facilities.
  - 5. Site grading.
  - 6. Excavation, trenching, and backfilling for structures and foundation including stone base as indicated on the Drawings.
  - 7. Borrow material including, but not limited to, material, excavating, hauling, placing, and compacting.
  - 8. Maintenance and stability of site.
  - 9. Disposal of waste and surplus material.
  - 10. Soil testing.
- B. Examine the site to determine the extent of excavating, grading, and related items necessary to complete the work.

##### **1.02 RELATED SECTIONS**

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
  - 1. Section 31 23 33 Trenching for Utilities
  - 2. Section 31 25 00 Erosion and Sedimentation Control

##### **1.03 MEASUREMENT AND PAYMENT PROCEDURES**

- A. Work in this section shall be included in the lump sum Base Bid as appropriate, unless specifically noted otherwise, and shall include, but not be limited to, the following:
  - 1. Topsoil stripping, stockpiling and spreading after the completion of the grading.
  - 2. Backfilling of area stripped of topsoil and filling from existing grades to new subgrade elevation. Providing borrow material for backfilling and filling.
  - 3. Excavating for structures.
  - 4. Stone base as indicated on the Drawings.
  - 5. Dewatering.
  - 6. Mass Rock Removal.
  - 7. Protection of existing service lines and utility structures.
  - 8. Maintenance and Stability of site grading.
  - 9. Disposal of waste and surplus material.
  - 10. Soil Testing.
- B. The following work shall be paid by the unit price as indicated in the Bid Form:
  - 1. Undercut of unsuitable material: Cu Yd
  - 2. Structural fabric: Sq Yd

- C. Unit price work shall be approved by the Engineer prior to proceeding with the work. Take measurements for determination of unit price quantities in the presence of the Engineer. Maintain daily log sheets of measured quantities. Log sheets must be signed by Engineer and submitted with payment request. Payment shall not be made for unit price quantities that have not been verified by the Engineer.
- D. Payment for the unit price items shall be for all labor, materials, equipment, and services required or reasonably implied by the Contract Documents and shall include, but not be limited to, the following:
  - 1. Undercut of unsuitable material: Complete removal and disposal of undercut material including, but not limited to, excavating, loading, hauling, and properly disposing of excavated material. Providing satisfactory material for backfilling shall include, but not be limited to, material, loading, hauling, placing and compacting in accordance with these specifications.
  - 2. Structural fabric: Price shall include providing material and placing in accordance with these specifications.

#### 1.04 **REFERENCE STANDARDS**

- A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)); 2012 (Reapproved 2021).
- C. ASTM D751 - Standard Test Methods for Coated Fabrics; 2019.
- D. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017 (Reapproved 2025).
- G. ASTM D3786/D3786M - Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm Bursting Strength Tester Method; 2018 (Reapproved 2023).
- H. ASTM D1586 - Penetration Test and Spilt-Barrel Sampling of Soils.
- I. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
- J. ASTM D2922 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

#### 1.05 **DEFINITIONS**

- A. Backfill: A specified material used in refilling a cut, trench, or other excavation, placed at a specified degree of compaction.



- B. Capillary Water Barrier: A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high porosity, which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of water to the area immediately below the slab.
- C. Compaction: Process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of compaction" shall be expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D698 (Standard Proctor).
- D. Excavation: The removal of soil or rock to obtain a specified depth or elevation.
- E. Fill: Specified material placed at a specified degree of compaction to obtain an indicated grade or elevation.
- F. Hard Material: Solid, homogeneous material which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment with ripper teeth. Material having a standard penetration resistance as determined by ASTM D1586 60 and 150 blows per foot is defined as "hard material."
- G. Lift: Layer of soil placed on top of a previously prepared or placed soil.
- H. Rock: Solid, homogeneous material which cannot be removed without the systematic drilling and blasting exceeding one (1) cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 greater than 150 blows per foot is defined as "rock." Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.
- I. Soil classification shall be in accordance with ASTM D2487.
  - 1. Satisfactory materials: Soils classified as GW, GP, GC, GM, SP, SC, SM, SW, ML, and CL.
  - 2. Unsuitable materials: Soils considered as unsatisfactory shall be materials that do not comply with the requirements of satisfactory above and include, but shall not be limited to, the following:
    - a. Soil containing organic matter, debris, stones larger than 6 inches, or frozen material. Stones greater than 4 inches will not be permitted in the top 12 inches.
    - b. Soils classified as Pt, CH, MH, OH, and OL.
  - 3. Cohesionless: Classified as GW, GP, SW, and SP. Soils classified as GM and SM shall be classified as cohesionless only when the fines have a plasticity index of less than 10.
  - 4. Cohesive: Classified as GC, SC, ML, CL, MH, and CH. Soils classified as GM and SM shall be classified as cohesive only when the fines have a plasticity index greater than 10.
- J. Subgrade: Lowest elevation upon which fill or other work will be placed in the absence of unsuitable material.
- K. Topsoil: Natural, friable soil, representative of productive soils in the vicinity of the site. Topsoil shall be free from roots, stones larger than 1 inch, objectionable weed seeds, toxic substances, and materials that hinder grading, planting, and maintenance operations.

## 1.06 SUBMITTALS

- A. Submit the following in accordance with Section, Submittal Procedures:
  - 1. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following.
    - a. Structural fabric.
  - 2. Manufacturer's Installation Procedures.
    - a. Structural fabric
  - 3. Test Reports: Submit for the following:
    - a. Moisture-density relations of soils.
    - b. Field moisture content.
    - c. Soil classification.
    - d. In-place field density.
    - e. Geotechnical engineer's daily field reports.
  - 4. Permits
    - a. Erosion control permits for borrow and disposal site(s).

## PART 2 PRODUCTS

### 2.01 MATERIAL

- A. Capillary water barrier: A clean crushed stone, crushed gravel, or uncrushed gravel conforming to ASTM C33 coarse aggregate grading size 57, 67, or 7.
- B. Stone Base: A clean crushed stone, crushed gravel, or uncrushed gravel conforming to ASTM C33 coarse aggregate grading size ABC
- C. Structural Fabric: Provide structural fabric specifically designed and manufactured to stabilize soft soils under an aggregate base for roads and parking areas. Fabric shall provide a permeable layer, planar flow, and tensile reinforcement for retaining the soil matrix. Fabric shall be inert to commonly encountered chemicals, hydrocarbons, resistant to mildew, rot, and ultraviolet light exposure, and meet or exceed the following test standards:

TEST	ASTM	
1. Fabric weight (oz / sq yd)	D-1910	6
2. Grab tensile strength (lbs.)	D-1682	200
3. Mullen burst strength (psi)	D-3786	320
4. Puncture strength (lbs.)	D-751	80

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Provide erosion control measures as specified in Section, Erosion Control and clearing and grubbing as specified in Section, Clearing and Grubbing.
- B. Protect existing structures and features to remain.
- C. Dispose of excavated material in such a manner that it will not obstruct the water flow, endanger existing improvements or Work in progress, impair the use or appearance of the existing facilities, or be detrimental to the completed Work.

- D. Weather Limitations: Proceed with fill and backfill operations based on the following weather conditions:
  - 1. Temperature must be above freezing.
  - 2. In windy, hot, or arid conditions with a high rate of evaporation add moisture to the material to maintain the optimum moisture content.
  - 3. Do not proceed in rain or on saturated subgrade.
- E. Repair or undercut and backfill soils that become damaged by construction activity or unsuitable due to being left exposed to the weather at no additional cost.
- F. Do not place material on surfaces that are muddy, frozen, or contain frost.
- G. Excavation carried below the elevation indicated on the Drawings shall be backfilled and compacted in accordance with these specifications.
- H. Remove and properly dispose of unsatisfactory and excess material from the site.

### 3.02 **CONSTRUCTION STAKING**

- A. Provide construction staking as indicated in paragraph 4.03 of the General Conditions. Engineer will only provide key reference points and benchmarks.
- B. Provide construction staking. Owner will provide key reference points and benchmarks for construction, which in the Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work as necessary for construction. Contractor shall protect and preserve the established reference points and property monuments.
- C. Contractor shall report to Engineer whenever a reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations. Contractor shall be responsible for the accurate replacement or relocation of such reference points or property monuments by a registered professional surveyor in the State of North Carolina.

### 3.03 **PROTECTION OF UNDERGROUND FACILITIES**

- A. Refer to paragraph 5.05 of the General Conditions and 5.05.A.2 of the Supplementary Conditions concerning the protection of Underground Facilities.
- B. Approximate locations of existing underground facilities at the site are indicated on the Drawings based on information available to the Engineer. Engineer and Owner do not take responsibility for the accuracy of the information.
- C. Follow North Carolina General Statutes, Chapter 87, Article 8A Underground Utility Safety and Damage Prevention Act. Contact NC811.org before the start of excavation. Investigate underground facility locations prior to the start of construction.
- D. Review and check all information and data regarding existing Underground Facilities at the Site.
- E. Repair damage to existing facilities at no additional cost to the Owner.
- F. A change in conditions may be considered due to the location of the existing facilities as allowed in the General Conditions. This does not include the cost for repair of damaged facilities not properly located in advance of construction.

### **3.04 WATER CONTROL**

- A. Inspect the site prior to mobilizing to determine the appropriate equipment for site grading and foundation work.
- B. Perform work to prevent surface water from accumulating in excavations, and unfinished fill areas. Perform grading and excavation so the work area and affected operations shall be continually and effectively drained.
- C. The geotechnical investigation found a the ground water table at 14 - 15 feet below the existing ground surface. Fluctuations of the groundwater table may be expected during the year due to seasonal and climatic changes.
- D. Install a dewatering system prior to excavating beneath the ground water table. Maintain the water table approximately 2 feet below the bottom of the excavation, if required.
- E. Maintain dewatering until backfilling has proceeded above the natural ground water level and the structural weight is sufficient to prevent "floating" of the structure. Provide a job superintendent experienced in dewatering work.
- F. Water from dewatering operations must be disposed of in accordance with the North Carolina Sedimentation Pollution Control Act.

### **3.05 USE OF EXPLOSIVES**

- A. Explosives may not be used on the Project.

### **3.06 TOPSOIL**

- A. Strip topsoil from areas to be disturbed to a depth of 4 inches and stockpile separate from other excavated material. Locate topsoil so that the material can be used readily for the finished grading. Protect and maintain topsoil until needed. Place topsoil after completion of work in accordance with Section, Lawns and Grasses.
- B. Perform stripping with wide track dozer or other appropriate equipment to minimize disturbance to subgrade soils. Do not use rubber-tired equipment.

### **3.07 SITE GRADING**

- A. Proof roll exposed soils following topsoil stripping with a partially loaded tandem axle dump truck to identify unsuitable subgrade areas as determined by the Engineer. Unsuitable areas will be repaired in place or undercut to firm soils as directed by the Engineer. Payment for in place repair or undercutting and backfilling of unsuitable areas shall be as indicated in the Measurement and Payment paragraph.
- B. Perform undercutting of unsuitable soils with a backhoe top loading dump truck or similar equipment approved for the use by the Engineer. Backfill undercut areas immediately.
- C. In undercut areas where the exposed soils may be wet and compaction of the initial fill may be difficult, a bridge lift of about 18 to 24 inches may be allowed at the direction of the Engineer.
- D. In-Place repair shall consist of discing and recompaction of existing soils to a depth of approximately 12 inches.

- E. At the direction of the Engineer provide a structural fabric for stabilization of unsuitable soil areas. Install fabric in accordance with the manufacturer's recommendation and the following minimum requirements.
  - 1. Provide a fabric overlap of 24 inches.
  - 2. Back dump and spread aggregate over fabric at the aggregate specified thickness.
  - 3. Compact aggregate with vibratory roller prior to allowing additional construction traffic.
- F. Site grading shall be unclassified except as specifically indicated otherwise. Perform grading within the limits of the Project. Finished surface shall conform to the grades and cross sections indicated on the Drawings and be uniformly sloped for a positive drainage away from structures.
- G. Excavate rock encountered in cut sections to a depth of 6 inches below finished subgrade and backfill with satisfactory material.
- H. Scarify the existing subgrade surface to a minimum depth of 6 inches and recompact if subgrade density is less than the degree of compaction for the proposed fill material. Plow or bench existing ground surfaces steeper than one vertical to four horizontal in such a manner that the fill material will bond with or be keyed to the existing surface. Use compaction equipment suitable for the soil being compacted. Moisten or aerate material as necessary to obtain the optimum moisture content within plus or minus one percent to obtain specified compaction.
- I. Soils used for fill and backfill shall be satisfactory soils classified SP, SM, or SW in accordance with ASTM D2487. Dry or wet soil as necessary to maintain optimum moisture.
- J. Place backfill and fill material in accordance with the following:
  - 1. Maximum uniform loose lifts: 8 inches
  - 2. Optimum moisture content: -3 - 3 percent
  - 3. Percent compaction at optimum moisture content:
    - a. From ex. grade to within one (1) foot of struc. subgrade: 95
    - b. Final foot to subgrade under floor slabs and pavements: 98
    - c. Under sidewalks and grass areas: 90
- K. Approved compacted subgrade that is disturbed by construction or adverse weather shall be scarified and re-compacted as specified previously. Re-compaction over utilities shall be by hand tamping.

### 3.08 **FILL AND BACKFILL**

- A. Place and compact fill and backfill material adjacent to structures in a manner that prevents wedging and eccentric loading on or against structures. Do not use equipment adjacent to structures that may overload structure. Backfill against structure only after concrete has attained the specified 28-day compressive strength.
- B. Stone Base: Structures shall have a compacted crushed stone subgrade to the depth of 12 inches, except the Control Building, which shall have a stone subgrade of 6 inches.

### 3.09 EXCAVATION FOR STRUCTURES

- A. Provide shoring or side slopes of excavations as necessary to protect workmen, and existing and new structures. Use, install, and remove shoring in accordance with State and Federal OSHA regulations.
- B. Furnish, erect, and maintain required guardrails at exposed boundaries of excavation.
- C. Perform excavation for utilities in accordance with Section, Trenching for Utilities. Install utilities to a minimum distance of five (5) feet beyond the face of the structure.
- D. Make excavation to the dimensions and elevations for the structures as indicated on the Drawings. Extend excavation a sufficient distance from walls and footings to allow for placing and removal of forms.
- E. Remove unsatisfactory material below required grade and replace with select backfill material as directed by Engineer.
- F. Excavation carried below the depths indicated, without specific directions, shall be backfilled and compacted as specified herein to the proper grade. In excavations for footings the concrete shall be extended to the bottom of the over excavation. Work caused by over excavation shall be at the Contractor's expense.
- G. Excavations for Embankments and Under Pavements and Concrete Footings - and Slabs: The entire area of the original ground under embankments and under pavements and concrete footings and slabs shall be excavated to remove all vegetable matter, sod, muck, rubbish, and other unsuitable materials to a minimum depth of 12 inches. In the event that it is required to remove unsuitable material to a greater depth than specified, an adjustment in the contract price may be made in accordance with applicable [provisions of the General Conditions of the contract unit prices from the Bid Schedule].
- H. Excavations for Embankments, Pavements and Structures: Unsuitable materials shall be excavated to a minimum depth of 12 inches below the existing ground elevations for embankments and the proposed subgrade elevation for pavement, footings and concrete slab areas. In the event that it is required to remove unsuitable material to a greater depth than specified, an adjustment in the contract price may be made in accordance with applicable provisions of the General Conditions of the contract unit prices from the Bid Schedule.
- I. Excavation Below Structures in Which Rock is Encountered: The rock shall be removed to a 12" depth below the structure bottom. The entire area excavated shall be brought to subgrade elevation with a suitable fill material compacted to 95% of the maximum density in accordance with ASTM D-2167.
- J. The subgrade at the foundation construction level of the new facilities should be rolled using a vibratory roller weighing a minimum of 20 tons until settlement from four complete passes does not exceed 1/8 inch. Any soft, uncompactible or unacceptable soils encountered in the subgrade should be replaced with structural fill placed and compacted to 95% of the maximum density in accordance with ASTM D-2167.
- K. The upper 9-inches of the subgrade after excavating for each structure should be compacted in place to at least 95% standard Proctor maximum dry density. The subgrade should be proof-rolled using a vibratory roller weighing a minimum of 10 tons (static load) until settlement from the last four complete passes does not exceed

1/8 inch. Any soft, unsuitable or unacceptable soils encountered in the subgrade should be replaced with structural fill placed and compacted to 95% of the standard Proctor maximum dry density.

### **3.10 ROCK EXCAVATION**

- A. Notify Engineer immediately in the event that rock is encountered when the Contract requires payment by the unit price.

### **3.11 BORROW MATERIAL**

- A. Provide borrow material required for fill and backfill to bring the site to the elevations indicated on the Drawings. Borrow material shall be subject to the approval of the Engineer. Notify Engineer as to the site selected for inspection and approval prior to transporting borrow material to the site.
- B. Obtain erosion control permit as necessary for borrow pit grading operations.
- C. Provide soil analysis for each type of material from proposed borrow pit(s) for Engineer's approval prior to placing borrow material. Contractor shall do necessary work to bring the borrow material to within plus or minus 1-1/2 percent of the optimum moisture content. A minimum of one sample per structure shall be obtained for analysis.

