



A R L I N G T O N
VIRGINIA

**Office of the Purchasing Agent
2100 Clarendon Blvd., Suite 500
Arlington, VA 22201**

**Invitation to Bid Number 21-DPR-ITB-304
Project Manual**

Department of Parks and Recreation

**Rosslyn Highland Park
18TH Street, North
Arlington, Virginia**

Project includes, but is not limited to, site work, playgrounds,
walkways, signage, bioretention and landscaping.

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SECTION 011000 – GENERAL CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Work covered by the Contract Documents.
 2. Use of premises.
 3. General requirements.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Rosslyn Highland Park
- B. Project Location: 18th Street, North, Arlington, VA
- C. Owner: Arlington County, Virginia
Department of Parks and Recreation
2100 Clarendon Boulevard, Suite 414
Arlington, VA 22201
- D. The Work consists of, but is not limited to, the following:
1. Site work, playgrounds, walkways, signage, bioretention and landscaping, including:
 - a. Site preparation including construction fences, tree protection fencing, temporary erosion and sediment control measures, test pits and construction stake-out.
 - b. Protection and maintaining and all other existing park property, Arlington County right-of-way, and other existing improvements as required.
 - c. Site restoration of all facilities damaged by construction operations, or as directed by Department of Parks and Recreation (DPR), to the original condition and/or the satisfaction of DPR. Site restoration includes, but is not limited to, pavement restoration, site grading, top soil, seeding and sodding.
 - d. Site Improvements:
 1. Construction of playgrounds as shown on the Plans and Specifications.
 2. Additional Site Improvements:
 - (a) Construction of concrete walks and aggregate base as shown on the Plans and Specifications.

- (b) Supply and install site furnishings and structures such as play structures, receptacles, benches, tables and chairs, and signage as shown on the Plans and Specifications.
 - (c) Plantings as shown as the Plans and Specifications.
 - (d) Tree protection fences, root pruning, and other tree protection measures as shown on the Plans and Specifications.
- E. Project will be constructed under a single prime contract.

1.3 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as indicated in the Specifications and on the Drawings by the Contract limits.
- B. Use of Site: Do not disturb portions of Project site beyond areas in which the Limit of Disturbance (LOD) is shown. Specific limitations on use of the site include the following:
- 1. Maintain public access to areas outside the limits of work whenever possible. Contractor shall request approval from Project Officer 72 hours in advance when closures outside the limits of work are necessary.

1.4 GENERAL REQUIREMENTS

- A. Coordination: The Contractor shall be responsible for coordinating all construction operations included in the various Sections of the Specifications to ensure efficient and orderly installation of each part of the work.
- B. Contact Person: The Contractor shall establish a single contact person that will be responsible for all communication between the Contractor (including all subcontractors) and the Project Officer, Landscape Architect, and/or Engineer.
- C. Submittals: Upon Contract award, the Contractor shall immediately prepare a list of required submittals, based on the specifications, and begin to gather the required submittals for submission to the Project Officer as soon as possible.
- D. Permits:
- 1. The County shall provide the Virginia Stormwater Management Permit (VSMP) and the building permit to the Contractor. The Contractor is responsible for obtaining all other required permits (including but not limited to ROW, electrical and/or any other work necessary for the completion of the project) from the Arlington County Department of Environmental Services (DES) and/or Inspection Services Division (ISD).
 - 2. The Contractor is required to submit designs, shop drawings, structural calculations, engineer certifications, or other items required for permit approval. In that case, the Contractor shall build in the required time for obtaining, submitting, and gaining approval of these items into the construction schedule.
- E. Subcontractors:

1. A competent person from the Prime Contractor shall be present on the site during the work of all subcontractors. If such a person is not present while a subcontractor is working on the site, the Project Officer reserves the right to stop work. No Claims for Delay will be allowed as a result of such stoppages.
2. All subcontractors must be furnished with a full set of the contract drawings and specifications at the Contractor's expense, and subcontractors shall be required to have these documents on site while the work is being performed. If the subcontractor does not have access to a full set of plans and specifications while working on the site, the Project Officer reserves the right to stop work. No Claims for Delay will be allowed as a result of such stoppages.

F. Construction Schedule:

1. The construction schedule shall indicate the dates and date ranges where major components of the Work will be performed.
2. The schedule shall indicate the dates that required submittals will be provided, and shall also indicate time allotted for the review and approval of submittals.
3. The Contractor shall maintain and update the schedule as necessary when conditions change, and shall resubmit the updated schedule to the Project Officer.
4. The Contract completion date cannot be changed by submission of a construction schedule indicating a different completion date. The Contract completion date can only be changed if specifically authorized by Change Order.

G. Preconstruction Meeting:

1. The Contractor shall attend a preconstruction meeting on-site with the Project Officer, Landscape Architect, their Consultants, the Contractor, major subcontractors, major suppliers, and other concerned parties.
2. At the meeting, the Contractor shall provide the following:
 - a. Construction schedule
 - b. List of required submittals
 - c. List of proposed subcontractors
3. Items of significance that could affect the progress of the work shall be discussed at the meeting.
4. Requirements for tree protection and erosion control shall be reviewed.
5. The Contractor shall record and distribute meeting minutes.

H. Notice to Proceed:

1. After the preconstruction meeting, the Project Officer will issue a written Notice to Proceed (NTP) to the Contractor.
2. The date of the NTP will be the first day of the timeframe in which the work is to be completed.
3. Generally, the NTP date is agreed-upon between the Project Officer and the Contractor. However, in the event of non-responsiveness or delay on the part of the Contractor, the Project Officer reserves the right to issue a NTP unilaterally without the agreement of the Contractor.

- I. Progress Meetings:
 - 1. The Contractor shall attend construction progress meetings on a bi-weekly basis, and at the request of the Project Officer.
 - 2. An updated construction schedule shall be submitted at each progress meeting.
 - 3. At the meeting, the following issues shall be discussed:
 - a. Work completed to date.
 - b. Work remaining to be completed and anticipated timeframes.
 - c. Issues affecting the progress of the work.
 - d. Items that require correction.
 - 4. The Project Officer shall record and distribute meeting minutes.
- J. Requests for Information (RFI):
 - 1. The Contractor shall submit a written RFI in any of the following instances (not all-inclusive):
 - a. If the intent of any item in the drawings and specifications is unclear.
 - b. If existing conditions differ from those indicated on the drawings.
 - c. To document any verbal agreements or instructions.
 - 2. In instances (a) and (b), the Contractor shall stop work in the affected area, notify the Project Officer, and await instructions.
 - 3. The Contractor shall be responsible for any expenses incurred due to unexpected conditions if he fails to notify the Project Officer and wait for direction prior to continuing work in the affected area.
 - 4. The Contractor's failure to properly document any verbal agreements or instructions will result in the rejection of any claim for changes to the Contract amount or additional time for completion.
 - 5. The Contractor is responsible for making the necessary inquiries to determine the design intent of the drawings and specifications if anything is unclear, prior to submitting a bid. Claims for changes to the contract amount submitted after Contract award due to an RFI response may be approved or rejected at the sole discretion of the Project Officer.
- K. Documentation of Events: The Contractor shall document and immediately report any of the following events to the Project Officer:
 - 1. Accidents.
 - 2. Stoppages, delays, shortages, and losses.
 - 3. Orders and requests of authorities having jurisdiction.
 - 4. Services connected and disconnected.
 - 5. Existing conditions that significantly differ from those indicated on the drawings.
- L. If the project site will not be worked on a particular work day or days, the Contractor shall notify the Project Officer that the site will not be worked on, and shall state the reason for such.
- M. Claims for Delay:

1. If the Contractor believes that the proposed time for completion in the Contract is unreasonable, the Contractor shall notify the Project Officer at least ten (10) working days prior to the bid opening date, and suggest a more reasonable contract time frame. If the proposed new time frame is accepted, an amendment to the bid will be issued.
 2. The Contractor shall submit a written Claim for Delay within ten (10) working days of any event where the Contractor believes that an extension to the Contract time for completion is necessary or justified.
 3. The written Claim for Delay must include the following information:
 - a. Amount of days claimed
 - b. Justification for the delay
 - c. Supporting documentation
 4. Justifications for Claims for Delay include the following:
 - a. Inclement weather that prevents work on the site
 - b. Events beyond the control of the Contractor that result in a delay to the project, with the following exceptions:
 - 1) Delays in the delivery of materials.
 - 2) Failure of suppliers to provide required submittals in a timely manner.
 - 3) Any delays that result from the actions of a subcontractor.
 - 4) Disputes between the Contractor and subcontractors or suppliers
 - 5) Rejection of submittals.
 - 6) Re-work resulting from unsatisfactory work.
 - 7) Re-work resulting from failure to provide required submittals.
 - 8) Re-work resulting from failure to submit a Request for Information (RFI) if the design intent is unclear.
 - 9) Failure to obtain required permits in a timely fashion, as stated in Section 1.4. D. Permits.
 - 10) Failure to request required inspections from the Inspection Services Division (ISD) in a timely fashion, or rejection of work by an inspector.
 - 11) Stop work orders issued by authorities having jurisdiction that are due to items that are the Contractor's responsibility.
 5. A Claim for Delay may be denied if the Contractor fails to continue work on other aspects of the project that are not affected by the particular delayed item, or if, in the Project Officer's determination, the Contractor has failed to continuously work on the project or effectively manage the project.
 6. If planting installation is not feasible because it is not the proper season for planting, the Contractor shall notify the Project Officer. The Project Officer, at his sole discretion, may decide to treat planting as a Punch List item, thereby exempting it as a requirement for a Determination of Substantial Completion.
- N. Liquidated Damages (Damages for Delay): The Project Officer does NOT have the authority to waive Liquidated Damages unless the supporting documentation described above has been provided by the Contractor (within the aforementioned time limit) and approved by the Project Officer.

- O. Existing Conditions: Dimensions and/or locations of existing facilities and/or underground utilities shown on the plans are approximate. Contractor shall verify exact locations before commencing work.
- P. Code Compliance: Comply with all applicable codes and regulations of authorities having jurisdiction.
- Q. Safety: Take all precautions necessary to protect the public during the construction period.
- R. Protection of Existing Conditions: Take all precautions necessary to protect existing facilities to remain during the construction period. Repair any and all damage to existing facilities to remain caused by construction operations. Maintain existing utilities and protect them against damage during construction. Contact Miss Utility at (800) 552-7001 for utility locations prior to any excavation.
- S. County Rights-of-Way: Work taking place within the right-of-way of County streets shall conform to the Arlington County DES Construction Standards and Specifications. The Contractor shall obtain a right-of-way permit from the County for work to take place within street rights-of-way.
- T. Differing or Conflicting Requirements: If a Specification section requires compliance with two or more standards, or if requirements conflict, the more stringent standard or requirement shall apply.
- U. Quality Control Testing and Laboratory Services: The Contractor shall provide necessary labor and supervision required to support field testing and inspection by the Project Officer. Defects disclosed by tests shall be rectified at no additional cost to the County.
- V. Operation and Maintenance Manuals: Contractor shall provide operations and maintenance manuals for all applicable products and systems used in the Work prior to substantial completion inspection.

END OF SECTION 011000

SECTION 012000 - MOBILIZATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Mobilization shall include the following items:
1. Furnish and set up Contractor's necessary general plant and equipment required for operations on to the site.
 2. Providing on-site sanitary facilities
 3. Providing on-site all OSHA required notices and establishment of safety programs.
 4. Obtaining all required permits for completion of the project.
 5. Having the Contractor's superintendent at the jobsite full time.
 6. The cost of required insurance and bonds and/or any other similar significant initial expense required for the initiation of the contract work shall be included in this item.
 7. Submitting initial submittals and log.

The determination of the adequacy of the Contractor's facilities, except as noted above, shall be made by the Contractor.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 Such work as is done in providing the facilities and services under this item shall be done in safe and workmanlike manner and shall conform with any pertinent County, State or Federal law, regulation, or code. Good housekeeping consistent with safety shall be maintained.

PART 4 – MEASUREMENT AND PAYMENT

The Contractor's attention is directed to the condition that no payment for Mobilization, or any part thereof, will be approved for payment under the Contract Documents until all Mobilization items listed above have been completed as specified to the satisfaction of the Project Officer.

For MOBILIZATION in accordance with the specifications the Contractor shall receive the Schedule-of-Values amount, which is not to exceed three percent (3%) of the total contract bid price excluding the bid for mobilization.

The LUMP SUM price bid for mobilization shall include furnishing, maintaining and demobilization of all services, and facilities noted in this specification, to the extent and at the time the Contractor deems them necessary for his operations, consistent with the requirements of this work and this contract.

END OF SECTION 012000

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Landscape Architect or Project Officer's responsive action.
- B. Informational Submittals: Written information that does not require Landscape Architect or Project Officer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 GENERAL REQUIREMENTS

- A. Upon Contract Award, the Contractor shall prepare a list of required submittals, and shall immediately begin working to compile all required submittals.
- B. The Contractor shall not begin work which requires the submission of other data, until said submittals are returned with the Project Officer's stamp indicating approval or "approved as noted."
- C. Deviations from Contract Documents: Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents. Approval of a submittal does not indicate acceptance of any deviations from the Contract Documents included in the submittal. Such deviations must be approved specifically in writing by the Project Officer.

1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
- B. Project Officer: All submittals shall be submitted to the Project Officer, who will then distribute submittals to the Landscape Architect, as applicable. Landscape Architect shall return submittals with action taken to the Project Officer who will then notify the Contractor.
- C. Submittals Schedule: Include a list of submittals for review in the construction schedule.

- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Project Officer's receipt of submittal. No extension of the Contract Time will be authorized because of the Contractor's failure to incorporate this time into the construction schedule, or transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow ten (10) business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Project Officer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow ten (10) business days for review of each resubmittal.
- E. Identification: Each submittal shall indicate the following:
1. Name of firm or entity that prepared each submittal.
 2. Project name.
 3. Date.
 4. Name and address of Contractor.
 5. Name and address of subcontractor.
 6. Name and address of supplier.
 7. Name and address of manufacturer.
 8. Applicable specification section.
 9. A unique identifier, such as a submittal number.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Project Officer will discard submittals received from sources other than Contractor.
- H. Resubmittals: Make resubmittals in same form as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "approved" or "approved as noted."
- I. Use for Construction: Use only final submittals with mark indicating "approved" or "approved as noted" by Project Officer.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Manufacturer's catalog cuts.
 - e. Compliance with specified referenced standards.
 - f. Testing by recognized testing agency.
 4. Number of Copies: Submit three (3) copies and one (1) electronic copy of Product Data, unless otherwise indicated. Project Officer will return one copy.
- C. Shop Drawings: Where required in the Specifications, prepare project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Schedules.
 - e. Notation of coordination requirements.
 - f. Notation of dimensions established by field measurement.
 - g. Relationship to adjoining construction clearly indicated.
 - h. Seal and signature of professional engineer if required.
 - i. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
 3. Number of Copies: Submit three (3) copies and one (1) electronic copy of each submittal. Project Officer will return one copy.
- D. Samples: When required by other specification sections, submit samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of samples that includes the following:

- a. Generic description of sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate specification section.
3. Samples for Initial Selection: If colors, textures, and/or patterns are not clearly indicated in the drawings and/or specifications, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
- a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Project Officer will return submittal with options selected.
4. Samples for Verification: Submit full-size units or samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
- a. Number of Samples: Submit one set of samples. Project Officer will retain the sample set and indicate acceptance or rejection in writing to the Contractor.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Project Officer will not return copies.
 2. Certificates and Certifications: Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Prior to submittal to Project Officer, review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions.

3.2 LANDSCAPE ARCHITECT'S ACTION

- A. Action Submittals: Landscape Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Landscape Architect will stamp each

submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. No Exceptions Taken or Approved: A marking of “approved or “No Exceptions Taken” indicates approval of a submittal for general conformance with the design concept of the Project and with the drawings and specifications.
 - a. The Contractor is still responsible for confirming and correlating dimensions at job site, for information which pertains to fabrication processes or construction techniques and for coordination of work of all trades.
 - b. Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents.
 2. Make Corrections, Approved as Noted or Approved as Noted: A marking of “Make Corrections, Approved as Noted” or “Approved as Noted” indicates conditional approval of a submittal.
 - a. The Contractor is expected to comply with the revisions or notes indicated by the Landscape Architect in the document. These notes become an integral part of the approved submittal and their acceptance by the Contractor indicates an agreement to comply with the noted requirements.
 - b. The Contractor is still responsible for confirming and correlating dimensions at job site, for information which pertains to fabrication processes or construction techniques and for coordination of work of all trades.
 - c. Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents.
 3. Revise and Resubmit: Based on the notations provided by the Landscape Architect, make revisions required to comply with the requirements in the Contract Documents, and resubmit for approval.
 4. Rejected: The product indicated does not comply with the requirements in the Contract Documents and shall not be used in the Project. Provide submittals for the correct product as indicated in the drawings and specifications.
- B. Informational Submittals: Landscape Architect will review each submittal and will not return it, or will return it if it does not comply with requirements.
- C. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 015000 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

1. This Section includes temporary measures throughout the life of the project to control erosion and siltation.
2. Such measures shall include, but are not limited to:
 1. Stabilized Construction Entrance
 2. Inlet Protection
 3. Site Construction Fencing
3. Temporary erosion and siltation control measures as described herein, shall be applied to erodible material exposed by any activity associated with construction, consistent with state and local control standards.

