



COMPLEX PROJECTS
REQUIRE RESOLVE
THRASHER'S GOT IT

**MCDOWELL COUNTY BOARD OF EDUCATION
MCDOWELL COUNTY, WEST VIRGINIA
COALFIELD ELEMENTARY**

ADDENDUM #1

February 15, 2023

THRASHER PROJECT #060-10301

TO WHOM IT MAY CONCERN:

A Mandatory Pre-Bid Conference was held on Tuesday, February 14, 2023, on the above-referenced project, a copy of the sign in sheet is included in this Addendum. The following are clarifications and responses to questions posed by contractors for the above reference project.

A. GENERAL

1. **THE BID FORM HAS BEEN REVISED. YOU MUST USE THE REVISED BID FORM WHEN PREPARING YOUR BID PACKAGE FOR THIS PROJECT.**

B. SPECIFICATIONS

1. An updated Index is included in this Addendum
2. Spec Sections 096400 Wood Flooring and 126600 Telescoping Stands were updated in this Addendum.
3. Division 31, 32 and 33 have been added to this Addendum.
4. Spec Section 085653 Security Transaction Windows has been added in this Addendum.

C. DRAWINGS

None on this Addendum

D. QUESTIONS AND RESPONSES

1. QUESTION

On the Sediment Basin "Temporary" Riser... On Sheet C3.08 the Detail on the left calls out a 30" Riser Pipe & the Detail on the right calls out a 48" Riser Pipe. Which size is correct?

RESPONSE

The detail on the left is correct, 30" Riser Pipe.

2. QUESTION

Can we get an updated Spec Index with the correct specs? The index shows specs for a retaining wall and a traction elevator that doesn't appear to be on this job. We are

missing all of the specs after division 28. There are specs in the spec book that are not on the index and some of them even have a different project listed on them so I'm not sure what actually applies to this project.

RESPONSE

The index and specifications have been updated in this addendum.

3. QUESTION

On the bid form, it has a lump sum price with a line for total bid to be written in both words and figures. Underneath that, there is a section for unit pricing for 3 items and then another line for total bid to be written in words and figures. Are those unit prices to be figured into the first lump sum price line or kept separate? Is the second total bid line to include only the unit priced items or is that where we combine the total of the unit priced items and the lump sum price.

RESPONSE

Bid Form has been revised. The unit prices should be figured into the lump sum price line.

4. QUESTION

Just for clarification for the SBA requirements, the 24 hour and 72 hour deadlines only apply to business days and not calendar days, correct?

RESPONSE

It is Business Days.

E. CLARIFICATIONS

Owner will award a separate contract for Commissioning of the HVAC system. Those operations will be conducted simultaneously with work under this Contract. Contractor under this Contract shall cooperate fully and coordinate Work of the Contract with work performed under the separate Commissioning contract.

If you have any questions or comments, please feel free to contact me at your earliest convenience. As a reminder, bids will be received until 1:00 p.m. on Thursday, March 2, 2023, at McDowell County Board of Education, 900 Mt. View Road, Welch, WV. Good luck to everyone and thank you for your interest in the project.

Sincerely,

THE THRASHER GROUP, INC.



AMANDA CHEUVRONT, AIA, NCARB
Project Manager



Name	Representing	Phone #	Email Address
Robert Deeb	DCI/SHIRES, INC. PO BOX 1259, BLUEFIELD WV 24701 PH 304-323-1996 FAX 304-323-3037 EMAIL: robertdeeb@dcishires.com		
PAUL DAVE	WIDE CONSTRUCTION	304-325-8446	BID@SUBREC.CO.COM
DUSTI SNIDER	MAIN STREET BUILDERS	304/4873912	D.C.SNIDER@OUTLOOK.COM
DERRICK SEARS	FOSTER SUPPLY	304-553-6565	dsears@fostersupply.com
Scott Cunningham	SQA Construction	304-532-3659	estimating@sqagc.com
Seth Fox	Thrasher	304-343-7601	sfox@thethrashergroup.com
Kayla Turner	City Construction Co.	304-623-2573	kayla@cccwv.us
Will Chapman	MCBOE	304-887-1206	wechapman@KIZ.wv.us

[illegible]

BID FORM FOR CONSTRUCTION CONTRACT

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

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to:

*McDowell County Board of Education
900 Mount View High School Road
Welch, WV 24801*

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

ARTICLE 2—ATTACHMENTS TO THIS BID

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

A. Bid Opening Requirements

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

GENERAL

The Bidder shall take notice of and shall be responsible for any local or state taxes levied and applicable, and the cost for the same shall be included as part of the submitted Bid.

The total Bid cost stated includes a complete operating installation including furnishing and installation of any and all changes or additions in plans, piping, mechanical work, additional electrical work, accessories, controls, etc. necessary to accommodate alternative equipment systems or materials used in construction.

BID PROPOSAL

The Bidder agrees to perform all required Work described in the detailed Specifications and as shown on the Plans for the complete construction and placing in satisfactory operation the Coalfield Elementary School. The Project "Sequence of Construction" has been detailed in the Drawings and Specification Division 1, Project Summary, Section 011000. The Bidder agrees to perform all the Work proposed for the total of the following Bid prices.

3.01 *Lump Sum Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the lump sum (stipulated) price(s), shown in the bid schedule.

B. Lump Sum Bids may be one of the following:

1. Lump Sum Price (Single Lump Sum)
 2. Lump Sum Price (Base Bid and Alternates)
 3. Lump Sum Price (Sectional Lump Sum Bids)
- C. All specified cash allowance(s) are included in the price(s) set forth in the bid schedule, and have been computed in accordance with Paragraph 3.8 of the General Conditions.
- D. All specified contingency allowances are included in the price(s) set forth in the bid schedule, and have been computed in accordance with Paragraph 3.8 of the General Conditions.

BID SCHEDULE

**PROPOSED
COALFIELD ELEMENTARY SCHOOL
FOR THE**

**MCDOWELL COUNTY BOARD OF EDUCATION
MCDOWELL COUNTY, WEST VIRGINIA**

3.02 Total Bid Price Lump Sum

NOTE: Bid PRICE amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern. Bids shall include sales tax and all other applicable taxes and fees.

BASE BID

Item #	Qty.	UNIT	DESCRIPTION	TOTAL PRICE
1	1	LS	Provide all labor, materials, equipment, fees, bonds, insurance and taxes to perform the work as detailed in the plans and specifications and addenda.	

TOTAL BID: _____
(Written in Words)

_____ (\$ _____)

(Amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

UNIT COST ITEMS

Item #	Qty.	UNIT	DESCRIPTION	UNIT PRICE	UNIT PRICE WRITTEN IN WORDS	TOTAL PRICE
1	8,400	CY	Cement stabilized material			
2	37,550	CY	Over excavation			
3	29,150	CY	Remaining undercut reprocessed and placed as structural fill			

ADDITIVE ALTERNATE #1 – Gymnasium and Restrooms

Item #	Qty.	UNIT	DESCRIPTION	TOTAL PRICE
1	1	LS	Add cost for Gymnasium and Restrooms as indicated on the drawings	

TOTAL ADD ALTERNATE #1: _____
(Written in Words)
(\$ _____)

(Amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ADDITIVE ALTERNATE #2 – Locker Rooms

Item #	Qty.	UNIT	DESCRIPTION	TOTAL PRICE
1	1	LS	Add cost to Alternate No. 1 for locker rooms and corridor connector as indicated on the drawings.	

TOTAL ADD ALTERNATE #2: _____
(Written in Words)

(\$ _____)

(Amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

3.02 *Method of Award*

If at the time this contract is to be awarded, the lowest total bid submitted by a qualified, responsive, responsible Bidder does not exceed the amount of funds then estimated by the Owner, as available to finance the contract, the construction contract will be awarded. Awarding of Additive Alternate(s) will not affect the lowest Bidder. If such bids exceed such amount, the Owner may reject all bids.

The Owner will award the contract on the total base bid amount inclusive or exclusive of alternates as determined by the Owner and submitted by a qualified, responsive, responsible Bidder. The Owner may elect to award any or all of the additive alternates in no particular order.

~~ARTICLE 4—BASIS OF BID—COST PLUS FEE DELETED~~

~~ARTICLE 5—PRICE PLUS TIME BID DELETED~~

ARTICLE 6—TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Article 8 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.
- 6.03 **Bidder sets the number of days until substantial completion is reached to be _____ calendar days with final completion being 30 calendars thereafter.**

ARTICLE 7—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

7.01 *Bid Acceptance Period*

- A. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

7.02 *Instructions to Bidders*

- A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

7.03 *Receipt of Addenda*

- A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 8—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS**8.01 *Bidder's Representations***

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

8.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.
2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
3. Bidder has not solicited or induced any individual or entity to refrain from bidding.
4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:
 - a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.
 - b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.
 - c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.
 - d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

(typed or printed name of organization)

By:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(typed or printed)

Address for giving notices:

Bidder's Contact:

Name:

(typed or printed)

Title:

(typed or printed)

Phone:

Email:

Address:

Bidder's Contractor License No.: (if applicable)

**MCDOWELL COUNTY BOARD OF EDUCATION
MCDOWELL COUNTY, WEST VIRGINIA
FOR THE
COALFIELD ELEMENTARY SCHOOL**

**Thrasher Project # 060-10301
INDEX**

BIDDING DOCUMENTS

Advertisement for Bid	AFB
Instructions to Bidders	AIA A701
SBA Supplemental Conditions to the AIA A701	SBA 400
Bid Opening Requirements	BOR
Bid Bond Example	AIA A310
Certification of Receipt of Addenda & Bid Certification Form	SBA 402
List of Proposed Major Subcontractors	SBA 403-A
Bid Proposal Form	BID

24 HOUR REQUIREMENT DOCUMENTS

List of Proposed Subcontractors Equipment / Material Suppliers	SBA 403-B
--	-----------

72 HOUR REQUIREMENT DOCUMENTS

Contractor's Qualifications Statement	SBA 405
---------------------------------------	---------

CONTRACT DOCUMENTS

Prime Contractor's Certification of Worker Compliance	SBA 404-B
Sub Contractor's Certification of Worker Compliance	SBA 404-C
Standard Form of Agreement Between Owners & Contractor	AIA A101
Agreement Addendum	WV-96
Performance Bond	AIA A312
Payment Bond	AIA A312

State of West Virginia Drug Free Workplace Conformance Affidavit WV-73
Affidavit of Non-Collusion

State of West Virginia Purchasing Affidavit

Change Order AIA G701

Application and Certificate for Payment AIA G702

Continuation Sheet AIA G703

Certified Payroll Form

Proposal Request AIA G709

Architect's Supplemental Instructions AIA G710

Construction Change Directive AIA G714

GENERAL CONDITIONS

General Conditions of the Contract for Construction AIA A201

SBA Supplemental Conditions to the AIA A201 SBA 401

Project Sign SBA 409

Construction Schedule Requirements SBA 410

Disclosure of Interested Parties to Contracts

State of WV Jobs Act Responsibilities

PROJECT CLOSEOUT DOCUMENTS

Certificate of Substantial Completion AIA G704

Construction Closeout Procedures Checklist SBA 500

Contractor's Affidavit of Payment of Debts/Claims AIA G706

Certificate of Insurance (Acord Form 25) AIA G715

Contractor's Affidavit of Release of Liens AIA G706A

Consent of Surety to Final Payment AIA G707

Consent of Surety to Reduction in or Partial Release of Retainage	AIA G707A
Verification of HVAC Training	SBA 500-A

PROJECT SPECIFICATIONS

Summary	011000
Unit Prices	012200
Alternates	012300
Substitution Procedures	012500
Contract Modification Procedures	012600
Payment Procedures	012900
Project Management & Coordination	013100
Construction Progress Documentation	013200
Submittal Procedures	013300
Quality Requirements	014000
Temporary Facilities & Controls	015000
Product Requirements	016000
Execution	017300
Construction Waste Management and Disposal	017419
Closeout Procedures (also see SBA -178 Project Closeout Procedures)	017700
Operation & Maintenance Data	017823
Project Record Documents	017839
Demonstration & Training	017900
Cast In-Place Concrete	033000
Polished Concrete Finishing	033543
Masonry Veneer	042613

Engineered Unit Masonry	042900
Adhered Stone Masonry Veneer	044313.16
Structural Steel Framing	051200
Steel Joist Framing	052100
Steel Decking	053100
Cold-formed Metal Framing	054000
Rough Carpentry	061000
Heavy Timber Trusses	061326
Wood Decking	061500
Bituminous Damp proofing	071113
Thermal Insulation	072100
Fluid Applied Membrane Air Barriers	072726
Standing-seam Metal Roof Panels	074113.16
Formed Metal Wall Panels	074213.13
Soffit Panels	074293
Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	075323
Roof Specialties	077100
Roof Accessories	077200
Snow Guards	077253
Penetration Firestopping	078413
Joint Firestopping	078443
Joint Sealants	079200