### **3.12 MAINTENANCE AND STABILITY**

- A. Maintain fills and embankments to the grade and cross section indicated on the Drawings until the final completion and acceptance of the Project. Repair areas that are damaged.

### **3.13 DISPOSAL OF SURPLUS MATERIAL**

- A. Dispose of surplus material not required or unsuitable for filling, backfilling, or grading in an approved spoil area in accordance with local ordinances.
- B. Obtain erosion control permit as necessary for disposal site(s).

### **3.14 SOIL TESTING FIRM**

- A. The following requirements for the soil testing and inspection firm shall be as indicated in Section 01 40 00, Quality Requirements.
  - 1. The party that shall retain and pay for the services.
  - 2. The qualifications, general responsibilities, and limitations of independent testing firm.
  - 3. Contractor responsibilities for assistance and coordination with testing firm.

### **3.15 TESTING REQUIRED**

- A. The testing laboratory soil specialist, as a minimum, shall be at the project site for the following:
  - 1. Monitor proof rolling of existing soils to determine requirements for undercutting unsuitable soils
  - 2. Monitor grading for the separation and wasting of unacceptable soils.
  - 3. Providing tests in accordance with the following schedule:
    - a. Optimum moisture and laboratory maximum density: Provide one (1) test per type of material to determine optimum moisture and maximum density values in accordance with ASTM D698.

- b. Moisture content: Provide two (2) tests per day per type of material in accordance with ASTM D2216.
  - 4. Provide in-place field density in accordance with ASTM D1556 or other approved test and the following schedule:
    - a. Provide a minimum of one (1) in-place bearing capacity test for every 1,200 sq ft of subgrade area under structures prior to the start of foundation work.
    - b. While filling activities are in progress for structures and paved areas. Provide a minimum of one (1) in-place density test for every 1,200 sq ft of lift with a minimum of one (1) test for every lift.
    - c. Provide a minimum of one (1) in-place bearing capacity test for every 100 feet of foundation trench.
  - 5. Monitor for settlement due to construction activities during excavation work adjacent to existing building.
- B. Verify soil-bearing capacity where proof rolling is not possible. Arrange and pay for a minimum of one (1), three foot deep penetrometer test and subsequent bearing capacity evaluation per 500 sf of structure footprint by the soil testing firm.

**END OF SECTION**



**SECTION 31 23 33**  
**TRENCHING & BACKFILLING FOR UTILITIES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Provide labor, equipment, and material to perform required excavating, backfilling, and compacting for utilities and related structures as specified herein and indicated on the Drawings. Work shall include, but not be limited to, the following:
1. Survey staking as required for construction.
  2. Protection of existing improvements.
  3. Location of installed utilities.
  4. Dewatering.
  5. Excavating, backfilling, and compacting for utilities.
  6. Installation of warning / identification tape and tracer wire.
  7. Borrow material.
  8. Disposal of surplus material.
  9. Demolition and removal of existing structures.
  10. Soil Testing.

**1.02 RELATED SECTIONS**

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
1. Section 31 25 00 Erosion and Sedimentation Control
  2. Section 32 92 00 Lawns and Grasses
  3. Section 33 14 13 Water Distribution System
  4. Section 33 31 11 Sanitary Sewer System
  5. Section 33 40 00 Storm Drain System

**1.03 MEASUREMENT AND PAYMENT**

- A. Include work specified in this Section in the lump sum or unit price cost for the utility installation as appropriate unless specifically specified elsewhere in the specifications.
- B. The following work shall be paid by the unit price as indicated in the Bid Form:
1. Undercut of unsuitable material Cu Yd
  2. Rock Excavation Cu Yd
- C. Take measurements for determination of unit price quantities in the presence of the Engineer. Maintain daily log sheets of measured quantities. Log sheets must be signed by Engineer and submitted with payment request. Payment shall not be made for unit price quantities that have not been field verified by the Engineer. Measurement shall be based on the actual quantities removed but not exceeding the maximum trench dimensions as specified herein.
- D. Payment for the unit price items shall be for all labor, materials, equipment, and services required or reasonably implied by the Contract Documents and shall include, but not be limited to, the following:

E.

1. Undercut of unstable soils: Complete removal and disposal of undercut material including, but not limited to, excavating, loading, hauling, and properly disposing of excavated material. Providing Class I material for backfilling shall include, but not be limited to, material, loading, hauling, placing and compacting in accordance with these specifications. Payment shall be based on the length of the undercut by the pipe O.D + 4 feet by depth of trench as directed by geotechnical engineer.
2. Rock excavation: Complete removal and disposal of excavated rock material including, but not limited to, drilling, blasting, excavating, loading, hauling, and properly disposing of excavated material. Rock excavation for manholes shall be paid for on the maximum basis of 1-foot greater diameter than the outside diameter of the manhole and to a depth of 1 foot greater than the bottom of the manhole. Providing Class I material for backfilling shall include, but not be limited to, material, loading, hauling, placing and compacting in accordance with these specifications.

1.04 **REFERENCED STANDARDS**

- A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)); 2012 (Reapproved 2021).
- B. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017 (Reapproved 2025).
- D. N.C. Department of Transportation - Standard Specifications for Roads and Structures (NCDOT). July 2018 or latest
- E. Uni-Bell PVC Pipe Association
  1. Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Sewer Pipe.

1.05 **DEFINITIONS**

- A. Backfill: A specified material used in filling the excavated trench and placed at a specified degree of compaction.
  1. Materials: Materials listed herein include processed materials plus the soil classifications listed under the Unified Soil Classification System, (USCS) (Method ASTM D2487 and Practice D2488). The soil materials are grouped into five broad categories according to their suitability for this application.
    - a. Class I: Angular, 6 to 40-mm (1/4 to 1-1/2-in), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shell.
    - b. Class II: Coarse sands and gravels with maximum particle size of 40 mm (1-1/2 in.), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class.
    - c. Class III: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC are included in this class.

- d. Class IV: Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. These materials shall not be used for bedding, haunching, or initial backfill.
  - e. Class V: This class includes the organic soils OL, OH, and PT as well as soils containing frozen earth, debris, rock larger than 40 mm (1 1/2 in.) in diameter, and other foreign materials. These materials shall not be used for bedding, haunching, or initial backfill.
- 2. Backfill Zones: Each backfill zone shall extend the full width of the trench bottom.
  - a. Foundation: Extending down from the bottom of bedding zone as defined below.
  - b. Pipe Embedment
    - 1) Bedding: Extending from 4 inches below the pipe bottom to the pipe bottom for 30-inch diameter and smaller and 6 inches below the pipe bottom for pipes larger than 30 inches in diameter.
    - 2) Haunching: Extending from the bedding (bottom of the pipe) to the pipe spring line.
    - 3) Initial Backfill: Extending from the haunching (pipe spring line) to 1 foot above the top of the pipe.
  - c. Final Backfill: Extending from the initial backfill to the finish ground elevation.
- B. Laying Conditions:
  - 1. Type 1: Flat bottom trench with loose backfill.
  - 2. Type 2: Flat bottom trench with backfill lightly consolidated to centerline of pipe.
  - 3. Type 3: Pipe bedded in 4 inches minimum of loose soil and backfill lightly consolidated to top of pipe.
  - 4. Type 4: Pipe bedded on Class I material to 1/8 pipe diameter (4 inch minimum) Backfill compacted to top of pipe a minimum of 80 percent of standard proctor.
  - 5. Type 5: Pipe bedded in compacted Class I material to pipe centerline with 4-inch minimum under pipe. Backfill to top of pipe with Class I, II, or III and compact to 90 percent of standard proctor.
- C. Compaction: Process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of compaction" shall be expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D698 (Standard Proctor).
- D. Excavation: The removal of soil or rock to obtain a specified depth or elevation.
- E. Hard Material: Solid, homogeneous material which is not included in the definition of "rock" but which may require the use of heavy excavation equipment with ripper teeth. Amount must exceed 1 cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 between 60 and 150 blows per foot is defined as "hard material."
- F. Lift: Layer of soil placed on top of a previously prepared or placed soil.
- G. Rock: Solid, homogeneous material which cannot be removed without the systematic drilling and blasting exceeding 1 cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 greater than 150 blows per foot is defined as "rock." Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

- H. Pipe Springline: A line running horizontally through the center of the pipe.
- I. Topsoil: Natural, friable soil, representative of productive soils in the vicinity of the site. Topsoil shall be free from roots, stones larger than 1 inch, objectionable weed seeds, toxic substances, and materials that hinder grading, planting, and maintenance operations.

## 1.06 SUBMITTALS

- A. Submit the following in accordance with Section, Submittal Procedures:
  - 1. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
    - a. Warning / Identification tape.
  - 2. Test Reports: Submit for the following:
    - a. Moisture-density relations of soils.
    - b. Field moisture content.
    - c. Soil classification.
    - d. In-place field density.
    - e. Geotechnical engineer's daily field reports.

## PART 2 PRODUCTS

### 2.01 STONE

- A. Class I material shall be #67 or #78M stone in accordance with NCDOT specifications Section 1005, General Requirements for Aggregate.

### 2.02 WARNING AND IDENTIFICATION TAPE

- A. Tape shall be a minimum 3-inch wide polyethylene plastic tape or approved equal, manufactured specifically for identification of buried utilities with means of enabling detection by a metal detector to a minimum depth of 3 feet. Tape shall be APWA color coded (ANSI Z535.1) and continuously imprinted with warning and identification markings in bold black letters to read "CAUTION - BURIED (utility) LINE BELOW" or approved similar wording. Color and printing shall be permanent, unaffected by moisture or soil and shall be as follows:

<u>Utility</u>	<u>Color</u>
Potable Water	Blue
Sanitary Gravity, Force Mains & Drains	Green
Electric	Red
Gas, Oil, Steam	Yellow
Communication, Alarms & Signals	Orange
Reclaimed Water, Irrigation	Purple
Proposed Excavation	White

- B. Tape shall be by Blackburn Manufacturing, Pollardwater, or Reef Industries Inc.

### 2.03 TRACER WIRE

- A. Tracer wire shall be #12 solid copper wire. All connections shall be by wire nuts and taped.

- B. Splices in tracer wire are to be kept to a minimum and joined with copper split nuts of appropriate size.

## **PART 3 EXECUTION**

### **3.01 PROJECT SAFETY**

- A. Contractor is responsible for Project safety.
- B. Perform work in conformance with applicable State and Federal safety regulations including, but not limited, to the following:
  - 1. North Carolina Safety and Health Standards for the Construction Industry (29CFR 1926 Subpart P).
  - 2. NC OSHA Industry Guide No. 14, Excavations.
  - 3. NC OSHA Industry Guide No. 20, Crane Safety.
- C. Provide barriers, warning lights, and other protective devices at excavations as necessary for safety of workers and the public.
- D. Provide sloping of bank, shoring, sheeting, or other means of maintaining the stability of the trench in accordance with the requirements of the Associated Contractor's Manual of Accident Prevention OSHA, Part 1926.P.

### **3.02 PROTECTION OF UNDERGROUND FACILITIES**

- A. Provide protection of Underground Facilities in accordance with paragraph 5.05 of the General Conditions.
- B. Approximate locations of existing underground facilities at the site are indicated on the Drawings based on information available to the Engineer. Engineer and Owner do not take responsibility for the accuracy of the information.
- C. Investigate underground facility locations prior to the start of construction.
- D. Repair damage to existing facilities at no additional cost to the Owner.
- E. A change in conditions may be considered due to the location of the existing facilities as allowed in the General Conditions paragraph 5.05.F. This does not include the cost for repair of damaged facilities not properly located in advance of construction.
- F. Separation distances shall be in accordance with utilities requirements.

### **3.03 CONSTRUCTION STAKING**

- A. Provide construction staking as indicated in paragraph 4.03 of the General Conditions. Engineer will only provide key reference points and benchmarks.
- B. Provide construction staking. Owner will provide key reference points and benchmarks for construction, which in the Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work as necessary for construction. Contractor shall protect and preserve the established reference points and property monuments.
- C. Report to Engineer whenever a reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations. Contractor shall be responsible for the accurate replacement or relocation

of such reference points or property monuments by a registered professional surveyor in the State of North Carolina.

#### **3.04 LOCATION OF INSTALLED UTILITIES**

- A. Provide location for contract installed utilities as requested by third parties proposing to dig in the contract area until the date that the entire contract is recommended for final payment by Engineer to Owner.

#### **3.05 WATER CONTROL**

- A. Prevent surface water from entering the trench.
- B. When trench bottom is below the existing ground water table, install a dewatering system to maintain water table 1 foot below trench bottom. Provide a man experienced in dewatering work at the job site.
- C. Maintain dewatering until backfilling has proceeded above the existing ground water level.
- D. Dispose of water from dewatering operations in accordance with the North Carolina Sedimentation Pollution Control Act.

#### **3.06 USE OF EXPLOSIVES**

- A. Explosives may not be used on the Project.

#### **3.07 EXCAVATING**

- A. Excavation shall be by open cut, unless otherwise indicated on the Drawings or specified herein. Short sections of trench may be tunneled or direct bored with the approval of the Engineer.
- B. Stockpile excavated material in such a manner that it will not obstruct the flow of runoff, streams, endanger Work, impair the use or appearance of existing facilities, or be detrimental to the completed Work.
- C. Segregate excavated material so as to maintain material suitable for backfill separate from material that is unsuitable.
- D. Trench dimensions at the pipe embedment and foundation zone unless noted otherwise shall be as follows:
  - 1. Minimum width: Pipe outside diameter plus 18 inches.
  - 2. Maximum width: Pipe outside diameter plus 24 inches.
  - 3. Sides shall be vertical to a minimum of one foot above the top of pipe.
- E. Shape trench bedding to provide uniform bearing for the full pipe length. Bottom shall be free of protrusions that could cause point loading on pipe. Provide bell holes as required for properly making pipe joint.
- F. Do not over excavate. Excavation below grade without approval of Engineer shall be backfilled with Class I material at no additional cost.
- G. Undercut soils that become unsatisfactory by construction activity or by being left exposed to the weather and backfill with Class I material at no additional cost.

- H. Remove shoring, bracing, and sheeting, unless otherwise noted, as the trench is backfilled. Engineer shall have the authority to require that the sheeting be left in place.
- I. Excavation of trench shall not advance more than 200 feet ahead of the installation. In no case should the excavation extend beyond that which can be backfilled by the end of the workday.
- J. Correct unstable soil conditions encountered at trench foundation by one of the following methods:
  - 1. Excavate below grade as approved by Engineer and backfill with Class I material or approved substitute material at unit price bid or the cost to be included in pipe unit bid price as indicated in Section, Unit Prices.
  - 2. Provide piling or timber cradles in a manner approved by the Engineer. Payment will be made as a change to the Contract Price.
  - 3. Provide concrete cradle or encasement of concrete at unit price bid or the cost to be included in the lump sum price as indicated in Section, Unit Prices.
- K. Rock and Hard Material
  - 1. Excavate rock and hard material to a minimum depth of 4 inches below the pipe for pipes smaller than 30 inches and 6 inches for pipes 30 inches and larger.
- L. Pressure Lines:
  - 1. Provide a minimum 3 feet of cover, unless indicated otherwise on the Drawings.
  - 2. Excavate trenches to provide vertical curve chords that will not exceed the pipe manufacturer's recommended joint deflection.
  - 3. Provide concrete thrust blocks having a compressive strength of 3,000 psi at 28 days at change in horizontal and vertical direction and reduction in the pipe size, unless other restraint systems are indicated on the Drawings. Cut trench sides vertical and square to receive concrete. Provide bearing area against trench wall as indicated on the Drawings.
- M. Gravity Lines:
  - 1. Excavate trench to the alignment and grade indicated on the Drawings.
- N. Utility Structures: Provide a minimum of 12 inches below subgrade and backfill with Class I compacted to 95 percent maximum density. If the soil conditions are found to be unsuitable for structural stability of the structure, Engineer may require additional depth of Class I material.

### 3.08 **BACKFILLING**

- A. Weather Limitations: Proceed with backfill operations based on the following weather conditions:
  - 1. Temperature must be above freezing and rising.
  - 2. In windy, hot, or arid conditions with a high rate of evaporation add moisture to the material to maintain the optimum moisture content.
  - 3. Do not proceed in rain or on saturated subgrade.
  - 4. Do not place material on surfaces that are muddy, frozen, or contain frost.
- B. General
  - 1. Maintain backfill operation within 200 feet from pipe laying operation.
  - 2. Backfill trench to existing ground surface with select excavated material at the specified compaction.