1.2 GENERAL REQUIREMENTS

- A. The Contractor is responsible for providing and maintaining facilities adequate to control erosion and sedimentation. The Project Officer reserves the right to order the performance of other temporary measures not specifically described herein to correct an adverse erosion or siltation condition.

1.3 APPLICABLE SPECIFICATIONS

- A. The following specifications are hereby incorporated into this specification section by reference.
 1. Arlington County Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code).
 2. Virginia Department of Environmental Quality Erosion and Sediment Control Handbook.
 3. See Division 2 Section “Tree Protection and Root Pruning” for requirements related to tree protection and root pruning.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Site construction fence
 1. Posts and rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thicknesses according to ASTM F 1043 based on the following:
 - a. Fence Height: 72 inches.

- b. Horizontal Framework Members: Top and bottom rails according to ASTM F 1043.
 - c. Brace Rails: ASTM F 1043.
 - 2. Provide fittings according to ASTM F 626.
- B. All other materials shall be at the Contractor's Option, in accordance with the Removals Plan and all applicable standards listed above.

PART 3 - EXECUTION

3.1 TIMING OF INSTALLATION

- A. No grading operations will be allowed until temporary erosion and sediment control measures have been installed in accordance with the Erosion and Sediment Control Plan and all applicable standards listed above.
- B. No control measures may be removed without the approval of the Arlington County Erosion and Sediment Control Inspector.

3.2 MINIMIZE EXPOSED SOIL

- A. The Contractor shall limit the surface area of earth material exposed by grubbing and stripping of topsoil and excavation to that which is necessary to perform the next operation within a given area.
- B. Unless specifically authorized by the Project Officer, the grubbing of root mat and stumps shall be confined to the area over which excavation is to be actively executed within 30 days following the grubbing operations.
- C. The stripping of topsoil shall be confined to the area over which excavation is to be actively executed within 15 days following the stripping operations.
- D. Excavation shall be confined to the minimum area necessary to accommodate the Contractor's equipment and work force engaged in the earth moving work.
- E. No disturbed area, including stockpiles, is to remain denuded longer than 30 days without temporary seeding or otherwise stabilizing the area.

3.3 CLEANING AND MAINTENANCE

- A. Control measures shall be periodically cleaned of silt and maintained. Immediately after every rainstorm, all control measures shall be inspected, and any deficiencies corrected by the Contractor.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 For furnishing and installing STABILIZED CONSTRUCTION ENTRANCE complete in accordance with the plans, specifications and directions of the Project Officer, the Contractor shall receive the LUMP SUM price bid.
- 4.1.1 The price bid for Stabilized Construction Entrance shall be LUMP SUM and shall include the cost of all labor, materials, equipment and incidental expenses necessary to complete the work.
- 4.2 The quantity of INLET PROTECTION shall be the number of Each, as delivered to the site, furnished, installed, maintained and removed at project completion in accordance with the plans and specifications.
- 4.2.1.1 The price bid shall be a unit price per EACH of Inlet Protection and shall include the cost of all labor, materials, equipment and incidental expenses necessary to complete the work.

Does not include excavation.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. See Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
- C. See Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 SUBMITTALS

- A. Proposed Equivalent Item Requests during bidding process:

Refer to Section I. – Instructions to Bidders, Paragraph 16. – Use of Brand Names/Substitutes of the solicitation document for request procedures.

- B. Substitution Requests after Contract award:

- 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Reasons why the specified product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the product specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and owners, if requested.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Statement of impact on the construction schedule. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - i. Cost information, including a proposal of change, if any, in the Contract Sum.

- j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - k. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
2. Project Officer's Action: If necessary, Project Officer will request additional information or documentation for evaluation within five (5) business days of receipt of a request for substitution. Project Officer will notify Contractor of acceptance or rejection of proposed substitution within ten (10) business days of receipt of request, or five (5) business days of receipt of additional information or documentation, whichever is later.
- a. Use product specified if Project Officer cannot make a decision on use of a proposed substitution within time allocated.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Project Officer.
 - 2. Special Warranty (if required by other specification sections): Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Project Officer.
- B. Special Warranties (if required by other specification sections): Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and that are new at time of installation.
1. Standard Products: Unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures:
1. Sole-Source: Where Specifications name a single product and manufacturer without the words "or approved equal," provide the named product that complies with requirements. No substitutions will be accepted.
 2. Product or Approved Equal: Where Specifications name a single product and manufacturer accompanied by the words "or approved equal," the specification establishes a minimum standard for design and quality. This should not be construed as eliminating from competition other products of equal or better quality that also satisfy the design intent of the project (as determined by the Project Officer). In this case, either provide the named product that complies with requirements, or submit proposed equivalent items for consideration by the Project Officer in accordance with process described in the solicitation documents.
 3. Product List: Where Specifications include a list of manufacturers and products, provide the specified quantity of one of the named products that complies with requirements or an equivalent. Product selected shall be compatible with products previously selected, even if previously selected products were also options. Alternatives not listed will be considered by the Project Officer based on the compliance with specification requirements. To request consideration of an alternative not listed, submit proposed equivalent items for consideration by the Project Officer in accordance with process described in the solicitation documents.

END OF SECTION 016000

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. See Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Project Officer of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Project Officer unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit as-built drawing markups, operation and maintenance manuals, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Project Officer. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Project Officer. Advise Project Officer's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.
 - 9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 10. Advise Project Officer of changeover in utilities.
 - 11. Submit changeover information related to Project Officer's occupancy, use, operation, and maintenance.
 - 12. Complete final cleaning requirements, including touchup painting.
 - 13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Final Completion. On receipt of request, Project Officer will either proceed with inspection or notify Contractor of unfulfilled

requirements. Project Officer will prepare the Certificate of Final Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by the Project Officer, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Acceptance.

1.3 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment.
2. Submit copy of Project Officer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Project Officer. The copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Project Officer's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Project Officer will either proceed with inspection or notify Contractor of unfulfilled requirements. Project Officer will process final payment after inspection or will notify Contractor of construction that must be completed or corrected before payment will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.5 WARRANTIES

A. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

- B. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Clean each surface or unit to condition expected in an average cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Remove snow and ice to provide safe access to site.
 - e. Remove labels that are not permanent.
 - f. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

- g. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - h. Replace parts subject to unusual operating conditions.
 - i. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - j. Leave Project clean and ready for use.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 022300 - SITE CLEARING, DEMOLITION & REMOVALS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees and landscaping to remain.
 - 2. Removing above-grade site items, including concrete curbs and sidewalks.
 - 3. Disconnecting and capping or sealing site utilities.
- B. Footings, bases and foundations for the above-mentioned removals shall be removed under Division 2, Section "Excavation and Fill."
- C. See Division 1 Section "Temporary Erosion and Sediment Control" for temporary erosion and sedimentation control measures.
- D. See Division 2 Section "Tree Protection and Root Pruning" for requirements related to tree protection.

1.2 MATERIAL OWNERSHIP

- A. Except for stripped topsoil, items identified by the Project Officer as salvage, or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Project Officer and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction. Accessible routes are required to be provided.
- B. Salvable Items: Carefully remove items indicated by the Project Officer to be salvaged and store on Owner's premises where indicated in the Demolition Plans.
- C. Utility Locator Service: Notify Miss Utility at (800) 552-7001 for utility location services 72 hours prior to site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Erect temporary tree protection fencing around existing trees to remain as indicated on the drawings and as specified in Division 2 Section "Tree Protection and Trimming"
- C. Protect existing site items to remain from damage during construction.
 - 1. Restore damaged existing site items to their original condition, as acceptable to Project officer.

3.2 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 Project Officer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Project Officer's written permission.

3.3 EXISTING SITE ITEMS

- A. Remove existing above-grade items as indicated and as necessary to facilitate new construction.
- B. All concrete items to be removed shall be saw cut from concrete to remain at the location indicated.

3.4 DISPOSAL

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

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 For performing the work of SITE CLEARING, DEMOLITION AND REMOVALS in accordance with the plans, specifications and directions of the Project Officer, the Contractor shall receive the LUMP SUM price bid.

- 4.1.1 The price bid shall be a LUMP SUM of Site Clearing, Demolition, and Removals and shall include storage and re-installation of relocated items the cost of all labor, materials, equipment and incidental expenses necessary to complete the work in accordance with the plans and specifications, to the satisfaction of the Project Officer.

END OF SECTION 022300

SECTION 022310 - TREE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Protection of existing trees to remain.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated in Section 2.1
- B. Certification: From Arlington County arborist or contract arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Requirements: From Arlington County arborist or contract arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Contract arborist Qualifications: Copy of ISA certification or local jurisdiction license.

1.3 QUALITY ASSURANCE

- A. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.
- B. Urban Forester Notification: The Contractor shall notify the Project Officer 72 hours prior to the following events, so that the County's Urban Forester can be present to supervise work:
 - 1. Tree protection fencing installation, to discuss locations and trees to be saved on-site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. 6' Height Plywood Tree Protection Fence: See plan.
- B. Tree Protection Signs: Shall be of heavy-duty sheet aluminum or weatherproof plastic material measuring 12 inches by 18 inches. Signs shall state "NO ENTRY, TREE PRESERVATION AREA, CALL 703-228-6557 TO REPORT VIOLATIONS" in both English and Spanish. Signs shall be mounted at each tree pit.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to the placement of tree protection fencing, the Contractor shall meet on-site with the Project Officer and County Urban Forester to review trees to remain and protective measures required.
- B. Tree Protection Fence: Install tree protection fencing and signs around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove all tree protection fence when construction is complete.
- C. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- D. No personnel, vehicles, equipment, construction materials, or construction debris shall be allowed inside the tree protection areas at any time during construction without the written consent of the Project Officer. If a violation is observed, the Contractor will be notified by the Project Officer and shall immediately rectify the situation. Continued and subsequent violations will result in a fine of \$500 per day of violation.

3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where utility trenches are required within tree protection zones, root pruning shall take place prior to trenching.
- D. Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.

3.3 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to Arlington County arborist or contract arborist's written instructions.
- B. The Contractor shall be responsible for any damage to trees within the Tree Protection Area caused by the Contractor's personnel, vehicles, or equipment at the site. Any damage to a tree to remain shall result in a payment by the Contractor to the Project office for the amount of damage based on the latest edition of the Council of Tree and Landscape Appraisers Guide for Plant Appraisal published by the International Society of Arboriculture (ISA). All trees are to be valued as landscape trees.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.

- B. Disposal: Remove excess excavated material and displaced trees from Owner's property.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 The quantity of 6' HEIGHT PLYWOOD TREE PROTECTION FENCE, shall be the number of LINEAR FEET as delivered to the site, furnished, installed, maintained and removed at project completion in accordance with the plans and specifications.
- 4.2 The price bid shall be a unit price per LINEAR FEET of 6' Height Plywood Tree Protection Fence/Construction Fence and shall include the cost of all labor, materials, equipment and incidental expenses necessary to complete the work.

END OF SECTION 022310

SECTION 023150 EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all labor, material and equipment to perform all work pertaining to earthwork as called for on the approved plans and as specified herein.

1.02 RELATED DOCUMENTS

- A. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Virginia Erosion and Sedimentation Control Handbook, Latest Edition
- C. Underground Utility Protection Ordinance – Chapter 55 Arlington County Code
- D. Local Governing Authority and Code Requirements – Chapter 57 Arlington County Code
- E. Arlington County DES Construction Standards and Specifications
- F. Virginia Department of Transportation Road and Bridge Specifications
- G. Tree Protection Standards and Specifications – as indicated in Construction Drawings

1.03 SUMMARY

- A. This Section includes the following:
 - 1. Excavation for footings, steps, subgrades for slabs-on-grade, walks, pavements, lawns and grasses.
 - 2. Subsurface drainage backfill for trenches.

- B. Related Sections include the following:

- 1. 022300 – Site Clearing, Demolition and Removals
- 2. 033000 – Cast in Place Concrete
- 3. 321313 – Concrete Pavement
- 4. 329100 – Seeding, Mulching, and Topsoil

1.05 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Project Officer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Project Officer. Unauthorized excavation, as well as remedial work directed by Project Officer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. 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.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.06 SUBMITTALS

- A. Product Data: For the following:
 - 1. Geotextile.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Geofilm.
- B. Samples: 12-by-12-inch Sample of subdrainage geotextile.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.
- D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.07 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Coordination, Field Engineering, Cutting and Patching, and Regulatory Requirements."

1.08 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Project Officer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Project Officer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. Protect all existing pipes, poles, wires, fences, trees, and landscape plant materials, and other structures that are to remain in place. In case of damage, notify the appropriate agency to affect repair in a manner resulting in a condition at least equal to the condition prior to damage.

- D. Excavations near existing structures shall not be closer than the distance from finished grade to the bottom of the foundation without sheeting and shoring to protect the existing structure.
- E. On paved surfaces, do not use or operate tractors, bulldozers, or other power-operated equipment, the treads or wheels of which are so shaped as to cut or otherwise damage such surfaces. Placing mats or using other methods of protection may be allowed subject to the approval of the Project Officer. Promptly restore all surfaces that have been damaged to a condition at least equal to that in which they were found immediately prior to the beginning of operations. Suitable materials and methods shall be used for such restoration.
- F. The Contractor shall be solely responsible for the stability of excavations and meeting of all State and Federal OSHA requirements. Provide all sheathing, lagging, bracing, and other support required to retain the stability of excavations.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups CL, ML, SC, GC, GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 4 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or crushed stone, slag, and natural or crushed sand: with or without soil motor.
- E. Base Course: designated as Type I or Type II as follows: Type I shall consist of crushed stone, crushed slag, or crushed gravel with or without soil mortar or other admixtures. Crushed gravel shall consist of particles of which at least 90 percent by weight of the material retained on the No. 10 sieve shall have at least one face fractured by artificial crushing. Type II shall consist of gravel, stone or slag screenings; fine aggregate and crushed coarse aggregate; sand-clay-soil mortar or other admixtures.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Crushed stone Virginia Department of Transportation (VDOT) size 57, 68, or 78 in accordance with VDOT specification section 203 Table II-5

- H. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 - 4. Tear Strength: 56 lbf; ASTM D 4533.
 - 5. Puncture Strength: 56 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: Equal to or smaller than 0.300mm.
 - 7. Permittivity: 0.8 second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 - 4. Tear Strength: 90 lbf; ASTM D 4533.
 - 5. Puncture Strength: 90 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in section 022300 Site Clearing, Demolition, and Removals.
- C. Protect and maintain erosion and sedimentation controls, which are specified in section 015000 Temporary Erosion and Sediment Control, during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

- A. Explosives: Use of explosives is prohibited.

3.04 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by the Geotech. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.
1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.08 SUBGRADE INSPECTION

- A. Notify Project Officer when excavations have reached required subgrade.
- B. If Project Officer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Project Officer, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Project Officer, without additional compensation.

3.09 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 Project Officer.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Project Officer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within tree protection areas and drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL FILL

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

3.14 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.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of final backfill soil material at 95 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 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.

3.17 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES

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

- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6.. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing for site work. The Project Officer may engage a qualified independent geotechnical engineering testing agency to perform testing for critical structures and building foundations.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Project Officer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 5,000 sf or less of building slab, but in no case fewer than 3 tests for building slabs and at least 1 test every 500 linear feet of paved roadway, but in no case fewer than 2 tests for pavements.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 3. Trench Backfill: At each compacted bedding and final backfill layer, at least 1 test for each 300' or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

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

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 The unit price for EARTH MOVING shall be LUMP SUM and shall include the cost of all labor, materials, equipment and incidental expenses necessary for the excavation, disposal, delivery, placing and compaction of select fill, dewatering, sheeting and shoring, grading, stockpiling, and other incidental work and expenses necessary to complete the work in accordance with the plans and specifications to the satisfaction of the Project Officer.