Hollow Metal Doors & Frames	081113
Flush Wood Doors	081416
Access Doors & Frames	083113
Aluminum-Framed Entrances and Storefronts	084113
Sectional Doors	083613
Security Transaction Windows	085653
Door Hardware	087100
Glazing	088000
Non-structural Metal Framing	092216
Gypsum Board	092900
Ceramic Tiling	093013
Acoustical Panel Ceilings	095113
Luminous Ceilings	095416
Wood Flooring	096400
Resilient Base and Accessories	096513
Resilient Tile Flooring	096519
Resinous Flooring	096723
Sound Absorbing Wall Panels	098433.11
Exterior Painting	099113
Interior Painting	099123
Dimensional Letter Signage	101419
Panel Signage	101423
Toilet Compartments	102113
Folding Panel Partitions	102239

Toilet, Bath, And Laundry Accessories	102800
Fire Extinguisher Cabinets	104413
Fire Extinguishers	104416
Canopies	105020
Metal Lockers	105113
Flagpoles	107500
Residential Appliances	113100
Food Service Equipment	114000
Stage Curtains	116143
Gymnasium Equipment	116623
Manufactured Plastic-laminate-clad Casework	123216
Solid Surfacing Countertops	123661.16
Roller Shades	122413
Telescoping Stands	126600
Wet Pipe Fire Suppression Sprinklers	211313
Common Work Results for Plumbing	220511
Meters And Gages for Plumbing Piping	220519
General Duty Valves for Plumbing Piping	220523
Hangers and Supports for Plumbing Piping & Equipment	220529
Identification for Plumbing Piping & Equipment	220553
Plumbing Insulation	220719
Domestic Water Piping	221116
Domestic Water Piping Specialties	221119
Domestic Water Pumps	221123

Drainage Waste & Vent Piping	221316
Drainage Waste Piping Specialties	221319
Sanitary Waste Interceptors	221323
Natural-gas Piping	221416
Electric Heat Pump Water Heaters	223300
Fuel-fired Water Heaters	223400
Plumbing Fixtures	224213
Common Work Results for HVAC	230511
Common Motor Requirements for HVAC Equipment	230513
Hangers & Supports for HVAC Piping & Equipment	230529
Vibration Controls for HVAC	230548.13
Identification for HVAC Piping & Equipment	230553
Testing, Adjusting and Balancing	230593
HVAC Insulation	230713
HVAC Instrumentation and Controls	230900
Refrigerant Piping	232300
Metal Ducts	233113
Duct Accessories	233300
Power Ventilators	233423
Diffusers, Registers and Grilles	233713
Commercial Kitchen Hoods	233813
Packaged, Outdoor, Central-Station Air-Handling Units	237339
Packaged, Large-capacity, Rooftop Air-conditioning Units	237416.13
Dedicated Outdoor-air Units	237433

Split-system Air-conditioning Units	238126
Variable Refrigerant Volume HVAC System	238129
Unit Heaters	238239
Common Work Results for Electrical	260500
Low-voltage Electrical Power Conductors and Cables	260519
Control-voltage Electrical Power Cables	260523
Grounding And Bonding for Electrical Systems	260526
Hangers & Supports for Electrical Systems	260529
Raceway And Boxes for Electrical Systems	260533
Cable Trays for Electrical Systems	260536
Identification for Electrical Systems	260553
Over Current Protective Device Coordination	260573
Lighting Control Devices	260923
Low-Voltage Transformers	262200
Switchboards	262413
Panelboards	262416
Wiring Devices	262726
Fuses	262813
Enclosed Switches & Circuit Breakers	262816
LED Interior Lighting	265100
Exterior Lighting	265619
Common Work Results for Communications	270500
Pathways for Communication Systems	270528

Communications Equipment Room Fittings	271100
Communications Backbone Cabling	271300
Communications Horizontal Cabling	271500
Intercom	275100
Gymnasium Sound System	275110
Dining Sound System	275126
Common Work Results for Electronic Safety and Security	280500
Conductors & Cables for Electronic Safety & Security	280513
Access Control System	281300
Video Intercom and Access Control System	281310
Digital Video Surveillance System	282300
Digital, Addressable Fire-alarm System	283111
Aggregates for Earthwork	310516
Site Clearing	311000
Earth Moving	312000
Asphalt Paving	321216
Concrete Paving	321313
Concrete Paving Joint Sealants	321373
Pavement Markings	321723
Turf & Grasses	329200
Sewer and Manhole Testing	330130.13
Manholes and Structures	330513
Manhole Frames and Covers	330513.01

Site Water Utility Distribution Piping	331116
Disinfection of Water Utility Piping Systems	331300
Sanitary Sewerage Piping	333100
Packaged Grinder Pump Station	333216
Sanitary Utility Sewerage Force Mains	333400
Stormwater Conveyance	334200

SECTION 085653 – SECURITY TRANSACTION WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed-glazed transaction windows.

1.3 COORDINATION

- A. Coordinate installation of anchorages for security windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for window units.
- B. Shop Drawings: For security windows.
 - 1. Include plans, elevations, sections and attachments to other work.
 - 2. Full-size section details of framing members, including internal armoring, reinforcement, and stiffeners.
 - 3. Glazing details.
 - 4. Details of deal tray transaction counter and speaking aperture.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Framing: 12-inch- (305-mm-) long sections of frame members.
 - 2. Transaction Drawer: 6 inches (150 mm) square.
- D. Cutaway Sample: Comer of security window, made from 12-inch (305-mm) lengths of full-size components, and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.

3. Glazing.

1.5 INFORMATION SUBMITTALS

- A. Qualification Data: For qualified Installer and testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each type of security window and accessory indicated as ballistics resistant, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty.
- E. Examination reports documenting inspections of substrates, areas. And conditions.
- F. Anchor inspection reports documenting inspections of built-in and cast-in anchors.
- G. Field quality-control reports documenting inspections of installed products.
 - 1. Field quality-control certification signed by Contractor.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code -Aluminum."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Pack security windows in wood crates for shipment. Crate glazing separate from :frames unless factory glazed. Apply safety padded material of sufficient thickness to prevent injury to handlers, at all comers of glazing to cover sharp edges.
- B. Label security window packaging with drawing designation.
- C. Store crated security windows on raised blocks to prevent moisture damage.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including deflections exceeding 1/4 inch (6 mm).
 - b. Failure of welds.
 - c. Faulty operation of sliding window hardware.
 - d. Deterioration of metals, metal finishes, and other material beyond normal use.
 - 2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Attach Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
 - 1. Ballistics Resistance: Level 3 when tested according to UL 752.

2.2 FIXED-GLAZED, TRANSACTION SECURITY WINDOWS

- A. Provide fixed-glazed, transaction security windows.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Laurence C. R. Co., Inc. Catalog No. NJ 1WI8A (Basis of Design).
 - b. Armortex.
 - c. Quikserv Corp.
- B. Configuration: One fixed-glazed panel with transaction window.
- C. Framing: Fabricate perimeter framing, mullions, and glazing stops from aluminum as follows:
 - 1. Profile: Manufacturer's standard, with minimum face dimension indicated.
- D. Head and Jamb Framing: Designed for gasket glazing.
- E. Glazing Meeting Edges: Polished glazing.
- F. Sill: Stainless-steel channel frame designed-for gasket glazing.
 - 1. Shelf: Plastic Laminate, 18 inches (457 mm) deep by width of security window, with integral deal tray.
 - 2. Reference Section 123623.13 – Plastic-Laminate-Clad Countertops
- G. Glazing and Glazing Materials: 1 ¼ inch thick acrylic glazing by security window manufacturer.
- H. Materials:

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M). Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength.

2.3 FABRICATION

- A. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.
 1. Provide units that are reglazable from the secure side without dismantling the nonsecure side of framing.
 2. Prepare security windows for glazing unless preglazing at the factory is indicated.
- B. Glazing Stops: Finish glazing stops to match security window framing.
 1. Secure-Side (Exterior) Glazing Stops: Welded or integral to framing.
 2. Nonsecure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.
- C. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- D. Factory-cut openings in glazing for speaking apertures.
- E. Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: A.AMA 611, AA-MI2C22A41, Class I, 0.018 mm or thicker.

2.6 ACCESSORIES

- A. Recessed Deal Trays: Formed from stainless steel with sliding stainless-steel cover; fabricated in curved shape with exposed flanges for recessed installation into horizontal surface.

1. Clear-Opening Size: Manufacturer's standard size, or 11 inches wide by 8 inches deep by 1-1/2 inches high (305 mm wide by 203 mm deep by 38 mm high).
- B. Speaking Apertures: Fabricate from stainless steel, designed to allow passage of speech at normal speaking volume without distortion.
 1. Shape: Circular.
 2. Ballistics Resistance: Same as security window.
 3. Listed and labeled as bullet resisting according to UL 752.
- C. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
- D. Compression Type Glazing Strips and Weather Stripping: Unless otherwise indicated, provide compressible stripping for glazing and weather stripping, such as molded EPDM or neoprene gaskets complying with ASTM D 2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D 2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.
- E. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers and with a proven record of compatibility with surfaces contacted in installation.
 1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
 2. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
 3. Spacers: Elastomeric blocks or continuous extrusions with a Type A Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B 633; provide sufficient strength to withstand design pressures indicated.
- G. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of security windows.
- B. Examine roughing-in for built-in anchors to verify actual locations of security window connections before security window installation.

- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of security windows.
- D. Inspect built-in and cast-in anchor installations, before installing security windows, to verify that anchor installations comply with requirements. Prepare inspection reports.
- E. For glazing materials whose orientation is critical for performance, verify installation orientation.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other security window anchors whose installation is specified in other Sections.

3.3 INSTALLTION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.
 - 1. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same ballistics-resistance performance as security window.
- B. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials.
- C. Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.
 - 1. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
 - 2. Seal frame perimeter with sealant to provide weathertight construction unless otherwise indicated.
- D. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.4 FIELD QUALITY CONTROL

- A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

- B. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- C. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

3.5 ADJUSTING

- A. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.
- B. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

3.6 CLEANING AND PROTECTION

- A. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.
- B. Clean glass of pre-glazed security windows promptly after installation. Provide temporary protection to ensure that security windows are without damage at time of Substantial Completion.

END OF SECTION

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SECTION 096400 - WOOD FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Field-finished wood flooring.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor assembly and accessory. Include plans, sections, and attachment details. Include expansion provisions and trim details.
- C. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hardwood Flooring: Comply with NWFA A500 for species, grade, and cut.
 - 1. Certification: Provide flooring that carries NWFA grade stamp on each bundle or piece.
- B. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.
 - 1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
- C. Softwood Flooring: Comply with WCLIB No. 17 grading rules for species, grade, and cut.

2.2 FIELD-FINISHED WOOD FLOORING

- A. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content; tongue and groove and end matched; with backs channeled.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acer Flooring.
 - b. Carlisle Wide Plank Floors.
 - c. Oregon Lumber Company.
 - d. WD Flooring, LLC.
 - 2. Grade and Species: Clear red oak.

3. Cut: Vertical grain.
 4. Thickness: 3/4 inch.
 5. Face Width: 2-1/4 inches.
 6. Lengths: Random-length strips complying with applicable grading rules.
 7. Simulated Wood Pegs: Contrasting wood pegs at ends of flooring pieces.
- B. Urethane Finish System: Complete solvent-based, oil-modified system of compatible components that is recommended by finish manufacturer for application indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Absolute Coatings, Inc.
 - b. Basic Coatings.
 - c. Bona US.
 - d. Dura Seal.
 - e. Hillyard, Inc.
 - f. MAPEI Corporation.
 - g. PoloPlaz.
 2. Stain: Penetrating and nonfading type.
 - a. Color: As selected by Architect from manufacturer's full range.
 3. Floor Sealer: Pliable, penetrating type.
 4. Finish Coats: Formulated for multicoat application on wood flooring.
- C. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.3 ACCESSORY MATERIALS

- A. Wood Sleepers and Subfloor: As specified in Section 061000 "Rough Carpentry" and Section 061600 "Sheathing."
- B. Wood Underlayment: As specified in Section 061600 "Sheathing."
- C. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.
- D. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines."
- E. Thresholds and Saddles: To match wood flooring. Tapered on each side.
- F. Reducer Strips: To match wood flooring. 2 inches wide, tapered, and in thickness required to match height of flooring.
- G. Wood Air Vents and Grilles: To match wood flooring and in sizes and design indicated on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines."
- B. Wood Sleepers and Subfloor: Install according to requirements in Section 061000 "Rough Carpentry" and Section 061600 "Sheathing."
- C. Wood Underlayment: Install according to requirements in Section 061600 "Sheathing."
- D. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.
- E. Solid-Wood Flooring: Blind nail or staple flooring to substrate.
 - 1. Plank Flooring: For flooring of face width more than 3 inches:
 - a. Hardwood: Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.
 - b. Softwood: Install no fewer than two countersunk nails at each end of each piece, spaced not more than 16 inches along length of each piece, in addition to blind nailing. Fill holes with matching wood filler.