3. If excavated material is unsuitable to obtain specified compaction, provide suitable off-site borrow material for backfill.
  4. Re-excavate trenches improperly compacted. Backfill and compact as specified.
  5. Provide appropriate tamping equipment, and water to obtain proper moisture content, to achieve specified compaction of backfill.
  6. Conduct operation of heavy equipment above pipe installation as to prevent damage to pipe.
  7. Install warning / identification tape over utilities. Bury tape one foot below finished grade above the utility. -
  8. Install tracer wire for non-metallic pipe. Bury tracer wire with pipe. Wire shall be looped into valve boxes to allow access for direct contact location.
- C. Backfill in pipe embedment zone (bedding, haunching, and initial backfill).
1. General:
    - a. Backfill with material as specified below. Material shall be free from objects larger than 2 inches.
    - b. Where rock and hard material has been excavated below pipe bottom, backfill and compact bedding with Class I material. Class II or III material may be used for bedding with Engineer's approval.
    - c. Place backfill material to assure placement of material under pipe haunches.
    - d. Take care during placement and compacting of material to avoid movement of pipe.
  2. Place backfill in bedding and haunching zones in 6 inch maximum lifts and compact to 90 percent density. Place initial backfill in one lift do not compact. Provide backfill material in pipe embedment zone as specified below.
    - a. Pressure Lines (Flexible and Rigid Pipe)
      - 1) Excavation in Class I, Class II, and Class III soils suitable for bedding, the bedding surface shall provide a firm foundation of uniform density. Backfill with select excavated material.
      - 2) Excavation in Class IV or Class V, running water, and other unstable soil conditions, excavate a minimum of 4 inches below pipe bottom and provide Class I material for bedding and haunch zone. Backfill with Class I, II, or III material in initial backfill.
    - b. Gravity Sewer Lines, Rigid pipe (concrete and ductile iron)
      - 1) Excavation in Class I, Class II, Class III, and stable Class IV soils suitable for bedding, the bedding surface shall provide a firm foundation of uniform density. Backfill with select excavated material.
      - 2) Excavation in Class V, unstable Class IV soils, running water, and other unstable soil conditions, excavate a minimum of 4 inches below pipe bottom and provide Class I material for bedding and haunch zone. Backfill with Class I, II, or III material in initial backfill.
      - 3) Ductile Iron over 16 inch
      - 4) Depth 0 - 12 feet: Type 2 laying conditions same as for pressure pipe.
      - 5) Depth over 12 feet: Provide Class I material for bedding and 4 inches up from bottom of pipe.
    - c. Gravity Sewer Lines, Flexible (PVC SDR 35)
      - 1) Depth 0 to 14 ft: Provide Class I material for bedding and haunching. Backfill with Class I, II, or III material in initial backfill.
      - 2) Depth over 14 ft: Provide Class I material for bedding, haunching, and initial backfill.
    - d. Gravity Sewer Lines, Semi-rigid pipe (PVC and ABS Truss Pipe)



- 1) Depth 0 to 14 ft: Provide Class I material for bedding and haunching. Backfill with Class I, II, or III material in initial backfill.
- 2) Depth over 14 ft: Provide Class I material for bedding, haunching, and initial backfill.

**D. Final Backfill**

1. Backfill with materials free of stones and free of debris larger than 6 inches in dimension. Place backfill in lifts not exceeding the thickness and compacted to the minimum density specified below.
2. Trench backfilled with noncohesive materials may be compacted with water flooding; except under roadways, shoulders of roadways, and other areas subject to vehicular movement, provided the method of compaction is approved by the Engineer and provides the degree of compaction required.
3. Lifts and density:
  - a. Undeveloped areas (i.e., forests, fields, and, croplands): Trench may be filled with bulldozer blade provided material fall will not damage pipe. Mound soil over the trench area sufficiently to settle level over time. Degree of compaction shall be 85 percent.
  - b. Lawns: Backfill in 12-inch lifts and compact to 90 percent. Top 12 inches shall be free of material with a dimension over 2 inches.
  - c. Roads (including Rights-of-way), drives, parking areas (including areas within 20 feet), and adjacent to existing utilities: Backfill in 6 inch lifts compact to 95 percent.
  - d. Within 20 feet of foundations: Backfill in 6-inch lifts compacted to 95 percent.

- E. Utility Structures:** Bring backfill to grade in even lifts on all sides. Lift depths and compaction densities shall be as specified according to area of installation for pipe above. Backfill against cast-in-place concrete structure only after concrete has attained the specified 28-day compressive strength.

### **3.09 SOIL TESTING**

- A. Compaction tests may be made at the option of Engineer. An independent testing laboratory will perform tests. Owner will pay for cost of the initial tests.
- B. For each test that fails the compaction requirements, the testing firm at the direction of the Engineer shall make two additional tests. Contractor shall pay cost of additional tests made because of failure of compaction test.
- C. Correct deficiencies in compaction.

### **3.10 SOIL TESTING FIRM**

- A. The following requirements for the soil testing and inspection firm shall be as indicated in Section 01 40 00, Quality Requirements.
  1. The party that shall retain and pay for the services.
  2. The qualifications, general responsibilities, and limitations of independent testing firm.
  3. Contractor responsibilities for assistance and coordination with testing firm.

### **3.11 SOIL TESTING**

- A. Testing laboratory soil specialist, as a minimum, shall be at the project site for the following:
  1. Provide a minimum of one (1) in-place density test for every 1,000 lf of trench.

- B. Density tests shall be made in accordance with ASTM D-698, Standard Proctor Method.
- C. Based on test results, make corrections, adjustments, and modifications of methods, materials, and moisture content for proper trench compaction.

### 3.12 **PAVEMENT PATCHING**

- A. Repair damaged pavement structure.
- B. Cut existing pavement for utility installation in straight lines generally parallel to the utility. Properly dispose of removed pavement structure.
- C. Extend pavement patch 1 foot beyond each side of trench on firm subgrade. Slope new surface to drain.
- D. Asphalt Pavements: Replace asphalt pavement with a pavement structure no less than as detailed on the Drawings. For roadways under NC Division of Highways jurisdiction, pavement shall be replaced in accordance with the requirements of the encroachment agreement.
- E. Concrete Pavements: Replace concrete pavement with pavement structure equal to existing but no less than as detailed as Drawings. Concrete shall be minimum 3,000 psi. When existing concrete joint is within 5 feet of trench remove existing concrete to joint. Provide expansion joint at edge of existing concrete. Surface treatment shall match existing.
- F. Curbs, Gutters, and Sidewalks: Replace curbs and gutters, and sidewalks removed or damaged with similar sections to match the existing. Remove to nearest existing joint.
- G. Approval of Other Authorities: Pavements under the jurisdiction of the NC Division of Highways shall be subject to the approval of a representative of that Division.
- H. Raise existing and new manholes and valve boxes to finished pavement grade. Excavate around top of existing manhole and valve box as necessary. Remove existing top ring, and install new grade ring(s) as necessary. Install existing cover. Raise existing valve box. Provide concrete collar around manhole ring and valve box.
- I. Pavement patching shall include the cost to adjust existing and new manhole and valve boxes to finished pavement elevations.

### 3.13 **GRADING AND CLEAN-UP**

- A. Provide for testing and clean up as soon as practicable, so these operations do not lag far behind the pipe installation. Perform preliminary clean up and grading as soon as backfill is complete.
- B. Provide positive drainage of finished grade and drain away from structures. Finished grade shall be reasonably smooth, compacted, free from irregular surface changes and comparable to the adjacent existing ground surface.
- C. Seed disturbed areas in accordance with Section, Lawns and Grasses.
- D. Upon completion of backfilling, remove and properly dispose of excess material and waste.

### **END OF SECTION**

**SECTION 31 25 00**  
**EROSION AND SEDIMENTATION CONTROL**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work shall include, but not be limited to, the following:
  - 1. Erosion control at project site.
  - 2. Erosion control at borrows and disposal areas as required by Contractor. Cost shall include erosion control permits as necessary for borrow and disposal areas.
  - 3. Removal of surface debris.
  - 4. Temporary and permanent ground cover.
  - 5. Maintain and remove erosion control devices.
  - 6. Self Inspection and Monitoring

**1.02 RELATED SECTIONS**

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
  - 1. Section 32 92 00, Lawns and Grasses

**1.03 REFERENCED STANDARDS**

- A. "Erosion and Sediment Control Planning and Design Manual," issued by the N. C. Sedimentation Control Commission.

**1.04 QUALITY ASSURANCE**

- A. Conform to rules and regulations of the Erosion Control Laws of the State of North Carolina, specifically the Sedimentation Pollution Control Act of 1973 (G.S. 113A) as amended, and the local jurisdiction where the project is located.
- B. Post a copy of the approved erosion control permit, furnished by Owner, at the site prior to starting work. Maintain a copy of the approved erosion control plan at the site.
- C. Provide permanent ground cover as soon as possible, and no later than 15 working days after completion of work in a specific area.

**1.05 WARRANTY**

- A. Contractor is liable for damages to public and private property and fines as may be placed on the Project by the governing agencies due to failure to provide adequate erosion control devices.

**1.06 SUBMITTALS**

- A. Submit the following in accordance with Section, Submittal Procedures:
  - 1. Self Inspection Reports

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Matting / Erosion Control Fabric (ECF): Matting and ECF shall be a 70% straw and 30% coconut blanket encased in a medium weight plastic netting (both sides). Matting shall be fully degradable but suitable until vegetation has been established. Installation of ECF shall be done with staples per temporary liner detail in the construction drawings. Commercially available ECFs may be used upon approval of the engineer. Approval of fabrics will require manufacturer's design data regarding velocity, shear strength, ditch slopes, method of installation, decay cycle, repair techniques, and grass growth enhancement characteristics.
- B. Wire Staples: 16 gauge steel wire, with minimum of 3" top and 4" long legs.
- C. Gravel for Stone Filters: #57 crushed stone.
- D. Filter Fabric: 7-1/2 oz. burlap fabric or other silt filtering fabric.
- E. Riprap:
  - 1. Class A: Stone shall conform to NCDOT standards and shall range in size from 2 to 6-inches with the stone gradation being equally distributed within the required size range.
  - 2. Class B: Stone shall conform to NCDOT standards and shall range in size from 5 to 12-inches with the stone gradation being equally distributed within the required size range.
- F. Temporary Construction Entrance: See Construction Plan for Details
- G. Inlet Protection: See Construction Plan for Details
- H. Skimmer Basins: See Construction Plan for Details
- I. Silt Fence/Tree Protection Combination: See Construction Plan for Details
- J. Silt Fence Outlets: See Construction Plan for Details
- K. Temporary Diversions: See Construction Plan for Details
- L. Dewatering Bag: See Construction Plan for Details

## **PART 3 EXECUTION**

### **3.01 INSTALL EROSION CONTROL DEVICES**

- A. Install erosion control devices, which shall be in place and operational prior to other land disturbing activity.
- B. After installing erosion control devices as indicated on the Drawings, verify that reasonable measures have been taken to prevent the sedimentation of nearby watercourses, existing and new facilities, and adjacent property.
- C. Should Contractor believe that additional measures are necessary to adequately prevent erosion, immediately notify Engineer. If rain is predicted before the Engineer can be notified, take measures as necessary to prevent siltation of nearby water courses and work will be paid for as provided in the General Conditions.

- D. After installing erosion control devices, request an inspection by the local agency having jurisdiction and the Engineer.
- E. Incorporate permanent erosion control work into the project at the earliest practicable time. Coordinate temporary erosion control measures with permanent erosion control measures and other work on the project to assure effective and continuous erosion control throughout the construction and post construction period.
- F. Maintain erosion control devices during construction until the disturbed areas are stabilized and the agency having jurisdiction and the Engineer have approved the removal of the erosion control devices.

### **3.02 BORROW AND DISPOSAL AREAS**

- A. Obtain and pay for erosion control permit for borrow and disposal areas as required by Contractor.
- B. Install and maintain erosion control devices in accordance with Contractor's approved plan.

### **3.03 MAINTENANCE**

- A. Inspect erosion control devices after each rainfall. Make required repairs immediately. Remove sediment deposits when deposits reach approximately one-half of the capacity of the erosion control device.
- B. Respread accumulated sediments on the project site in a manner that will not adversely affect erosion control facilities and permanent ground cover.
- C. Silt Fence: Should the filter fabric decompose or become ineffective before approval of its removal by the Engineer, replace fabric immediately at no additional cost to the Owner.
- D. Temporary Construction Entrance: Maintain entrance in a condition that will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with 2 inches of stone, as conditions require, at no additional cost to the Owner.

### **3.04 SEEDING**

- A. Disturbed areas not covered by new construction shall be seeded.
- B. Provide temporary and permanent seeding in accordance with Section, Lawns and Grasses.

### **3.05 STABILIZATION AND CLEAN-UP**

- A. Remove erosion control devices upon the approval of the permanent stabilization of this site by the agency having jurisdiction of the area and the Engineer. Dress sediment deposits remaining in place after the erosion control devices are removed to conform to the existing grade, prepared and seeded. Include cost of removal and cleanup in the cost of the installation of the device.

### **3.06 SELF INSPECTION AND MONITORING**

- A. Provide self-inspection and reporting as required by the Sedimentation Pollution Control Act for the duration of the project. These inspections will performed to ensure

that the approved sedimentation and erosion control measures on the Drawings are installed, maintained, and working adequately.

1. The inspections need to be conducted after each phase of the project, and continue until permanent ground cover is established.
  2. The self-inspection forms and information regarding this program are available at the following website: Form Rev 07012020
    - a. <https://www.deq.nc.gov/energy-mineral-and-land-resources/land-quality/combined-construction-stormwater-monitoring-form/demlr-monitoring-form-rev-07012020/download>
  3. Documentation of inspections shall be recorded on a single copy of the approved erosion and sedimentation control drawings. These Drawings and inspection reports shall be made available at the project site.
- B. Provide weekly self-monitoring in accordance with the NPDES Stormwater permit for all construction activities.

**END OF SECTION**

**SECTION 32 12 12**  
**PAVEMENT AND APPURTENANCES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Provide pavement, curb and gutter, and sidewalk sections as indicated on the Drawings and specified herein. Construction shall conform with the lines, grades, thickness, and typical cross-section indicated on the Drawings.
- B. Provide for the milling of the existing pavement.

**1.02 RELATED SECTIONS**

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
  - 1. Section 31 20 00 Earth Moving

**1.03 REFERENCED STANDARDS**

- A. The latest revision, at the time of bidding, of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
  - 1. N.C. Department of Transportation - Specifications for Roads and Structures (NCDOT). 2002
- B. Paragraphs in the NCDOT standard regarding measurement and payment do not apply to this Project.

**1.04 SUBMITTALS**

- A. Submit the following in accordance with Section, Submittal Procedures:
  - 1. Certificates of Compliance: Certificates shall attest that supplied products conform to the referenced standard and this specification, that all tests set forth in each applicable referenced publication have been performed, and that all test requirements have been met. Submit for each of the following materials:
    - a. Asphalt Concrete
    - b. Aggregate Base Course
    - c. Pavement Marking Material
    - d. Brick Pavers
    - e. Pervious Pavers

**1.05 PROTECTION OF EXISTING PAVEMENT, CURB AND GUTTER, AND SIDEWALK**

- A. Existing pavement, curb and gutter, and sidewalks at the site are in good condition. Contractor, Owner, and Engineer shall inspect the entire site prior to the start of construction and mark existing damaged areas and note areas on Contractor's plan set to be used for the Record Drawings.
- B. Protect existing pavement, curb and gutter, and sidewalks during construction.
- C. Remove areas of existing curb and gutter, and sidewalks damaged during construction. Removal shall include to the nearest existing joint. Replace damaged areas with new curb and gutter, and sidewalks to match the existing section.

- D. Remove areas of existing pavement damaged during construction. New pavement patch in the Right of Way Limits, shall consist of re-stabilizing the subgrade, and providing 8 inches of ABC and 2 inches of SF9.5C asphalt to match existing pavement surface.
- E. Repair damage to existing pavement, curb and gutter, and sidewalks.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS AND MIXES**

- A. Tack Coat: Conforming to materials and compositions required in NCDOT Section 605, Asphalt Tack Coat.
- B. Asphalt Concrete Surface Course - Type SF9.5B: Conforming to materials and composition required in NCDOT Section 610, Asphalt Concrete Plant Mix Pavements.
- C. Concrete for Curb and Gutter, and Sidewalks: Conforming to materials and composition required in NCDOT Section 846, Concrete Curb, Curb and Gutter, Concrete Gutter, Shoulder Berm Gutter, Concrete Expressway Gutter, Concrete Valley Gutter and Concrete Flumes, and Section 848, Concrete Sidewalks and Driveways and Wheelchair Ramps.
- D. Base Course: Aggregate base course shall comply with requirements of NCDOT Section 520, Aggregate Base Course.
- E. Pavement Markings and Symbols: Conforming to materials and composition required in NCDOT Section 1205, Pavement Marking General Requirements.
- F. Brick pavers: Type ASTM C62 grade SW, size, and color to match existing.
- G. Pervious Pavers: Techno Block, Pure and Valet, Refer to plans for details.