END OF SECTION 023150

SECTION 033000 – CAST IN PLACE CONCRETE

PART I – GENERAL

1.1 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Foundation for Site Furnishings
2. Curbs (ALL)
3. Cast-in-Place Cheek Walls and Steps

1.2 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- C. Comply with ACI 301, "Specification for Structural Concrete."
- D. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- E. Expansion Joint sealant colors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For concrete pavement mixture.
- C. Delivery tickets for concrete including the date, time, truck identification, concrete plant, plant inspector, ticket and load number concrete class and design mix, moisture content of aggregates, quantity and location of placement.
- D. 12" x 12" x 12" on-site mock up of each color with specified finish.

PART 2- PRODUCTS

2.1 STEEL REINFORCEMENT

- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

- F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed, sizes as shown on the drawings.
- H. Plain Steel Wire: ASTM A 82, as drawn.
- I. Deformed-Steel Wire: ASTM A 496.
- J. 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."

2.2 CONCRETE MATERIALS

- A. The design of the concrete mix, equipment, workmanship, and materials shall conform to the applicable requirements of Division 3 sections, except as hereinafter specified. Minimum compressive strength after 28 days shall be 3000 psi. Maximum size of aggregate shall be 1-01/2 inches, but not less than 3/4 inch. Air content by volume shall be 4-1/2 per-cent, plus or minus 1-1/2 percent. The same brand of cement, source of sand, and water/cement ratio shall be maintained for each load of concrete.
 - 1. Provide Class A3 General Use (3,000 psi) concrete for curbs (all) and site furnishing foundations.
 - 2. Provide 3,500 psi concrete for all walls and steps.
- B. Portland Cement air-entrained, ASTM C 150, Class A3 General Use (3,000 psi) per VDOT 217.

2.3 CURING MATERIALS (non-colored concrete)

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.4 EXPANSION JOINT FILLER

- A. Joint filler shall be 1/2 inch preformed asphalt expansion joint material conforming to ASTM D994 or ASTM D1751.

- B. If bituminous fiber material is used, a bond breaker such as one-half (1/2”) wide polyethylene tape or five eighths inch (5/8”) diameter expanded polyethylene foam backer rod shall be installed as recommended by the manufacturer.

2.5 EXPANSION JOINT SEALANT

- A. Expansion Joint Sealant: Sealant shall be one-component polyurethane-base elastomeric sealant. Asphalt cement will not be approved as a substitution. Sealant color shall match color of adjacent pavement. Where joints fall between pavement sections of different colors, color shall be approved by Project Officer to match one of the pavement colors.
 - 1. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
 - a. SikaFlex-1a by Sika Corporation.
 - b. Sonolastic NP-1 by Sonneborn and Chem Rex Inc.

PART 3 – EXECUTION

3.1 SAMPLING, TESTING AND ENFORCEMENT

- A. Sampling and testing shall be performed in accordance with Section 03100- Concrete Formwork Reinforcement and Materials, Arlington County Department of Public Works Construction Standards and Specifications.

3.2 PLACING REINFORCEMENT

- C. Comply with specified codes and standards, and comply with Concrete Reinforcing Steel Institute's Manual of Standard Practice for placing reinforcements.
- D. Clean reinforcement of loose rust and mill scale, earth, ice and other materials, which reduce or destroy bond with concrete.
- E. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations before concrete is placed. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required. Wet placement of rebar is prohibited.
- F. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- G. Concrete cover: Protect reinforcing by thickness of concrete indicated on drawings. Where not otherwise shown thickness over reinforcement shall be as follows:

Provide clear distance to outermost reinforcing as follows:

Concrete Cast Against Earth..... 3 inches

Concrete Exposed to Earth or Weather:

#5 or smaller	1-1/2 inches
#6 or Larger.....	2 inches

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

3.4 PREPARATION FOR PLACING CONCRETE

A. Formwork:

1. General: Construct forms of sound material, and of the correct shape and dimensions shown on the Drawings, constructed tightly and of sufficient strength. Brace and tie the forms together so that the movement of workers, equipment, materials, or placing and vibrating the concrete will not throw them out of line or position. Forms shall be strong enough to maintain their exact shape under all imposed loads. Construct forms that may be easily removed without damage to the concrete. Before concrete is placed in any form, the horizontal and vertical position of the form shall be carefully verified, and all inaccuracies corrected. Complete all wedging and bracing in advance of placing concrete.
2. Coat contact surfaces of forms with a form coating compound before reinforcement is placed.
2. Chamfered Corners: Unless otherwise indicated, provide chamfered corners on all exposed corners. Provide 3/4-inch moldings in forms for all chamfering required.
3. Form Ties: Use form ties of sufficient strength and in sufficient quantities to prevent spreading of the forms. Place ties at least 1-inch away from the finished surface of the concrete. Do not use ties consisting of twisted wire loops. Leave inner rods in concrete when forms are stripped. Space all form ties equidistant, and symmetrical, and line up both vertically and horizontally.
4. Cleanouts and Access Panels: Provide removable cleanout sections or access panels at the bottom of all forms to permit inspection and effective cleaning of loose dirt, debris, and waste material. Clean all forms and surfaces to receive concrete of all chips, sawdust, and other debris and thoroughly blow out with compressed air just before concrete is placed.
5. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

- B. Preparing the Subgrade: Thoroughly prepare and compact the subgrade as specified in Section 023150 – Earthwork. Subgrade shall be excavated to the required elevation below the finished surface of the pavement in accordance with grades and lines shown on the Drawings.

- C. Layout: Cast in place concrete shall have true curves to the radii indicated on the Drawings. No straight segments or tangents shall be approved. A digital CADD file containing the project

layout is available from the Project Officer to aid in the installation of cast in place concrete elements.

- D. Dewatering: Remove water from excavations before concrete is deposited. Divert any flow of water through proper side drains and remove water without washing over freshly-deposited concrete. Remove hardened concrete, debris, ice, and other foreign materials from the interior of the forms, and from the inner surfaces of mixing and conveying equipment. Secure reinforcing in position and place vapor barrier and have inspected and approved before the concrete is poured. Do not wheel equipment used to deposit concrete over reinforcement.
- E. Inspection: After placement of reinforcing steel in the forms, and prior to placing concrete, notify the Project Officer so that proper inspection may be made. Such notification shall be made at least 48 hours in advance of placing concrete to permit proper arrangements for inspection.

3.5 DELIVERY

- A. Submit a delivery ticket indicating the mix and design strength of the concrete, design slump, and time of leaving the truck mixer with each batch at the time of delivery. Record on the back of the delivery ticket: (a) the time of arrival of the truck mixer on the site; (b) the time of deposit of the concrete from the truck; and (c) the place of deposit of the concrete. The completed delivery ticket shall be delivered to the Project Officer. Failure to deliver such completed ticket to the Project Officer will be cause for the Project Officer to reject the deposited concrete at any time and cause it to be removed and replaced at no additional expense to the County.
- B. All batching of concrete shall be in accordance with the manufacturer's instructions.
- C. Do not use concrete on the job site when it has exceeded the allotted mixing time as specified in Section of the 217.09 of the VDOT Specifications.

3.6 PLACING CONCRETE

- A. Before placing concrete, remove all construction debris, water and ice from the places to be occupied by the concrete. Give particular attention to the removal of dirt and debris from all formed construction joints.
- B. Concrete, when deposited, shall have a temperature ranging between a minimum of 50 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit. When the temperature of the surrounding air is below 50 degrees or above 90 degrees Fahrenheit, concreting shall be done in accordance with the recommendations noted in ACI-306 and ACI-305 respectively.
- C. Depositing of concrete shall be in accordance with the manufacturer's instructions.
- D. Mix concrete in such quantities as required for immediate use and place prior to loss of slump. Do not re-temper concrete.
- E. Spade, work and vibrate concrete as it is being poured, to secure its maximum density, free from voids and completely filling the forms. Thoroughly work concrete to secure the complete envelopment of all parts of the reinforcing steel and completely fill the corners of the forms. Maintain not less than 2 approved vibrators on the work at all times. Use tremies or chutes for drops of more than 5-feet.

3.7 REMOVAL OF FORMS

- A. After concrete has been placed, all forms, bracing and supports shall remain undisturbed long enough to allow the concrete to reach the strength necessary to support with safety its own weight plus any live load and earth pressure that might be placed upon it without causing excessive settlement or deflection or any temporary or permanent damage to the structure. Prevent the breaking of edges and corners of concrete in the stripping of forms. Upon removal of formwork, immediately patch honeycombed areas and other voids to the satisfaction of the Project Officer.
- B. Thoroughly clean forms and recoat with specified form coating before each reuse. Do not reuse any form for exposed work which cannot be reconditioned to "like new" condition. Discard forms considered unsatisfactory by the Project Officer. Apply form coating to all forms in accordance with the manufacturer's specifications. Apply form coatings before placing reinforcing steel.

3.8 PROTECTION OF NEW WORK

- A. Protect all freshly placed concrete from mechanical injury or action of the elements until such time as the concrete is thoroughly set.
- B. Protect sleeves, projecting inserts, anchor bolts and other embedded items from disturbances until the concrete has sufficiently set to hold such items.

3.9 CONTROL JOINTS

- A. Provide sawn or tooled joints or removable insert strips; depth equal to 1/4 slab thickness. Spacing as required and approved by the Project Officer.

3.10 EXPANSION JOINTS

- A. Furnish and install preformed expansion joint material at locations shown on the drawings or every 20 feet on center, minimum, full depth of concrete at approved locations by Project Officer. Cut preformed expansion joint material slightly less than the full width of the cross section of the concrete to allow for a liquid joint sealant with any backup material. Provide smooth dowels across joint which permit 1-inch horizontal movement and no vertical shear movement.
- B. Tool the concrete edges at expansion or contraction joints to a one-eighth (1/8)-inch radius.

3.11 FINISHING

- A. Finishing and caulking of concrete shall be in accordance with the manufacturer's instructions.
- B. Concrete Walls: All areas of exposed concrete walls from the top of the wall to 1 foot below the finished grade of the structure shall be finished in the following manner:
 - 1. After removal of forms, point cavities, stone pockets, and tie holes in exposed surfaces with mortar by thoroughly wetting the repair area. Cut out honeycombs down to dense concrete, and then patch and point as described above. The mortar mix for patching shall be determined by trial to obtain a good color match with the concrete when both patch

- and concrete are cured and dry. The amount of mixing water shall be as little as consistent with the requirements of handling and placing the mortar.
2. Ground off form joint marks and fins to a smooth surface, dense and free of prominent grain markings and bulges or depressions more than 1/8-inch in 4 feet.
 3. When the mortar pointing has set, the entire exposed concrete surface shall be thoroughly covered with water by means of brush and rubbed with carborundum brick to remove all blemishes and leave the entire exposed surface uniform in color and texture.
 4. All walls shall receive a light sandblast finish. Prepare mock-up for approval prior to commencing work.
- C Concrete Flush Curbs Troweled with Fine-Broom Finish:
1. General: Do not add water to concrete surfaces during finishing operations.
 2. 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.
 3. 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.

3.12 CURING

- A. Curing shall be started as soon as it is possible to apply the curing medium without damaging the surface, preferably immediately upon completion of the finishing operation. Curing shall continue uninterrupted for a minimum period of 14 days. Rapid drying upon completion of the curing period shall be prevented. At no time during the curing period shall the temperature of the concrete be permitted to drop below 40 degrees Fahrenheit.

3.13 DEFECTIVE CONCRETE

- A. Defective concrete is defined as concrete in place which does not conform to strength, shapes, alignments, appearance, and/or elevations as shown on the Drawings; areas which contain faulty surface areas and/or concrete surfaces not finished in accordance with these specifications.
- B. Remove all defective concrete and replace in a manner meeting with the Project Officer's approval. Should only surface imperfections occur, patch at the discretion of, and in a manner satisfactory to, the Project Officer. Permission to patch the work shall not be considered as a waiver of the County's right to require complete removal and replacement of such defective work should the patching fail to satisfactorily restore the required quality and appearance of the work.

PART 4- MEASUREMENT AND PAYMENT

- 4.1 The measurement of CAST IN PLACE CONCRETE to be paid for shall be the number of Cubic Yards constructed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.2 The price bid shall be a unit price per CUBIC YARD of Cast In Place Concrete and shall include the cost of furnishing all labor, materials, equipment, and incidental expenses necessary to complete the work, including expansion material, sealant, color, steel reinforcement, curing material, concrete, aggregate subbase, all in accordance with the plans and specifications and to the approval of the Project Officer.

- 4.3 The measurement of CURBS (ALL) to be paid for shall be the number of Linear Feet constructed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.4 The price bid shall be a unit price per LINEAR FOOT of Curb (ALL) and shall include the cost of furnishing all labor, materials, equipment, and incidental expenses necessary to complete the work, including expansion material, sealant, color, steel reinforcement, curing material, concrete, aggregate subbase, all in accordance with the plans and specifications and to the approval of the Project Officer.

Does not include excavation.

END OF SECTION 033000

SECTION 051210 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Extent of structural steel work as shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Products furnished but not installed under this section:
 - 1. Steel anchorages cast in concrete.
- C. General: Unless otherwise specifically approved in writing, furnish exact section, weights, and kinds of material specified, using details and dimensions shown.
- D. Details shown are typical; similar details apply to similar conditions, unless otherwise indicated.

1.3 QUALITY ASSURANCE

- A. Welding Procedures: Establish that joint welding procedures are prequalified or test in accordance with AWS D1.1 qualification procedures.
- B. Welder Qualifications: Welders must be currently certified under American Welding Society qualification procedures. If recertification is required, retesting will be the Contractor's responsibility.
- C. Regulatory Requirements: Unless other requirements of governing authorities or particular requirements of this specification are more stringent, comply with provisions of the following:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design," with Commentary and Supplements.
 - 3. ANSI/AWS D1.1 -- Structural Welding Code - Steel; American Welding Society.
 - 4. ASTM A 123 -- Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. Specification for Structural Joints Using ASTM A325 or A490 Bolts; Research Council on Structural Connections; American Institute of Steel Construction, Inc. (AISC).
- E. Specification for Structural Steel Buildings -- Allowable Stress Design and Plastic Design; American Institute of Steel Construction, Inc. (AISC).

1.4 SUBMITTALS

- A. Product Data: Upon request, submit producer's or manufacturer's data for products as follows, including sufficient data to show compliance with specified requirements:
1. Shop Drawings: Submit complete shop drawings at 1/8 scale minimum for structural steel, including information on location, type, and size of all bolts, and welds, distinguishing between those made in the shop and those made in the field. (Reproduced contract drawings are not acceptable for use as erection plans.)
 - a. CAD files of the structural drawings are available for use by the contractor at a standard processing fee. If files are desired, contact Ehlert/Bryan, Inc. at 703-827-9552.
 2. The Contractor shall verify all existing conditions and dimensions prior to submitting of shop drawings. Shop drawings shall not be submitted until all field checking of dimensions have been shown on the shop drawings.
 3. Welder Qualifications: Submit evidence that welders employed in the work are currently certified under AWS qualification procedures.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Structural Steel Angles, Channels, Tees, Plates, and Bars: ASTM A 36.
- B. Structural Steel Wide Flange Shapes: ASTM A572, Grade 50.
- C. Anchor Bolts: ASTM A 36
- D. High-strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, quenched and tempered medium-carbon steel, complying with ASTM A 325.
- E. Electrodes for Welding: Comply with AWS Code, use E70XX Series.
- F. Standard Primer Paint: High solids, low VOC, rust inhibitive, all-purpose shop primer which is free of lead, chromates, and other heavy metals. Acceptable products, or equivalent:
1. Structural Steel Primer (B5ONV12 Red, B5OAV11 Gray) by Sherwin Williams Company, Cleveland, OH.
 2. Duraclad High Solids Shop Coat Metal Primer (33-082 Red, 33-083 Gray) by Duron Paints and Wall Coverings, Beltsville, MD
 3. Devoe Rustgard 4140 Quick Drying Shop Primer (4140-7100 Red, 4140-6120 Gray) by ICI Dulux Paints, Louisville, KY.
- G. Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

2.2 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in the shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
- B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
- C. Connections: Weld or bolt shop connections, as indicated.
- D. Bolts need only to be tightened to a snug tight condition in accordance with the RCSC specification for shear/bearing bolts except for those identified as slip critical bolts.
- E. Welded Construction: Comply with AWS Code for procedures, appearance, and quality of welds, and methods used in correcting welding work.
- F. Galvanizing: Provide a zinc coating for those items indicated or specified to be galvanized, as follows: ASTM A 153 for galvanizing iron and steel hardware. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier. ASTM A 386 for galvanizing assembled steel products.