3.2 FIELD FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that are noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
 - 1. Comply with applicable recommendations in NWFA's "Installation Guidelines."
- B. Fill open-grained hardwood.
- C. Fill and repair wood flooring defects.
- D. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
 - 1. Apply stains to achieve an even color distribution matching approved Samples.
 - 2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
- E. Cover wood flooring before finishing.
- F. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.3 PROTECTION

- A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 - 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096400

SECTION 126600 - TELESCOPING STANDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electrically operated telescoping stands.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For telescoping stands in both stacked and extended positions.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product certificates.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Telescoping stands shall withstand the effects of gravity loads, operational loads, and other loads and stresses according to ICC 300.
- B. Accessibility Standard: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.2 TELESCOPING STANDS

- A. System Description: Operable system of multiple-tiered seating on interconnected folding platforms that close for storage, without being dismantled, into a nested stack. Telescoping-stand units permit opening and closing of adjacent, individual and multiple rows, and close with vertical faces of platforms in the same vertical plane.
 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Telescoping-Stands Standard: ICC 300.
- B. Wall-Attached Telescoping Stands: Forward-folding system, in which the bleachers open in the forward direction by moving the front row away from the stack to the fully extended position and the rear of bleacher understructure permanently attaches to wall construction.
 1. **Manufacturers: Subject to compliance with requirements, provide products by one of the following:**
 - a. Intekal Inc.
 - b. Irwin Seating Company; Folding Bleacher Company Subsidiary.
 - c. Hussey Seating Co.
 2. Operation: Electrically operated, with friction-type, integral power unit.
 3. Electrical Characteristics for Each Seating Section:
 - a. Horsepower: 1-1/2 horsepower.
 - b. Voltage: 208 V ac, three phase, 60 hertz.
 4. Electrical Controls:
 - a. Control Devices: Wall-attached control system.
 - b. Limit Switches: Automatically stop power system when telescoping stands reach fully opened or closed positions.

- c. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB at 10 feet, mounted under telescoping seating for audio and visual warning during operation.
- d. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

2.3 COMPONENTS

A. Benches: Seats and skirts.

- 1. Material: Molded plastic with contour surfaces.
 - a. Color: As selected by Architect from manufacturer's standard.
- 2. Bench Height: Not less than 16 inches or more than 18 inches.
- 3. Bench Depth: 12 inches.
- 4. Bench Seat Width: Not less than 18 inches.

B. Wheelchair-Accessible Seating: Locate seating cutouts to provide wheelchair-accessible seating at locations indicated on Drawings.

- 1. Equip tiers adjacent to wheelchair-accessible seating with front rails as required by ICC 300.
- 2. Equip cutouts with full-width front closure panels that match decking construction and finish and that extend from underside of tiers adjacent to cutouts to 1-1/2 inches from finished floor.

C. Risers: Steel sheet with manufacturer's standard, rust-inhibiting coating or hot-dip galvanized finish.

D. Safety Rails: Steel, finished with manufacturer's standard powder coat system.

- 1. Self-storing mid-aisle handrails located at centerline of each aisle with seating on both sides.
- 2. End rails (guards) that are telescoping and self-storing.
- 3. Back rails (guards) along rear of units where required by ICC 300.
- 4. Removable front rails (guards) along front of units where required by ICC 300.
- 5. Removable rails around accessible seating cutouts and truncations.
- 6. Removable, programming-support front rails to allow seating in upper rows while lower rows remain in the stored position.
- 7. Color: Manufacturer's standard neutral color.

E. Understructure: Structural steel.

- 1. Finish: Manufacturer's standard rust-inhibiting finish.
- 2. Color: Manufacturer's standard.

F. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.

1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but no fewer than four per column or less than 4 inches in diameter and 1-1/2 inch wide.

G. Control Devices:

1. Wall Attached: Manufacturer's standard control station, located within full view of each stand and its movement area. Provide two keys per station.

2.4 ACCESSORIES

A. Steps:

1. Slip-resistant, abrasive tread surfaces at aisles.
2. Intermediate aisle steps, fully enclosed, at each aisle.
3. Transitional top step, fully enclosed, at each aisle where last row of telescoping stands is adjacent to a cross aisle.
4. Removable front steps, fully enclosed, at each aisle, that engage with front row to prevent accidental separation or movement and are equipped with a minimum of four skid-resistant feet.

B. Closure Panels and Void Fillers:

1. Aisle closures at foot level that produce flush vertical face at aisles when system is stored.
2. End panels covering exposed ends of stands in the stored position.
3. Back panels covering rear of freestanding units. Panels extend full height and width of unit.
4. Panels at cutouts and truncations for accessible seating.
5. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.
6. Gap fillers for closing openings between stand units or between stand units and adjoining construction.

2.5 FABRICATION

- A. Fabricate telescoping stands to operate easily without special tools or separate fasteners unless otherwise indicated.
- B. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.
- C. Form exposed work with flat, flush surfaces, level and true in line.
- D. Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair their usefulness.
 1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install telescoping stands according to ICC 300 and manufacturer's written instructions.

3.2 ADJUSTING

- A. Adjust backrests so that they are at proper angles and aligned with each other in uniform rows.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect, adjust, operate, and maintain telescoping stands.

END OF SECTION 126600

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SECTION 310516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse-aggregate materials.
2. Fine-aggregate materials.

B. Related Requirements:

1. Section 312000 – Earth Moving-Trenching: Excavating as required for building foundations and utilities within building perimeter.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.
2. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg Rammer and a 457-mm Drop.

B. ASTM International:

1. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
4. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
6. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Product Data: Submit name of imported materials source.

B. Samples: Submit, in airtight containers, 10-lb. sample of each type of fill to testing laboratory.

- C. Supplier's Certificate: Certify that products meet or exceed specified requirements.
- D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

1.4 QUALITY ASSURANCE

- A. Furnish each coarse- and fine-aggregate materials from single source throughout Work.
- B. Perform Work according to State of West Virginia Department of Transportation standards.
- C. Maintain a copy of each standard affecting Work of this Section on Site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Coarse Aggregate: Conforming to the West Virginia Department of Transportation standard.

2.2 FINE AGGREGATE MATERIALS

- A. Fine Aggregate: Conforming to the West Virginia Department of Transportation standard.

2.3 SOURCE QUALITY CONTROL

- A. Testing and Analysis:
 - 1. Coarse-Aggregate Material: Comply with AASHTO T 180.
 - 2. Fine Aggregate Material - Testing and Analysis: Perform according to AASHTO T 180.
 - 3. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Excavation:
 - 1. Excavate aggregate materials from Site locations as designated by Owner and as specified in Section 312000 - Earth Moving-Trenching.
 - 2. Remove excess excavated coarse-aggregate and fine-aggregate materials not intended for reuse from Site.
 - 3. Remove excavated materials not meeting requirements for coarse aggregate and fine aggregate from Site.

B. Stockpiling:

1. Stockpile materials on Site at locations as designated by Owner.
2. Stockpile excavated material meeting requirements for coarse-aggregate and fine-aggregate materials.
3. Stockpile in sufficient quantities to meet Project schedule and requirements.
4. Separate different aggregate materials with dividers or stockpile apart to prevent intermixing of aggregate types or contamination.
5. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
6. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching until they are disposed.

3.2 CLEANING

A. Stockpile:

1. Remove stockpile and leave area in clean and neat condition.
2. Grade Site surface to prevent freestanding surface water.
3. Restore site to previous, or better, conditions.

END OF SECTION 310516

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SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing existing vegetation.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping, or sealing site utilities.
6. Temporary erosion and sedimentation control.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at the Project site.

1.3 MATERIAL OWNERSHIP

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

1.4 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving - Trenching."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

- C. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and Section 024119 "Selective Demolition."

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
1. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 2. Use only hand methods or air spade for grubbing within protection zones.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.6 SITE IMPROVEMENTS

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

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING-TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade and walks.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

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

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

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

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

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

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

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

- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct under-cut conference on site.
- B. Preinstallation Conference: Conduct conference for crushing existing material and installing engineered fill
- C. Preinstallation Conference: Conduct conference from cement stabilization.

1.4 INFORMATIONAL SUBMITTALS

- A. Material test reports.
- B. Methods for crushing existing material
- C. Material, methods, layout plan, mix design, equipment, etc. for cement stabilization.

1.5 FIELD CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

- B. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- C. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- D. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- E. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- D. Based on geotechnical borings, the existing subsurface materials consists un-engineered strip mine soil and rock fill. Therefore, the material below the proposed building will required complete removal to a depth of 6 feet below the proposed subgrade elevation and replacement

in a controlled engineered fill. Undercutting shall extend a minimum of 20' outside the proposed building footprint.

3.2 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Based on geotechnical borings, the existing subsurface materials consists un-engineered strip mine soil and rock fill. Therefore, the material below the proposed building will required complete removal to a depth of 6 feet below the proposed subgrade elevation and replacement in a controlled engineered fill. Undercutting shall extend a minimum of 20' outside the proposed building footprint. It is recommended that Portland Cement stabilization of the undercut site fill material be performed in a minimum 3 feet of depth below the proposed foundations. It is anticipated that on site excavated material can be used for the engineered fill and cement stabilization but will require processing of all material through a rock crusher and screening plant. Maximum particle size shall be 4 inches. Please refer to the Geotech Report dated July 2022 by American Geotech, Inc. for additional information and interpretations to aid in a providing a plan to stabilize the existing material.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.4 EXCAVATION FOR WALKS

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

3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.6 SUBGRADE INSPECTION

- A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

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

3.8 STORAGE OF SOIL MATERIALS

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

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

3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- E. Initial Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 1. Under grass and planted areas, use satisfactory soil material.
 2. Under walks and pavements, use satisfactory soil material.
 3. Under steps and ramps, use engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 - 1. Shape subbase course and base course to required crown elevations and cross-slope grades.
 - 2. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698 and ASTM D1557.

3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt overlay.
3. Cold milling of existing asphalt pavement.
4. Hot-mix asphalt patching.

B. Related Requirements:

1. Section 312000 "Earth Moving-Trenching" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
2. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs and gutters.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Herbicide.

B. Hot-mix asphalt designs.

C. Sustainable Design Submittals:

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

1. Aggregates.
2. Asphalt binder.
3. Tack coat.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of WV Department of Transportation for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: ASTM D6373 or AASHTO M 320 binder designation PG 58-28 PG 64-22 PG 70-22.
- B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material.
- C. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 MIXES

- A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: WVDOH Marshall HMA Type 2.
 - 3. Surface Course: WVDOH Marshall HMA Type 1.

PART 3 - EXECUTION

3.1 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Mill to a depth of 1-1/2 inches.
 - 2. Patch surface depressions deeper than 2 inches after milling, before wearing course is laid.

3.2 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
 - 1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.3 SURFACE PREPARATION

- A. Ensure that prepared subgrade is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.
- B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

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

3.4 HOT-MIX ASPHALT PLACEMENT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Spread mix at a minimum temperature of 250 deg F.
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feetwide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.

- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/2 inch.
 - 2. Surface Course: Plus 1/7 inch, no minus.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Replace and compact hot-mix asphalt where core tests were taken.

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

3.9 WASTE HANDLING

- A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving Including the Following:

1. Curbs and gutters.
2. Walks.

B. Related Requirements:

1. Section 321373 "Concrete Paving Joint Sealants" for installation of cold-applied and hot-applied joint sealants, joint-sealant backer materials, and primers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- C. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.
- D. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.3 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C150/C150M, gray portland cement Type I/II.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S, uniformly graded. Provide aggregates from a single source.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
- E. Water: Potable and complying with ASTM C94/C94M.

2.4 CURING MATERIALS

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

- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B, dissipating.

2.5 RELATED MATERIALS

- A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
- B. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
- C. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
- D. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): See Detailed drawings for specific applications.
 - 2. Maximum W/C Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

3.2 PREPARATION

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

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

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

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness:
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed paving surface with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
 - 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions.
 - 1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
 - 2. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

3.8 CONCRETE PROTECTION AND CURING

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

- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these.

3.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 3/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch
 - 4. Joint Spacing: 3 inches.
 - 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 6. Joint Width: Plus 1/8 inch, no minus.

3.10 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Joint-sealant backer materials.
4. Primers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each kind and color of joint sealant required.
- C. Paving-Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product certificates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D5893/D5893M, Type NS.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D5893/D5893M, Type SL.
- C. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.
- D. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.
- E. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade P, Class 25, for Use T.

2.3 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I.
- B. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I or Type II.
- C. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I, II, or III.
- D. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type IV.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

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

PART 3 - EXECUTION

3.1 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Cleaning of Joints: Clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
- C. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer.
- D. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.
- E. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- F. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
 - 1. Place joint sealants so they fully contact joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- H. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- I. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

END OF SECTION 321373

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.
2. Painted markings applied to concrete surfaces.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product
- B. Samples: For each exposed product and for each color and texture specified

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.3 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint, Solvent-Borne: MPI #32, solvent-borne traffic-marking paint.
1. Color: White, Yellow, and Blue or as indicated.
- B. Pavement-Marking Paint, Acrylic: Acrylic, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952F, Type II, with drying time of less than 45 minutes.
1. Color: As indicated.