## **PART 3 EXECUTION**

### **3.01 PREPARATION OF SUBGRADE**

- A. Refer to applicable portions of Section, Earthwork.
- B. Compaction shall be to at least 95 percent maximum density Standard Proctor Method.
- C. Remove unsuitable material to a minimum depth of one foot and replace with an approved material. Loosen exceptionally hard spots and re-compact. Finish subgrade to provide uniform bearing surface.
- D. Maintain subgrade in satisfactory condition and properly drain until surface courses are placed.
- E. Preparation, shaping, and compaction shall be in accordance with NCDOT Section 500, Fine Grading Subgrade, Shoulders, and Ditches.



### **3.02 MILLING ASPHALT PAVEMENT**

- A. Milling of existing asphalt pavement shall be in accordance with applicable paragraphs of NC DOT Section 612.
- B. Milled asphalt shall be properly disposed by the Contractor.
- C. Minimize heavy construction equipment traffic within areas of reduced pavement sections .

### **3.03 AGGREGATE BASE COURSE**

- A. This applies to both the aggregate base course as indicated on the Drawings for paved and unpaved roads.
- B. The stone base shall be constructed in accordance with the applicable paragraphs of NCDOT Section 520.
- C. Compacted base shall be of the thickness indicated on the Drawings.

### **3.04 ASPHALT CONCRETE SURFACE COURSE**

- A. Spreading, compaction, and finishing shall comply with the requirements of NCDOT Section 610 Asphalt Concrete Plant Mix Pavements.
- B. Compacted thickness shall be as indicated on the drawings.

### **3.05 TACK COAT**

- A. Application rates, method of application, and curing shall be in accordance with the requirements of NCDOT Section 605.

### **3.06 CONCRETE CURB & GUTTER**

- A. Provide concrete curb and gutter where indicated on the Drawings. Curb and Gutter shall conform to the section indicated on the Drawings.
- B. Construct Curb and Gutter in accordance with NCDOT Section 846.

### **3.07 CONCRETE SIDEWALKS**

- A. Provide concrete sidewalks where indicated on the Drawings. Construction shall be in conformity with the materials, lines, grades, thickness, and typical section as indicated on the Drawings.
- B. Construct sidewalks in accordance with NCDOT, Section 848, and the following specifications.
- C. Space contraction joints equal to the width.
- D. Place a 1/2 inch wide expansion joint at all intersections and wherever walks abut structures and other walks.
- E. Place additional expansion joints at each fifth contraction joint.
- F. Walks shall receive a light broom finish.

### **3.08 PAVEMENT MARKINGS AND SYMBOLS**

- A. Mark parking spaces in paved areas with 4 inch white paint stripe the length of the parking space.

- B. Stripe roads maintained by the NCDOT or the local municipality in accordance with the agency requirements.
- C. Provide painted pavement symbols as indicated on the Drawings.

3.09 **BRICK PAVERS INSTALLATION**

- A. Compact existing earth with mechanical tamper.
- B. Provide geotextile fabric on top of compacted earth.
  - 1. D1910 6
  - 2. D1682 200
  - 3. D3786 320
  - 4. D751 80
- C. Provide 2-inches of compacted sand base.
- D. Install pavers in a pattern as indicated on the Drawings. Coursing shall be in straight line and not deviate more than 1/8-inch 15 feet.
- E. Scatter sand screenings and sweep into cracks.

3.10 **PERVIOUS PAVERS**

- A. Installation and details are found in construction plans.

**END OF SECTION**

**SECTION 32 92 00**  
**LAWNS AND GRASSES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work shall include, but not be limited to, the following:
  - 1. Surface preparation of subsoil.
  - 2. Placing topsoil.
  - 3. Addition of lime and fertilizer.
  - 4. Seeding.
  - 5. Maintenance to produce a permanent stand of grass.

**1.02 PAYMENT PROCEDURES**

- A. Base bid for the work on the specified quantities of lime, fertilizer, and seed. After the specified soil tests have been made, Engineer may vary specified quantities. Should the actual quantities applied in the field vary appreciably from those specified, an adjustment in the contract price may be made.

**1.03 REFERENCES**

- A. N.C. Department of Agriculture - NCDA
- B. U.S. Department of Agriculture - USDA

**1.04 PERFORMANCE REQUIREMENT**

- A. Grassed area shall be considered established when it presents a green appearance from eye level 50 feet away and the grass is vigorous and growing well in each square foot of seeded area. It is not required that the seeded area be thick and heavy as an old established lawn.
- B. Should the permanent seed not germinate and produce a strand of grass, reseed affected areas until a permanent stand is established.

**1.05 SUBMITTALS**

- A. Not less than 6 weeks prior to seeding, obtain representative soil samples from areas to be seeded and deliver the properly packaged samples with an information sheet for each sample properly filled out to the Soils Division of the NC Department of Agriculture or a private laboratory. Based on the test results, submit to the Engineer a recommendation as to the quantity and type of lime, fertilizer and seed for the area covered by the test.

**1.06 QUALITY ASSURANCE**

- A. Quality of fertilizer, lime, and seed, and operations in connection with the furnishing of this material, shall comply with the requirements of the N.C. Fertilizer, Lime and Seed Law; and with the requirements of the rules and, regulations adopted by the NC Department of Agriculture in accordance with the provisions of the said law.
- B. Seed containers shall bear an official "Certified Seed" label as inspected by the N.C. Crop Improvement Association.

- C. Packages for soil conditioners and fertilizer shall bear manufacturer's guaranteed analysis.
- D. Do not apply lime, fertilizer or seed in strong wind, when the soil is extremely wet, or otherwise unworkable. No rolling shall be done if precipitation after seeding would make the operation detrimental to the seed bed.

#### **1.07 DELIVERY, STORAGE, AND PROTECTION**

- A. Deliver grass seed mixture in sealed containers showing percentage of seed mix, year of production, net production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

#### **1.08 MAINTENANCE SERVICE**

- A. Maintain seeded areas until grass is well established and exhibits a vigorous growing condition for a minimum of two cuttings. Mow grass at regular intervals to a maximum height of 3 inches. Hand clip where necessary.
- B. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
- C. Water areas seeded between May 1 and July 15 at such intervals as to maintain the seeded area in a moist condition until the grass is established and accepted by the Engineer. Provide equipment to transport and distribute the water to the seeded areas. Areas seeded between September 1 and November 1 need not be irrigated beyond the initial watering specified above except that the Contractor may apply water at his own discretion.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds, and roots; pH value of minimum 5.4 and maximum of 7.0.
- B. Lime: Ground Dolomitic agricultural limestone, not less than 85 percent total carbonates, ground so that 50 percent passes 100 mesh sieve and 90 percent passes 30 mesh sieve. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing No. 100 mesh sieve.
- C. Fertilizer: Mixed, commercial, fertilizer containing 10-10-10 percentages of available nitrogen, phosphoric acid, and potash respectively, plus superphosphate with 20 percent P2O5 content. Fertilizer shall be dry, in granular (pellet) form, shall be delivered to the site in the manufacturer's original bag or container which shall be plainly marked as to formula.
- D. Seed: See construction plans for temporary and permanent seeding requirements.
- E. Matting / Erosion Control Fabric (ECF): Matting and ECF shall be heavy jute mesh over mulch held in place by staples. Commercially available ECFs may be used upon

approval of the engineer. Approval of fabrics will require manufacturer's design data regarding velocity, ditch slopes, method of installation, decay cycle, repair techniques, and grass growth enhancement characteristics.

- F. Wire Staples: 16 gauge steel wire, with minimum of 3" top and 4" long legs.
- G. Mulch: Threshed straw of oats, wheat, or rye; free from seed of obnoxious weeds; or clean salt hay. Straw which is fresh and excessively brittle or straw which is in such an advanced stage of decomposition as to smother or retard growth of grass will not be acceptable.
- H. Water: Water shall be free from substances harmful to growth of grass.

## **PART 3 EXECUTION**

### **3.01 PREPARATION OF SUBSOIL**

- A. Complete operations in the area to be seeded and prepare subsoil to eliminate uneven areas and low spots. Bring surface to the approximate design contours.
- B. Scarify subsoil to a depth of 3 inches. Remove weeds, roots, stones and foreign materials 1-1/2 inches in diameter and larger.

### **3.02 PLACING TOPSOIL**

- A. Place topsoil during dry weather and on dry unfrozen subsoil.
- B. Spread topsoil to a minimum depth of 4 inches. Remove vegetable matter and foreign non-organic material from topsoil while spreading. Grade surface to provide positive drainage and prevent water ponding. Lightly compact topsoil with at least one pass of a cultipacker or similar equipment
- C. Maintain the finished surfaces by protecting, and replacing topsoil and subsoil as necessary until the area is accepted under the contract.

### **3.03 APPLICATION OF LIME**

- A. Liming shall be done immediately after grading has reached the fine grading stage, even though actual seeding may not be done until several months later.
- B. Spread lime evenly by means of a mechanical distributor.
- C. When lime is distributed by commercial liming dealers, sales slips showing the tonnage delivered shall be filed with the Engineer and shall show the full tonnage required for the acres treated.
- D. Incorporate lime in the top 2 to 3 inches of soil by harrowing, disking, or other approved means.

### **3.04 APPLICATION OF FERTILIZER**

- A. Spread fertilizer not more than 2 weeks in advance of seeding.
- B. To verify application rate, determine acreage to be fertilized and provide Engineer with total weight of fertilizer applied to the area.

- C. Provide mechanical spreader for even distribution and spread half of the rate in one direction, and the other half at right angles to the first. Mix thoroughly into upper 2 to 3 inches of soil by disking, harrowing or other approved methods.

### 3.05 **SEEDING**

- A. Accomplish seeding by means of an approved power-drawn seed drill, combination corrugated roller-seeder, approved hand operated mechanical seeder, or other approved methods to provide even distribution of seed.
- B. Do not seed when ground is excessively wet or excessively dry. After seeding, roll area with a roller, not less than 18 inches in diameter and weighing not more than 210 pounds per foot of width. Upon completion of rolling, water area with a fine spray.
- C. Immediately following seeding apply mulch or matting. Do not seed areas in excess of that which can be mulched on same day.
- D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil depth

### 3.06 **MULCHING AND MATTING**

- A. Apply mulch or matting as required to retain soil and grass, but no less then the following:
  - 1. Slopes from 0 to 20 percent by spreading a light cover of mulch over seeded area at the rate of not less than 85 lbs. per 1000 sq. ft.
  - 2. Slopes greater than 20 percent mulch with matting. Pin matting to the ground with wire staples at 5 foot intervals, immediately after seeding.
  - 3. Use tack to prevent disruption of mulch.
- B. For tack use an asphalt tie-down of emulsified asphalt grade AE-3 or cut-back asphalt grade RC-2 or other approved equal. The application rate shall be 0.10 gal/sy (11 gal / 1000 sq ft). An approved jute mesh or net may be used in lieu of tacking straw mulch.
- C. Other types of mulch and anchoring methods may be used upon approval by the Engineer.

### 3.07 **PROTECTION**

- A. Protect seeded areas from damage by barricades, signs, and other appropriate means. Maintain and protect slopes from weather damage.

## **END OF SECTION**

**SECTION 33 14 13**  
**WATER DISTRIBUTION SYSTEM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work under this section includes, but is not limited to, piping, valves, fire hydrants, water service line, and appurtenances for a complete potable water distribution system.

**1.02 RELATED SECTIONS**

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
  - 1. Section 31 23 33 Trenching for Utilities
  - 2. Section 33 01 02 Disinfection of Potable Water System
  - 3. Section 33 05 07.23 Bore and Jack of Conduits
  - 4. Section 33 05 07.13 Horizontal Directional Drilling for Pipe Installation

**1.03 REFERENCE STANDARDS**

- A. AWWA A100
- B. AWWA C515
- C. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.
- D. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies; 2021.
- E. ASSE 1060 - Performance Requirements for Outdoor Enclosures for Fluid Conveying Components; 2017 (Reaffirmed 2025).
- F. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2025.
- G. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
- H. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2025.
- I. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2024.
- J. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2024.
- K. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 2019 (Reapproved 2025).
- L. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).

- M. ASTM F1483 - Standard Specification for Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe; 2023.
- N. AWWA A100 - Water Wells; 2020.
- O. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; 2022.
- P. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
- Q. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
- R. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.
- S. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges; 2020.
- T. AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe; 2021 (Reaffirmed 2023).
- U. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.
- V. AWWA C153/A21.53 - Ductile-Iron Compact Fittings; 2019.
- W. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.
- X. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; 2020.
- Y. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.
- Z. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm); 2022.
- AA. AWWA C909 - Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. (100 mm) and Larger; 2022.
- BB. NFPA 1 - Fire Code; 2024, with Errata.
- CC. NSF 61 - Drinking Water System Components - Health Effects; 2024.
- DD. Publications are referred to in the text by basic designation only.
  - 1. American Society for Testing and Materials (ASTM)
    - a. Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines 2016
    - b. Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures 2019
    - c. Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals. 2020
    - d. Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds 2020
    - e. Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals 2019
    - f. Standard Specification for Polyethylene Plastics Pipe and Fittings Materials 2014



- g. Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe 2014
- h. Standard Specification for Oriented Poly(Vinyl Chloride) PVCO, Pressure Pipe 2017
- 2. American Water Works Association (AWWA)
- 3. National Sanitation Foundation (NSF) Standards

#### 1.04 **SUBMITTALS**

- A. Submit the following in accordance with Section, Submittal Procedures:
  - 1. Affidavit of Compliance: Affidavit shall attest that supplied products conform to the referenced standard and this specification and that all tests set forth in each applicable referenced publication have been performed and that all test requirements have been met. Submit for each of the following materials:
    - a. Pipe and Fittings
      - 1) Ductile iron
      - 2) Valves
        - (a) Gate
        - (b) Tapping
        - (c) Post indicator
      - 3) Meters
    - b. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
      - 1) Pipe and Fittings
        - (a) Ductile iron
        - (b) Polyvinyl Chloride (PVC)
        - (c) Schedule 40 & 80
      - 2) Valves
        - (a) Gate
        - (b) Tapping
        - (c) Post indicator
      - 3) Tapping sleeves
      - 4) Valve boxes
        - (a) Valve markers
        - (b) Valve box collars
      - 5) Fire Department Connection
      - 6) Meters
    - c. Reports:
      - 1) Field test report for each section of pipe for the following:
        - (a) Measured chlorine residual
        - (b) Bacteriological test
        - (c) Pressure test
      - 2) Field test report for each backflow prevention device.
    - d. Operation and Maintenance Instructions: Submit complete operation and maintenance manual for the following:
      - 1) Valves
      - 2) Meters

## **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Provide a suitable pipe hook and/or rope sling properly certified for the load when handling the pipe with a crane, excavator, or backhoe. Lifting of the pipe shall be done in a vertical plane. Under no conditions shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to both the tongue and groove ends.
- B. Deliver pipe in the field as near as practicable to the place where it is to be installed. Distribute pipe along the side of the trench opposite to the spoil bank. Where necessary to move the pipe longitudinally along the trench, it shall be done in such a manner as not to injure the pipe or coating.
- C. Shield PVC pipe, PEX tubing and associated fittings stored on site from the sun's ultraviolet rays by suitable cover, or indoor storage.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Products with surfaces intended to be in contact with the potable water shall be certified and listed in accordance with NSF 61 for potable water.

### **2.02 DUCTILE IRON PIPE**

- A. Pipe 3-inch to 64-inch shall conform to AWWA C150, AWWA C151 and the following requirements:
  - 1. Pipe Size(s): As indicated on the Drawings
    - a. Nominal Laying Length: 20-feet
    - b. Minimum Pressure class: 350 (unless indicated otherwise)
    - c. Minimum Laying Condition: Type 2 See Section 31 23 33 Trenching for Utilities
- B. Pipe Joints:
  - 1. Below ground service: Push-on conforming to AWWA C111 and AWWA C151.
  - 2. Above ground service: Flanged conforming to AWWA C115/A21.15.
- C. Fittings: Conform to AWWA C110, or AWWA C153 and to the following requirements:
  - 1. Below ground service: Mechanical joints
  - 2. Above ground service: Flanged AWWA C115
    - a. Pressure Class: 250
    - b. Flange Material: Ductile Iron
    - c. Pipe wall thickness: As required by AWWA C115
  - 3. Material: Ductile Iron
- D. Special Pipe Joints
  - 1. Restrained
    - a. Restrained joint fittings may be push-on joint type.
    - b. Megalugs, Series 1100, as manufactured by EBAA Iron Sales or approved equal shall be allowable for restraint where fittings or valves are not available with restrained joints from the pipe manufacturer.

## 2.03 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

### A. General

1. Pipe and fitting size shall be as indicated on the Drawings.
2. PVC materials shall comply with ASTM D1784 with a cell classification of 12454.
3. Pipe shall be certified and listed for potable water distribution products in accordance with NSF 14 or NSF 61 and bear the NSF seal on each section of pipe.
4. Pipe: Blue in color for potable water use.