2.3 SHOP PAINTING

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
- B. Apply two coats of paint to those surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- C. Surface Preparation: After inspection and before galvanizing or shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows: SSPC - SP-3 "Power Tool Clean" for concealed steel.
- D. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting method which result in full coverage of joints, corners, edges and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erector must examine the areas and conditions under which structural steel work is to be installed and notify the Contractor, in writing, of conditions detrimental to the proper and timely

completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.

- B. Erector must survey as-built anchor bolt, bearing plate and embedded plates used for beam connection layouts prior to setting structural steel. If structural steel is set prior to surveying, erector is responsible for all modifications necessitated by improperly located bolts or plates.
- C. Erector must inform the Architect when the erection of steel deviates from the approved shop drawings due to fabrication errors, misalignment of embeds and any additional type of deviation. The erector must submit, for review, a report of the deviation condition in writing, including cause and possible solution. A written acceptance of all deviates must be maintained at the jobsite for review by the Owner's testing laboratory.
- D. Temporary Support: Provide temporary guys, braces, falsework, cribbing, or other elements required to secure the steel framing against loads equal in intensity to design loads. Remove such temporary support only when permanent connections have been made and the steel framing is fully capable of supporting design loads, including any temporary constructions loads.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Shipping: Deliver steel in timely fashion, to permit the most efficient and economical flow of work. Deliver steel members properly marked for field assembly and erection.
- B. Deliver anchor bolts, washers, and other anchorage devices to be built into other work in time to avoid delays and permit their proper installation.
- C. Storage: Protect steel and other materials of this section from damage and corrosion. If temporary storage at the project site is required, keep steel members off the ground, using platforms or pallets, in location easily accessible for inspection.

3.3 ERECTION

- A. General: Erect structural steel in compliance with AISC Code and Specifications.
- B. Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- C. Level and plumb individual members of the structure within specified AISC tolerances.
- D. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.
- E. Splice members only where indicated and accepted on final shop drawings.
- F. Do not enlarge unfair holes in members by burning or by the use of drift pins. Ream holes that must be enlarged to admit bolts.

- G. Gas Cutting: Do not use gas cutting torches in the field for correcting fabrication errors in primary structural framing.
- H. Expansion Bolts to Masonry: Anchor only to masonry grouted solid. If masonry is not grouted at the time of anchor installation, immediately notify General Contractor of condition. Do not proceed until condition is corrected by grouting solid & cured for a minimum of three days.
- I. Expansion Bolts: Install in accordance with manufacturer's instructions using only acceptable masonry carbide bits for drilling. Provide bolts with a minimum embedment of 5" unless otherwise noted on drawings.
- J. Touch-up Painting: After erection, wire brush clean and paint scarred areas, welds, rust spots on steel, using same type of shop paint used on adjacent surfaces.

3.4 FIELD QUALITY CONTROL

- A. Owner will engage an independent testing and inspection agency.
- B. The testing agency shall visit the fabricator's plant and verify that the fabricator's detailed fabrication and quality control procedures are in place and conform to industry standards. If the fabricator can demonstrate that they currently comply with the AISC quality certification program category I, the testing agency's plant inspection may be omitted.
- C. The testing agency will conduct tests in accordance with industry standards and interpret the tests and state in each report whether the test specimens comply with the requirements and specifically state any deviations therefrom.

PART 4 – MEASUREMENT AND PAYMENT

4.1 The unit price for STRUCTURAL STEEL shall be LUMP SUM and shall include the cost of all labor, materials, equipment and incidental expenses necessary to complete the work in accordance with the plans and specifications to the satisfaction of the Project Officer.

END OF SECTION 051210

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Bar Grating Bridge
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.3 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

- A. The Contractor acknowledges its responsibility to submit complete submittals in a timely fashion. Failure to do so may result in automatic rejection of work and/or materials. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays or costs caused by un-submitted or late submittals or the return of incomplete or incorrect submittals.
- B. Product Data: For the following:
 - 1. Metal trim.
 - 2. Finishes.

3. Grout.

C. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Verification:

1. For each type and finish of metal trim.
2. For each type and finish of color coating.

E. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

F. Welding certificates.

G. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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 concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Tubing: ASTM A 500, cold formed steel tubing.
- D. Bar Grating: NAAMM MBG 531.
1. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
 2. Wire Rods: ASTM A 510 (ASTM A 510M).

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).
- D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- H. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- I. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- J. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material for Anchors in Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.5 COATING MATERIALS

- A. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.
1. Use primer with a VOC content of 300 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Polyurethane Intermediate Coat and Topcoat: Complying with MPI #72 and compatible with undercoat.
1. Use product with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 1. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.

2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.11 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.

2.12 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.13 METALLIC-COATED STEEL FINISHES

- A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate or other conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- C. Color Coat: Epoxy/urethane shop-applied paint including primer, finish coat, and clear top coat.
 - 1. Color: As indicated

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized and/or color coated after fabrication. Join with bolted or screwed field connections.
- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use non-shrink, nonmetallic grout in exterior locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 09 96 00 - HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Coating systems for site metals.

1.2 RELATED SECTIONS

- A. Division 32 Section "Decorative Metal Fences and Gates."

1.3 REFERENCES

- A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.4 DEFINITIONS

- A. Definitions of Painting Terms: In accordance with ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.5 SUBMITTALS

- A. The Contractor acknowledges its responsibility to submit complete submittals in a timely fashion. Failure to do so may result in automatic rejection of work and/or materials. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays or costs caused by un-submitted or late submittals or the return of incomplete or incorrect submittals.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Operation and maintenance data.
- C. Samples for Initial Selection: For each product specified, complete set of color chips representing Manufacturer's full range of standard colors, finishes, and patterns.
- D. Samples for Verification: For each product specified, two samples, minimum size 4 inches (100 mm) square, demonstrating actual product, color, and patterns, prepared on actual substrate.

- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Submit Manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- B. Applicator's Qualifications: Submit list of a minimum of 3 completed projects of similar size and complexity to this Work. Include for each project:
 1. Project name and location.
 2. Name of owner.
 3. Name of contractor.
 4. Name of architect.
 5. Name of coating Manufacturer .
 6. Approximate area of coatings applied.
 7. Date of completion.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 1. Prepare a mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application.
 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 3. Refinish mock-up area as required to produce acceptable work.
 4. Retain mock-ups to establish intended standards by which coating systems will be judged.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in Manufacturer's original, unopened containers and packaging, with labels clearly identifying:
 1. Coating or material name.
 2. Manufacturer .
 3. Color name and number.
 4. Batch or lot number.
 5. Date of manufacture.
 6. Mixing and thinning instructions.
- B. Storage:
 1. Store materials in a clean dry area and within temperature range in accordance with Manufacturer's instructions.
 2. Keep containers sealed until ready for use.
 3. Do not use materials beyond Manufacturer's shelf life limits.
- C. Handling: Protect materials during handling and application to prevent damage or contamination.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions within limits recommended by Manufacturer for optimum results. Do not install products under environmental conditions outside Manufacturer's absolute limits.
- B. Weather:
 - 1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with Manufacturer's instructions.
 - 2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
 - 3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with Manufacturer's instructions.
 - 4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
 - 5. Wind: Do not spray coatings if wind velocity is above Manufacturer's recommended limit.
- C. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with Manufacturer's instructions.
- D. Dust and Contaminants:
 - 1. Schedule coating work to avoid excessive dust and airborne contaminants.
 - 2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 - PRODUCTS

2.1 MANUFACTURER S

- A. Manufacturer: Coating Manufacturers must be approved by Master Painters Institutes Approved Product Listing. Basis of Design Manufacturer is Sherman Williams. Other Approved Manufacturers include:
 - 1. AkzoNobel/Devo,
 - 2. Benjamin Moore/Corotech
 - 3. PPG/Pitthane.

2.2 COATING SYSTEMS FOR STEEL FRAMING – ARCHITECTURAL EXPOSE STEEL

- A. Primer: MPI #108; S-W Marcopoxy 646 Fast Cure Epoxy B58-600 Series (applied at 5 – 10 mils DFT).
- B. Top Coats: MPI # 7; S-W Acrolon 218 HS Polyurethane Coating, Semi-Gloss B65-650 Series (or Gloss B65-600 Series), (applied at 3 – 6 mils DFT).
- C. Finish Color:
 - 1. As selected by Architect from Manufacturer's standard colors and finishes.

2.3 ACCESSORIES

A. Coating Application Accessories:

1. Accessories required for application of specified coatings: Provide in accordance with coating Manufacturer's instructions, including thinners.
2. Products of coating Manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION, GENERAL

- A. Surface Preparation: Iron & Steel, Atmospheric Conditions, SSPC-SP2/3. Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, mill glaze and other foreign material to ensure adequate adhesion. See product data sheet for complete information.

3.4 SURFACE PREPARATION OF STEEL

- A. Prepare steel surfaces in accordance with Manufacturer's instructions. Correct all defects and otherwise deleterious conditions in substrate prior to commencing Work.
- B. Fabrication Defects include, but are not limited to, the following:
 1. Correct steel and fabrication defects revealed by surface preparation.
 2. Remove weld spatter and slag.
 3. Round sharp edges and corners of welds to a smooth contour.
 4. Smooth weld undercuts and recesses.
 5. Grind down porous welds to pinhole-free metal.
 6. Remove weld flux from surface.
- C. Ensure surfaces are dry.

- D. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3, unless otherwise specified.
- E. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.
- F. Shop Primer: Prepare shop primer to receive field coat in accordance with Manufacturer's instructions.

3.5 APPLICATION

- A. Apply coatings in accordance with Manufacturer's written specifications.
- B. Do not proceed with application when actual and/or potential environmental and adjacent conditions may deleteriously affect the coating.
- C. Mix and thin coatings, including multi-component materials, in accordance with Manufacturer's instructions.
- D. Keep containers closed when not in use to avoid contamination.
- E. Do not use mixed coatings beyond pot life limits.
- F. Use application equipment, tools, pressure settings, and techniques in accordance with Manufacturer's instructions.
- G. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- H. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- I. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.6 REPAIR

- A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with Manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.7 CLEANING

- A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.8 PROTECTION OF COATING SYSTEMS

- A. Protect surfaces of coating systems from damage during construction.
- B. Touch-up, or repair damaged products before Substantial Completion.

3.9 ONE-YEAR INSPECTION

- A. Owner will set date for one-year inspection of coating systems.
- B. Inspection shall be attended by Owner, Contractor, Architect, and Manufacturer's representative.
- C. Repair deficiencies in coating systems, as determined by Architect, in accordance with Manufacturer s instructions.

END OF SECTION 09 96 00

SECTION 101400 – SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Playground Entrance Signs
 - 2. Playground Rules Signs

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings for all signs: Include plans, elevations, sections of components, and installation details.

1.3 WARRANTY

- A. Warranty Period: Minimum of one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Available Manufacturers: Subject to compliance with requirements, provide the signs by the following or approved equal:
 - 1. Engraphix Architectural Signage, Inc., 132 Hanley Industrial Court, St. Louis, MO 63144 (314) 781-7878.
 - 2. Sign graphics, text layout and color shall be as shown on the drawings.
- B. Manufacturers NOT listed above must meet the following requirements:
 - 1. The vendor(s) shall have a long and established history (no less than five (5) years) of producing high quality, easily maintained, and cost-conscious sign fabrications.
 - 2. The vendor shall a long-term relationship with municipalities and public entities in the region, such as Arlington County.
 - 3. Vendor shall be prepared to fabricate sign(s) on time and within acceptable budget provisions while providing the expected quality of craftsmanship.

2.2 MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 5005-H15.
- B. Vinyl Film: Opaque, nonreflective vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing, suitable for exterior applications.
- C. Colored Coatings for Plastic Sheet: Nonfading coatings, including inks and paints for copy and background colors. Use coatings that are recommended by manufacturers for optimum adherence to type of plastic used.
- D. Steel Plate: ASTM A36.
- E. Steel Tubing: ASTM A500, Grade B.
- F. Concrete for Postholes: Comply with requirements in Division 3 Section "Cast-in-Place Concrete."
- G. Hardware: Hot-dipped galvanized or stainless steel.

2.3 POSTS

- A. General: Fabricate posts to lengths required for mounting method indicated.
 - 1. Direct-Burial Method: Provide posts 36 inches longer than height of sign to permit direct embedment in concrete foundations.
 - 2. Size: As indicated on the drawings.
 - 3. Color: As shown on the drawings.

2.4 SIGN PANELS

- A. Signs:
 - 1. Unframed Single-Sheet Panels: Provide unframed single-sheet sign panels with edges mechanically and smoothly finished.
 - a. Panel Material: 0.125-inch- thick aluminum sheet.
 - b. Panel Finish: Standard Matthews Paint System with clear matte finish coat.

2.5 TEXT

- A. All sign text shall read as shown on the Drawings.

2.6 GRAPHICS

- A. Graphic Content and Style: Provide sign copy that complies with requirements indicated in Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel Finish: Cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603, medium gloss.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.8 ACCESSORIES

- A. Mounting Methods: Use fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Excavation: In firm, undisturbed or compacted soil, drill or (using a post-hole digger) hand-excavate holes for posts to diameters and spacing indicated.
 - 1. Excavate hole depths as indicated on the drawings.
- B. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation, unless otherwise indicated. Place concrete and vibrate or tamp for consolidation. Check for alignment and hold in position until concrete has achieved its initial set.
- C. Install signs level, plumb, and at height indicated, with surfaces free from distortion.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 The quantity of SIGN to be paid for under this item shall be the number of EACH type, furnished and installed in accordance with the plans, specifications and to the satisfaction of the Project Officer.
- 4.2 The unit price bid per EACH of Sign include the cost of all labor, materials, and incidental expenses necessary to complete the work, hardware, concrete footings, in accordance with the plans

and specifications, to the satisfaction of the Project Officer. Excavation shall be paid for separately.

END OF SECTION 101400

SECTION 116800 – PLAYGROUND AND ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all equipment and materials, and do all work necessary to furnish and install the playground and athletic equipment, as indicated on drawings and as specified herein. Equipment shall include, but not be limited to:
 - 1. Playground equipment.

1.2 RELATED WORK

- A. Examine contract documents for requirements that affect work of this section. Other specification sections that directly relate to the work of this section include, but are not limited to:
 - 1. 334001 – Subdrainage
 - 2. 321816.13 – Playground Protective Surfacing

1.3 RELATED WORK

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. Manufacturer's Data and Recommended Installation Requirements

1.4 SUBMITTALS

- A. Manufacturers Product Data
 - 1. Provide manufacturers qualifications as described in section 1.5 and product data for all products listed in this specification prior to actual field installation work, for landscape architect's review and approval.
- B. Qualification Data: For qualified Installer and Testing Agency.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of playground equipment.
- D. Field quality-control reports.
- E. Shop Drawings
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include fall heights and use zones for equipment, coordinated with the critical-height values of protective surfacing specified in other Sections.

- F. Operation and Maintenance Data: Submit operation, cleaning, maintenance data for equipment provided, including lists of replacement parts and sources. Include a copy of this information in the final "Project Information Manual".
- G. Installer qualifications as described in section 1.5

1.5 QUALITY ASSURANCE

- A. Manufacturers warranties shall pass to the landscape architect and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.
- B. Installer Qualifications: Not less than 5 years documented, successful experience with work comparable to the work of this project, and licensed by the manufacturer.

1.6 PRODUCT DELIVERY AND STORAGE

- A. Materials delivered to the site shall be examined for damage or defects in shipping. Any defects shall be noted and reported to the landscape architect. Replacements, if necessary, shall be immediately reordered, so as to minimize any conflict with the construction schedule. Sound materials shall be stored above ground under protective cover or indoors so as to provide proper protection.

PART 2 - PRODUCTS

2.1 PLAYGROUND EQUIPMENT

- A. Subject to compliance with requirements, provide the named product from the named manufacturer on the play equipment schedule, or an equal, as approved by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

- A. Examine supporting structure and conditions under which the work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. All athletic equipment shall be installed as recommended with manufacturer's written directions, and as indicated on the drawings. Install equipment only after completion of contiguous work and according to final shop drawings and manufacturer's instructions and recommendations.
- C. Coordinate design and installation of framing and supports with the roof structural system.
- D. Set work accurately as measured from established building lines and levels and from court playing lines. Set work true and plumb and in alignment with previously completed work.

3.2 TESTING

- A. Before final acceptance, test operation of assemblies in presence of Architect and Owner to demonstrate satisfactory operation acceptable to Owner.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections: For playground and playground equipment and components during installation and at final completion and to certify compliance with ASTM F 1487 and CPSC No. 325.
- E. Prepare test and inspection reports.
- F. Notify Owner 48 hours in advance of date and time of final inspection.