- C. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.
 - 1. Color: As indicated.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow asphalt paving or concrete surfaces to age for a minimum of 7 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface.

END OF SECTION 321723

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding.
2. Sodding.

1.2 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of Grass Seed
 - 1. Certification of each seed mixture for turfgrass sod
- C. Product Certificates
- D. Maintenance Instructions

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 1. Pesticide Applicator: State licensed, commercial.
- B. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
 - 1. State recommendations for nitrogen, phosphorous, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable vegetables.
 - 2. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
- C. Preinstallation conference: Conduct Conference at the Project Site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Grass Seed Mix: Proprietary seed mix as follows:

1. Products subject to compliance with requirements, provide the following:

- a. seed mix or approved equal.

Seed mix		
Seed%	Variety	Germ %
29.42	Arrowhead Kentucky Bluegrass	85
29.38	Bluenote Kentucky Bluegrass	85
19.62	Homerun Perennial Ryegrass	90
19.58	Apple GL Perennial Ryegrass	90
00.25	Other Crop Seed	
01.70	Inert Matter	
00.05	Weed Seed	

2.2 TURFGRASS SOD

- A. Turfgrass Sod: Certified Number 1 complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.

2. Sun and Partial Shade: Proportioned by weight as follows:

- 50 percent Kentucky bluegrass (*Poa pratensis*).
- 30 percent chewings red fescue (*Festuca rubra* variety).
- 10 percent perennial ryegrass (*Lolium perenne*).
- 10 percent redtop (*Agrostis alba*).

3. Shade: Proportioned by weight as follows:

- 50 percent chewings red fescue (*Festuca rubra* variety).

- b. 35 percent rough bluegrass (*Poa trivialis*).

2.3 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

2.4 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.

2.5 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 10 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 10 percent nitrogen, 20 percent phosphorous, and 20 percent potassium, by weight.

2.6 PLANTING SOILS

- A. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 1. Lime will be applied according to soil test requirements to correct the soil pH to between 6.0 and 6.5
 - 2. Fertilizers will be applied according to soil test requirements

2.7 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, general grain straw exclusive or cellulose fiber.

PART 3 - EXECUTION

3.1 TURF AREA PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply superphosphate fertilizer directly to subgrade before loosening
 - 2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 3. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Reduce elevation of planting soil to allow for soil thickness of sod.
- B. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply superphosphate fertilizer directly to surface soil before loosening.
 - 3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
- B. Sow seed at a total rate of 5 to 6 lb/1000 sq. ft. Seed shall not be sown through mulch.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- E. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch/mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.3 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across angle of slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.4 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
- B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.

3.5 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches
 - 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

END OF SECTION 329200

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SECTION 330130.13 - SEWER AND MANHOLE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing of Gravity Sewer Piping:
 - a. Low pressure air testing.
 - b. Exfiltration testing.
 - c. Infiltration testing.
2. Testing of pressure piping.
3. Deflection testing of plastic sewer piping.
4. Testing of Manholes:
 - a. Vacuum testing.
 - b. Exfiltration testing.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
2. ASTM C1244M - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
3. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

B. American Water Works Association:

1. AWWA C600 - Installation of Ductile Iron Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:

1. Testing procedures.
2. List of test equipment.
3. Testing sequence schedule.

4. Provisions for disposal of flushing and test water.
5. Certification of test gage calibration.
6. Deflection mandrel drawings and calculations.

C. Test and Evaluation Reports: Indicate results of manhole and piping tests.

PART 2 - PRODUCTS

2.1 VACUUM TESTING

A. Equipment:

1. Vacuum pump.
2. Vacuum line.
3. Vacuum Tester Base:
 - a. Compression band seal.
 - b. Outlet port.
4. Shutoff valve.
5. Stopwatch.
6. Plugs.
7. Vacuum Gage: Calibrated to 0.1 in. Hg.

2.2 EXFILTRATION TESTING

A. Equipment:

1. Plugs.
2. Pump.
3. Measuring device.

2.3 AIR TESTING

A. Equipment:

1. Air compressor.
2. Air supply line.
3. Shutoff valves.
4. Pressure regulator.
5. Pressure relief valve.
6. Stopwatch.
7. Plugs.
8. Pressure Gage: Calibrated to 0.1 psi.

2.4 INFILTRATION TESTING

- A. Equipment: Weirs.

2.5 HYDROSTATIC TESTING

- A. Equipment:
 - 1. Hydro pump.
 - 2. Pressure hose.
 - 3. Water meter.
 - 4. Test connections.
 - 5. Pressure relief valve.
 - 6. Pressure Gage: Calibrated to 0.1 psi.

2.6 DEFLECTION TESTING

- A. Equipment:
 - 1. "Go, no go" mandrels.
 - 2. Pull/retrieval ropes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that manholes and piping are ready for testing.
- C. Verify that trenches are backfilled.
- D. Verify that pressure piping thrust restraint system is installed.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for preparation.
- B. Lamping:
 - 1. Lamp gravity piping after flushing and cleaning.
 - 2. Perform lamping operation by shining light at one end of each pipe section between manholes.
 - 3. Observe light at other end.

4. Pipe not installed with uniform line and grade will be rejected.
5. Remove and reinstall rejected pipe sections.
6. Reclean and lamp until pipe section is installed to uniform line and grade.

C. Plugs:

1. Plug outlets, wye branches, and laterals.
2. Brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Low-Pressure Air Testing:

1. Test each reach of gravity sewer piping between manholes.
2. Introduce air pressure slowly to approximately 4 psig.
3. Determine ground water elevation above spring line of piping.
4. For every foot of ground water above spring line of piping, increase starting air test pressure by 0.43 psi.
5. Do not increase pressure above 10 psig.
6. Allow pressure to stabilize for at least five minutes.
7. Adjust pressure to 3.5 psig or to increased test pressure as determined above when ground water is present.
8. Do not make allowance for laterals.
9. Minimum Testing Duration in Minutes per 100 feet:
 - a. Pipe Size 3 Inches: 0.2.
 - b. Pipe Size 4 Inches: 0.3.
 - c. Pipe Size 6 Inches: 0.7.
 - d. Pipe Size 8 Inches: 1.2.
 - e. Pipe Size 10 Inches: 1.5.
 - f. Pipe Size 12 Inches: 1.8.
 - g. Pipe Size 15 Inches: 2.1.
 - h. Pipe Size 18 Inches: 2.4.
 - i. Pipe Size 21 Inches: 3.0.
 - j. Pipe Size 24 Inches: 3.6.
 - k. Pipe Size 27 Inches: 4.2.
 - l. Pipe Size 30 Inches: 4.8.
 - m. Pipe Size 33 Inches: 5.4.
 - n. Pipe Size 36 Inches: 6.0.
10. Record drop in pressure during testing period.
11. If air pressure drops more than 1.0 psi during testing period, piping has failed.
12. If 1.0 psi air pressure drop has not occurred during testing period, piping is acceptable; discontinue testing.
13. If piping fails, test reach of piping in incremental stages until leaks are isolated, repair leaks, and retest entire reach between manholes.

C. Testing of Pressure Piping:

1. Test system according to AWWA C600 and following:
 - a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
 - b. Conduct hydrostatic testing for at least two hours.
 - c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
 - d. Install corporation cocks at high points.
 - e. Close air vents and corporation cocks after air is expelled.
 - f. Raise pressure to specified test pressure.
 - g. Observe joints, fittings, and valves undergoing testing.
 - h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage.
 - i. Retest.
 - j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
 - k. Maintain pressure within plus or minus 5.0 psi of test pressure.
 - l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
 - m. Compute maximum allowable leakage using following formula:
 - 1) $L = \frac{C}{P}$.
 - 2) L = testing allowance, gph.
 - 3) S = length of pipe tested, feet.
 - 4) D = nominal diameter of pipe, inches.
 - 5) P = average test pressure during hydrostatic testing, psig.
 - 6) C = 148,000.
 - 7) If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.
2. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
3. Correct visible leaks regardless of quantity of leakage.

D. Deflection Testing of Plastic Sewer Piping:

1. Perform vertical ring deflection testing on PVC and acrylonitrile butadiene styrene sewer piping after backfilling has been in place for at least 30 days but not longer than 12 months.
2. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.
3. Perform deflection testing using properly sized rigid ball or "go, no go" mandrel.
4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe, as determined by ASTM standard to which pipe is manufactured; measure pipe diameter in compliance with ASTM D2122.
5. Perform testing without mechanical pulling devices.

6. Locate, excavate, replace, and retest piping that exceeds allowable deflection.

E. Manhole Testing:

1. If air testing, test whenever possible prior to backfilling in order to more easily locate leaks.
2. Repair both outside and inside of joint to ensure permanent seal.
3. Test manholes with manhole frame set in place.
4. Vacuum Testing:
 - a. Comply with ASTM C1244.
 - b. Plug pipe openings; securely brace plugs and pipe.
 - c. Inflate compression band to create seal between vacuum base and structure.
 - d. Connect vacuum pump to outlet port with valve open, then draw vacuum to 10 in. Hg.
 - e. Close valve.
 - f. Manhole Test Duration in Seconds:
 - 1) Diameter 4 Feet60.
 - 2) Diameter 5 Feet75.
 - 3) Diameter 6 Feet90.
 - g. Record vacuum drop during test period.
 - h. If vacuum drop is greater than 1 in. Hg during testing period, repair and retest manhole.
 - i. If vacuum drop of 1 in. Hg does not occur during test period, manhole is acceptable; discontinue testing.
 - j. If vacuum test fails to meet 1 in. Hg drop in specified time after repair, repair and retest manhole.

END OF SECTION 330130.13

SECTION 330513 - MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Cast-in-place concrete manholes and structures with transition to cover frame, covers, anchorage, and accessories.
2. Modular precast concrete manholes and structures with tongue-and-groove joints and transition to cover frame, covers, anchorage, and accessories.
3. Doghouse manhole connections to existing sanitary sewer lines.
4. Bedding and cover materials.
5. Connection to existing sewer.
6. Manhole Abandonment.

- B. Related Requirements:

1. Section 013300 - Submittal Procedures.
2. Section 312000 – Earth Moving
3. Section 330130.13 - Sewer and Manhole Testing
4. Section 330513 – Manholes and Structures
5. Section 333113 - Public Sanitary Utility Sewerage Piping
6. Section 334113 - Public Storm Utility Drainage Piping

1.3 REFERENCE STANDARDS

- A. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
4. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
5. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
6. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for manhole covers, component construction, features, configuration, and dimensions.
- C. Shop Drawings:
 - 1. Indicate structure locations and elevations.
 - 2. Indicate sizes and elevations of piping and penetrations.
- D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statements:
 - 1. Submit qualifications for manufacturer and installer.
 - 2. Submit manufacturer's approval of installer.

1.5 QUALITY ASSURANCE

- A. Perform Work according to ASTM C478 Standards.
 - 1. Provide minimum wall thickness as per ASTM C76 Wall B Standard.
- B. All completed connections shall meet the water tightness standards set forth elsewhere in these Specifications.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three (3) years' experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three (3) years' experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

- C. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing, and moving precast manholes and drainage structures.
- D. Storage
 - 1. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
 - 2. Repair property damaged from materials storage.

1.8 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

PART 2 - PRODUCTS

2.1 MANHOLES AND STRUCTURES

- A. Precast Concrete Manholes and Structures
 - a. Description: Reinforced precast concrete conforming to ASTM C478 with butyl mastic sealant conforming to ASTM D3330 or with gaskets conforming to ASTM C923.
 - b. Provide minimum wall thickness as per ASTM C76 Wall B Standard.
 - c. All precast concrete shall include Crystalline Concrete Waterproofing admixture as specified in Section 033050 – Crystalline Concrete Waterproofing.
- 2. Joints for Precast Manholes and Structures
 - a. Form joints of the manhole sections entirely of concrete employing a round rubber gasket conforming to ASTM C443, or Butyl rubber sealant meeting the requirements of ASTM C-990, Section 10.1 as manufactured by Conseal Sealants, Inc. or equal applied at the interior and the exterior meeting faces of the manhole joint. The manhole joint, when assembled, shall be self-centering and make a uniform watertight joint.
 - b. If provided, make lift holes watertight.
 - c. Maximum Leakage: 0.025 gallon per hour per foot of joint at 3 feet of head.
- B. Cast-in-Place Concrete
 - 1. Provide minimum of 4,000-pound-per-square-inch (psi) 28-day-strength Portland cement concrete as specified in Section 033000 - Cast-in-Place Concrete in the construction of manholes.
 - 2. Provide reinforcement as shown on the Drawings and as specified in Section 033000 - Cast-in-Place Concrete in the construction of manholes.
- C. Grout

1. As specified in Section 036000 - Grouting.
 - D. Shaft Construction and Eccentric Cone Top Section
 1. Pipe Sections: Reinforced precast concrete.
 2. Joints
 - a. Lipped male/female.
 3. Sleeved to receive pipe sections.
 - E. Shape: as indicated on the Drawings.
 - F. Clear Inside Dimensions: as indicated on the Drawings.
 - G. Clear Cover Opening: minimum of 26 inches
 - H. Pipe Entry: Furnish openings as indicated on Drawings.
 - I. Steps
 1. Rungs: Grade 60 deformed reinforcing bar encapsulated in polypropylene.
 2. Formed integral with manhole sections.
 3. Diameter: 1/2-inch.
 4. Width: **12 inches**.
 5. Spacing: 16 inches o.c. vertically, set into structure wall.
 6. Do not exceed 24 inches between the top of the casting and the first step.
- 2.2 FRAMES AND COVERS
- A. Furnish in accordance with Section 330513.01 - Manhole Frames and Covers.
- 2.3 RISER SECTIONS
- A. Provide riser sections, if used, in any combination to obtain the desired depth. Final grade adjustment to manhole casting elevation shall be accomplished by the use of riser sections.
 - B. Adjusting rings with a maximum combined height not to exceed 10" will be required to be installed on all manholes installed in rigid pavements, gravel or earthen roadways, driveways, and roadway berms and shoulders. Adjusting rings in other areas are not required unless needed to adjust to final grades.
 - C. Risers and Adjusting Rings
 1. Risers 4 inches to 6 inches thick
 - a. Material: Precast concrete.
 - b. Comply with ASTM C478.