### B. Schedule 40 & 80: Schedule 40 & 80 PVC pipe 1/2-inch to 12-inch shall conform to ASTM D1785 and the following requirements:

1. Outside diameter shall conform to iron pipe.
2. Pipe shall be schedule Select Schedule.
3. Pipe shall have an integral elastomeric-gasket bell end or solvent weld joints.
4. Fittings for the pipe shall conform to ASTM D2466 or ASTM D2467 as appropriate for the pipe schedule.

## 2.04 TAPPING SLEEVE

- ### A. Tapping Sleeve: Tapping sleeves shall be 304 stainless steel, flanged for the tapping valve and manufactured for a working pressure of 150 psi. Sleeve shall have a full body 360-degree gasket. Sleeve shall have a 3/4-inch test plug. Bolts and nuts shall be stainless steel.

## 2.05 VALVES

### A. General: Valves shall meet the following requirements:

1. Size shall be as required for the pipe size and material as indicated on the Drawings and specified.
2. Open by counterclockwise rotation.
3. Provide an interior protective epoxy coating in accordance with AWWA C550 on ferrous surfaces in contact with the liquid.
4. Components in contact with the liquid shall be in compliance with NSF 61.
5. Standard system working pressure is 84 pressure psi.
6. Equip valves with a suitable means of operation.
7. Ends shall be mechanical joint for underground location and flanged joint for above ground location/underground utility vaults.
8. For buried valves over 5 feet deep, provide extension stems of cold rolled steel to bring the operating nut to within 2 feet of the ground surface. Extension stems shall also be provided as required for floor stands and to floor valve box.
9. Provide valve accessories as required for proper valve operation for valve locations as indicated on the Drawings and as recommended by valve manufacturer.
10. Similar valve types shall be of one manufacturer.

### B. Gate Valves, Resilient-Seated: Gate valves 3-inch to 20-inch shall conform to AWWA C509 or AWWA C515 and to the following requirements:

1. O-ring stem seal on non-rising (NRS) stem valves.
2. Ends shall be mechanical joint for underground locations and flanged joint for above ground locations.

3. Valves shall be non-rising stem (NRS) with wrench nut for underground locations and Outside Screw and Yoke (OS&Y) with handwheel for above ground locations unless noted otherwise on the Drawings.
  4. Valves 16-inch and larger shall be equipped with gearing to facilitate opening. Gear cases shall be extended or totally enclosed type. Geared valves shall be equipped with indicators to show the position of the gate in relation to the water.
  5. Valves 16-inch and larger shall be equipped with a by-pass.
  6. Special material for bolts and nuts.
- C. Tapping Valves: Tapping valves shall conform to the specifications for the gate valves as indicated in this Section and the following:
1. Valve shall be specifically modified for the passage and clearance of the tapping machine cutter.
  2. The mating end to the tapping sleeve shall be raised male surface to provide true alignment to the sleeve and tapping machine. The valve shall be compatible with the tapping sleeve.

## 2.06 VALVE ACCESSORIES

- A. Valve Box, Below Ground: Boxes shall be high strength cast iron of the screw or telescopic type. Box shall consist of a flare base section, center extension as required, and a top section with the word "WATER" cast in the cover. Length of box shall be such that full extension of box is not required at the depth of water main cover. Valve Boxes shall consist of no more than two sections; dis-similar materials (such as PVC pipe) are not permitted for deep installations
- B. Extension Stem (if necessary): Stem shall be sized so as to transmit full torque from the operating mechanism to the valve stem without binding, twisting, or bending. Stem shall be made from extra heavy steel pipe, bronze, stainless steel, cold rolled steel, galvanized. Stem shall be complete with couplings for connection to valve and floor stand where required. When valve extension kits are used they must be as recommended by the valve manufacturer.

## 2.07 INDICATOR POST

- A. Indicator post shall be made of carbon steel or ductile iron. Post shall be UL Listed and FM approved. Design shall allow for the addition of a supervisory switch. The operating wrench shall be easily removed by Owner. Wrench shall also be able to be locked to the post with a padlock (owner supplied) to prevent unauthorized operation.
- B. Post Indicator shall be the vertical type, having two large window openings covered with a heavy clear plexiglass at the post top. Aluminum target plates shall be provided with the words OPEN and SHUT cast in large, easy-to-read, raised letters located directly behind each window.
- C. Stem, indicators and working parts shall be fully protected from moisture and weather damage by complete enclosure.
- D. Operating nuts shall be 1-1/4 inches square. Provide wrench with the indicator post.
- E. Provide tamper switch to allow for connection to building security system. Gate valve tamper switches shall be installed on valve in accordance with manufacturer's instructions. The mechanism shall be contained in a weatherproof die cast aluminum housing, which shall provide a 3/4 inch tapped conduit entrance and incorporate the

necessary facilities for attachment to the valve. Switch housings shall be finished in red baked enamel. Switch mechanism shall have a minimum rated capacity of one amp, 125 volt AC - .25 amp. 24 volt DC. Assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting. Gate valve switches shall be Underwriter's Laboratories listed and Factory Mutual approved. Provide and turn over to Owner a wrench for tamper boxes.

## **2.08 METERS**

- A. Compound Meters: Compound meters shall conform to AWWA C702 and to the following requirements:
  - 1. Meter size shall be as indicated on the Drawings.
  - 2. Meter ends shall match pipe fittings.
  - 3. Provide magnetic drive with sealed gear housing.
  - 4. Main casing shall be cast iron.
  - 5. Totalizer shall have:
    - a. 4-inch dial reading in gallons
    - b. Six-digit totalizer
    - c. Circular test dial
    - d. Must be capable of remote readout to match Owner's existing system.

## **2.09 DISINFECTANT**

- A. The following products may be used as the disinfectant:
  - 1. Chlorine, liquid: AWWA B301.
  - 2. Hypochlorite, calcium and sodium: AWWA B300.

# **PART 3 EXECUTION**

## **3.01 GENERAL**

- A. Pipe installation shall meet the following general guidelines:
  - 1. Lay pipe in the presence of Engineer, unless specifically approved otherwise.
  - 2. Handle pipe and accessories in accordance with manufacturer's recommendations. Take particular care not to damage pipe coatings.
  - 3. Carefully inspect pipe immediately prior to laying. Do not use defective pipe. Replace pipe damaged during construction.
  - 4. Lay pipe to grade and alignment indicated on the Drawings.
  - 5. A minimum distance of 12 inches shall be maintained between the outside of the water main and the outside of other utilities.
  - 6. Provide proper equipment for lowering pipe into trench.
  - 7. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
  - 8. Provide tight closure on pipe ends when work is not in progress.
  - 9. Keep pipe interior free of foreign materials.
  - 10. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendations.
  - 11. Disinfection of pipe during installation:
    - a. Soak gaskets for minimum of one hour in a 50 - 100 ppm hypochlorite solution prior to installation.
    - b. Mop bells and spigots of pipe, fittings and valves with a 50 - 100 ppm hypochlorite solution immediately prior to making joints.

12. Block fittings with concrete, or restrain as indicated on the Drawings or as required to prevent movement.

### 3.02 **RELATION OF WATER MAINS TO NON-POTABLE WATER MAINS**

- A. For the purposes of this paragraph, sewer shall mean any existing or proposed gravity or force main used to convey sanitary or industrial process waste.
- B. Lateral Separation of Sewers and Water Mains. Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation, in which case:
  1. The water main shall be laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
  2. the water main shall be laid in the same trench as the sewer, with the water main located at one side on a bench of undisturbed earth and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
- C. Crossings. A water main that crosses a sewer shall be laid a minimum vertical distance of 18 inches from the outside of the water main and the outside of the sewer, either above or below the sewer, with preference to the water main located above the sewer. One full length of water pipe shall be located so that both joints will be as far from the sewer as possible.
- D. Water Mains and Reclaimed Water Distribution Lines. Water lines shall be located at least 10 feet horizontally from or at least 18 inches above water pipes carrying treated and disinfected wastewater in reclaimed water distribution lines. Crossings shall be made in accordance with Paragraph (B) .

### 3.03 **WATER SERVICE**

- A. Water service lines shall extend from the main distribution line to a meter box located at the right-of-way.
- B. 3/4-inch water service lines may be direct tapped to ductile iron pipe. Water service taps larger than 3/4-inch shall be made using a service saddle.
- C. Taps shall be located at 10 or 2 o'clock on the circumference of the pipe.
- D. Service taps shall be staggered, alternating from one side of the water main to the other and at least 12 inches apart.
- E. Taps on the same side of the main shall be a minimum of 24 inches apart.
- F. Taps shall be minimum 18 inches from any pipe joint.
- G. Service line piping shall be one continuous line with no intermediate couplings.
- H. Install meter boxes and water service components so top of meter will be within 6 inches of the surface.
- I. Owner will provide and install water meter.

### 3.04 **DUCTILE IRON PIPE**

- A. Install pipe in conformance with AWWA C600 and the following:
  1. For laying pipe in a vertical or horizontal curve, each full length pipe may be deflected by the following offset distance, unless otherwise directed by the pipe manufacturer:

- a. Push-on joint
  - 1) 3 to 12-inch pipe: 14-inch offset
  - 2) 14 to 36-inch pipe: 8-inch offset
- b. Mechanical joint
  - 1) 3 to 6-inch pipe: 20-inch offset
  - 2) 8 to 12-inch pipe: 15-inch offset
  - 3) 14 to 20-inch pipe: 8-inch offset
  - 4) 24 to 36-inch pipe: 6-inch offset
- 2. For laying restrained joint pipe in a vertical or horizontal curve, except for horizontal directional drills (HDD), each full length pipe may be deflected by the following offset distance, unless otherwise directed by the manufacturer:
  - a. 6 to 12-inch pipe: 11-inch offset
  - b. 16 to 20-inch pipe: 7-inch offset
  - c. 24 to 30-inch pipe: 5-inch offset
  - d. 36-inch pipe: 4-inch offset
  - e. 42 to 48-inch pipe: 1 ¼ -inch offset

### 3.05 **PVC PRESSURE PIPE**

- A. Install PVC C900 pipe in conformance with AWWA C605.
- B. Solvent Weld: Field cut ends shall be sanded to roughing the surface. Joints shall be cleaned of foreign material. Solvent shall be applied to the joint and joint made as recommended by the manufacturer. Excess solvent shall be wiped off. Joint should not be moved until sufficiently set up.
- C. Bell and Spigot Joints: Clean bell and spigot ends prior to jointing. Ends of field cut pipe shall be beveled with file. Gasket shall be clean and lightly lubricated. Joint shall be made as recommended by the manufacturer.

### 3.06 **VALVES AND FITTINGS**

- A. Install buried valves on top of an 18-inch square, 3-inch thick, solid concrete pad (minimum dimensions). The concrete pad may be provided by a pre-cast manufacturer or cast-in-place in the field above grade. Concrete used for the pads shall be a minimum 3,000 psi mix. The pads may not be cast-in-place in the pipe trench. Connection to pipe shall be such that there shall be no stress at the joint caused by misalignment or inadequate support of pipe or valve.
- B. Valve Box: Set a valve box over each buried valve. Support box so that no stress shall be transmitted to the valve or pipe line. Install box plumb and set top flush with finished grade. Operating nut shall be centered in box. Provide a 24-inch x 24-inch wide by 6-inch thick concrete pad at top of valve boxes outside paved areas.
- C. Valve operation nut shall be within 24 inches of the top of box. Provide stem extension if necessary to bring operating nut to within 24 inches of the top of box.
- D. Install fittings as recommended by the manufacturer. Fittings shall be blocked or otherwise restrained from movement.
- E. Install valves, gates, and accessories indicated on the Drawings and in complete accordance with the manufacturer's recommendations.
- F. Install air / vacuum valve inside a manhole.

### 3.07 **POST INDICATOR VALVE**

- A. Post indicator shall be installed plumb and such that the top of the post is 36" above finished grade.
- B. The "OPEN" and "SHUT" targets shall be set for the appropriate valve size.
- C. Coordinate installation of tamper switch with electrical contractor. Mount switches so not to interfere with the normal operation of the valve and shall be adjusted to operate within two revolutions of the valve control or when the stem has moved no more than one-fifth of the distance from its normal position.

### 3.08 **METERS**

- A. Install meter boxes and water service components so top of meter will be within 6 inches of the surface.

### 3.09 **PAINTING**

- A. Equipment shall receive the manufacturer's standard coating for the intended application. Coatings shall be suitable for the intended application.
- B. Repaint damaged paint surfaces.
- C. Above ground piping and piping within vaults shall be painted in accordance with Section, Painting.

### 3.10 **PRESSURE TESTING**

- A. Pressure test in accordance with AWWA C600 for ductile iron pipe and AWWA C605 and AWWA M23 for PVC pipe and as specified herein
- B. General:
  - 1. The Engineer shall approve the source, quality, and method of disposal of water to be used in test procedures.
  - 2. Obtain Owner's permission 48 hours prior to filling or flushing of pipe system with water from Owner's water system. Owner shall operate valves connected to the existing water system. Where large quantities of water may be required for flushing, Owner reserves the right to require that flushing be done at periods of low demand.
  - 3. Clean and flush pipe system of foreign matter prior to testing.
  - 4. Provide air vents at the high points in the line section to be tested for releasing of air during filling. Service corporation stops may be used for air vent when located at a high point. Include cost of air vents in price of testing. Leave corporation stops in place after testing and note locations on As-Built Drawings.
  - 5. Allow concrete blocking to reach design strength prior to pressure testing.
  - 6. Test main prior to installation of service taps.
  - 7. Repair defects in the pipe system. Make repairs to the same standard as specified for the pipe system.
  - 8. Retest repaired sections until acceptance.
  - 9. Repair visible leaks regardless of the test results.
  - 10. Pipe sections shall not be accepted and placed into service until specified test limits have been met.
- C. Testing
  - 1. Notify Owner and Engineer a minimum of 48 hours prior to testing.



2. Perform tests in the presence of Engineer.
3. Make pressure tests between valves. Furnish suitable test plugs where line ends in "free flow."
4. Upon completing a section of pipe between valves, test pipe by maintaining for a two-hour period a hydrostatic pressure of 150 psig.
5. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.
6. No length of line shall be accepted if the leakage is greater than that determined by the following formula based on the appropriate test pressure: (Note: The below formulas are an algebraic reduction of the formula from AWWA C605 for PVC pipe and AWWA C600 for DI of  $Q = (LD(\text{sq root of } P) / 148,000$ . Assumes 50 joints in 1,000 feet)
  - Q = Allowable leakage per 1,000 feet of pipe in gallons per hour.
  - D = Nominal diameter of the pipe in inches.
  - 100 psi:  $Q = D \times 0.07$
  - 150 psi:  $Q = D \times 0.08$
  - 200 psi:  $Q = D \times 0.09$
  - 250 psi:  $Q = D \times 0.10$

### 3.11 DISINFECTION

- A. After satisfactory completion of the pressure test, disinfect new potable water mains and existing mains that have required repair in accordance with AWWA C651 and as specified herein.
- B. General:
  1. Provide a superintendent experienced in the required procedures for disinfecting with chlorine.
  2. Obtain Owner's permission 48 hours prior to filling, flushing, and chlorinating of the water mains. Owner shall operate valves connected to the existing water system.
  3. Do not allow highly chlorinated water into the existing distribution system.
  4. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize the residual chlorine. Federal, state, or local environmental regulations may require special provisions or permits prior to disposal of highly chlorinated water.
  5. Perform disinfection and testing in the presence of Engineer.
- C. Connection to Existing System: Notify Owner 48 hours prior to making connections to the existing system. Thoroughly clean the existing water main exterior prior to the installation of tapping sleeves and corporation stops. Lightly dust with calcium hypochlorite powder the water main exterior and the interior surface of the tapping sleeve, and corporation stops.
- D. After satisfactory flushing of the main, disinfect by injection of a chlorine solution. Induce chlorine in sufficient quantity to maintain a chlorine residual of at least 50 ppm throughout the system to be tested. Maintain the chlorine solution in the system for at least 24 hours.
- E. Valves and Fire Hydrants: Open and close valves on the mains being disinfected a minimum of three times during the chlorine contact period and a minimum of three times during flushing. Fire hydrants and other appurtenances should receive special attention to insure proper disinfection.