3.3 CLEANING AND ADJUSTMENT

- A. Clean all surfaces exposed to view before final acceptance.
- B. Clean and lubricate joints and bearings in accordance with manufacturer's instructions.
- C. Protect units during remaining construction period so that units will be without damage or wear at time of final acceptance.

END OF SECTION 116800

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Benches
2. Trash Receptacles
3. Recycling Receptacles

1.2 RELATED SECTIONS:

- A. Section 023150 - Earthwork
- B. Section 033000 - Cast in Place Concrete

1.3 SUBMITTALS

- A. Shop Drawings: Provide fabricator's shop drawings for each type of product indicated for approval prior to any fabrication.
- B. Product Data: For each type of product indicated.
- C. Fastener Data: For each type of fastener used.
- D. Material Certificates: For site furnishings, signed by manufacturers.
- E. Maintenance Data.

PART 2 - PRODUCTS

2.1 BENCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Kenneth Lynch & Sons, 114 Willenbrock Road, Oxford, Connecticut 06478. Phone: (203) 264-2831.
- B. Style:
 1. F2 – 1964 World's Fair Bench: 6733; 1964 World's Fair Bench with Armrests; 8 foot length.
- C. Frame: Cast ductile iron, powdercoated Silver or approved equal.

- D. Slats: Shall be Ipe of the sizes and dimensions shown on the drawings.
1. Manufacturers: Subject to compliant with requirements, provide products by the following or approved equal: Kebony, Inc. Pheasant Ridge Commercial Center, Suite 302, 4419 Pheasant Ridge Road, Roanoke, VA 24014. Phone: (540) 904-6781
 2. Slats shall be milled perfectly smooth to the finished length. Each slat shall be of one continuous piece; no joints will be allowed. Lumber shall be parallel cut without heart center or sap-wood and shall be straight grained, maximum slope of grain to be 1:10. All milled surfaces shall be sanded smooth on all four sides and both ends after being worked to the required dimensions. All edges shall be eased to a radius of one-eighth inch (1/8"). All wood shall be thoroughly seasoned and shall contain no more than fifteen percent (15%) to twenty percent (20%) of moisture by weight.
 3. Lumber shall be in sound condition, free from worm holes, knots, longitudinal heart cracks, firm or soft sap wood, fungus, and deformation (twisting or cupping) which cannot be removed during installation using normal installation methods and tools. Natural drying checks, to a maximum of one-eighth inch (1/8") in width, will be acceptable. Dimensional tolerance (measured at 20% moisture content) shall be plus or minus .08" in both width and thickness.
 4. The County reserves the right to independently identify species of samples of wood taken from the job site. Random samples must be supplied to PRCR for identification, at the request of the Project Officer. Should the wood provided on the job site not be as previously approved, the Contractor shall replace all the incorrect wood at no extra cost to the County.
- E. Hardware: Bolts, nuts, and washers used to secure slats to standards shall be stainless steel. Anchor bolts used to secure the benches to pavements may be either stainless steel or hot-dipped galvanized steel. Type and dimensions of all bolts, nuts, and washers shall be as indicated on the plans. Threads of all bolts shall have the ends upset after installation of nuts so as to render the connection vandal resistant.
- F. Finish: Surfaces of the cast iron bench standards, bars and brace rods shall be powder coated with a polyester thermosetting Powder Coating as manufactured by Tiger Drylac, Sherwin Williams, PPG or Spraylat, or an approved equivalent. Powder coating shall be applied at a film thickness of 3 to 4 mils (.08 mm to .10 mm) by electrostatic spray process and bake finished per the manufacturer's directions. It shall be applied without voids, tears or cuts that reveal the substrate and shall thoroughly adhere to the metal without peeling when scratched with a pick device or knife blade point.
1. PPG Powder primer PCM70140
 2. All surfaces shall first receive hot-iron phosphating treatment.
 3. Finish shall pass the Cross Hatch test per ASTM standard, method B.
 4. Color: To be specified from manufacturer's full range of colors.

2.2 TRASH RECEPTACLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Victor Stanley, Inc., P.O. Drawer 330, Dunkirk, Maryland 20754. Phone: (800) 368-2573.
- B. Style: Ironsites Model SD-42 with Dome Lid and Side Door.
- C. Support Frames: Steel; welded.
- D. Trash Receptacles:
 - 1. Receptacle Shape and Form: Round cylinder with optional S-2 formed dome lid; with opening for depositing trash in top.
 - 2. Inner Container: High density plastic liner designed to be removable and reusable.
 - 3. Capacity: Not less than 36-gallon.
- E. Steel Finish: Powdercoat.
 - 1. Color: To be specified from manufacturer's full range of colors.

2.3 RECYCLING RECEPTACLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Victor Stanley, Inc., P.O. Drawer 330, Dunkirk, Maryland 20754. Phone: 800- 368-2573.
- B. Style: Ironsites Model S-42 with recycle lid, custom decal band with "Arlington County name and logo" and side door.
- C. Support Frames: Steel; welded.
- D. Recycling Receptacles:
 - 1. Receptacle Shape and Form: Round cylinder with optional recycling package with lid, plaque, and decals; with opening for depositing recyclables in top.
 - 2. Inner Container: High density plastic liner designed to be removable and reusable.
 - 3. Capacity: Not less than 36-gallon.
- E. Steel Finish: Powdercoat.
 - 1. Color: VS Blue

2.4 FOOTING MATERIAL

- A. Concrete Footings. Shall be Portland Cement, Class A3, air entrained in conformance with VDOT, Section 217. Minimum 28-day compressive strength of 3000 psi.

- B. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior applications.
- C. Epoxy Sealer. After the grout has hardened, the remaining space shall be filled with an epoxy sealer fillet, equivalent to Sonneborn Epo-Grip and Epo-Gel Epoxy system, as manufactured by Sonneborn, Shakopee, Mn

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Field locate and mark all site furnishings at the location indicated on the drawings for approval by the Landscape Architect before installing footers or drilling for surface mounted site furnishing in hardscape
- D. Install site furnishings level, plumb, true, and anchored.
- E. Post Setting: Set cast-in support posts in concrete footing with smooth top. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled surfaces according to manufacturer's written instructions. Protect site furnishings from damage until acceptance by Project Officer.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 The quantity of BENCH to be paid for under this item shall be the number of EACH furnished and installed in accordance with the plans, specifications and to the satisfaction of the Project Officer.
- 4.1.2 The unit price bid per EACH Bench of each shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, including, concrete footings, hardware, in accordance with the plans and specifications, to the satisfaction of the Project Officer. Does not include excavation.

- 4.2 The quantity of TRASH and/or RECYCLING RECEPTACLE to be paid for under this item shall be the number of EACH type furnished and installed in accordance with the plans, specifications and to the satisfaction of the Project Officer.
- 4.2.1 The unit price bid per EACH type of Trash/Recycling Receptacle shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, including concrete footings, hardware, custom decals, in accordance with the plans and specifications, to the satisfaction of the Project Officer. Does not include excavation.

END OF SECTION 129300

SECTION 131105 - EPS GEOFOAM LIGHTWEIGHT FILL

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 expanded polystyrene (EPS) Geofoam for soil replacement over the structural building slab.

1.3 REFERENCES

- A. ASTM D6817 - Standard Specification for Rigid, Cellular Polystyrene Geofoam.

1.4 SUBMITTALS

- A. Product Data: Submit EPS Geofoam manufacturer's product literature, TechData, and ICC-ES evaluation report including:
 - 1. Physical properties in compliance with ASTM D6817 Type specified.
 - 2. 10-year physical property warranty.
 - 3. UL or ICC-ES evaluation report covering termite resistance in accordance with ICC-ES AC 239, Acceptance Criteria for Termite-Resistant Foam Plastics.
- B. Shop Drawings: Showing EPS Geofoam block layout.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer with experience using Geofoam.
- B. Source Limitations: Obtain geofoam through one source from a single manufacturer.
- C. Certificates: Manufacturer shall supply a product certificate showing evidence of Third Party Quality Control.
- D. Initial Test Compliance: Testing from an ISO17025 Accredited Laboratory showing compliance with compressive resistance @ 1% deformation and flexural strength requirements of ASTM D6817 for Type specified prior to first shipment.

- E. Ongoing Test Compliance: Testing from an ISO17025 Accredited Laboratory showing compliance with compressive resistance @ 1% deformation of ASTM D6817 for Type specified. Testing frequency shall be in compliance with ASTM D7557.

1.6 DELIVERY, STORAGE & HANDLING

- A. Deliver geofoam labeled with ASTM D6817 Type.
- B. Store protected from moisture and sunlight prior to installation.
- C. Product should not be exposed to open flame or other ignition sources.
- D. Product should not be exposed to organic solvents, petroleum products and their vapors. Examples include but are not limited to are acetone, paint thinner, and gasoline. E. Provide temporary ballast or other restraint prior to and during installation.

1.7 WARRANTY

- A. Provide EPS Geofoam 10-year warranty covering the long-term physical property of expanded polystyrene Geofoam.

PART 2 - PRODUCTS

- 2.1 Rigid Cellular Polystyrene Geofoam for Backfill Replacement: ASTM D 6817, compressive resistance indicated below and with a flame spread index less than 25 and smoke developed index less than 450 per ASTM E84/UL723.

- A. Type EPS 29
 - 1. Minimum compressive resistance at 1% deformation of 10.9 psi
 - 2. Minimum flexural strength of 50.0 psi
 - 3. Minimum density of 1.80 lbs per cubic foot
- B. Termite Resistance
 - 1. Perform Guard or Perform Guard treatment
 - 2. Compliance with ICC-ES AC239, Acceptance Criteria for Termite-Resistant Foam Plastics
- C. Size
 - 1. 4 foot x 8 foot, typically. Cut and trim as needed to fit spaces.

2.2 Accessories

- 1. GeoGripper Plates
 - a. GeoGripper plates shall be used to restrain Geofoam from moving laterally in layer over layer applications.
 - b. The plate shall be made of galvanized steel with two-sided multi-barbed design capable of piercing geofoam. Each plate shall be capable of a lateral holding strength of 60 lbs.

- c. Install a minimum of two (2) GeoGripper plates for each 4 foot x 8 foot section of geofoam.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Install geofoam material after subgrade materials have been prepared. Place geofoam on level, compacted grade.
- B. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers. Use largest possible dimensions to reduce the number of joints.
- C. Cut and trim geofoam blocks neatly to fit spaces. Blocks shall be free from chips or broken edges.
- D. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.
- E. Compliance: Comply with manufacturer's EPS Geofoam product data; including technical bulletins.
- F. Site Verification of Conditions: Verify conditions of substrate, grade and other conditions which affect installation of geofoam. Do not backfill block until it has been inspected and approved by the third-party inspector.

3.2 PROTECTION

- A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION 131105

SECTION 26 56 00 - LOW VOLTAGE POWER CONDUCTORS & CABLES**PART 1 - GENERAL****1.1 SUMMARY**

- A.** This Section includes the following:
 - 1.** Building wires and cables rated 600 V and less.
 - 2.** Connectors, splices, and terminations rated 600 V and less.
 - 3.** Sleeves and sleeve seals for cables.

1.2 DEFINITIONS

- A.** EPDM: Ethylene-propylene-diene terpolymer rubber.
- B.** NBR: Acrylonitrile-butadiene rubber.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A.** Qualification Data: For testing agency.
- B.** Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A.** Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1.** Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B.** Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C.** Comply with NFPA 70.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW, UF and SO.
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC, mineral-insulated, metal-sheathed cable, Type MI.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Contractor shall account for voltage drop when running branch circuits and feeders. The actual routing and/or planned routing of branch circuits and feeders is known only to the Contractor. An increase in conductor size is warranted if the load and the length create a voltage drop in excessive of those stated in the National Electrical Code. In general the conductor sizes indicated on the Contract Documents are coordinated with the overcurrent protection devices only and do not account for voltage drop. The Contractor shall account for voltage drop in installation and shall have also accounted for larger conductor sizes as warranted in their bid. No change in the Contract price shall be entertained where the load and length of run could have been calculated during the bid process.
- B. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

- B.** Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 56 26 - Grounding and Bonding

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Conductors and connectors.
- B. Qualification Data: For qualified testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member Company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. 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.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

3.4 LABELING

- A. Underground-Line Warning Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 4. Color and Printing: Comply with ANSI Z535.1 through ANSI Z535.5. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
- B. Power cable identification materials
 - 1. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

2. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- B. Grounding system will be considered defective if it does not pass tests and inspections.

END OF SECTION

SECTION 26 50 33 - RACEWAYS & BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Handholes and boxes for exterior underground cabling.
- B. Related Requirements:
 - 1. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

1.2 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.
- D. EMT: Electrical metallic tubing.
- E. EPDM: Ethylene-propylene-diene terpolymer rubber.
- F. FMC: Flexible metal conduit.
- G. IMC: Intermediate metal conduit.
- H. LFMC: Liquidtight flexible metal conduit.
- I. LFNC: Liquidtight flexible nonmetallic conduit.
- J. NBR: Acrylonitrile-butadiene rubber.
- K. RNC: Rigid nonmetallic conduit.

1.3 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

- B. Shop Drawings:** For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1.** Custom enclosures and cabinets.
 - 2.** For handholes and boxes for underground wiring, including the following:
 - a.** Duct entry provisions, including locations and duct sizes.
 - b.** Frame and cover design.
 - c.** Grounding details.
 - d.** Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e.** Joint details.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings:** Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1.** Structural members in paths of conduit groups with common supports.
 - 2.** Plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Certificates:** For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
- C. Source quality-control reports.**

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers:** Subject to compliance with requirements, provide products by the following:
 - 1.** AFC Cable Systems, Inc.
 - 2.** Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3.** Anamet Electrical, Inc.
 - 4.** Electri-Flex Company.
 - 5.** O-Z/Gedney; a brand of EGS Electrical Group.
 - 6.** Picoma Industries, a subsidiary of Mueller Water Products, Inc.
 - 7.** Republic Conduit.
 - 8.** Robroy Industries.
 - 9.** Southwire Company.
 - 10.** Thomas & Betts Corporation.
 - 11.** Western Tube and Conduit Corporation.
 - 12.** Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling:** Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC:** Comply with ANSI C80.1 and UL 6.

- D.** ARC: Comply with ANSI C80.5 and UL 6A.
- E.** IMC: Comply with ANSI C80.6 and UL 1242.
- F.** PVC-Coated Steel Conduit: PVC-coated [rigid steel conduit] [IMC].
 - 1.** Comply with NEMA RN 1.
 - 2.** Coating Thickness: 0.040 inch (1 mm), minimum.
- G.** EMT: Comply with ANSI C80.3 and UL 797.
- H.** FMC: Comply with UL 1; zinc-coated steel.
- I.** LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- J.** Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1.** Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2.** Fittings for EMT:
 - a.** Material: Steel.
 - b.** Type: Setscrew.
 - 3.** Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4.** Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- K.** Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A.** Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1.** AFC Cable Systems, Inc.
 - 2.** Anamet Electrical, Inc.
 - 3.** Arco Corporation.
 - 4.** CANTEX Inc.
 - 5.** CertainTeed Corp.
 - 6.** Condux International, Inc.
 - 7.** Electri-Flex Company.
 - 8.** Kraloy.
 - 9.** Lamson & Sessions; Carlon Electrical Products.
 - 10.** Niedax-Kleinhuis USA, Inc.
 - 11.** RACO; a Hubbell company.
 - 12.** Thomas & Betts Corporation.
- B.** Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- I. RTRC: Comply with UL 1684A and NEMA TC 14.
- J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- K. Fittings for LFNC: Comply with UL 514B.
- L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman; a Pentair company.
 - 7. Hubbell Incorporated; Killark Division.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney; a brand of EGS Electrical Group.
 - 12. RACO; a Hubbell Company.
 - 13. Robroy Industries.
 - 14. Spring City Electrical Manufacturing Company.
 - 15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.

- B.** General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C.** Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- D.** Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E.** Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- F.** Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- G.** Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) or 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep)

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A.** General Requirements for Handholes and Boxes:
 - 1.** Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2.** Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B.** Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1.** Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a.** Armorcast Products Company.
 - b.** Carson Industries LLC.
 - c.** CDR Systems Corporation; Hubbell Power Systems.
 - d.** NewBasis.
 - e.** Oldcastle Precast, Inc.; Christy Concrete Products.
 - f.** Synertech Moulded Products; a division of Oldcastle Precast, Inc.
 - 2.** Standard: Comply with SCTE 77.
 - 3.** Configuration: Designed for flush burial with open bottom on 6" pea gravel base unless otherwise indicated.
 - 4.** Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 5.** Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 6.** Cover Legend: Molded lettering, "ELECTRIC."
 - 7.** Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 8.** Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC or RNC, Type EPC-80-PVC.
 - 2. Concealed Conduit, Aboveground: GRC EMT or RNC, Type EPC-40-PVC.
 - 3. Underground Conduit: RNC or Type EPC-40-PVC direct buried or concrete encased.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
 - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- C. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Complete raceway installation before starting conductor installation.
- C. Arrange stub-ups so curved portions of bends are not visible above finished slab.