2. Adjusting Rings less than 4 inches thick
 - a. Material: Cast iron.
 - b. Comply with AASHTO M306.
3. Rubber Seal Wraps
 - a. Wraps and Band Widths: Conform to ASTM C877, Type III.
 - b. Cone/Riser Section Joint: Minimum 3 inches overlap.
 - c. Frame/Riser Section Joint: 2 inches overlap.
 - d. Additional Bands: Overlap upper band by 2 inches.
4. Joints of the adjusting rings shall be sealed by using a butyl rubber sealant meeting the requirements of ASTM C-990, Section 10.1 as manufactured by Conseal Sealants, Inc. or equal, and when assembled shall make a uniform watertight joint. Conditions may exist where the final top of casting elevation is required to match a sloped finished surface. If in the Engineer's opinion, and when authorized, mortar shall be used as joint material in assembling the adjusting rings to achieve the final elevation required. All joints shall be smooth and completely filled with mortar.

D. Accessories

1. Bolts: Stainless Steel: Comply with ASTM F593.

2.4 MATERIALS

A. Bedding

1. Bedding: Adequate foundations for all manhole structures shall be obtained by removal and replacement of unsuitable material with well-graded granular material. Base shall be a well-graded granular bedding course conforming to the requirements for sewer bedding but not less than 6 inches in thickness and extending either to the limits of the excavation or to a minimum of 12 inches outside the outside limits of the base section. In the latter case, the balance of the excavated area shall be filled with select material well tamped to the level of the top of the bedding to positively prevent any lateral movement of the bedding when the weight of the manhole is placed upon it. The bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast elements.

B. Cover

1. Cover: Initial 18 inches of backfill shall be placed in layers not to exceed 4 inches in depth and thoroughly tamped by mechanical tampers or approved hand tampers. Maximum 4 inches for hand tamper or walk behind roller. Maximum 6 inches for areas accessible with 10 ton vibratory roller. Compaction shall be equal to or greater than adjacent undisturbed soil.

C. Concrete

1. Concrete to be utilized in the abandonment in place of manhole shall conform to Specification Section 033000 - Cast-in-Place Concrete.

2.5 ACCESSORIES

A. Inside Drop Manhole Connections.

1. Provide inside drop manhole connections for sanitary sewers when called for on the Drawings or as directed. Inside drop bowl assembly with a Force Line Hood shall be as manufactured by Reliner-Duran, Inc. Drop pipe shall be constructed of SDR 35 PVC unless otherwise noted. Attach and anchor drop bowl/hood assembly and drop pipe with stainless steel anchors and straps.

B. Foundation Slab:

1. Cast-in-place bases shall be at least 10 inches in thickness and shall extend at least 6 inches radially outside of the manhole wall. Concrete shall have a minimum of 4000 psi 28-day compression strength.
2. Top Surface: Level.

C. Soil Backfill from Above Pipe to Finish Grade:

1. Soil Type S1 and/or as specified in Section 310513 – Soils for Earthwork.
2. Subsoil: No rocks over 6 inches in diameter, frozen earth, or foreign/organic matter.

2.6 CONNECTIONS

A. The sewer pipe to manhole connections on all sanitary sewers shall be flexible and watertight.

1. To maintain flexibility in the connection, leave a 1-inch space between the end of the pipe inside the manhole and the concrete channel; fill this space with waterproof flexible joint filler. The watertight flexible joint filler shall be CS-1500 Rapid Cure Elastomeric Sealant as manufactured by ConSeal, Pro-Stik Butyl Sealant as manufactured by Press-Seal; sealants shall be used in conjunction with a skim coat of grout, or equal. The watertight flexible joint filler between the end of the pipe and the concrete channel is to only be installed half way up to the springline of the pipe
2. The watertight connection shall meet the following requirements.
 - a. Any metal or hardware that is used shall be Type 300 series stainless steel.
 - b. Elastomers must be EPDM or isoprene.
 - c. Comply with ASTM C 923.
 - d. Connectors shall be cast into manholes and shall be Z-Lok Connectors as manufactured by A-Lok Products, Inc. or equal.
3. Do not extend the sewer pipe barrel at the springline more than 1 inch beyond the inside face of the manhole.

4. All stub connections shall be pipe with the same joint, strength, and specification as the sewer pipe. Plug and block the stub with an approved watertight stopper compatible with the sewer pipe joint.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements
- B. Verify that items provided by other Sections of Work are properly sized and located.
- C. Verify that built-in items are in proper location and are ready for roughing into Work.
- D. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements.
- B. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, identifying symbols and numbers as indicated on Drawings.
- C. Coordinate placement of inlet and outlet pipe sleeves required by other Sections.
- D. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.
- E. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.
- F. Wastewater Flow Control: Contractor shall bypass existing sewage flow where force mains or gravity sewer lines restrict the installation procedure. Contractor shall work at such hours as to cause the least sewage flow control problems to Owner. Contractor shall not perform installation in structures until a plan for bypassing sewage flow has been implemented. Additionally, no plugging of the utility system gravity lines will be made without the approval of Owner and Engineer.

3.3 REMOVAL OF EXISTING MANHOLES

- A. Excavate only the area required to remove the existing manhole and appurtenances and to make re-connections to existing sewers.
- B. Saw cut pavement with clean vertical surfaces in areas where existing manholes are located in concrete or asphalt pavement.

- C. The manhole and appurtenances shall be carefully removed with mechanical equipment. Contractor shall take great care in protecting the surrounding environment from contamination due to spillage of sewage during the removal process.
- D. Remove all contaminated soil and bedding after the manhole has been removed.
- E. Safely dispose of the manhole and appurtenances at a site approved by the Engineer.

3.4 INSTALLATION

A. Excavation and Backfill:

- 1. Excavate for manholes and structures as specified in Section 312316 - Excavation and in indicated locations and depths.
- 2. Provide clearance around sidewalls of manhole or structure for construction operations and granular backfill.
- 3. If groundwater is encountered, prevent accumulation of water in excavations; place manhole or structure in dry trench. Water level shall be a minimum of 2 feet below the invert elevation of the trench or excavation.
- 4. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation, as approved by Engineer.

B. Foundation Slab:

- 1. Place foundation slab and trowel top surface level.
- 2. Place manhole sections plumb and level, trim to correct elevations, and anchor to foundation slab.

C. Install manholes and structures supported at proper grade and alignment as indicated on Drawings.

D. Backfill excavations for manholes and structures as specified in Section 312316.13 - Trenching.

E. Form and place manhole or structure cylinder plumb and level, to correct dimensions and elevations.

F. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel.

G. Set cover frames and covers level to correct elevations without tipping.

H. Precast Concrete Manholes and Structures:

- 1. Lift precast components at lifting points designated by manufacturer.
- 2. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
- 3. Set precast structures, bearing firmly and fully on crushed stone bedding, compacted as specified in Section 312316 - Excavation and/or Section 312316.13 Trenching or on other support system as indicated on Drawings.

4. Assembly:
 - a. Assemble multi-section manholes and structures by lowering each section into excavation.
 - b. Install rubber gasket joints between precast sections according to manufacturer's recommendations.
 - c. Lower, set level, and firmly position base section before placing additional sections.
5. Remove foreign materials from joint surfaces and verify sealing materials are placed properly.
6. Maintain alignment between sections by using guide devices affixed to lower section.
7. Joint sealing materials may be installed on Site or at manufacturer's plant.
8. Verify that installed manholes and structures meet required alignment and grade.
9. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
10. Cut pipe flush with interior of structure.
11. Shape inverts through manhole and structures as indicated on Drawings.

I. Doghouse Manholes and Structures:

1. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.
2. Carefully excavate around existing sewer line to adequate depth for foundation slab installation.
3. Protect existing pipe from damage.
4. Cut out soft spots and replace with granular fill compacted to **95** percent maximum density.
5. Prepare crushed stone bedding or other support system, as indicated on Drawings, to receive foundation slab as specified for precast manholes and structures.
6. Install pre-cast concrete manhole or structure around existing pipe according to applicable Paragraphs in this Section.
7. Grout pipe entrances.
8. Perform connection to existing pipe during low flow conditions. Coordinate with Engineer to determine low flow conditions. Connection could require night work.
9. Consider including following Subparagraph if Project requires connection into an existing pipe that experiences large flow volumes and off-peak hour tie-in is necessary.
10. Block upstream flow at existing manhole or structure with expandable plug.
11. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up the outside diameter on each side of the pipe.
12. Bottom half of pipe to remain as manhole flow channel.
13. Saw cut to smooth finish with top half of pipe flush with interior of manhole or structure.
14. Grout base of manhole or structure to achieve slope to manhole or structure channel and trowel smooth and/or as shown on the drawings.

J. Castings:

1. Set frames using four (4) 5/8-inch diameter stainless steel anchor bolts as shown on the Drawings, mortar, butyl mastic and pre-cast concrete grade adjusting rings as indicated on Drawings.

2. Install pre-cast concrete grade adjusting rings with ¼ inch thick vertical joints at inside perimeter.
3. Lay grade adjusting rings in full bed of mortar and completely fill joints.
4. Adjusting rings with a maximum combined height not to exceed 10 inches will be required to be installed on all manholes installed in rigid pavements, gravel or earthen roadways, driveways, and roadway berms and shoulders. Adjusting rings in other areas are not required unless needed to adjust to final grades.
5. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.

3.5 FIELD QUALITY CONTROL

- A. Section 017000 - Execution and Closeout Requirements.
- B. Test cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete.
- C. Test concrete manhole and structure sections as specified in Section 330130.13 - Sewer and Manhole Testing. Testing shall be witnessed by the Engineer's RPR.
- D. Vertical Adjustment of Existing Manholes and Structures
 1. If required, adjust top elevation of existing manholes and structures to finished grades as indicated on Drawings.
 2. Frames, Grates, and Covers:
 - a. Carefully remove frames, grates, and covers cleaned of mortar fragments.
 - b. Reset to required elevation according to requirements specified for installation of castings.

3.6 GENERAL CONNECTIONS

- A. As shown on the Drawings or where directed by the Engineer, the existing force main shall be connected to the new force main, the new gravity sewer line or force main shall be connected to the existing manhole, or the new gravity line shall be connected to a new straddle manhole on the existing gravity line. Existing lines shall be plugged as noted on the Drawings.
- B. Provisions satisfactory to the Engineer shall be made to handle the flow of existing sewage. In general, this will require the blocking or plugging of the existing force or gravity sewer main at a point and the re-routing or pumping of sewage to some point of disposal that will not affect the construction work or present a health hazard.
- C. Construction techniques and materials used in making the actual connection shall be the same as for construction of new sewer.
- D. The Contractor shall develop a plan and schedule of operation showing the exact procedure to be followed in each case which shall be submitted to and approved by the Engineer in writing, if required or different from sequence listed in this Specification.

End of Section

SECTION 330513.01 - MANHOLE FRAMES AND COVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. General: Provide the labor, tools, equipment, and materials necessary to remove and dispose of existing manhole frames and covers and furnish and install new manhole frames and covers at the locations shown on the Drawings.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Contractor shall perform all Work required to furnish and install the manholes in compliance with applicable requirements of governing agencies having jurisdiction.

1.4 SUBMITTALS

- A. General: Submit all Submittals in accordance with the Section 013300 - Submittal Procedures and the requirements within this Specification section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General
 - 1. Inspect all manhole frames, covers, and accessories for damage immediately upon delivery to the Project Site.
 - 2. Handle all manhole frames, covers, and accessories carefully using proper handling devices.
 - 3. Materials cracked, gouged, chipped, dented, or otherwise damaged will be rejected.