- F. For Cut-In Construction: Use the following procedures for disinfecting of the new installation and the existing main at the cut-in point in accordance with AWWA C651, Section 9:
  - 1. Apply liberal quantities of hypochlorite, in the form of tablets, to the open trench.
  - 2. Interior of new pipe and fittings and the ends of the existing mains shall be swabbed or sprayed with a one percent hypochlorite solution before installation.
  - 3. Install a 2-inch tap downstream of the work area. Tap shall be used for blowing off the main or use the next fire hydrant downstream of the work area for blowing off the main.
  - 4. Install a 2-inch tap just upstream of the new installation. Control Water from the existing system so as to flow slowly into the work area during the application of chlorine. After the line is thoroughly flushed, add chlorine solution at a concentration of 100 ppm by the continuous feed method and hold in the main for one (1) hour.
- G. Prior to flushing, the free chlorine residual shall be a minimum of 10 ppm. Flushing of the lines shall proceed until the lines contain the normal chlorine residual of the system.
- H. Test in the field for free chlorine residual:
  - 1. Sample location shall be the same as required for the bacteriological test samples.
  - 2. Immediately after injection of the chlorine solution. Sample shall have a chlorine residual as specified.
  - 3. Prior to flushing of the highly chlorinated water from the potable water system and a minimum of 24-hours after the initial injection of the chlorine. Sample shall have a minimum chlorine residual as specified.

### 3.12 BACTERIOLOGICAL TESTING

- A. Required location for obtaining water samples:
  - 1. Every 2,000 lf
  - 2. End of each main.
  - 3. A minimum of one from each branch.
  - 4. Mains at cut-in locations: Each side of work area. Time between samples to be determined by Engineer in field.
- B. A laboratory, certified for the required testing by the State of North Carolina, shall collect the sample and perform the testing. The laboratory shall be the same for both sampling and testing.
- C. Obtain two water samples at each specified location for bacteriological testing. Take the first sample immediately after flushing the chlorinated water and again in 24-hours.
- D. Recommended additional samples. During the required sampling of water from the new system, it is recommended that samples be taken from the existing potable water source to determine if coliforms are present.
- E. Take care in sampling. No hose or fire hydrant shall be used for the collection of samples. Take samples from an approved sample tap consisting of a corporation stop installed in the main with a copper tube gooseneck assembly. Operation shall be such as to ensure that the sample collected is from water that has been in the new system.

Copper tube gooseneck assembly shall be removed and sample tap corporation stop shut off upon completion of testing bacteriological testing is requirements.

- F. Test samples for the presence of coliform organisms in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater. Testing method used shall be the multiple-tube fermentation technique, the membrane-filter technique, or presence/absence.
- G. Test for odor. The water in the new system should also be tested to assure that no offensive odor exists due to chlorine reactions or excess chlorine residual.
- H. If samples show the presence of coliform, procedure 1 or 2 described below shall be followed, with the approval of the Owner, before placing the unit or facility in service.
  - 1. Take repeat samples at least 24 hours apart until consecutive samples do not show the presence of coliform.
  - 2. Again subject the system to chlorination and sampling as described in this section.
- I. If samples are free of coliform, and with the approval of the Owner, the potable water system may be placed in service.
- J. Contamination: If, in the opinion of the Engineer, possible contaminants have entered the existing water system, or water samples show the water in the existing system to be unsafe on completion of the work, the existing water system shall be disinfected as specified herein and shall include all contaminated components. Disinfection of the existing system shall be coordinated with the Owner.

### 3.13 VALVE OPERATION

- A. Prior to final acceptance provide competent personnel to operate each valve in presence of Engineer. Verify that valves are left in the open position.

**END OF SECTION**

**SECTION 33 31 11**  
**SANITARY SEWER SYSTEM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work under this section includes, but is not limited to, piping, valves, and appurtenances for a complete sanitary sewer collection system.

**1.02 RELATED SECTIONS**

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
1. Section 31 32 33, Trenching and Backfilling for Utilities

**1.03 REFERENCES**

- A. Publications are referred to in the text by basic designation only.
1. American Society for Testing and Materials (ASTM)
    - a. Gray iron Castings and Valves, Flanges and Pipe Fittings.
    - b. Reinforced Concrete Low-Head Pressure Pipe.
    - c. Flexible Watertight Joints for Precast Manhole Sections
    - d. Precast Reinforced Concrete Manhole Sections 88a
    - e. Low-Pressure Air Test of Vitrified Clay Pipe Lines (4 to 12 inch) 78
    - f. Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
    - g. Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
    - h. Test Method for Concrete Sewer Manholes by the Negative Air Pressure 93
    - i. Polyethylene Plastics Molding and Extrusion Materials
    - j. Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds 81
    - k. Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series) 89
    - l. Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
    - m. Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Pipe 95
    - n. Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 89
    - o. Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals 77
    - p. Polyethylene Plastics Pipe and Fittings Materials
    - q. Elastomeric Seals (Gaskets) for Joining Plastic Pipe 76
    - r. Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter 89a
    - s. Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings 96a
    - t. Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
    - u. Specification for Oriented Poly(Vinyl Chloride) PVCO, Pressure Pipe
  2. American Water Works Association (AWWA)
    - a. Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water 95

- b. Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids 93
- c. Ductile-Iron and Gray-Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids 93
- d. Flanged Ductile-Iron Pipe with Threaded Flanges 94
- e. Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids 96
- f. Ductile-Iron Compact Fittings, 3 inch through 16 inch, for Water and Other Liquids 94
- g. Rubber-Seated Butterfly Valves 94
- h. Ball Valves, 6 inch through 48 inch
- i. Swing-Check Valves for Waterworks Service, 2 inch Through 24 inch NPS 93
- j. Resilient-Seated Gate Valves for Water Supply Service 94
- k. Air-Release, Air / Vacuum, and Combination Air Valves for Waterworks Service 92
- l. Protective Epoxy Interior Coatings for Valves and Hydrants 90
- m. Standard for Installation of Ductile Iron Water Mains and Their Appurtenances 87
- n. Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water 94
- o. Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 12 inch, for Water Distribution 97
- p. Polyethylene (PE) Pressure Pipe and Fittings 4 inch through 63 inch for Water Distribution
- q. C909
- r. PVC Pipe - Design Installation 80
- 3. National Sanitation Foundation (NSF) Standards
  - a. Plastic Piping Components and Related Materials
- 4. UNI-BELL Plastic Pipe Association (UNI)
  - a. Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Sewer Pipe 89
  - b. Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe 90

#### 1.04 SUBMITTALS

- A. Submit the following in accordance with Section, Submittal Procedures:
  - 1. Affidavit of Compliance: Affidavit shall attest that supplied products conform to the referenced standard and this specification and that tests set forth in each applicable referenced publication have been performed and that test requirements have been met. Submit for each of the following materials:
    - a. Pipe
      - 1) SDR 35
      - 2) Schedule 40, drain, waste, and vent (DWV) pipe
    - b. Pre-cast concrete manholes
  - 2. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
    - a. Pipe
      - 1) SDR 35
      - 2) Schedule 40, drain, waste, and vent (DWV) pipe

- b. Pre-cast Concrete Manholes and the following appurtenances:
  - 1) Manhole steps
  - 2) Pipe connectors
  - 3) Joint material
  - 4) Castings
- 3. Operation and Maintenance Instructions: Submit complete operation and maintenance manual for the following:

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide a suitable pipe hook or rope sling when handling the pipe with a crane. Lifting of the pipe shall be done in a vertical plane. Under no conditions shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to both tongue and groove ends.
- B. Deliver pipe in the field as near as practicable to the place where it is to be installed. Distribute pipe along the side of the trench opposite to the spoil bank. Where necessary to move the pipe longitudinally along the trench, it shall be done in such a manner as not to injure the pipe or coating.
- C. Shield PVC pipe and fittings stored on site from the sun's ultraviolet rays by suitable cover, or indoor storage.

### PART 2 PRODUCTS

#### 2.01 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

- A. General
  - 1. Pipe and fitting size shall be as indicated on the Drawings.
  - 2. PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
  - 3. Pipe shall have an integral elastomeric-gasket bell end. Gaskets shall be in conformance with ASTM F477.
  - 4. See Section, Trenching for Utilities, for trench bedding and haunching requirements.
- B. SDR 35: PVC SDR 35 gravity sewer pipe 4-inch to 15-inch and related fittings shall conform to ASTM D-3034 and the following requirements:
  - 1. Pipe shall have standard dimension ratio of SDR 35.
  - 2. Nominal pipe length shall be a minimum of 13 feet.

#### 2.02 MANHOLES

- A. Provide manholes made of precast concrete sections in conformance with ASTM C478, NC Department of Transportation, and the following requirements:
  - 1. General
    - a. Provide manholes to the depth as indicated on the Drawings. Manhole inside diameter shall be 4 feet unless noted otherwise on the Drawings.
    - b. Precast concrete manholes shall be as manufactured by Adams Concrete, Carolina Precast Concrete, Inc., D & M Concrete Specialties, Inc., N. C. Products Corp., Stay Right Tank, Tindall Concrete Products, Inc. or approved substitute.
  - 2. Precast Concrete Sections
    - a. Minimum wall thickness shall be 5-inches.

- b. Base: Cast monolithically without construction joints or with an approved PVC waterstop in the cold joint between the base slab and the walls. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.
  - c. Riser: Minimum lay length of 16 inches.
  - d. Eccentric Cone: Top inside diameter shall be 24 inches. Width of the top ledge shall be no less than the wall thickness required for the cone section.
  - e. Transition Cone: Provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Minimum slope angle for the cone wall shall be 45 degrees.
  - f. Transition Top: Provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. Tops shall not be used in areas subject to vehicle traffic.
  - g. Flat Slab Top: Designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces. Provide a float finish for exterior slab surface.
  - h. Precast or core holes for pipe connections. Diameter of hole shall not exceed outside diameter of pipe by more than 3-inches.
  - i. Grade Rings: May be used to adjust frame and cover to finished grade. Grade Rings shall be no less than 4 inches in height.
  - j. Lifting Devices: Devices for handling precast components shall be provided by the precast manufacturer and comply with OSHA Standard 1926.704.
3. Joints
- a. Manufacturer in accordance with tolerance requirements of ASTM C 990 for butyl type joints.
  - b. Minimize number of joints. Do not use riser section for manholes up to 6 feet tall and no more than one riser for each additional 4 feet in height.
  - c. Flexible Joint Sealants: Preformed butyl rubber based sealant material conforming to Federal Specification SS-S-210A, Type B and ASTM C990.
  - d. External Seal: Polyethylene backed flat butyl rubber sheet no less than 1/16-inch thick and 6-inches wide.
4. Inverts
- a. Brick and mortar or precast concrete invert.
  - b. Form and finish invert channel to provide a consistent slope from inlet(s) to outlet up to 4-inches.
  - c. Channel walls shall be formed to 3/4 of the height of the outlet pipe diameter.
  - d. Finish benches with a minimum uniform 1.5:12 slope. Provide a 1/4-inch radius at the edge of bench and trough.
5. Flexible Pipe Connectors: Provide flexible connectors for pipe to manhole that conform to ASTM C923. Location of connectors shall vary from Project Drawings no more than 1/2-inch vertically and 5 degrees horizontally. Provide stainless steel pipe clamp type band around flexible connection to sewer pipe.
6. Manhole Steps:
- a. Steps shall be in accordance with ASTM C478 and made of 1/2-inch grade 60 steel encapsulated by co-polymer polypropylene and have serrated tread and tall end lugs.
  - b. Secure steps to the wall with compression fit in tapered holes or cast-in-place. Align steps along a vertical wall and shall not be located over a pipe opening. First step shall be a maximum of 26 inches from the bottom.

- c. Steps shall be by American Step Co., Inc., Bowco Industries, Inc., M. A. Industries, Inc. or approved substitute.

## 2.03 CASTINGS

### A. General

1. Made of gray iron, ASTM A-48 - class 30, or ductile iron, ASTM A536, grade 65-45-12.
2. Castings shall be free from imperfections not true to pattern. Casting tolerances shall be plus or minus 1/16-inch per foot of dimension. Top shall set neatly in frame, with edges machined for even bearing and proper fit to prevent rattling and flush with the edge of frame.
3. Castings shall be as manufactured by Neenah Foundry Co., U.S. Foundry & Manufacturing Corp., or Vulcan Foundry

### B. Manhole Frame and Cover:

1. Minimum clear opening shall be 22 inches.
2. Minimum weight for frame and cover shall be 300 pounds and suitable for Heavy Duty Highway Traffic Loads of H-20.
3. Frame shall have four 3/8-inch anchor bolt holes equally spaced.
4. Cast "Sanitary Sewer" on the cover. Casting shall bear the name of the manufacturer and the part number.
5. Provide solid cover.
6. Provide cover with two 1-inch perforated holes unless noted as watertight on the Drawings.
7. Provide the following where indicated on the Drawings:
  - a. Ring and cover shall be watertight.
  - b. Bolt down cover. Bolt down covers shall be provided with four (4) 3/8-inch stainless steel hex head bolts at 90 degrees.

## 2.04 TRANSITION COUPLINGS FOR GRAVITY SEWER PIPE

- A. Pipe material changes between manholes may be permitted provided there is not a substantial difference in inside diameters, a smooth uniform flow line is maintained and a watertight rubber sleeve or mechanical coupler conforming to ASTM C-425 is used to make the transition. Metal hardware shall be stainless steel. Transition sleeves shall be manufactured by Fernco, Indiana seal or approved equal.

## 2.05 SEWER SERVICE

- A. Provide PVC service wye the same material as the main. Saddles shall be solvent welded and fastened with double stainless steel bands.
- B. Insert a Tee or approved equal shall be used for connection to PVC ribbed pipe.
- C. Service saddle for cast iron soil pipe services may be "ROMAC C" sewer saddles consisting of a virgin SBR gasket compounded for sewer service, a ductile iron saddle casting, a 304 stainless steel adjustable strap for fastening the gasket and the saddle casting to the sewer main, and a 304 stainless steel adjustable circle clamp for securing the service line into the SBR gasket.



## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Pipe installation shall meet the following general guidelines:
  - 1. Lay pipe in the presence of Engineer, unless specifically approved otherwise.
  - 2. Handle pipe and accessories in accordance with manufacturer's recommendations. Take particular care not to damage pipe coatings.
  - 3. Carefully inspect pipe immediately prior to laying. Do not use defective pipe. Replace pipe damaged during construction.
  - 4. Lay pipe to grade and alignment indicated on the Drawings.
  - 5. Provide proper equipment for lowering pipe into trench.
  - 6. Provide tight closure pipe ends when work is not in progress.
  - 7. Keep pipe interior free of foreign materials.
  - 8. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
  - 9. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendation.
  - 10. Block fittings with concrete, or restrained as indicated on the Drawings or as required to prevent movement.
- B. Gravity Pipe: Gravity pipe installation shall meet the following general guidelines:
  - 1. Lay pipe upgrade from the lower end and at the grades and alignment indicated on the Drawings.

### **3.02 RELATION OF WATER MAINS TO SEWERS**

- A. Lateral Separation: Lay water mains at least 10 feet laterally from existing and proposed sewers. Where existing conditions prevent a 10-foot lateral separation, the following shall be followed with approval of the Engineer:
  - 1. Lay water main in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
  - 2. Lay water main in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
- B. Crossing Separation: Lay bottom of water main at least 18 inches above the top of the sewer. Where existing conditions prevent an 18-inch vertical separation, construct both the water main and sewer of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.
- C. Crossing a Water Main Under a Sewer: When it is necessary for a water main to cross under a sewer, construct both the water main and the sewer of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

### **3.03 SEWER PIPE**

- A. Lay sewer pipe to true lines and grades by use of laser beam equipment or other acceptable means.
- B. Minimum Separation Distances:

1. 100-foot horizontal separation from wells or other water supplies.
2. 24-inch vertical separation from storm sewers or ferrous pipe shall be used.
3. For separation from water mains see paragraph 3.02 above.

#### 3.04 **MANHOLES**

- A. Set base plumb and level. Align manhole invert with pipe invert.
- B. Secure pipe connectors to pipe in accordance with manufacturer's recommendation.
- C. Clean bells and spigots of foreign material that may prevent sealing. Unroll the butyl sealant rope directly against base of spigot. Do not stretch. Follow manufacturer's instructions when using O-ring seals.
- D. Set precast components so that steps align.
- E. Plug lift holes using a non-shrink grout. Cover with a butyl sealant sheet on the outside and seal on the inside with an application of an epoxy gel 1/8-inch thick extending 2 inches beyond the opening.
- F. Set manhole frames to grade with grade rings. Seal joints between cone, adjusting rings, and manhole frame with butyl sealant rope and sheet.
- G. Apply external seal to the outside of joint.
- H. Finish the interior by filling fractures greater than 1/2-inch in length, width or depth with a sand cement mortar.
- I. Clean the interior of the manhole of foreign matter.

#### 3.05 **SEWER CLEANOUTS**

- A. Sewer cleanouts connected to ductile iron pipe shall also be ductile iron sewer pipe conforming to these specifications.
- B. Sewer cleanouts connected to PVC pipe shall also be PVC sewer pipe schedule 40 conforming to ASTM-D-3034 latest revision. Use elastomeric gaskets for pipe joints.
- C. Service wyes shall be used on new PVC pipe. Service saddles shall be used on existing PVC, solvent welded to the main and fastened with double stainless steel bands.
- D. Cleanouts shall be a minimum of 4-inch diameter unless noted otherwise on the Drawings. Provide sewer cleanouts with screw-in watertight cap. Installation shall be in accordance with the details as shown on the Drawings.