- D.** Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- E.** Raceways Embedded in Slabs:
 - 1.** Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2.** Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3.** Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - 4.** Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5.** Change from ENT to RNC, Type EPC-40-PVC, or GRC before rising above floor.
- F.** Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- G.** Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- H.** Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- I.** Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- J.** Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K.** Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- L.** Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- M.** Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N.** Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

- O.** Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

 - 1.** Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2.** Where an underground service raceway enters a building or structure.
 - 3.** Where otherwise required by NFPA 70.
- P.** Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Q.** Expansion-Joint Fittings:

 - 1.** Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2.** Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a.** Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b.** Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - 3.** Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 - 4.** Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5.** Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- R.** Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

 - 1.** Use LFMC in damp or wet locations subject to severe physical damage.
 - 2.** Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- S.** Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- T.** Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- U.** Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a 6" thick level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior luminaires with lamps and ballasts.
- B. Related Sections:
 - 1. Section 265100 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LED: Light Emitting Diode.
- D. LER: Luminaire efficacy rating.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.
- F. Pole: Luminaire support structure, including tower used for large area illumination.
- G. Standard: Same definition as "Pole" above.

1.3 ACTION SUBMITTALS

- A. Product Data: For each luminaire and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 6. Photoelectric relays.
 - 7. Ballasts, including energy-efficiency data.

8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
 9. Materials, dimensions, and finishes of poles.
 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
- B.** Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A.** Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A.** 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.
- B.** Comply with IEEE C2, "National Electrical Safety Code."
- C.** Comply with NFPA 70.

1.6 WARRANTY

- A.** Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A.** Products: Subject to compliance with requirements, provide product indicated on the "Lighting Fixture Schedule" on the Drawings. The products indicated are "The Basis of Design" and its support and accessories indicated are only applicable to that particular manufacturer. Any substitutions will be judged on appearance as well as performance. Only one substitution review will be granted for each fixture scheduled.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction..
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.3 LIGHT EMITTING DIODE (LED) DRIVERS AND LAMPS

- A. Low-Temperature Driver Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures minus 20 deg C and higher.
 - 1. Driver Characteristics:
 - a. Efficiency: 90 percent, minimum.
 - b. Low sound emitting. Class A
 - c. UL listed.

- d. Wet location labeled
 - e. Over voltage protection.
 - f. Over current protection.
 - g. Instant start.
 - h. EMC and FCC approved: Power supplies designated by the manufacturer for residential applications must meet FCC requirements for consumer use (FCC 47 CFR Part 18 Consumer Emission Limits).
 - i. Output operating frequency ≥ 120 Hz.
 - j. Power supply shall comply with IEEE C.62.41-1991, Class A operation. The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode.
2. Lamp Characteristics:
- a. 100,000 hour minimum life.
 - b. Minimum CRI of 80.
 - c. Minimum efficacy: 55 lumens per watt (lm/W)
 - d. Wet location labeled
 - e. Lamps shall deliver at least 70% of initial lumens for at least 25,000 hours.
 - f. The change of chromaticity over the lifetime shall be within 0.007 on the CIE 1976 (u',v') diagram.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Lighting fixtures:
 - 1. Set level, plumb, and square with walls unless otherwise indicated.
 - 2. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

- A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric and time clock controls.

END OF SECTION

SECTION 321313 – CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior concrete pavement for, but not limited to, the following:
 - 1. Walkways.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For concrete pavement mixture.
- C. Delivery tickets for concrete including the date, time, truck identification, concrete plant, plant inspector, ticket and load number concrete class and design mix, moisture content of aggregates, quantity and location of placement.
- D. 24" x 24" on-site mock up of each color with specified finish.
- E. Color of expansion joint sealant.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed, sizes as shown on the drawings.
- D. Plain Steel Wire: ASTM A 82, as drawn.

- E. Deformed-Steel Wire: ASTM A 496.
- F. 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."

2.2 CONCRETE MATERIALS

- A. The design of the concrete mix, equipment, workmanship, and materials shall conform to the applicable requirements of Division 3 sections, except as hereinafter specified. Minimum compressive strength after 28 days shall be 3000 psi. Maximum size of aggregate shall be 1-1/2 inches, but not less than 3/4 inch. Air content by volume shall be 4-1/2 per-cent, plus or minus 1-1/2 percent.
 - 1. Provide Class A3 General Use (3,000 psi) concrete for walkways.
- B. Portland Cement air-entrained, ASTM C 150, Class A3 General Use (3,000 psi) per VDOT 217.

2.3 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.4 EXPANSION JOINT FILLER

- A. Joint filler shall be 1/2 inch preformed asphalt expansion joint material conforming to ASTM D994 or ASTM D1751.
- B. If bituminous fiber material is used, a bond breaker such as one-half (1/2") wide polyethylene tape or five eighths inch (5/8") diameter expanded polyethylene foam backer rod shall be installed as recommended by the manufacturer.

2.5 EXPANSION JOINT SEALANT

- A. Expansion Joint Sealant: Sealant shall be one-component polyurethane-base elastomeric sealant. Asphalt cement will not be approved as a substitution. Sealant color shall match color of

adjacent pavement. Where joints fall between pavement sections of different colors, color shall be selected by Project Officer to match one of the pavement colors.

1. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
 1. SikaFlex-1a by Sika Corporation.
 2. Sonoclastic NP-1 by Sonneborn and Chem Rex Inc.
- B. Approved equal requirements: Premium-grade, high performance, moisture cured, polyurethane based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C, Type II, Class A. Meets ASTM C-920, Type S, Grade NS, Class 35, use T, NT, O, M, G, I.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive concrete with Project Officer present for compliance with requirements for installation tolerances and other conditions which might affect the performance of the concrete. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement 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. Forms shall be set to alignment and grade and to conform smoothly to the shapes and dimensions indicated on the Drawings. All curves, where shown on the drawings or as require, shall be smooth. No tangents or broken segments shall be accepted.
- C. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

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

3.4 JOINTS

- A. Construct expansion and contraction joints at right angles to the lines of the sidewalks and pads.
- B. Control joints in sidewalks and pads shall be formed 1/4 depth of the slab with a tool designated for that purpose, and shall be spaced as indicated on Drawings, or if not shown, as directed by Project Officer. Saw-cut joints are not acceptable under any circumstances.

- C. Where structures, such as light standards, poles, fire hydrants, etc., are within the limits of the sidewalk area, place pre-molded expansion joint around the structure for the full depth of the concrete.
- D. Form expansion joints using 1/2-inch-thick pre-molded expansion joint fillers, full depth of the concrete, conforming to the shape of the sidewalks and curb and gutters. Place expansion joints where walks or exterior concrete slabs abut other vertical surfaces, including but not limited to building perimeter, curbs, columns, retaining or cheek walls, etc. Place expansion joints elsewhere as indicated on Drawings or as directed by Architect.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

3.5 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- 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 pavement surfaces 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 bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8-inch-deep with a stiff-bristled broom, perpendicular to line of traffic.

3.7 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, screening, 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 shall be stated as soon as it is possible to apply the curing medium without damaging the surface. Curing shall continue uninterrupted for a minimum period of 14 days. Rapid drying upon completion of the curing period shall be prevented. At no time during the curing period shall the temperature of the concrete be permitted to drop below 40° F.
- F. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these methods.

3.8 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

PART 4 - MEASUREMENT AND PAYMENT

- 4.1 The measurement of 4" CONCRETE to be paid for shall be the number of SQUARE FOOT of 4" thick poured in place reinforced concrete pavement constructed in accordance with the plans, specifications and to the satisfaction of the Project Officer.
- 4.2 The price bid shall be a unit price per SQUARE FOOT of 4" Concrete and shall include the cost of furnishing all labor, materials, equipment and incidental expenses necessary to complete the work, including expansion material, sealant, stain, steel reinforcement, curing compound, concrete, aggregate subbase, all in accordance with the plans, specifications and approval of the Project Officer. Does not include excavation.

END OF SECTION 321313

SECTION 321816.13 - PLAYGROUND PROTECTIVE SURFACING

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes poured-in-place rubber safety surfacing. Surface shall be unitary and seamless.
- B. Related Sections
 - 1. Section 116800 – Play Equipment and Structures
 - 2. Section 321313 – Cement Concrete Pavement

1.03 DEFINITIONS

- A. Critical Height: Standard measure of shock attenuation according to ASTM-F2223, same as “critical fall height: in ASTM-F1292.
- B. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface, same as “unitary system” in ASTM-F2223.

1.04 SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: The Contractor shall submit one sample (minimum 6 inches x 6 inches) of the safety surface material for each different color and texture specified. Samples shall include certified test data showing the material meets or exceeds ASTM F-1292.
- C. Installer Certification and Qualifications: Installer must be trained and certified by the manufacturer. Installer’s certification on manufacturer’s letterhead shall be submitted to the Project Officer. Installer must have completed at least 10 surfacing projects within the last 5 years. Installer shall submit a list of 10 projects. The list shall contain projects which require the same level of difficulty, size, color transition and graphics.
- D. Shop Drawings:
 - 1. For each playground surface system, include materials, plans, cross sections, drainage, installation, and edge termination. Include patterns made by varying colors of surfacing. Include details of graphics.
 - 2. Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

- a. Extent of surface systems and use zones for equipment.
 - b. Critical heights for playground surfaces and fall heights for equipment specified in Section 116800 "Play Equipment and Structures."
- E. Manufacturer's Warranty. Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.
- F. Material data safety sheet for all proposed rubber. Certification that no recycled tire rubber content or recycled rubber with known carcinogens will be/ were used in the installation of the proposed surfacing.
- G. Lead Content Testing from Independent Third-Party Material Testing Laboratory: All components of the Poured-in-Place (PiP) rubber surface system shall cumulatively contain less than 400 parts per million of lead per the United States Environmental Protection Agency (EPA) regulations for play areas. Testing data shall be the most recent data, a maximum of 24 months from submittal.
- 1. Any PiP system with more than the allowable limit will be rejected.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground surface system to include in maintenance manuals.
- B. Material Certificates: Material certificates will be filled out and signed by specified manufacturer/supplier that specified materials were shipped and in proper amounts for square footage/thickness/color.
- C. Warranty Documents.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer. Compliance with Section 1.04.B, above.
- C. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.

1.07 PERFORMANCE REQUIREMENTS

- A. Shock and Impact Attenuation: ASTM F-1292.
- B. Flammability: ASTM D-2859.
- C. Accessibility of Surface Systems: ASTM F1951.
- D. Coefficient of Friction: ASTM 2047-82.

- E. Tensile Strength: ASTM D412-87.
- F. Tear Resistance: ASTM D624
- G. Accelerated U.V.: Test to not less than 5-year stability.
- H. IPEMA certified: Product and crew chiefs must be IPEMA certified.
- I. Standard Guide for ASTM Standards on Playground Surfacing: ASTM F2223
- J. Playground Equipment: ASTM F1487-11

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground surface system that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Reduction in impact attenuation.
 - b. Deterioration of surface and other materials beyond normal weathering.
 - c. Excessive UV fade/ loss of color.
 - 2. Warranty Period: Five (5) years from date of Final Completion.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels still attached.
- B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum of 45 degrees F and a maximum temperature of 85 degrees F.

PART 2 – PRODUCTS

2.01 POURED-IN-PLACE SAFETY SURFACING

- A. Dual-density, poured-in-place system with wearing course over cushion course. The surface system shall be manufactured from a base mat consisting of 100% recycled tires mixed with a proprietary binder and a wearing course comprised of EPDM rubber and a UV-resistant proprietary binder. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F1951.
- B. No recycled tire rubber content shall be accepted as part of the surface wearing course on this installation. Any recycled rubber content with known carcinogens that can affect human health will also be rejected. See section 1.04-G, above, for requirements pertaining to third-party lab testing.

1. Subject to compliance with requirements, provide products by one of the following or an approved equal:
 - a. GameTime; GT Impax Poured.
 - b. Surface America Incorporated.
 - c. Xgrass Commercial Playground Surfaces.
 - d. PlaySpec Surfacing
- B. Thickness: The thickness of the material shall exceed critical fall height requirements for the locations used, as established by the current editions of Publication No. 325, Consumer Product Safety Commission (CPSC) guidelines and the American Society for Testing and Materials (ASTM F-1487) standards.
- C. Wearing Course: Minimum ½” thick after troweling using rubber granules 1-3.5mm. Urethane shall be 21% of the weight of the rubber. All colors must be UV stable for a minimum of 5 years. Polymer content must be 25% minimum. Tiles will not be allowed. Wear mats will not be allowed.
- D. Color: The wearing course shall have an integral color as indicated on the Drawings or as selected by the Landscape Architect. All installation procedures and recommendations of the manufacturer shall be followed.
- E. Binder: Weather-resistant, flexible, non-hardening, 100 percent solids polyurethane complying with requirements of authorities having jurisdiction for nontoxic and low VOC content.. No TDI urethanes will be permitted. Aliphatic urethane binder shall be used for the top surface regardless of EPDM color.
- F. Critical Height: Manufacturer of playground equipment must supply contractor with adequate documentation. A field drop test in accordance with the latest ASTM 1292 standards shall be submitted to the Project Officer after the PiP is installed.
- G. Source Limitations: Obtain playground surface system materials, including primers and binders, from manufacturer specified
 1. Provide secondary materials including adhesives, primers, and repair materials of type and from source recommended by manufacturer of playground surface system materials.

2.02 BASE

- A. Base for poured-in-place safety surfacing shall be in conformance with the Drawings and with Section 321313, Cement Concrete Pavement. New concrete must be cured for a minimum of 7 days. Concrete shall be finished with a light broom finish, unsealed.
- B. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by playground surface system manufacturer.

PART 3 – EXECUTION

3.01 GENERAL

- A. Play equipment shall be wrapped with safety fencing after installation per Section 116800, Play Equipment and Structures.
- B. Installation of safety surfacing shall be in accordance with CPSC guidelines and manufacturers installation instructions.
- C. The safety surfacing shall be installed over a concrete base as shown on the Drawings and in accordance with Section 321313, Cement Concrete Pavement". All installation procedures and recommendations of the manufacturer shall be followed.
- D. All safety surfacing shall either be flush with surrounding finish grade or have a beveled perimeter transition piece along its entire open perimeter to allow for a smooth, easy transition between the surrounding finish grade and the level of the safety surfacing as shown on the Drawings.

3.02 WEATHER/JOB CONDITIONS

- A. Poured-in-place shall be installed when the weather is at a temperature of 45° F or greater and rising and a maximum temperature of 90° F , and shall remain at 45° F or greater for at least 7 days after application. No installations can be made when the forecast calls for freezing temperatures, snow or rain. The area must be dry during the entire installation process.
- B. Contractor shall ensure that material temperature is a minimum of 50 degrees F at the time of installation.
- C. Maximum surface temperation shall be a maximum of 80 degrees F.
- D. Adjacent materials and the poured-in-place shall be protected during installation while curing and/or unattended from weather and other damage.

3.03 EXAMINATION

- A. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary playground surface system installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to playground surface system manufacturer's written requirements for cross-section profile.
 - 1. Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with playground surface system or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by playground surface system manufacturer.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 INSTALLATION OF SEAMLESS PLAYGROUND SURFACE SYSTEMS

- A. Seamless Surface: Mix and apply components of playground surface system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface and impact-attenuating system of total thickness indicated.
1. Poured Cushion Course: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints. Thickness of cushion course should meet ASTM 1292-04 guidelines and shall be a minimum of 1" thick. Varying thickness is allowed to match fall height.
 2. Intercoat Primer: Over cured cushion course, apply primer at manufacturer's standard spreading rate.
 3. Wearing Course: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with **no** cold joints. Finish surface to produce manufacturer's standard wearing-surface texture. Minimum thickness of wear course shall be ½" after being troweled. A minimum of 5/8 screed rod shall be used when leveling wear course.

3.05 FIELD QUALITY CONTROL

- A. Testing is required after installation to ensure that it meets drop height requirements. Contractor shall provide third-party inspection and Triax drop-testing of playground safety surface system in accordance with ASTM-1292 standards from a qualified testing agency. Testing shall be performed in the presence of the Project Officer. 48 hours notice is required. Provide written report of findings, with photographs, to the Project Officer.
- B. Remove and replace applications of playground surface system where test results indicate that it does not comply with requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with requirements.
- D. Do not allow foot traffic on poured-in-place surfacing until a minimum of 80 percent cure is obtained for a minimum of 48 hours.
- E. Protect the installed playground surface from damage resulting from subsequent construction activity on site.