PART 2 - PRODUCTS

2.1 FRAMES AND COVERS

- A. Frames and Covers

1. Manhole frames and covers shall be gray iron meeting the requirements of ASTM-A-48, Class 35B.
2. Standard covers shall be heavy-duty Neenah Model R-1642 frame and cover with self sealing gasket lids with a concealed pick hole. Watertight covers shall be heavy-duty Neenah Model R-1915-S1 with bolted gasket cover. All frame seats shall be machined to prevent rocking and rattling.
3. Cast the words "SANITARY SEWER" or "STORM SEWER" on all covers depending on the application.
4. Frame shall be sealed to top adjusting ring with 1 inch butyl rubber mastic sealant meeting the requirements of ASTM C-990, Section 10.1, as manufactured by Conseal, or equal, and a bed of mortar.
5. Frame shall be anchored to manhole with four (4) $\frac{5}{8}$ -inch diameter 304 grade (min.) stainless steel anchor bolts as shown on the Drawings.
6. Provide solid covers, unless noted otherwise on the Drawings.

B. Corrosion Resistant Coating

1. Corrosion resistant coatings shall be one of the following products:
 - a. Tnemec Perma-Shield PL Series 431.
 - b. Koppers "Bitumastic Super-Service Black".
 - c. Or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Carefully check all frames and covers for cracking, dents, damaged gaskets, and other damage. Dispose of all damaged frames and covers.
- B. Thoroughly clean the frames and covers using a wire brush or other method approved by the Engineer. Do not damage gaskets.

3.2 PAINTING

- A. Paint the underside of all manhole covers using one of the corrosion resistant coatings specified. Do not allow any paint to get on gaskets. Apply to a dry film thickness (DFT) of 40 mils minimum. Do not paint the top side of the manhole cover.
- B. Paint all surfaces of the manhole frame. Apply to a DFT of 40 mils.
- C. If the 40 mil DFT thickness is not applied in a single coat, allow the coating to dry and then sand the surface before applying the next coat per the manufacturer's recommendations.
- D. Protect the coatings from damage until the castings are installed on the manholes.

3.3 REMOVAL OF EXISTING CASTINGS

- A. Remove the existing manhole frames and covers and dispose of them in a manner acceptable to the Engineer.
- B. Prepare the existing concrete manhole by cleaning the surface to remove any rough edges and debris remaining after removal of the casting.

3.4 INSTALLATION, GENERAL

- A. Use precast concrete grade rings to adjust the final height so that the manhole cover is flush with finish grade. Use two (2) 1-inch wide strips of butyl mastic at each joint. Use a maximum 10 inches total height of grade rings.
- B. Install the manhole frame anchoring it at four (4) points using $\frac{5}{8}$ -inch diameter 304 grade (min.) stainless steel anchor bolts as shown on the Drawings. Set the frame in a bed of butyl mastic prior to final anchoring.
- C. Touch up any chipped surfaces of the corrosion protection coating.
- D. Restore any disturbed ground surfaces to its original condition.

END OF SECTION 330513.01

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SECTION 331116 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for Site water line, including domestic water line.
2. Underground pipe markers.
3. Bedding and cover materials.

B. Related Requirements:

1. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
2. Section 312000 – Earth Moving-Trenching: Requirements for excavation, backfill, and trenching as required by this section.
3. Section 331300 - Disinfecting of Water Utility Distribution: Disinfection of Site service utility water piping.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
3. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. [ASTM A48M - Standard Specification for Gray Iron Castings.](#)
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. [ASTM B88M - Standard Specification for Seamless Copper Water Tube.](#)

5. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
6. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³).
7. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
8. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
9. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
10. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
11. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
12. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
13. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
14. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C502 - Dry-Barrel Fire Hydrants.
7. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).
8. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
9. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
10. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
11. AWWA C606 - Grooved and Shouldered Joints.
12. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
13. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
14. AWWA C702 - Cold-Water Meters - Compound Type.
15. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
16. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
17. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service.
18. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.
19. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

F. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. [AWS A5.8M - Specification for Filler Metals for Brazing and Braze Welding.](#)

G. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

H. UL:

1. UL 246 - Hydrants for Fire-Protection Service.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Perform Work according to local municipality's standards.
- B. Maintain one copy of each standard affecting Work of this Section on Site.

PART 2 - PRODUCTS

2.1 WATER PIPING

- A. Ductile Iron Pipe:
 1. Comply with AWWA C151.
 2. Fittings:

- a. Material: Ductile iron.
 - b. Thickness: Standard.
 - 3. Joints:
 - a. Comply with AWWA C111.
 - b. Provide rubber gasket with rods.
 - 4. Jackets (Polyethylene Encasement): Comply with AWWA C105, polyethylene jacket double layer, half lapped, 10-mil polyethylene tape.
- B. Polyvinylchloride (AWWA C900 PVC, C 905 PVC, and/or C909 PVC):
- 1. Comply with AWWA C900, C 905, and/or C905 as shown in Drawings and/or described in Pay Item(s). Dimension ratio and/or Pressure Class as shown in the Drawings and/or described in the Pay Item(s).
 - 2. Compact Fittings: Ductile Iron Fittings. Comply with AWWA C153. Provide adaptors as required.
 - 3. Joints:
 - a. Comply with ASTM D3139.
 - b. Seals: PVC flexible elastomeric.
 - c. Solvent-cement couplings are not permitted.

2.2 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves:
- 1. Manufacturers:
 - a. JCM Industries, Inc.
 - b. Kennedy Valve Company
 - c. Mueller Company
 - d. Smith-Blair, Inc.
 - e. U.S. Pipe Valve & Hydrant
- B. Description:
- a. Material: Ductile iron.
 - b. Type: Dual compression.
 - c. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 125 and MSS SP-60.
- C. Tapping Valves:
- a. JCM Industries, Inc.
 - b. Kennedy Valve Company
 - c. Mueller Company

- d. Smith-Blair, Inc.
- e. U.S. Pipe Valve & Hydrant

D. Description:

- a. Comply with AWWA C500.
- b. Type: Double disc with non-rising stem.
- c. Inlet Flanges: Comply with ASME B16.1, Class 125 and MSS SP-60.
- d. Mechanical Joint Outlets: Comply with AWWA C111.

2.3 UNDERGROUND PIPE MARKERS

A. Magnetic Warning Tape:

Magnetic warning tape shall consist of a minimum thickness 0.35 mils solid aluminum coil core running a full length and width, encased in a protective, highly visible, color coded inert plastic that is impervious to all known alkalis, acids, chemical reagents, and solvents found in soil. Minimum overall thickness 5 mils. Tape shall a minimum of 6" wide, marked "water" in blue, and shall be magnetically detectable.

B. Tracer Wire (where shown in the Trench Detail(s) in the Drawings)

- 1. Electronic detection materials for nonconductive piping products.
- 2. Tracer wire shall be #12 AWG solid copper or high strength copper clad steel with 30 mil high molecular weight polyethylene (HMWPE) insulation or high density polyethylene (HDPE) insulation. Color shall be blue.
- 3. Splices shall be avoided to the maximum extent possible. Where splices are required, use 3M DBR (direct bury splice kit, copperhead snake bite connectors, or approved equal.

2.4 MATERIALS

- A. Bedding: As shown in Trench Detail(s) in the Drawings.
- B. Cover: As shown in the Trench Detail(s) in the Drawings and as specified in Section 312316.13 – Trenching.

2.5 ACCESSORIES

- A. Concrete for Thrust Restraints: As shown in the Details(s) in the Drawings.
- B. All-Thread and Bolts: Comply with ASTM A36 or ASTM A307, coated with coal tar after installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that trench excavation base is ready to receive work.
- B. Verify that existing utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

- A. Correct over-excavation as specified in Section 312316.13 – Trenching.
- B. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
- C. Protect and support existing utilities and appurtenances.
- D. Pipe Cutting:
 - 1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
 - 2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
 - 3. Grind edges smooth with beveled end for push-on connections.
- E. Remove scale and dirt on inside and outside before assembly.
- F. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Bedding:
 - 1. Excavate pipe trench as specified in Section 312000 – Earth Moving-Trenching.
 - 2. Place bedding material at trench bottom.
 - 3. Compact to 95 percent of maximum density.
 - 4. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to 95 percent of maximum density.
- B. Piping:
 - 1. Maintain 10 feet horizontal separation of water main from sewer piping and 18” vertical separation from sewer line.
 - 2. Group piping with other Site piping work whenever practical.
 - 3. Install pipe to elevations indicated on Drawings.
 - 4. Install ductile iron piping and fittings according to AWWA C600.

5. Install grooved and shouldered pipe joints according to AWWA C606.
6. Route pipe in straight line.
7. Install access fittings to permit disinfection of water system performed under Section 331300 - Disinfecting of Water Utility Distribution.
8. Thrust Restraints:
 - a. Form and place concrete for pipe thrust restraints at each elbow or change of pipe direction.
 - b. Place concrete to permit full access to pipe and pipe accessories.
 - c. See drawings for sq. ft. of thrust restraint bearing area on subsoil.
9. Establish elevations of buried piping with not less than the cover shown in the Trench Detail(s) in the Drawing.
10. Pipe Markers:
 - a. Install plastic ribbon tape continuous buried 18 inches below finish grade. Install tracer wire above piping where shown in the Trench Detail(s) in the Drawings.
 - b. Coordinate with trench Work as specified in Section 312000 – Earth Moving-Trenching.
11. Backfill trench as specified in Section 312000 – Earth Moving-Trenching.

C. Disinfection:

1. Flush and disinfect system as specified in Section 331300 - Disinfecting of Water Utility Distribution.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Install pipe within tolerance of 5/8 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Pressure test system according to AWWA C600 and following:
 1. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
 2. Conduct hydrostatic test for at least two hours.
 3. Slowly fill with water section to be tested and expel air from piping by installing corporation cocks at high points.
 4. Close air vents and corporation cocks after air is expelled and raise pressure to specified test pressure.

5. Observe joints, fittings, and valves under test. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage and retest.
6. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
7. Maintain pressure within plus or minus 5 psi of test pressure.
8. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
9. Compute maximum allowable leakage using following formula:
 - a. $L = SD \times \sqrt{P/C}$.
 - 1) L = testing allowance, gph.
 - 2) S = length of pipe tested, feet.
 - 3) D = nominal diameter of pipe, inches.
 - 4) P = average test pressure during hydrostatic test, psig.
 - 5) C = 148,000.
 - b. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
10. Leakage:
 - a. If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
 - b. Correct visible leaks regardless of quantity of leakage.
- A. Where significant lengths of mainline HDPE pipe are located in the system and those sections cannot meet the testing requirements of AWWA C600 and as described above, those sections of HDPE pipe may be isolated and tested according to ASTM F2164 as directed by the Engineer.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- C. Frequency of Compaction Tests: As required under Section 312000 – Earth Moving-Trenching

END OF SECTION 331116

SECTION 330110.58 - DISINFECTION OF WATER UTILITY PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Disinfection of potable water distribution system.
2. Testing and reporting of results.

B. Related Requirements:

1. Section 331116 – Site Water Distribution Piping: Product and execution requirements for installation and testing of domestic water piping.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA B300 - Hypochlorites.
2. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Disinfection Procedure:

1. Submit description of procedure, including type of disinfectant and calculations indicating quantities of disinfectants required to produce specified chlorine concentration.

B. Product Data: Submit manufacturer information for proposed chemicals and treatment doses.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Certify that final water complies with disinfectant quality standards of authority having jurisdiction.

E. Test and Evaluation Reports: Indicate testing results comparative to specified requirements.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.

1.4 CLOSEOUT SUBMITTALS

A. Disinfection Report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

1.5 QUALITY ASSURANCE

- A. Perform Work according to AWWA C651.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals:

1. Hypochlorite: Comply with AWWA B300.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested.
- B. Perform scheduling and disinfecting activity with startup, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

- A. Provide required equipment to perform Work of this Section.
- B. Perform disinfection of water distribution system and installation of system and pressure testing as specified in Section 331113 – Water Distribution Piping.
- C. Inject treatment disinfectant into piping system.
- D. Maintain disinfectant in system for 24 hours.
- E. Flush, circulate, and clean until required disinfectant quality standard has been achieved using municipal domestic water.
- F. Replace permanent system devices that were removed for disinfection.

3.3 FIELD QUALITY CONTROL

- A. Disinfection, Flushing, and Sampling:
 - 1. Disinfect pipeline installation according to AWWA C651.
 - 2. Use of liquid chlorine is not permitted.
 - 3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
 - 4. Disposal:
 - a. Legally dispose of chlorinated water.
 - b. If chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
 - 5. After final flushing and before pipeline is connected to existing system or placed in service, certify that disinfectant level meets quality standards of authority having jurisdiction.

END OF SECTION 330110.58

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SECTION 333100 - SANITARY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewerage piping.
2. Bedding and cover materials.

B. Related Requirements:

1. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
2. Section 312000 – Earth Moving-Trenching: Requirements for excavation, backfill, and trenching as required by this Section.
3. Section 334200 – Stormwater Conveyance: Concrete Manholes for sanitary sewerage piping.

1.2 DEFINITIONS

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

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
7. AWWA C153 - Ductile-Iron Compact Fittings.

C. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

2. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
3. [ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe \(Metric\)](#).
4. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
5. [ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe \(Metric\)](#).
6. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
7. [ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets \(Metric\)](#).
8. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
10. [ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals \(Metric\)](#).
11. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
12. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
13. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
14. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
15. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
16. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
17. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
18. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
19. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
21. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 COORDINATION

- A. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

1.5 PREINSTALLATION MEETINGS

- A. Convene minimum one week weeks prior to commencing Work of this Section.

1.6 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information indicating pipe material to be used, pipe accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Source Quality-Control Submittals: Indicate results of shop tests and inspections.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statement:
 - 1. Submit qualifications for manufacturer and installer.

1.7 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record finished locations of pipe runs, connections, manholes, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 QUALITY ASSURANCE

- A. Maintain copy of each standard affecting Work of this Section on Site.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Store valves in shipping containers with labeling in place.
- C. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Block individual and stockpiled pipe lengths to prevent moving.
 - 3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPING

- A. Cast-Iron Soil Pipe:
 - 1. Comply with ASTM A74.
 - 2. Type: Service.
 - 3. Fittings: Cast iron.
 - 4. Joints:
 - a. Joint Devices: Rubber gasket.
 - b. Comply with ASTM C564.
- B. Ductile-Iron Pipe:
 - 1. Comply with AWWA C150 or AWWA C151.
 - 2. Minimum Pressure Class: 150.
 - 3. Minimum Special Thickness Class: 50.
 - 4. End Connections: Bell and spigot.
 - 5. Outside Coating:
 - a. Type: Asphaltic.

- b. Minimum Uniform Thickness: 1 mil.
 - c. Comply with AWWA C151.
- 6. Lining:
 - a. Cement mortar lined.
 - b. Comply with AWWA C104.
- 7. Lining:
 - a. Seal coating applied to lining at following thickness:
 - 1) Nominal Pipe Sizes 6 through 12 Inches: 1/8 inch.
 - 2) Nominal Pipe Sizes 14 through 24 Inches: inch.
- 8. Lining:
 - a. Type: Asphaltic sealcoat.
 - b. Minimum Uniform Thickness: 1 mil.
 - c. Comply with AWWA C104.
- 9. PE Encasement: Comply with AWWA C105.
- 10. Fittings:
 - a. Material: Ductile iron, Class 50 or greater.
 - b. Comply with AWWA C153 or AWWA C110.
 - c. Lining: Seal coat lined and coated with bituminous paint].
- 11. Coating:
 - a. Coat pipe and fittings exposed inside of structures with two coats of bituminous paint to achieve minimum dry film thickness of 7mils per coat.
- 12. Joints:
 - a. Rubber gasket joint devices.
 - b. Comply with AWWA C111.
- C. Plastic Pipe:
- D. Plastic Pipe:
 - 1. Material: Polyvinyl chloride (PVC).
 - 2. Comply with ASTM D3034, SDR-35
 - 3. Inside Nominal Diameter: as per plan
 - 4. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.
 - 5. Fittings: PVC.
 - 6. Joints:

- a. Elastomeric gaskets.
- b. Comply with ASTM F477.

2.2 FLEXIBLE COUPLINGS

A. Description:

- 1. Material: Resilient, chemical-resistant, elastomeric PVC.
- 2. Attachment: Two Series-300 stainless-steel clamps, screws, and housings.

2.3 FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES

- 1. Material: EPDM.
- 2. Comply with ASTM C923.
- 3. Attachment: Series-300 stainless-steel clamp and hardware.

2.4 SUSTAINABILITY CHARACTERISTICS

- ### A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

2.5 MATERIALS

A. Bedding and Cover:

- 1. Bedding: Fill Type, as specified in in the drawings
- 2. Cover: Fill as specified in the drawings
- 3. Soil Backfill from Above Pipe to Finish Grade:
 - a. Subsoil with no rocks more than 6 inches in diameter, frozen earth, or foreign matter.

2.6 MIXES

- ### A. Grout: As specified in Section 330130.61 - Packer Injection Grouting.

2.7 ACCESSORIES

- ### A. Pipe Markers- Identification and Signage for Utilities.

2.8 SOURCE QUALITY CONTROL

- ### A. Provide shop inspection and testing of pipe.

B. Owner Inspection:

1. Make completed pipe sections available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that trench cut or excavation base is ready to receive Work of this Section.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Correct over-excavation with coarse aggregate.
- C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
- D. Protect and support existing sewer lines, utilities, and appurtenances.
- E. Utilities:
 1. Maintain profiles of utilities.
 2. Coordinate with other utilities to eliminate interference.
 3. Notify Architect/Engineer if crossing conflicts occur.

3.3 INSTALLATION

A. Bedding:

1. Excavate pipe trench as specified in Section 312316.13 - Trenching.
2. Place bedding material at trench bottom.
3. Level materials in continuous layer not exceeding 6 inches.
4. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Piping:

1. Install pipe, fittings, and accessories according to ASTM D2321>, and seal joints watertight.
2. Lay pipe to slope gradients as indicated on Drawings.
3. Begin at downstream end of system and progress upstream.
4. Bedding: Install at sides and over top of pipe, to minimum compacted thickness of 12 inches.
5. Bedding: As indicated on Drawings.
6. Lay bell-and-spigot pipe with bells upstream.
7. Do not displace or damage pipe when compacting.
8. Connect to building sanitary sewer outlet and municipal sewer system.
9. Pipe Markers as per details.
10. Install Site sanitary sewage system piping to within 5 feet of building, and connect to building sanitary waste system.

C. Backfilling:

1. Backfill around sides and to top of pipe with cover fill in minimum lifts of 6 inches.
2. Tamp fill in place, and compact to 95 percent of maximum density.
3. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.
4. Maintain optimum moisture content of bedding material as required to attain specified compaction density.

D. Backfilling: As specified in Section 312323 - Fill.

3.4 FIELD QUALITY CONTROL

A. Request inspection by Architect/Engineer prior to and immediately after placing bedding.

B. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Perform testing on Site sanitary sewage system according to local code standards.
3. Compaction Testing:

- a. Comply with AASHTO T 180.

3.5 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
- C. Cap open ends of piping during periods of Work stoppage.

END OF SECTION 333100

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SECTION 333216 – PACKAGED GRINDER PUMP STATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Packaged sewage grinder pumping units (Duplex).
 - 2. FRP basins.
 - 3. Pump control systems.

- B. Related Requirements:

- 1. Section 310516 – Aggregates for Earthwork.
 - 2. Section 312000 – Earth Moving.
 - 3. Section 312316 - Excavation.
 - 4. Section 333400 – Sanitary Utility Sewerage Force Main.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

1.4 REFERENCE STANDARDS

- A. American Bearing Manufacturers Association:

- 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

- B. ASTM International:

- 1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

- C. National Electrical Manufacturers Association:

- 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

- D. American Water Works Association

1. AWWA C508 – Swing-Check Valves for Waterworks Service
2. AWWA C517 – Resilient-Seated Cast-Iron Eccentric Plug Valves

1.5 COORDINATION

- A. Coordinate Work of this Section with other related applicable Specification Sections and utilities within construction area.

1.6 SUBMITTALS

- A. Comply with Section 013300 - Submittal Procedures.
- B. Product Data: Submit manufacturer information concerning materials of construction and fabrication.
- C. Shop Drawings: Indicate detailed dimensions for materials and equipment, including pump basins, pumps, piping, controls including wiring schematics, and accessories.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures, anchoring, and layout.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- G. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.
- H. Qualifications Statements: Submit qualifications for manufacturer.

1.7 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three (3) years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Handling:
 - 1. Handle materials to prevent damage to interior or exterior surfaces.
 - 2. Prepare pumps and accessories for shipment in such a manner as to prevent entry of foreign matter into product body.
- C. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Store products in areas protected from weather, moisture, or possible damage.
 - 3. Do not store products directly on ground.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. The Owner and Engineer believe the following manufacturers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the requirements of this Section. It shall be the responsibility of the Contractor to coordinate with the "selected" equipment manufacturer by use of this specification and all related design drawings for any necessary adjustments, modifications, or alterations to standard products to ensure that the product complies with all sections of this specification.
- B. Candidate manufacturers include the following: E-One, Flygt, or Engineer's Approved Equal.

2.2 UNITARY RESPONSIBILITY

- A. In order to unify responsibility for proper operation of the complete pump station, it is the intent of these Specifications that all system components, including, but not limited to: pumps, controls, enclosures, accessories, and ancillary equipment, be furnished by a single supplier (unitary source). The pump station shall be of standard catalog design, totally warranted by the manufacturer. Refer to contract drawing for location and details.

2.3 DESIGN CRITERIA

- A. Contractor shall furnish and install a duplex grinder pump station. Both pumps shall be capable of pumping a minimum of 11 GPM at 55 feet of total dynamic head while achieving a grinding action capable of macerating large solids to pass through a 1-1/2" forcemain.
- B. The electrical service available at the site is 240 VAC, 3-phase, 60 Hz.

2.4 PUMP

- A. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.5 GRINDER

- A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.
- B. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as

to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
 2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to minimize jamming and as such must be adhered to.
 3. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and minimizes blinding of the pump by large objects that block the inlet shroud.
 4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.
- C. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/2" diameter PVC discharge piping.

2.6 ELECTRIC MOTOR

- A. As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt, 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability. The wet portion of the motor armature must be 300 Series stainless steel. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

2.7 MECHANICAL SEAL

- A. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.8 DISCHARGE HOSE AND DISCONNECT VALVE

- A. All discharge fittings and piping shall be constructed of polypropylene, EPDM or PVC. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick

disconnect feature to simplify installation and pump removal. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

2.9 ELECTRICAL QUICK DISCONNECT

- A. The grinder pump core shall include a factory-installed NEMA 6P electrical quick disconnect (EQD) for all power and control functions. The EQD will be supplied with 32' total, 25' of useable, electrical supply cable (ESC) to connect to the alarm panel. The EQD shall require no tools for assembly, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. Junction boxes are not acceptable due to the large number of potential leak points. The EQD shall be so designed to be conducive to field wiring as required.

2.10 CHECK VALVE

- A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin. The valve shall be rated for continuous operating pressure of 235 psi. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

2.11 ANTI-SIPHON VALVE

- A. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

2.12 CORE UNIT

- A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit shall be established by a 100% factory test at a minimum of 5 PSIG.

2.13 PUMP BASIN

A. Basin:

1. Material: Fiberglass-reinforced polyester resin.
2. Nominal Wall Thickness: 0.25 inches.
3. Inlet Connection from gravity side to accept either 4-inch PVC SDR-35 customer service lateral pipe or 6-inch PVC SDR-35 gravity sewer line, as indicated on the Contract Drawings.

B. Anti-Flotation Ring:

1. Formed integral with basin.
2. Concrete: As specified in Section 033000 - Cast-in-Place Concrete.

C. Cover:

1. Material: Aluminum.
2. Attachment: Bolted and gasketed.
3. Loading: Superimposed dead load concentrated load at center.

D. Inlet: Integrally formed or cast-iron calking-type hub or plastic pipe adapter fastened to basin with stainless-steel hardware.

2.14 CONTROLS

- A. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Locating motor starting controls in a plastic enclosure is not acceptable. Wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. Level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. Level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc. Level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermoplastic elastomer. The use of PVC for the level sensing housing is not acceptable.
- B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.
- C. All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch

of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

2.15 ALARM PANEL

- A. Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel. The standard enclosure shall not exceed 12.5" W x 16" H x 7.5" D.
- B. The panel shall contain one 15-amp single pole circuit breaker for the alarm circuit and one 15-amp double pole circuit breaker per core for the power circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.
- C. The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).
- D. The high-level alarm system shall operate as follows:
 - 1. The panel will go into alarm mode if either pump's alarm switch closes. During the initial alarm mode both pumps will run and the alarm light and buzzer will be delayed for a period of time based on user settings (default is 3-1/2 minutes). If the station is still in high-level alarm after the delay, the light and buzzer will be activated.
 - 2. The audible alarm may be silenced by means of the externally mounted push-to-silence button.
 - 3. The visual alarm remains illuminated until the sewage level in the wet well drops below the "off" setting of the alarm switch for both pumps.
- E. The entire alarm panel, as manufactured and including the following options shall be listed by Underwriters Laboratories, Inc.