#### 3.06 **SERVICE CONNECTIONS**

- A. Make service connections in accordance with the standard detail on the Drawings.
- B. Service connections to the main lines shall be perpendicular to the main line to the edge of the right-of-way or easement line.
- C. Four-inch lines shall have a minimum slope of 1.0 % and have cleanouts every 75 feet at a minimum in addition to a cleanout at the right-of-way line or at the edge of the easement.
- D. Six-inch lines shall have a minimum slope of 0.60 % and have cleanouts every 100 feet at a minimum in addition to a cleanout at the right-of-way line or at the edge of the easement.

- E. 6-inch service lines shall tie directly into a manhole.
- F. Service lines, which are connected into manholes, shall be installed less than 2.5 feet above the invert or shall be installed as a standard drop.
- G. Service connections made using a "ROMAC C" sewer saddle shall be made only when the service line is cast iron soil pipe and when the sewer main is 8-, 10-, or 12-inch diameter concrete, ductile iron, or PVC sewer pipe. This type connection cannot be used on truss sewer pipe. The opening in the sewer main for the "ROMAC C" sewer saddle shall be cut with a hydraulically driven or pneumatically driven circular tapping saw of the same nominal diameter as the sewer service line.

### 3.07 PAINTING

- A. Equipment shall receive the manufacturer's standard coating for the intended application. Coatings shall be suitable for the intended application.
- B. Repaint damaged paint services.
- C. Above ground piping and piping within vaults shall be painted in accordance with Section, Painting.

### 3.08 TESTING

- A. General
  - 1. Clean and flush pipe system of foreign matter prior to testing.
  - 2. Notify Owner and Engineer a minimum of 48 hours prior to testing.
  - 3. Perform tests in the presence of Engineer.
  - 4. Length of line to be tested at one time shall be subject to approval of Engineer.
  - 5. Pipe sections shall not be accepted and placed into service until specified test limits have been met.
  - 6. Repair defects in the pipe system. Make repairs to the same standard as specified for the pipe system.
  - 7. Retest repaired sections until acceptance.
  - 8. Repair visible leaks regardless of the test results.
- B. Gravity Sewer Mains
  - 1. Test gravity lines between manholes.
  - 2. Light Testing: Engineer will check for displacement of pipe as follows:
    - a. A light will be flashed between the ends of the pipe section being tested.
    - b. If the illuminated interior shows misalignment, or other defects as designated by Engineer, defects shall be repaired.
  - 3. General
    - a. Infiltration shall not exceed 100 gallons per inch of diameter, per mile of pipe, per 24 hours. Engineer may require flow measurement for verification of infiltration.
    - b. Verify that maximum infiltration rate shall not be surpassed by air testing as follows.
  - 4. Low Pressure Air Test:
    - a. Air testing of sewer mains shall conform to UNI-B-6 and the following requirements:
    - b. Perform initial air test when each section of main is complete including services to right of way. Test as construction proceeds.
    - c. Wet interior surfaces of porous pipe material prior to testing.

- d. Safety
    - 1) Provide a superintendent who has experience in low pressure air testing of gravity sewer mains.
    - 2) Follow safety recommendations of air testing equipment manufacturer.
    - 3) Properly brace sewer plugs during testing. Test plugs prior to use in air testing.
    - 4) No one shall be allowed in manhole or trench when pipe is under pressure.
    - 5) Pressurizing equipment shall include a regulator and a pressure relief valve, which are set no higher than 9 psig. Monitor gauges continuously to assure that the pressure does not exceed 9 psig.
  - e. Equipment
    - 1) Sewer plugs shall be specifically designed for low pressure air testing.
    - 2) Use two separate air hoses.
    - 3) One to connect the control panel to the sealed line for introducing the air.
    - 4) One from the sealed line to the control panel to provide constant monitoring of the air pressure in the line.
    - 5) If Pneumatic plugs are used a separate line shall be used to inflate the plugs.
    - 6) As a minimum the above ground air testing equipment shall include a shutoff valve, pressure regulating valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from 0 to at least 10 psig.
    - 7) Continuous monitoring pressure gauge shall be at least 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of +/- 0.04 psi.
    - 8) Monitoring gauges shall be subject to calibration as deemed necessary.
    - 9) Air used for testing shall pass through a single above ground control panel.
  - f. Testing
    - 1) Groundwater Determination: Immediately prior to each air test, determine groundwater level by a method acceptable to the Engineer. Adjust pressure used in air test in accordance with groundwater level.
    - 2) Apply air slowly to the test section until the pressure reached is 4.0 psi plus an adjustment of 0.433 psi for each foot of ground water above the crown of the pipe. Internal air pressure, including adjustment for ground water, should never exceed 9.0 psi.
    - 3) When the above required pressure is reached, throttle air supply to maintain internal pressure for at least two minutes to permit stabilization.
    - 4) When pressure has stabilized at required pressure, shut off air supply.
    - 5) While observing the continuous monitoring pressure gauge, decrease pressure approximately 0.5 psi from required pressure.
    - 6) At this reading timing shall commence with a stop watch and allowed to run until pressure has dropped 1.0 psi or allowable time has lapsed. Line shall be "Acceptable" if the pressure drop does not exceed 1 psig in the time prescribed for the test in Table 1, Low Pressure Air Testing for Gravity Sewer Mains, at the end of this section.
5. Deflection Test for SDR 35 and Ribbed (ASTM F 949) PVC pipe.
- a. Measure for deflection of pipe no sooner than thirty days after installation and backfill.

- b. Deflection shall not exceed 5 percent of pipe diameter. Maximum allowable long term deflection shall be 5 percent.
- c. Measure deflection with an approved "GO-NO-GO GAUGE" method or by an approved recording deflectometer. Verify gauge on site prior to testing.

**END OF SECTION**

**SECTION 33 40 00**  
**STORM DRAINAGE SYSTEM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work under this section includes, but is not limited to, piping and appurtenances for a complete storm drainage system.

**1.02 RELATED SECTIONS**

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
  - 1. Section 31 23 33 Trenching for Utilities

**1.03 REFERENCES**

- A. Publications are referred to in the text by basic designation only.
  - 1. American Society for Testing and Materials (ASTM)
    - a. A126 (latest)
    - b. C361 (latest)
    - c. C76 Reinforced Concrete Culverts, Storm Drain and Sewer Pipe (latest)
    - d. C443 Flexible Watertight Joints for Circular Concrete Pipe and Precast Manhole Sections (latest)
    - e. C478 Precast Reinforced Concrete Manhole Sections (latest)
    - f. C858 Underground Precast Concrete Utility Structures (latest)
    - g. C890 Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures (latest)
    - h. C913 Precast Concrete Water and Wastewater Structures (latest)
    - i. C923 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals (latest)
    - j. C990 Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (latest)
    - k. D1248 Polyethylene Plastics Molding and Extrusion Materials (latest)
  - 2. American Association of State Highway and Transportation Officials (AASHTO)
    - a. M170 Standard Specifications for Reinforced Concrete Culverts, Storm Drain, and Sewer Pipe (latest)
  - 3. UNI-BELL Plastic Pipe Association (UNI)
    - a. B-06 Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe (latest)
  - 4. NCDOT Standard Specifications for Roadway and Structure and Standard Details.

**1.04 SUBMITTALS**

- A. Submit the following in accordance with Section 01 33 00, Submittal Procedures:
  - 1. Affidavit of Compliance: Affidavit shall attest that supplied products conform to the referenced standard and this specification and that all tests set forth in each applicable referenced publication have been performed and that all test requirements have been met. Submit for each of the following materials:
    - a. Pipe

- 1) Reinforced Concrete Pipe
    - 2) HDPE (Solid and Perforated)
    - 3) Corrugated Metal Pipe (CMP)
  - b. Pre-cast concrete manholes
  - c. Pre-cast concrete boxes
2. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
  - a. Pipe
    - 1) Reinforced Concrete Pipe
    - 2) HDPE (Solid and Perforated)
    - 3) Corrugated Metal Pipe (CMP)
  - b. Pre-cast Concrete Manholes and the following appurtenances:
    - 1) Manhole steps
    - 2) Pipe connectors
    - 3) Joint material
  - c. Pre-cast Concrete Boxes and the following appurtenances:
    - 1) Manhole Steps
    - 2) Pipe Connectors
    - 3) Joint material
3. Reports:
  - a. Field test report for each section of pipe for the following:
    - 1) Low-pressure air test for storm drain piping.
4. Calculations:
  - a. If non-round manholes are used, uplift calculations sealed by a North Carolina Professional Engineer shall be provided. The minimum acceptable safety factor against uplift will be 1.2.
  - b. Provide calculations/certifications sealed by a North Carolina Professional Engineer as specified herein or on the Drawings.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Provide a suitable pipe hook or rope sling when handling the pipe with a crane. Lifting of the pipe shall be done in a vertical plane. Under no conditions shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to both tongue and groove ends.
- B. Deliver pipe in the field as near as practicable to the place where it is to be installed. Distribute pipe along the side of the trench opposite to the spoil bank. Where necessary to move the pipe longitudinally along the trench, it shall be done in such a manner as not to injure the pipe or coating.
- C. Shield PVC pipe and fittings stored on site from the sun's ultraviolet rays by suitable cover, or indoor storage.

### **PART 2 PRODUCTS**

#### **2.01 REINFORCED CONCRETE PIPE**

- A. Pipe shall conform to the following requirements:
  1. Size shall be as indicated on the Drawings.
  2. Suitable for pressures as specified ASTM C76.

- B. Reinforced Concrete Pipe shall conform to ASTM C76, AASHTO M170, and to the following requirements:
  - 1. Pipe lengths shall be not less than 8 feet.
  - 2. Pipe shall be Class III minimum per ASTM C76. If less than 1' of cover use class IV pipe.
  - 3. Pipe shall be designed for a Type 2 laying condition at the depth of cover indicated on the Drawings.
  - 4. Joints shall be flexible preformed butyl rubber-based sealant material conforming to Federal Specification SS-S-210A, Type Butyl Rubber, unless otherwise shown on the drawings.

## 2.02 HDPE PIPE (SOLID AND PERFORATED)

- A. Pipe Requirements
  - 1. ADS N-12 WT IB pipe (per ASTM F2648) shall have a smooth interior and annular exterior corrugations.
    - a. 4- through 60-inch (100 to 1500 mm) pipe shall meet ASTM F2648.
- B. Joint Performance
  - 1. Pipe shall be joined using a bell & spigot joint meeting ASTM F2648. The joint shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. 12- through 60-inch (300 to 1500 mm) diameters shall have an exterior bell wrap installed by the manufacturer.
- C. Fittings
  - 1. Fittings shall conform to AASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM F2306.
  - 2. Mar Mac Dissimilar Pipe Coupler or approved equal for all cast iron to HDPE
- D. Field Pipe and Joint Performance
  - 1. To assure watertightness, field performance verification may be accomplished by testing the accordance with ASTM F2487. Appropriate safety precautions must be used when field-testing any pipe material. Contact the manufacturer for recommended leakage rates.
- E. Material Properties
  - 1. Material for pipe production shall be an engineered compound of virgin and recycled high-density polyethylene conforming with the minimum requirements of cell classification 424420C (ESCR Test Condition B) for 4- through 10-inch (100 to 250 mm) diameters, and 435420C (ESCR Test Condition B) for 12- through 6-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%.

## 2.03 CMP PIPE

- A. Corrugated steel culvert pipe and pipe arch shall meet AASHTO M 197 with the following exceptions:
  - 1. Coupling Bands



- a. Use corrugated coupling bands except as otherwise provided below.
  - b. A hugger type corrugated band having one annular corrugation at each outside edge of the band will be acceptable.
  - c. Coupling bands with projections (dimples) may be used where it is necessary to join new pipe to existing pipe having helical corrugations at the joint locations. The bands shall be formed with projections in annular rows with one projection for each corrugation of helical pipe. Use an approved sealer with this type of coupling band. Coupling bands with projections may be used for circumferential pipe, helical pipe, or a combination of both.
  - d. Fasten coupling bands on the ends with at least two ½ inch bolts.
  - e. Annular corrugated bands shall have a minimum width of 10 ½ inches where 2 2/3 inches x ½ inch corrugations are used.
  - f. The continuous flat gasket material to be used with all connecting bands shall be 3/8" thick and 24" wide and made from closed cell neoprene rubber which upon assembly provides a watertight seal.
2. Corrugations
- a. Where ¼ inch deep corrugations are permitted by AASHTO M 197, the maximum pitch of the corrugations shall be 1 7/8 inch.
  - b. Where 3 inches x 1 inch corrugations are required, the Contractor will be permitted to use 5 inches x 1 inch corrugations.
  - c. Pipe with helical corrugations shall have rerolled ends with at least 2 annual corrugations at each end.
3. Elongated Pipe
- a. When elongated pipe is called for by the contract, use pipe that is shop formed to provide for a 5% vertical elongation.
4. Lifting Straps
- a. The pipe may be furnished either with or without lifting straps for handling. Attach the lifting straps by bolting or by welding. Bolt holes for attaching the straps shall be a smooth hole that is either punched or drilled. No burning of holes will be permitted. Design the lifting straps so the holes can be plugged to prevent infiltration of backfill material.
  - b. Design the placement of lifting straps to ensure the pipe is equally supported along its axis.
5. Type IA
- a. Type IA pipe will not be permitted.
6. Aluminum Alloy Pipe
- a. Aluminum Alloy Pipe shall meet all requirements herein except that the pipe and coupling bands shall be fabricated from aluminum coated steel sheet meeting AASHTO M 197.
7. Marking Requirements
- a. Pipe sections and special attachments for pipe 60 inches or larger diameter pipe shall be alphanumerically match-marked at the plant site before shipping. There may be additional markings as required by the Department's Brand Certification Program.
  - b. Pipes must be manufactured by pipe manufacturer on the NCDOT approved products list.

## 2.04 MANHOLES

- A. Provide manholes made of precast concrete sections in conformance with ASTM C478, NC Department of Transportation, and the following requirements:
  - 1. General

- a. Provide manholes to the depth as indicated on the Drawings. Manhole inside diameter shall be 4 feet unless noted otherwise on the Drawings.
  - b. Precast concrete manholes shall be as manufactured by Adams Concrete, Carolina Precast Concrete, Inc., D & M Concrete Specialties, Inc., N. C. Products Corp., Stay Right Tank, Tindall Concrete Products, Inc. or approved substitute.
2. Precast Concrete Sections
- a. Minimum wall thickness shall be 5-inches.
  - b. Base: Cast monolithically without construction joints or with an approved PVC waterstop in the cold joint between the base slab and the walls. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.
  - c. Riser: Minimum lay length of 16 inches.
  - d. Eccentric Cone: Top inside diameter shall be 24 inches. Width of the top ledge shall be no less than the wall thickness required for the cone section.
  - e. Transition Cone: Provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Minimum slope angle for the cone wall shall be 45 degrees.
  - f. Transition Top: Provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. Tops shall not be used in areas subject to vehicle traffic.
  - g. Flat Slab Top: Designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces. Provide a float finish for exterior slab surface.
  - h. Precast or core holes for pipe connections. Diameter of hole shall not exceed outside diameter of pipe by more than 3-inches.
  - i. Grade Rings: May be used to adjust frame and cover to finished grade. Grade Rings shall be no less than 4 inches in height.
  - j. Lifting Devices: Devices for handling precast components shall be provided by the precast manufacturer and comply with OSHA Standard 1926.704.
3. Joints
- a. Manufacturer in accordance with tolerance requirements of ASTM C 990 for butyl type joints.
  - b. Minimize number of joints. Do not use riser section for manholes up to 6 feet tall and no more than one riser for each additional 4 feet in height.
  - c. Flexible Joint Sealants: Preformed butyl rubber-based sealant material conforming to Federal Specification SS-S-210A, Type B and ASTM C990.
  - d. External Seal: Polyethylene backed flat butyl rubber sheet no less than 1/16-inch thick and 6-inches wide.
4. Inverts
- a. Brick and mortar or precast concrete invert.
  - b. Form and finish invert channel to provide a consistent slope from inlet(s) to outlet up to 4-inches.
  - c. Channel walls shall be formed to 3/4 of the height of the outlet pipe diameter.
  - d. Finish benches with a minimum uniform 1.5:12 slope. Provide a 1/4-inch radius at the edge of bench and trough.
5. Flexible Pipe Connectors: Provide flexible connectors for pipe to manhole that conform to ASTM C923. Location of connectors shall vary from Project Drawings

no more than 1/2-inch vertically and 5 degrees horizontally. Provide stainless steel pipe clamp type band around flexible connection to sewer pipe.