PART 4 – MEASUREMENT

4.01 The measurement of PLAYGROUND PROTECTIVE SURFACING shall be the number of SQUARE FEET of Playground Protective Surfacing including all labor, materials, equipment and incidental expenses necessary to complete the work, in accordance with the plans, specifications and to the satisfaction of the Project Officer. Does not include excavation.

END OF SECTION 321816.13

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

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. Decorative steel metal picket fence.
2. Decorative steel metal swing gate.
3. Steel tree pit fence

B. Related Sections:

1. Division 31 Section "Earth Moving" for site excavation, fill, and backfill where decorative metal fences and gates are located.

1.3 SUBMITTALS

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

- B. Shop Drawings: For each gate, for each type of typical fence panel required, for typical racked panels, and for each configuration of stepped panels. Include plan drawings indicating location and extent of each. Include elevations, sections, details, and attachments to other work.

- C. Samples: For each fence material and for each color specified.

1. Provide Samples 6 inches (150 mm) in length for linear materials.
2. Provide Samples 6 inches (150 mm) square for infill materials.

- D. Welding certificates.

- E. Maintenance Data: For gate operators to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for emergency access.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Include 10-foot (3-m) length of fence complying with requirements.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Pre-installation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Products: Subject to compliance with requirements, provide the named product(s) produced by the named manufacturer(s), unless otherwise indicated.

2.2 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Tubing: ASTM A 500, cold formed steel tubing.
- D. Bar Grating: NAAMM MBG 531.
 - 1. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
 - 2. Wire Rods: ASTM A 510 (ASTM A 510M).

2.3 COATING MATERIALS

- A. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.
 - 1. Use primer with a VOC content of 300 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Polyurethane Intermediate Coat and Topcoat: Complying with MPI #72 and compatible with undercoat.
 - 1. Use product with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in 03 Section "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size.
- C. Non-shrink Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

2.5 DECORATIVE STEEL FENCES

- A. Decorative Steel Fences: Fences made from steel bars and shapes, hot-dip galvanized.
- B. Posts: Steel tubing.
 - 1. Size: As indicated
- C. Rails: Steel Bar.
 - 1. Size: As indicated
- D. Infill: Pickets.
 - 1. Size: As indicated
- E. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.
- F. Fabrication: Assemble fences into sections by welding pickets to rails.
 - 1. Fabricate sections with clips welded to rails for fastening to posts in field.
 - 2. Drill posts and clips for fasteners before finishing to maximum extent possible.
- G. Fabrication: Fabricate bar grating infill into sections of size indicated.
 - 1. Drill rails for fastening to posts in field.
 - 2. Fabricate posts with angles welded to posts for fastening rails.
 - 3. Weld pickets to rails.
- H. Finish exposed welds to comply with NOMMA Guideline 1,.
- I. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
 - 1. Hot-dip galvanize posts.
 - 2. Hot-dip galvanize rail and picket assemblies after fabrication.

2.6 METALLIC-COATED STEEL FINISHES

- A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate or other conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- C. Color Coat: Epoxy/urethane shop-applied paint including primer, finish coat, and clear top coat.
 - 1. Color: As indicated

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Install fence panels with horizontal rails level and pickets plumb, unless otherwise indicated.
 - 1. For racked panels, maintain matched angle among minimum 5 adjacent panels, unless otherwise indicated.
 - 2. For stepped panels, maintain matched step height within each fence run. Provide custom bottom of stepped panels, parallel with grade. Maintain matched angle among minimum 5 adjacent panels, unless otherwise indicated.
- C. Fine grade below fence centerline, minimum 48" wide with maximum 5.0 percent side slopes, as necessary to maintain required fence clearance above grade.

- D. Install fences by setting posts as indicated and fastening rail sand infill panels to posts. Cut off excess threads at 1/8 inch beyond nut. Peen threads of bolts after assembly to prevent removal.
- E. Post Setting: Core drill 3 inch maximum diameter hole in the center of the 9" vertical curb to a depth of 1 foot. Set 1 3/4 inch posts in the hole and grout the void solid. Apply a sealant at the surface and angle to drain away from the post. Sealant color to be selected by architect from manufacturer's full range of colors.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
 - 3. Space posts uniformly at spacing indicated.

3.4 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION 323119

SECTION 329100 - PLANTING PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes erosion control materials, soil amendments, mulching and topsoil.
- B. Provide all labor, materials, tools and equipment as required to have topsoil, planting soil mix, soil stabilization, amendments, and mulch applied per the specifications on all areas disturbed by construction to receive plant materials as indicated in the approved plans.
- C. Related Sections:
 - 1. Section 311000 Site Clearing, Preparation, Demolition and Removals
 - 2. Section 311300 Tree Protection and Root Pruning
 - 3. Section 312000 Earthwork
 - 4. Section 312500 Temporary Erosion and Sediment Control
 - 5. Section 329300 Exterior Plants
- D. In addition to the specifications contained herein, Work shall be performed in accordance with the:
 - 1. Drawings and general provisions of the contract, including general and supplementary conditions
 - 2. Arlington County Department of Parks & Recreation Design Standards as shown on the plans and available online at:
<http://parks.arlingtonva.us/design-standards/>

1.02 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Imported Topsoil: Soil obtained off-site that meets the specifications herein for topsoil and is suitable for use in planting soil/backfill soil mixture when existing soil quantities are insufficient.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Bioretention Media: Soil mixture imported from off-site that meets stormwater management specifications (see plans) for stormwater management facilities.
- E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- F. ISA: International Society of Arboriculture
- G. CBAY: Chesapeake Bay, typically referring to CBAY watershed.
- H. Urban Forester/County Urban Forester: Refers to the Arlington County Urban Forester

- I. Landscape Architect: Refers to an Arlington County Landscape Architect or their designee.

1.03 SUBMITTALS

- A. Samples of all materials specified shall be submitted to the Project Officer for approval with coordination of the Landscape Architect. All approvals shall be in writing.
- B. Samples:
 - 1. Imported Topsoil: If imported topsoil is required, Contractor shall provide a 1-pound sample of the imported topsoil with the soil test reports as noted below.
 - 2. Imported Topsoil for Bioretention Areas: If bioretention areas are indicated in the approved plans, the Contractor shall submit soil sample per specifications.
 - 3. Bioretention Basin and Planter Box: See Plans for specifications.
 - 4. Mulches and Organic Matter/Compost: Sample of mulch and organic matter/compost may be requested in lieu of inspection.
 - 5. Product certificates: Contractor shall submit for each type of manufactured product, to be approved by the Project Officer in coordination with Landscape Architect or Urban Forester and complying with the following:
 - 6. Manufacturer's certified analysis for standard products.
- E. Geotextile/Soil Stabilization/Erosion Control Fabric: Sample

1.04 QUALITY ASSURANCE

- A. Contractor shall have all furnished topsoil to be used for seeding and sodding, and for planting areas tested by a state laboratory or recognized commercial soil-testing laboratory in order to determine recommendations for the types and quantities of soil amendments. The results of this test will determine the rates and types of fertilizers, lime, soil conditioners, and other amendments, if necessary.
 - 1. Soil tests shall use a representative sample of furnished topsoil.
 - 2. Adjustments should be made based on soil test results.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials shall conform to those stipulated below, unless otherwise approved in writing by the Project Officer with confirmation by the Landscape Architect or County Urban Forester.
- B. Specified materials to be applied in amounts and methods herein stipulated.
- C. Delivery tickets indicating date, weight, analysis and vendor's name, to be submitted to Project Officer.

2.02 SOIL AMENDMENTS

- A. Lime: Application rates for liming materials and lime material type chosen shall be determined by required soil tests and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester.
1. When required and unless test results indicate otherwise, lime material shall be dry and free flowing pulverized limestone, hydrate lime or burnt lime that contains at least 50% total oxides (calcium oxide plus magnesium oxide). Ground limestone shall be ground to such fineness that at a minimum of 50% will pass through a 100-mesh sieve and 98% - 100% will pass through a 20-mesh sieve. Lime material shall meet the Virginia Agricultural Liming Materials Act, Code of Virginia Section 3.1-126.1.
 2. Fertilizer: Fertilizer type and application rate shall be determined by results of required soil tests and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester:
 - a. When required and unless test results indicate otherwise, commercial-grade complete fertilizer will be 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:
 - i. Composition: 10 percent nitrogen, 20 percent phosphorous, and 10 percent potassium, by weight.
 - b. All fertilizers shall be uniform in composition, free flowing, and suitable for application with approved equipment.
 - c. Fertilizers shall be delivered to the Project Site fully labeled according to applicable state fertilizer laws and shall bear the name, trade name, or trademark and warranty of the product.
 3. Delay mixing fertilizer with planting soil if planting will not proceed within 2 days.
 4. Spread fertilizer and lime with approved equipment.

2.04 PLANTING SOIL MIX/BACKFILL SOIL MIXTURE

- A. The planting soil mix (also known as backfill soil mixture) shall consist of imported topsoil or manufactured topsoil that has been approved for planting per the specifications above and approved organic matter.
- B. The planting soil mix/backfill soil mixture shall be composed of $\frac{3}{4}$ approved imported topsoil or manufactured topsoil and $\frac{1}{4}$ approved organic matter as described in the Arlington County DPR Standard planting details, unless otherwise indicated by the Project Officer with confirmation by the Landscape Architect and Urban Forester.
- C. The imported topsoil or manufactured topsoil shall be a sandy loam uniform in composition and shall be in a friable condition and shall contain less than 3 percent subsoil, hardpan material, stones and clods larger than $\frac{1}{2}$ inch in diameter in any direction. It shall also be free of sticks, tree or shrub roots, debris and other material undesirable for plant growth. The area and the topsoil shall be free of undesirable plant material such as, but not limited to, Bermuda grass, nut sedge, mugwort or noxious weeds as set forth in the Federal Seed Act.

- D. The imported topsoil or manufactured shall contain at least 5 percent organic matter. It shall be a sandy loam consisting of at least 5 but not more than 20% clay, at least 10 but not more than 80% sand. It shall have a pH between 5.5 to 6.5. Soluble salts (salinity) shall not exceed 500 ppm. Soil fertility shall be "High" in natural nutrients based on the coordinated ratings in pounds per acre as established by the National Soil and Fertilizer Research Committee.
- E. Placement of the planting soil mix shall be to a depth of 5 feet from finish grade unless otherwise indicated. Spread planting soil mix in 8 inch lifts compacting to 85% proctor.
- F. Topsoil which has been manufactured by blending materials which individually do not meet the requirements of this specification will not be accepted even though the resulting blend meets the organic matter, mechanical analysis, pH and soluble salts requirements. Agricultural limestone at not more than 5 pounds per cubic yard of topsoil any be used to adjust the pH provided it is well mixed in a manner which does not destroy the structure of the soil.

2.05 IMPORTED TOPSOIL FOR BIO-RETENTION AREAS

- A. Soil for bioretention areas shall comply with the Filter Media and Surface Cover section of the Virginia Department of Environmental Quality's (DEQ) Design Specification No. 9 for Bioretention, Version 2.0, January 1, 2013.
- B. Placement of the planting soil in the bioretention area should be in lifts of 12 to 18 inches and lightly compacted. Minimal compaction effort can be applied to the soil by tamping with a bucket from a dozer or backhoe.

2.06 MULCHES AND ORGANIC MATTER

- A. Straw Mulch for Seeded Areas: Provide air-dry, clean, mildew and seed-free, salt hay or threshed straw of wheat, rye, oats or barley.
- B. Wood Chip Bark Mulch for Planted Areas: Wood Chip Bark Mulch shall be double-shredded hardwood bark mulch, uniform in size and free of stones, clods, non-organic debris or other foreign material and aged for at least 6 months from an approved source. Insufficiently or improperly aged mulch containing high bacterial counts or high levels of bark or other materials resistant to decomposition shall not be used. Mulch shall not contain the trunk of trees.
- C. Organic Matter/Compost Mulch: Well-composted, trash-free, stable, and weed-free organic matter such as composted bark, leaf mold or other plant debris material that has been composted to a point of decay and is mature.
 - 1. pH range of 5.5 to 8; moisture content 35 to 55 percent by weight
 - 2. 100 percent passing through 1-inch sieve
 - 3. Peat moss shall not be used.
 - 4. Organic amendments shall be commercially prepared and shall comply with the U.S. Compost Council Seal of Testing Assurance Program's Test Methods for the Examination of Composting and Compost (STA/TMECC) criteria, or as modified in approved plan documents.

2.07 SOIL STABILIZATION/EROSION CONTROL FABRIC

- A. ECS-2B Double New Straw Biodegradable Rolled Erosion Control Product, or an approved equal shall be used in all planting beds.
 - 1. Shall meet Type 2.D specifications for ECTC and HFWA FP-03 Section 713.17
 - 2. Shall have two (2) layers of organic jute netting sewn together with biodegradable thread.
 - 3. Overlap sections 12” and secure with manufacturer’s recommended steel wire v
- B. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer’s recommended steel wire staples, 6 inches long.
- C. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd with 50 to 65 percent open area. Include manufacturer’s recommended steel wire staples, 6 inches.
- D. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped grades, of 3inch nominal mat thickness. Include manufacturer’s recommended anchorage system for slope conditions.
 - 1. Products: Subject to compliance with requirements and plan documents, the products below, or an approved equivalent, be used:
 - a. Curlex Excelsior Erosion Control Mat; American Excelsior, or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All identified areas within the project limits shall have approved topsoil mix spread on them and be prepared for seeding and sodding by bringing ground surfaces to grades shown on the drawings. Planting pits and bed areas identified on the approved plans shall be prepared in accordance with the applicable DPR Landscape Standard details.
 - 1. No seeding shall be done on frozen ground or when the temperature is 32F or lower. Refer to specification 329200, “Seeding and Sodding.” Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, sidewalks and areas.
 - 2. Rototilling shall not be performed within the critical root zone of trees to be preserved.
 - 3. The soil shall not be tilled or amended when the soil’s moisture capacity is above field capacity or when the soil is frozen.
 - 4. Contractor shall identify utilities, existing irrigation and underground utilities. All areas on either side of the utility marking shall be amended by hand.
 - 5. Contractor shall verify that no foreign or deleterious material or liquid has been deposited in soil within a planting area.
 - 6. Contractor shall proceed with installation only after both unsatisfactory conditions

have been corrected and rough grading has been completed and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester.

7. Contractor shall protect structures, utilities, sidewalks, pavements and other facilities, trees, shrubs and plantings from damage caused by planting operations.
 - a. Protect adjacent and adjoining areas from hydro-seeding and hydro-mulching overspray.
 - b. Protect grade stakes set by others until directed to move them.
 8. Surfaces shall conform to finish grade, free of water retaining depressions, soil friable, free of clay and of uniformly firm texture.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1/2 inch in any direction and sticks, roots, rubbish, and other extraneous matter including grass vegetation and turf and legally dispose of them off of Arlington County property. Do not mix into surface soil.
1. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix. Delay mixing amendments with soil if planting will not proceed within 2 days.
 2. Loosen surface soil to a depth of at least of 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.
 3. Spread planting soil mix to a depth of 4 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.
- C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
1. Remove stones larger than 1/2 inch in any dimension and sticks, roots, trash, and other extraneous matter. Legally dispose them off of Arlington County property. 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 the planting soil mix proportion and mix thoroughly into the top 4 inches of soil.
- D. Finish Grading: Grade landscape areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Adjust for the thickness of sod, where applicable. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
 - E. If bioretention areas are specified in the approved plans, the Contractor shall construct these areas in accordance with the Virginia DEQ Stormwater Design Specification No. 9, Version 2.0, January 1, 2013.
 - F. Contractor shall avoid unnecessary compaction of the soil during grading.
 - G. Contractor shall ensure appropriate slopes of the swales, berms and final grades.
 - H. Immediately following each day's work, contractor shall clean all dirt, excess soil, debris and trash from the Project Site. Contractor shall protect and store additional soils in stockpiles protected from saturation, erosion, weed growth and contamination with plastic sheeting or tarps.
 - I. Amendments for seeding and sodding areas shall be applied after determining by soils test as follows:
 1. Lime as specified shall be spread uniformly over designated area. Rate depends on soil tests. Soil tests shall be made before lime application at 8 to 10 plugs per acre taken by the method prescribed the United States Department of Agriculture.
 2. Fertilizer shall be spread after the lime has been applied. Rate shall be as recommended per the soil tests.
 3. Fertilizer shall be spread with approved equipment and at an even rate over the area to be seeded or sodded.
 4. Work lime and fertilizer into top 4 inches of topsoil and grade to smooth surface ready for seeding.
 - J. Restore areas if eroded or otherwise disturbed after finish grading and before planting.
 - K. Prepared lawns and planting areas shall be inspected and approved by Project Officer in coordination with Landscape Architect prior to seeding, sodding or planting.
 - L. If the graded areas develop volunteer weed growth, the growth shall be eliminated at the expense of the Contractor.
 - M. Refer to Sheet LS-01, Detail 1/LS-02 and Detail 2/LS-02 for additional information.