1. Alarm Activated Dry Contacts – Normally open relay contact closes upon alarm activation.
 2. Alarm Activated Contacts for Remote Indoor Alarm Module – Will work with or without power to the alarm panel and is designed to work with E/One's Remote Sentry.
 3. Includes Inner Door Dead Front.
 4. Separate LED's for each condition.
- F. The alarm panel shall provide protection against the following operating conditions:
1. Low Voltage (Brownout) Protection – A lockout cycle will prevent the motor from operating and will illuminate the Trouble LED if:
 - a. the incoming AC Mains voltage drops below a predetermined minimum, typically 12% of nameplate (211 volts for a 240 volt system) for 2 to 3 seconds, regardless of whether the motor is running.
 - b. the lockout cycle will end if the incoming AC Mains voltage returns to a predetermined value, typically 10% of nameplate (216 volts for a 240 volt system).
 2. The system continues to retest the voltage every second indefinitely. If the lockout cycle has been initiated and the voltage comes back above the predetermined starting voltage, the system will function normally. The Trouble LED remains illuminated during a Brownout condition and a corresponding Brownout message will be displayed on the LCD screen. The LED will turn off when the Brownout condition ends and the LCD message remains latched until the panel is reset. The audible and visual alarm will not be activated unless there is a high wastewater level in the tank.
 3. Run Dry Protection – A 20-minute lockout cycle will prevent the motor from operating and will illuminate the Trouble LED when the wastewater level in the tank is below the pump inlet shroud. A corresponding Run Dry message will be displayed on the LCD screen. The condition is rechecked every 20 minutes and the LCD message remains latched. If the condition is satisfied, the pump is allowed to cycle normally and the Trouble LED will go out, but the LCD message remains latched. The LCD message will remain latched until the panel is reset. If the condition is not satisfied after 3 consecutive attempts, the visual alarm will be activated until the panel is reset or until there is one cycle of normal operation. If a high level condition is presented at any time, a pump run cycle will be activated.
 4. High System Pressure Protection – A 20-minute lockout cycle will prevent the motor from operating and will illuminate the Trouble LED when the pressure in the discharge line is atypically high (closed valve or abnormal line plug). A corresponding Overpressure message will be displayed on the LCD screen. The condition is rechecked every 20 minutes. If the condition is satisfied, the pump is allowed to cycle normally and the Trouble LED will turn off, but the LCD message remains latched. The LCD message will remain latched until the panel is reset. If the condition is not satisfied after 3 consecutive attempts, the pump is locked out indefinitely and the audible and visual alarm will be activated. The LCD message and alarms will remain latched until the condition is removed and the panel is reset.
- G. In all of the above cases, if more than one error condition is presented, the LCD message depicting the most recent error condition will be displayed.
- H. The alarm panel shall include the following additional indicators and controls:

1. High/Low Voltage monitoring with Trouble indication.
2. High/Low Wattage (wattage is used instead of current because it is a better indicator of pump performance) monitoring with Trouble indication.
3. Extended Run Time monitoring with Trouble indication.
4. Cycle/Event Counter.
5. Run Time Counter (Hour Meter).
6. Run Time Limit — time adjustable, user-selected options: 10 minutes (default) to 120 minutes in 1-minute intervals.
7. Power-up Delay — time adjustable, user-selected options: None (default), to 300 minutes in 1-minute intervals.
8. Alarm Delay — time adjustable, user-selected options: zero to 10 minutes in 30-second increments; 4 minutes is default.
9. System self-test diagnostic.
10. User-selectable Alarm latch.
11. User-selectable Protect Mode disable.
12. User-selectable buzzer timer.
13. Ready LED to indicate AC power to the station is satisfactory.
14. Pump Run LED to indicate pump is operating (LCD indicates which pump is running).
15. Trouble LED indicator and predictive Visual Alarm notification (“blinking” alarm lamp; clears on Normal cycle).
16. High Level Alarm LED indicator (LCD indicates which pump is in alarm).
17. Manual Run switch to manually activate pumps.
18. Lead/Lag indication (LCD indicates which pump is lead).
19. Menu-driven programmable controller with navigation overlay-type buttons (Enter, Scroll, Up, Down).
20. Normal Operation LED and Mode button for Mode status.
21. Pump Performance menu LED with LCD display of the following pump performance statistics:
 - a. Real-time Voltage.
 - b. Real-time Amperage.
 - c. Real-time Wattage.
 - d. Minimum/Maximum/Average Voltage.
 - e. Minimum/Maximum/Average Amperage.
 - f. Minimum/Maximum/Average Wattage.
 - g. Minimum/Maximum Run-time.
 - h. Average Run-time.
 - i. Last Run-time.
 - j. Cycle/Event Counter.
 - k. Run Time Counter (Hour Meter).
22. Diagnostics Menu LED.
23. Initialize System Menu LED.
24. Run Limit Menu LED.
25. Alarm Delay Menu LED.
26. Power Delay Menu LED.
27. Pump alternating options (no alternation, adjustable time based and test).
28. Pump alternating time options — 24 hours to 72 hours in 12-hour increments.

- I. Remote Sentry Indoor Alarm Module – A separate, remote indoor alarm module shall be provided to indicate a high-level alarm with or without AC power to the grinder pump station. The Remote Sentry indoor alarm module shall have an internal power source enabling its continued operation without AC power. The Remote Sentry shall have an audible alarm and a visual alarm, both of which shall automatically reset if the high-level alarm condition is eliminated. The Remote Sentry indoor alarm module shall include a Silence button for the audible alarm and a Test button.

2.16 SERVICEABILITY

- A. The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been removed from the pump assembly. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.17 SAFETY

- A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use. UL listing of components of the station, or third-party testing to UL standard are not acceptable.
- B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low-pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International. Third-party testing to NSF standard is not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 017000 - Execution and Closeout Requirements.
- B. Verify layout and orientation of pumps, accessories, and piping connections.

3.2 INSTALLATION

- A. Coordinate location of pump control panel with Owner and Engineer.
- B. Excavation: As specified in Section 312316 - Excavation.
- C. Install pump units and accessories where indicated on Drawings and according to manufacturer's instructions.
- D. Provide and connect piping, accessories, and power and control conduit and wiring to make system operational and ready for startup.
- E. Flush piping with clean water.

3.3 FIELD QUALITY CONTROL

- A. Comply with Section 014000 - Quality Requirements.
- B. Inspection: Check and adjust liquid-level control and alarm settings.
- C. Startup and Performance Testing:
 - 1. Test unit on clear water through minimum of four (4) complete cycles under supervision of manufacturer's representative and in presence of Engineer.
 - 2. Demonstrate that system performance, control functions, and alarms meet specified requirements.
 - 3. Hydrostatically test system piping for leaks in accordance with Section 330130.13 - Sewer and Manhole Testing.
- D. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products to be placed under this Section for not less than two (2) days on-Site for installation, inspection, field testing, startup, and instructing Owner's personnel in maintenance of equipment.
- E. Equipment Acceptance:
 - 1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
 - 2. Make final adjustments to equipment under direction of manufacturer's representative.
- F. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 DEMONSTRATION

- A. Comply with Section 017000 - Execution and Closeout Requirements.

- B. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

3.5 PROTECTION

- A. Comply with Section 017000 - Execution and Closeout Requirements.
- B. Conduct operations as to not interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas to the Work.

END OF SECTION 333216

SECTION 333400 - SANITARY UTILITY SEWERAGE FORCE MAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Force mains.
2. Bedding and cover materials.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete material requirements.
2. Section 310513 - Soils for Earthwork: Soil backfill from above pipe to finish grade.
3. Section 310516 - Aggregates for Earthwork: Aggregate for pipe bedding and cover.
4. Section 312317 - Trenching: Excavation, backfilling, compacting, and fill over underground pipe markers.
5. Section 312323 - Fill: Requirements for fill over underground pipe markers.
6. Section 330130.13 - Sewer and Manhole Testing: Pressure, infiltration, and deflection testing.
7. Section 330526 - Utility Identification: Pipe markers.
8. Section 333100 - Sanitary Utility Sewerage Piping: Connections to sanitary sewerage system.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Pipe and Fittings:

1. Basis of Measurement: By linear foot
2. Basis of Payment: Includes excavation, backfill, bedding, thrust restraints, pipe, and fittings.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

2. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Transmission and Distribution.

C. ASTM International:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
3. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
4. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
5. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
6. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
7. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

D. Ductile Iron Pipe Research Association (DIPRA):

1. Thrust Restraint Design for Ductile Iron Pipe.

1.4 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with connection to existing City of Welch.

1.5 PREINSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

1.6 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information indicating pipe material used, pipe accessories, valves, restrained joint details and materials.

- C. Shop Drawings:
 - 1. Indicate piping piece numbers and locations.
 - 2. Indicate restrained joint locations.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for restrained joints, including establishing lengths of restrained joint piping required.
- F. Manufacturer Instructions: Indicate special procedures required to install specified products.
- G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- H. Qualifications Statements:
 - 1. Submit qualifications for manufacturer, installer, and licensed professional.
 - 2. Submit manufacturer's approval of installer.

1.7 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record invert elevations and actual location of pipe runs and connections.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 QUALITY ASSURANCE

- A. Perform Work according Industry Standards.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.
- C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of West Virginia.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Do not place materials on private property without written permission of property owner.
 - 3. Do not stack pipe higher than recommended by pipe manufacturer.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Store gaskets for mechanical and push-on joints in cool and dry location, out of direct sunlight, and not in contact with petroleum products.
 - 3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PVC PIPE

- A. PVC Pressure Sewer Pipe and Fittings, 3-Inch Nominal Size:
 - 1. Comply with ASTM D2241.
 - 2. SDR: 13.5.

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.
- B. Material and Resource Characteristics:

2.3 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type, as specified in Section 310516 - Aggregates for Earthwork.
2. Cover: Fill Type as specified in Section 310516 - Aggregates for Earthwork.
3. Soil Backfill from above Pipe to Finish Grade: Soil Type, as specified in Section 310513 - Soils for Earthwork.
4. Subsoil: No rocks more than 6 inches in diameter, frozen earth, or foreign matter.

2.4 MIXES

- ### A. Concrete: As specified in Section 033000 - Cast-in-Place Concrete.

2.5 ACCESSORIES

- ### A. Pipe Markers: As specified in Section 330526 - Utility Identification.

PART 3 - EXECUTION

3.1 EXAMINATION

- #### A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- #### B. Verify that trench cut is ready to receive Work.
- #### C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- #### A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- #### B. Correct over-excavation with fine aggregate.
- #### C. Remove large stones or other hard matter capable of damaging pipe or of impeding consistent backfilling or compaction.

3.3 INSTALLATION

A. Bedding:

1. Excavate pipe trench as specified in Section 312317 - Trenching.

2. Place bedding material at trench bottom.
3. Level materials in continuous layers not exceeding 6 inches depth.
4. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Piping:

1. Installation Standards: Install Work according West Virginia Health Department standards.

C. Thrust Restraints:

1. Provide pressure pipeline with restrained joints or concrete thrust blocking at bends, tees, and changes in direction.
2. Construct concrete thrust blocking as indicated on Drawings.

D. Cradles and Encasements:

1. Provide concrete cradles and encasements for pipelines where indicated on Drawings and as specified in Section 033000 - Cast-in-Place Concrete.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Inspections: Request inspection by Engineer prior to and immediately after placing bedding.

C. Testing:

1. Pipe Testing:

- a. Pressure Test: As specified in Section 330130.13 - Sewer and Manhole Testing.
- b. Infiltration Test: As specified in Section 330130.13 - Sewer and Manhole Testing.
- c. Deflection Test: As specified in Section 330130.13 - Sewer and Manhole Testing.

2. Compaction Testing:

- a. Comply with ASTM D1557.

3.5 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 333400

SECTION 334200 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. PE pipe and fittings.
 - 2. PVC pipe and fittings.
 - 3. Non-pressure transition couplings.
 - 4. Cleanouts.
 - 5. Manholes.
 - 6. Catch basins.
 - 7. Stormwater inlets.
 - 8. Concrete.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
 - 2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 CORRUGATED-PE PIPE AND FITTINGS

- A. Corrugated-PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252, Type S, with smooth waterway for coupling joints.
- B. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.
- C. Corrugated-PE Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
- D. Corrugated-PE Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings.

2.2 PVC PIPE AND FITTINGS

- A. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- B. PVC Corrugated Sewer Piping:
 - 1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
 - 2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
 - 3. Gaskets: ASTM F477, elastomeric seals.
- C. Adhesive Primer: ASTM F656.

2.3 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
 - 2. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings:
 - 1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, Flexible Couplings:

1. Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.4 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Heavy Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

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

2.5 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12 to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

2.6 CONCRETE

- A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:
 1. Cement: ASTM C150/C150M, Type II.
 2. Fine Aggregate: ASTM C33/C33M, sand.
 3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.7 CATCH BASINS

- A. Standard Precast Concrete Catch Basins:
 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
 4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
 8. Steps: Individual FRP steps or FRP ladder Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing

rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.

9. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
 1. Size: 24 by 24 inches minimum unless otherwise indicated.
 2. Grate Free Area: Approximately 50 percent unless otherwise indicated.
- C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter flat grate with small square or short-slotted drainage openings.
 1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving-Trenching."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure drainage piping in accordance with the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping 30-inch minimum cover.
 - 3. Install PE corrugated sewer piping in accordance with ASTM D2321.
 - 4. Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
 - 1. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
 - 2. Join PVC corrugated sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
 - 3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

3.6 CATCH BASIN INSTALLATION

- A. Set frames and grates to elevations indicated.

3.7 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

3.8 CONCRETE PLACEMENT

- A. Place cast-in-place concrete in accordance with ACI 318.

3.9 IDENTIFICATION

- A. Materials and their installation are specified in Section 312000 "Earth Moving - Trenching." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use warning tape or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.10 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.

- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping in accordance with ASTM F1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.11 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 334200