6. Manhole Steps (where indicated on the Drawings):

- a. Steps shall be in accordance with ASTM C478 and made of 1/2-inch grade 60 steel encapsulated by co-polymer polypropylene and have serrated tread and tall end lugs.
- b. Secure steps to the wall with compression fit in tapered holes or cast-in-place. Align steps along a vertical wall and shall not be located over a pipe opening. First step shall be a maximum of 26 inches from the bottom.
- c. Steps shall be by American Step Co., Inc., Bowco Industries, Inc., M. A. Industries, Inc. or approved substitute.

## 2.05 CASTINGS

### A. General

1. Made of gray iron, ASTM A-48 - class 30, or ductile iron, ASTM A536, grade 65-45-12.
2. Castings shall be free from imperfections not true to pattern. Casting tolerances shall be plus or minus 1/16 inch per foot of dimension. Top shall set neatly in frame, with edges machined for even bearing and proper fit to prevent rattling and flush with the edge of frame.
3. Castings shall be as manufactured by Neenah Foundry Co., U.S. Foundry & Manufacturing Corp., or Vulcan Foundry

### B. Manhole Ring and Cover:

1. Minimum clear opening shall be 22 inches.
2. Minimum weight for frame and cover shall be 300 pounds and suitable for Heavy Duty Highway Traffic Loads of H-20.
3. Frame shall have four 1-inch anchor bolt holes equally spaced.
4. "Storm Sewer" shall be cast on the cover as appropriate. Casting shall bear the name of the manufacturer and the part number.
5. Provide cover with two 1-inch perforated holes.

### C. Grate and Frame:

1. Grate and Frame shall be NCDOT Standard.
2. Grate and Frame shall be suitable for Heavy Duty Highway Traffic Loads of H-20.
3. Casting shall bear the name of the manufacturer and the part number.

## 2.06 PRECAST BOXES

### A. Provide precast concrete boxes made of precast concrete sections in conformance with ASTM C913 and the following requirements.

#### 1. General

- a. Provide boxes to the dimensions as indicated on the Drawings. Precast boxes include:
  - 1) Wet well structure
  - 2) Trash removal structures
  - 3) Square/Rectangular catch basin boxes and drop inlets
  - 4) Non-round manhole structure
- b. Precast manufacturer shall have a professional engineer registered in the State of North Carolina on staff. Provide a certification signed and sealed by the North Carolina Professional Engineer that the boxes provided for the

Project are in conformance with the reference standards and these specifications and are structurally sufficient (i.e., adequate wall thickness and reinforcing). The boxes shall be adequate for the existing site conditions as described in the soils reports provided in these Project specifications.

- c. Precast concrete boxes shall be manufactured by Adams Concrete, Carolina Precast Concrete, Inc., D & M Concrete Specialties, Inc, N. C. Products Corp., Stay Right Tank, Tindall Concrete Products, Inc. or approved substitute.
2. Precast Concrete Sections
  - a. General: Concrete compressive strength shall be 4,000 psi minimum and rated for H-20 loading.
  - b. Base: Cast monolithically without construction joints or with an approved PVC waterstop in the cold joint between the base slab and the walls. The width of the base extensions shall be no less than the base slab thickness and shall be as indicated on the drawings.
  - c. Riser: Minimum lay length of 16 inches.
  - d. Flat Slab Top: Designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slap Tops shall be sized to fit within the top and bottom surfaces. Provide a float finish for the exterior slab surface and a 1-inch chamfer on all exposed edges.
  - e. Lifting Devices: Devices for handling precast components shall be provided by the precast manufacturer and comply with OSHA Standard 1926.704.
3. Joints
  - a. Manufacturer in accordance with tolerance requirements of ASTM C 990 for butyl type joints.
  - b. Minimize number of joints.
  - c. Flexible Joint Sealants: Provide preformed butyl rubber-based sealant material conforming to Federal Specification SS-S-210A, Type B - Butyl Rubber or O-ring rubber gasket conforming to ASTM C443.
  - d. External Seal: Provide a polyethylene backed flat butyl rubber sheet no less than 1/16-inch and 6-inches wide applied to outside perimeter of joint.
4. Flexible Pipe Connectors: Provide flexible connectors for pipe to box that conform to ASTM C923. Location of connectors shall vary from Project Drawings no more than 1/2-inch vertically and 5 degrees horizontally.

## 2.07 ACCESS HATCHES

- A. Provide access hatches in conformance with the following requirements:
  1. Size as indicated on the Drawings. Size is for the required minimum clear opening. Unless specifically indicated on the Drawings the doors can be single or double door as required for opening size.
  2. Provide aluminum extrusion frame and aluminum checkered tread plate for the door(s) with a mill finish. Provide necessary anchors for setting frame in concrete. Provide stainless steel hinges, nuts, bolts, and washers. Unit shall be tamperproof from outside.
  3. Design and construct hatches for a minimum 300 lb / sq ft live load unless an H20 load is indicated on the Drawings. Maximum deflection shall not exceed 1/150 th of the span at the design load.
  4. Provide bituminous coating at locations in contact with concrete.
  5. Provide waterproof hatch where indicated on the Drawings.
  6. Door(s) shall have the following:
    - a. Auto-lock stainless steel hold open arm with aluminum release handle.

- b. Retractable lifting handle.
  - c. Double doors shall be interlocked.
  - d. Door(s) shall open to a full 90-degree position.
  - e. Door(s) shall close flush with frame and rest on a built-in neoprene gasket.
  - f. Door(s) shall have padlocking provision. Lock shall be provided for each hatch and keyed alike for multiple hatches.
  - g. Doors requiring greater than a 50 lb lift shall be provided with a stainless steel spring assist.
- 7. Hatches shall be of one manufacturer.
  - 8. Manufacturer shall be Bilco, Electric Specialty, Halliday Products, Thompson Fabricating Co, Washington Aluminum, or approved substitute.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Pipe installation shall meet the following general guidelines:
  - 1. Lay pipe in the presence of Engineer, unless specifically approved otherwise.
  - 2. Handle pipe and accessories in accordance with manufacturer's recommendations.
  - 3. Carefully inspect pipe immediately prior to laying. Do not use defective pipe. Replace pipe damaged during construction.
  - 4. Lay pipe to grade and alignment indicated on the Drawings.
  - 5. Provide proper equipment for lowering pipe into trench.
  - 6. Provide tight closure pipe ends when work is not in progress.
  - 7. Keep pipe interior free of foreign materials.
  - 8. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
  - 9. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendation.
  - 10. Provide pneumatic plug at each entrance into the new storm drain system and maintain plugged until the project is complete.
- B. Storm Drainage Pipe: Gravity pipe installation shall meet the following general guidelines:
  - 1. Lay pipe upgrade from the lower end and at the grades and alignment indicated on the Drawings.
  - 2. Lay storm drainage pipe to true lines and grades by use laser beam equipment or other acceptable means.

### **3.02 MANHOLES**

- A. Provide stone base as specified in Section, Trenching for Utilities to extend a minimum of 6 inches beyond the manhole base.
- B. Set base plumb and level. Align manhole invert with pipe invert.
- C. Secure pipe connectors to pipe in accordance with manufacturer's recommendation.
- D. Clean bells and spigots of foreign material that may prevent sealing. Unroll the butyl sealant rope directly against base of spigot. Do not stretch. Follow manufacturer's instructions when using O-ring seals.
- E. Set precast components so that steps align.

- F. After joining manhole sections, apply the butyl sealant sheet around the outside perimeter of the joint.
- G. Plug lift holes using a non-shrink grout. Cover with a butyl sealant sheet on the outside and seal on the inside with an application of an epoxy gel 1/8-inch thick extending 2 inches beyond the opening.
- H. Set manhole frames to grade with grade rings. Seal joints between cone, adjusting rings, and manhole frame with butyl sealant rope and sheet.
- I. Encase manhole rings in a concrete collar 18-inches wide by 6-inches thick of 3,000 psi concrete beneath the travel surface.
- J. Finish the interior by filling fractures greater than 1/2 inch in length, width or depth with a sand cement mortar. Do not fill the joints between the precast components.
- K. Clean the interior of the manhole of foreign matter.

### 3.03 **PRECAST BOXES**

- A. Provide 24 inches of No. 67 or No. 57 stone base beneath wet well/weir structure and trash removal structures to extend a minimum of 6 inches beyond the base or to the thickness indicated on the Drawings, whichever is greater. Catch basins and drop inlet shall receive 12 inches of No. 67 or No. 57, to extend 6 inches beyond the base.
- B. Set base plumb and level. Align box invert with pipe invert.
- C. Secure pipe connectors to pipe in accordance with manufacturer's recommendation.
- D. Clean bells and spigots of foreign material that may prevent sealing. Unroll the butyl sealant rope directly against base of spigot. Do not stretch. Follow manufacturer's instructions when using O-ring seals.
- E. After joining box sections, apply the butyl sealant sheet around the outside perimeter of the joint.
- F. Plug lift holes using a non-shrink grout. Cover with a butyl sealant sheet on the outside and seal on the inside with an application of an epoxy gel 1/8-inch thick extending 2 inches beyond the opening.
- G. Finish the interior by filling fractures greater than 1/2 inch in length, width or depth with a sand cement mortar. Do not fill the joints between the precast components.
- H. Clean the interior of the structure of foreign matter.

### 3.04 **TESTING**

- A. General
  - 1. Clean and flush pipe system of foreign matter prior to testing.
  - 2. Notify Owner and Engineer a minimum of 48 hours prior to testing.
  - 3. Perform tests in the presence of Engineer.
  - 4. Length of line to be tested at one time shall be subject to approval of Engineer.
  - 5. Pipe sections shall not be accepted and placed into service until specified test limits have been met.
  - 6. Repair defects in the pipe system. Make repairs to the same standard as specified for the pipe system.
  - 7. Retest repaired sections until acceptance.

8. Repair visible leaks regardless of the test results.
- B. Storm Drainage
1. Test gravity lines between manholes or junction boxes.
  2. Light Testing: Mains will be checked by Engineer for displacement after the trench has been filled to two feet above the pipe and tamped as specified, and upon completion of the project. Test will be as follows:
    - a. A light will be flashed between the ends of the pipe section being tested.
    - b. If the illuminated interior shows any misalignment, or other defects as designated by Engineer, defects shall be repaired.

**END OF SECTION**

**SECTION 33 40 01**  
**ALUMINIZED TYPE II (ALT2) CORRUGATED METAL PIPE (CMP) UNDERGROUND**  
**DETENTION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This item shall govern the furnishing and installation of Underground Detention and Infiltration Systems for all types, sizes and designations as shown on the plans.
- B. Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the CMP System, appurtenances and incidentals in accordance with the Drawings and as specified herein.
- C. A stormwater treatment device upstream of the CMP System is recommended as the appropriate means of pretreating for the purpose of extending the maintenance interval on the CMP System and reducing the life cycle cost. Both engineered solutions shall be provided by a single supplier/manufacturer. Filtration by wrapping a system with geotextile is not an acceptable means of pretreatment.
- D. Applicable provisions of any Division shall govern work in this section.
- E. American Association of State Highway and Transportation Officials (AASHTO)
  - 1. AASHTO Design Section 12 – Soil-Corrugated Metal Structure Interaction Systems
  - 2. AASHTO Construction Section 26 – Metal Culverts
  - 3. AASHTO M36 – Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
  - 4. AASHTO M274 – Standard Specification for Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe
- F. American Society for Testing and Materials (ASTM)
  - 1. ASTM A760: Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
  - 2. ASTM A929: Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
  - 3. ASTM A798: Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
  - 4. ASTM A998: Standard Practice for Structural Design of Reinforcements for fittings in Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
- G. Site layout drawings, product specifications, materials, corrugation, gage, hydraulic storage data and supported calculations of proposed alternatives shall be submitted to the EOR for review at a minimum of 10 working days prior to bid closing.
- H. Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:



1. Before installation of the CMP System, Contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.
- I. All proposed alternatives to the CMP System shall conform to applicable above referenced AASHTO and ASTM specifications. NCSPA provides design service life guidance for certain products up to 100 years in recommended environments.

## **PART 2 MATERIALS**

### **2.01 DETAILS**

- A. Aluminized Type II material shall conform to the applicable requirements of AASHTO M274 or ASTM A929. CMP shall be manufactured in accordance with the applicable requirements of AASHTO M36 or ASTM A760.
- B. The pipe sizes, gauges and corrugations shall be as shown on the project plans. Joint performance requirements are published in Division II, Section 26.4.2, of the current edition of the AASHTO Bridge Construction Specifications.
- C. Soil tight, gravity flow, non-pressure, drainage pipe joints shall conform to AASHTO M36 and ASTM A760. Minimum joint spacing shall be 10 ft.
- D. Overlapping of adjacent pipes are not permitted and appropriate banding must be utilized in order to properly secure individual pipes in place.
- E. Integral End Sections: Each barrel of the CMP System shall either be connected to a fitting composing a manifold for hydraulic distribution or have an integrated bulkhead to resist loading at the end/start of the barrel, end cap sections shall not be permitted.
- F. Material selected shall be flame resistant and capable of retaining 80% of strength when subjected to a temperature of 400 degrees Fahrenheit for one hour.
- G. All fittings shall be manufactured prior to arriving on the jobsite to ensure structural integrity. Fitting reinforcement shall be in accordance with ASTM A998 and reinforcing details. Bulkhead design and fabrication does not vary with differing coatings on the steel components.
- H. Bulkheads shall be constructed using 12-gage or heavier material, with both the water and soil side final coatings matching the specified CMP coating. Bulkhead plates must be fully welded to the connecting pipe. The design of bulkheads shall adhere to Chapter 8 of the NCSPA CSP Design Manual, meeting the height of cover design requirements with appropriate reinforcements or a minimum required plate thickness. Additionally, reinforcing members shall be post-coated with zinc-rich paint in accordance with AASHTO M 36 for Galvanized & Aluminized CMP Systems.
- I. The manufacturer of the CMP System shall be one that has regularly been engaged in the engineering design and production of these systems for at least fifteen (15) years and which has a history of successful production, acceptable to the EOR. In accordance with the Drawings, the CMP System shall be supplied by the following (or approved equal):

Contech Engineered Solutions  
9100 Centre Pointe Drive  
West Chester, OH 45069  
Tel: 1 800 338 1122

- J. Sampling, testing, and inspection of metal sheets and coils used for manufacturing the CMP System shall be in accordance with to the above applicable referenced specifications. All fabrication of the product shall occur within the United States.

## **PART 3 PERFORMANCE**

### **3.01 INFORMATION**

- A. The CMP System proposal shall be sized in accordance to the design provided and approved by the Engineer of Record (EOR). Any Contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, HydroCAD modeling and engineering drawings.
- B. The CMP System shall comprise of manhole access with minimum dimensions of 24 inches diameter to provide adequate inspection and maintenance without restrictions and obstructions to entry into interior of the CMP System. Manholes shall be provided to allow full entry into and visual inspection of the complete CMP System, at a minimum as to allow full maintenance of the CMP System. Cleanouts or inspection ports are not acceptable access points for maintenance and inspection nor are any other alternatives which do not allow for full entry into the system.
- C. CMP spacing, gage (thickness) and stone base thickness can be altered with consultation from EDR.
- D. The CMP System shall be designed for a minimum HS-20/HS-25 final live loading conditions. The CMP System shall meet HS-20/HS-25 loading requirements with a minimum of 12-inches of cover to bottom of flexible pavement for pipe spans less than or equal to 96 inches and 18 inches of cover to bottom of flexible pavement for pipe spans greater than 96 inches.
- E. The CMP System shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by transporting stormwater through stone.

## **PART 4 EXECUTION**

### **4.01 REQUIREMENTS**

- A. The CMP System installation shall be in accordance with AASHTO Standard Specifications for Highways Bridges, Section 26, Division II or ASTM A798 and in conformance with the project plans and specifications.
- B. The CMP System shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. Handling &

assembly shall be in accordance with National Corrugated Steel Pipe Association's (NCSPA) recommendations.

- C. For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the pipe. The Height-of-Cover shall meet the minimum requirements shown in the table below. The use of heavy construction equipment necessitates greater protection for the pipe than finished grade cover minimums for normal highway traffic.

**Minimum Cover (ft) Requirements**

Pipe Span (inches)	Axle Loads (kips)			
	18 – 50	50 -75	75 – 110	110 – 150
12 – 42	2.0	2.5	3.0	3.0
48 – 72	3.0	3.0	3.5	4.0
78 – 120	3.0	3.5	4.0	4.0
126 – 144	3.5	4.0	4.5	4.5

- D. Minimum cover may vary, depending on local conditions. The contractor must provide the additional cover required to avoid damage to the pipe. Minimum cover is measured from the top of the pipe to the top of the maintained construction roadway surface
- E. Refer to the Construction Plans for additional guidance regarding installation, inspection and maintenance.
- F. The contractor shall follow Occupational Safety and Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.
- G. Backfill material shall be placed in 8 inch loose lifts and compacted to 90% AASHTO T99 standard proctor density.
- H. Supplier will conduct an on-site preconstruction meeting with the contractor prior to the scheduled delivery date of the CMP System.

**END OF SECTION**