3.02 SOIL STABILIZATION MATERIALS

- A. Prepare planting area as specified.
- B. Moisten prepared planting area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Install Soil Stabilization from top of slope, overlapping joints by 12 inches, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- D. Plant shrubs, trees and perennials through Soil Stabilization fabric by carefully separating fabric layers to allow space for planting.
- E. Remove non-biodegradable stabilization materials after plant establishment.

PART 4 – MEASUREMENT AND PAYMENT.

- A. Not used.

END OF SECTION 329100

SECTION 329113 – SOIL PREPARATION (STRUCTURAL SOILS)

PART 1 - GENERAL

1.1 SUMMARY

- A. This work consists of supplying, testing, amending, mixing and installing various planting soil categories for use in continuous soil panels (tree pits), covering the following:
1. Planting Soil shall refer to Sand-Based Topsoil.
 2. Sand Based Topsoil: soil blend for trees where planting soils are beneath permeable surfaces.
 3. Compost: a soil amendment to be used with existing soil
 4. Sand: for making the Sand Based Topsoil and for the choker layer around the pipe

1.2 SUBMITTALS AND TESTING

A. Critical Path Processing - Soils Testing Report Submittals.

The Contractor is responsible for recognizing that these project materials warrant timely and serious attention, that the testing process to achieve approved materials shall be considered a lead time item, and that under no circumstance shall failure to comply with all specification requirements be an excuse for a delay or for expedient substitution of unacceptable material(s).

B. Sources for Soil Components and Soil Mixes: Within seven (7) days after notice to proceed, submit information identifying sources for soil components and the firm responsible for mixing of soil mixes:

1. Soil mix supplier shall have a minimum of five years of experience supplying custom planting soil mixes.
2. Submit supplier name, address, telephone and fax numbers and contact name.
3. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

C. Testing Agency: Within seven (7) days after notice to proceed, Contractor shall furnish the name and location of the proposed testing agency. Agency proposed for testing of horticultural soils shall be an approved member of the Performance Assessment Program (PAP) administered by the North American Proficiency Testing (NAPT) Oversight Committee. The Testing agency shall be accepted by the Chief Engineer.D. Product Data: No later than 30 days prior to planned soil construction, submit most recent printed information from manufacturer for:

1. Organic Material: identify the material(s) from of which is it composed and identify the location where material was composted.
 2. Fertilizers
 3. Ground Limestone
 4. Sulfur
- E. Samples and Test Reports: Submit representative samples and reports to the Chief Engineer and the Testing Agency as described herein for approval. Delivered materials shall closely match the approved samples.
1. Submit 1 gallon soil samples and horticultural soil test reports in two phases.
 - a. Planting Soil Base Components:
 - 1) Base Loam
 - 2) Organic Amendment (Compost)
 - 3) Sand

Submit samples of above to the Testing Agency. Submit soil testing reports to SPW no later than 21 days prior to planned soil construction.
 - b. Only after approval of base components, submit soil blend mixes / mediums for approval.

Mixing and batching of soil mediums in the same manner as bulk soils will be prepared for delivery to site, and shall include:

 - 1) Sand-Based Topsoil

Submit samples of above to the Testing Agency. Submit duplicate samples and soil testing reports to Chief Engineer no later than 14 days prior to planned soil construction.
 - c. Samples of each soil type delivered to the site shall taken and tested for conformance with the Specification Requirements. Submit duplicate samples and soil testing reports to Chief Engineer.
 2. Soil Sampling: Sampling shall be done by the Soil Supplier. Samples shall be representative of the material to be brought to the site. Each sample shall be a Composite Sample, which consists of 5 separate sub-samples taken from a minimum of (5) different locations at each source and mixed together to make the test sample.
 3. Test Reports shall be certified and shall cover the items below. All reports must be from recent analyses, less than 90 days old, and represent materials that are available for delivery to the site.
 - a. Mechanical gradation (sieve analysis) shall be performed and compared to the

USDA Soil Classification System.

- b. The silt and clay content shall be determined by a Hydrometer Test of soil passing the #270 sieve. Percent clay (0.002 mm) shall be reported separately in addition to silt (ASTM D- 422-63, hydrometer method).
- c. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Manganese, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

Tests shall be conducted in accordance with Recommended Soil Testing Procedures for the Northeastern United States, Current Edition, Northeastern Regional Publication No. 493; Agricultural Experiment Stations of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and West Virginia. Tests include the following:

- 1) Test for soil Organic Matter by loss of weight on ignition, as described in Northeastern Regional Publication No. 493.
 - 2) Test for soil CEC by exchangeable acidity method as described in Northeastern Regional Publication No. 493.
 - 3) Test for soil Soluble Salts shall be by the 1:2 (v:v) soil:water Extract Method as described in Northeastern Regional Publication No. 493.
 - 4) Test for Buffer pH by the SMP method as described in Northeastern Regional Publication No. 493.
 - 5) Certified reports on analyses from producers of composted organic materials are required. Analyses will include all tests for criteria specified herein.
 - 6) Density Tests: In-place density testing is required in all areas by the following: ASTM D1556 Density of Soil and Rock In Place Using Sand Cone Method, ASTM D6398-10 Nuclear Methods or ASTM D2167-08 Rubber Balloon method. AASHTO T-99 (Standard Effort) shall be used for Laboratory Compaction Characteristics of Soil unless otherwise directed by the SPW inspector.
 - a) Contractor shall perform In-place density tests at a rate of one test per 2,000 square feet for each type of material placed.
 - 7) Test data and recommendations for soil amendments including but not limited to: nitrogen, phosphorus, potassium and limestone
4. Certificates: No later than 7 days prior to planned soil construction, submit certification that soil blend components and soil mediums meet applicable environmental standards of Arlington County.

1.3 QUALITY ASSURANCE

- A. Due to the natural material used in this specification, adjustments may be made to the following requirements as part of the submittal and approval process in conjunction with the SPW, and the landscape architect, and soil scientist.

1.4 PRE-INSTALLATION EXAMINATION AND PREPARATION

- A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- B. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify SPW in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by SPW.
- C. Examination of Conditions: Prior to the start of soil placement existing conditions shall be reviewed.
Any deficiencies shall be noted and related to SPW in writing prior to acceptance of the subgrade by the Landscape Contractor. Deficiencies include, but shall not be limited to the following:
 - 1. Construction debris present within the planting areas.
 - 2. The subgrade is at incorrect depths for installing the designed soil profile and/or drainage layer.
 - 3. Incomplete irrigation and/or subsurface drainage installation.

PART 2 – PRODUCTS

2.1 GENERAL – SAND-BASED TOPSOIL MIXTURE

- A. Soils mixtures are composed of a blend of three base components: base loam, organic material and sand. The Soil Supplier is responsible for locating and obtaining approval of sources for base loam, organic material and sand that meet the Specification requirements. The Soil Supplier is responsible for mixing the components. Approximate mixing ratios are as specified herein, but may require adjustment, depending on the characteristics of the final base materials.
- B. Base Components
 - 1. Base Loam: a natural A-horizon growing medium free from admixtures.
 - 2. Organic Material or Compost: a fully decomposed yard waste organic material.
 - 3. Sand: uniformly-graded medium to coarse sand.

- C. Soil medium materials shall fulfill the requirements as specified and be tested to confirm the specified characteristics.

2.2 BASE LOAM

- A. Base Loam shall be natural A-horizon topsoil free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Base Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut-like tubers of nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Base Loam shall not be delivered or used for planting while in a frozen or muddy condition.
- B. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after burning off organic matter by ignition. The organic content shall be between 3.0 and 6.0 percent by weight. Base Loam shall have a well-developed and stable crumb structure.
- C. Unless otherwise recommended by the Soil Supplier's Soil Scientist: Soluble Salts shall be not more than 2,000 ppm/2.0 mmhos/cm.

2.3 COARSE SAND FOR SOIL MIXTURES

- A. Sand for blending, protection layer above filter fabrics, and drainage below planting soils shall be uniformly graded medium to coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, surface coatings and deleterious materials, include no more than 0.5% mica, and have the following gradation for material passing the #10 sieve by weight.

<u>U.S. Sieve Size Number</u>	<u>Percent Passing</u>	
	<u>MIN.</u>	<u>MAX.</u>
10	100	--
18	60	80
35	25	45
60	8	20
140	0	8
270	0	3
0.002mm	0	0.5

- B. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 15% by weight of the total sample. The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.0 or less (D70/D20 <3.0). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after burning off organic matter by ignition.
- C. Coarse sand shall be non-calcite and shall not be derived from serpentine. pH shall be

less than 7.5.

2.4 ORGANIC AMENDMENT (COMPOST)

- A. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of leaf and yard waste composted for a minimum of one year (12 months). The leaf and yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf and yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.
1. The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.
 2. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (latest version). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by a SPW approved lab.
 3. Pathogens/Metals/Vector Attraction reduction for compost material derived from biosolids shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32, (for applications to soils with human activity).
 4. Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 3/8-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve.
 5. pH: The pH shall be between 6.5 to 7.2 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis.
 6. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).
 7. The compost shall be screened to 1/2 inch maximum particle size and shall contain no more than 3 percent material finer than 0.002mm as determined by hydrometer test on ashed material.
 8. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH. The Soil Supplier's Soil Scientist shall provide a recommendation as to the suitability of the compost based on review of the test results.

2.5 SOIL ADDITIVES

- A. Ground Limestone: dolomitic limestone and contain not less than 50 percent of total carbonates and 25 percent total magnesium with a neutralizing value of at least 100 percent. Material shall be ground to such fineness that 40 percent will pass through the 100 mesh U.S. standard sieve and 98 percent will pass through the 20 mesh U.S. standard sieve.
- B. Acidulant for adjustment of planting soils pH shall be commercial grade sulfur, ferrous sulfate, or aluminum sulfate for horticultural use that are unadulterated. Acidulants shall be delivered in unopened containers with the name of the manufacturer, material, analysis and net weight appearing on each container.
- C. Fertilizer: slow-release granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in a composition as recommended by the Soil Testing Laboratory.
- D. Use of peat moss is prohibited.

2.6 SAND

- A. For the layer underneath structural soil as called for in the Contract Documents shall meet the gradation requirements of Section (C), of this provision.

PART 3 - EXECUTION

3.1 PROPORTIONING

Soil Supplier shall uniformly mix ingredients on an approved hard surface area or with soil blending equipment. Soils and Organic Amendment shall be maintained moist, not wet, during mixing. Amendments shall not be added unless approved to extent and quantity by the owner and additional tests have been conducted to verify type and quantity of amendment is acceptable. Percentages of

components, unless otherwise noted, will be established upon completion of individual test results for components of the various mixes.

After component percentages are determined by the Soil Supplier's Soil Scientist, each planting soil medium shall be tested for physical and chemical analysis.

A. SAND-BASED TOPSOIL

Sand-Based Structural Soil shall consist of a blend of approximately 60% by volume Coarse Sand, 15% by volume Base Loam and 25% by volume Organic Amendment. The components shall be blended to create a uniform mixture. Percentages will be adjusted as necessary to achieve the following grain size distribution and criteria below for material passing the #10 sieve by weight:

Percent Passing

U.S. Sieve Size Number	Minimum	Maximum	
10	100	-	(Coarse Sand)
18	68	90	(Coarse Sand)
35	38	63	(Coarse Sand)
60	18	39	(Fine Sand)
140	10	18	(Fine Sand)
270	8	10	(Silt)
0.002mm	1	4	(Clay)

1. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 15% by weight of the total sample.
2. The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.0 or less (D70/D20 <3.0).
3. The final mix shall have a saturated hydraulic conductivity of no less than 6.0 inches per hour according to test procedure ASTM D5856-95 (2000) when compacted to a minimum of 88 percent of the maximum density as determined by AASHTO T-99, unless the soil will be placed in an area that experiences loading. If the soil will be placed under sidewalk, curbs or gutter, the density shall be a minimum of 93 percent maximum dry density as determined by AASHTO T-180. The mixes shall be compacted at 60% to 80% optimum moisture content.
4. Organic content shall be between 2.5 and 3.5 percent by weight.
5. Unless otherwise specified or recommended by the Soil Supplier's Soil Scientist: pH shall be between 6.5 and 7.2; CEC shall be a minimum of 6; and Soluble Salts shall be less than 500 ppm/0.5 mmhos/cm.

3.2 PREPARATION AND MIXING OF PLANTING SOIL MIXES

Preparation, amendment, and mixing of the planting soil shall be performed at the Soil Supplier location. The following procedure shall be followed:

- A. Soil shall be amended to meet pH requirements and horticultural deficiencies as determined by the Testing Agency.
- B. Examine soil and remove foreign materials, stones and organic debris over 1/2" in size.
- C. Correct deficiencies in soil as directed by horticultural soil test results. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.
- D. Planting soil mixtures shall be produced with equipment that blends together each component in a thorough and uniform manner.

- E. Preparation and mixing shall be accomplished when the soil moisture content is less than field capacity and at a moisture content approved by SPW.
- F. Incorporate pre-plant fertilizer as directed.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Material shall not be handled or hauled when it is wet or frozen. Soil shall be hauled only when the moisture content is between 60% and 100% of optimum moisture content as determined by AASHTO T-99 for all planting soils except Sand-Based Structural Soil which shall be determined by AASTO T-180. Stockpiles shall be covered during wet weather. The Soil Supplier is responsible for meeting these requirements until the soil is delivered to the site. Soil which is delivered that exceeds the allowable maximum moisture content shall be replaced with new soil that meets the requirements.
- B. Contractor shall store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

3.4 SUBGRADE PREPARATION

- A. Coordinate the following scarification work to eliminate subgrade compaction resultant from Construction Operations when located in lawn and planting areas.
 - 1. General Site Subgrade Compaction Mitigation for all planting areas that are not heavily compacted:
 - i. Immediately prior to placing any Planting Soil or any drainage materials beneath planting soils, the entire subgrade shall be loosened to a minimum depth of 3-inches using the teeth of a backhoe or other suitable equipment.
 - ii. After the subgrade soils have been loosened, re-compressed and inspected, remove any stones or debris 6" or greater and dispose off the project site. Do not bury large stones or debris.

3.5 PREPARATION OF SOILS

The contractor or soil supplier shall not work soil when the moisture content is less than 60% nor more than 100% of optimum moisture content as determined by AASHTO T-99 for all planting soils except Sand-Based Structural Soil which shall be determined by AASTO T-180 or when it is frozen. Apply water, if necessary, or dry the soil to bring soil within the acceptable moisture content range.

3.6 PLACEMENT of DRAINAGE MATERIALS AND SOIL LAYERS

- A. Preparation for Placement of Planting Soils
 - 1. Notify SPW of soil placement operations at least seven calendar days prior to

the beginning of work.

2. Prevent compacting soils by beginning work in corner, against walls, or the center of isolated beds, and progressing outwards towards borders.
 3. Never move or work Planting Soils when wet or frozen.
 4. Place barricades as required to prevent compaction of planting soil from vehicles, equipment, or pedestrian traffic.
- B. In accordance with the Contract Documents and Detail Drawings, proceed with placement of base materials as follows:
1. Where geosynthetics are required per the contract plans, place geosynthetic layers in accordance with SPW approved specification for Geosynthetics for Stormwater Management.
 2. Where subsurface storage is required, place sand or stone layer as shown on the drawings in accordance with SPW approved specification for Aggregates for Stormwater Management.
 3. Where subsurface drainage is required, install in accordance with SPW specifications.
- C. General Placement Requirements
1. No rubber-tired equipment or heavy equipment except for a small bulldozer shall pass over the subsoils (subgrade) after they have been loosened and recompressed. If the Contractor plans to utilize such areas for any use of heavy equipment, this work should be carried out prior to beginning the process of loosening soils or filling in that area.
 2. Place and spread Planting Soils in layers as specified to a thickness greater than required such that after settlement,
 3. The surface area of each lift, including the subgrade after it has been compacted, shall be scarified by raking immediately prior to placing the next lift.
 4. Place and spread topmost layers of planting medium to the thickness such that, after settlement, finished grades conform to the lines, grades and elevations shown on the Drawings. Ensure proper drainage in an uninterrupted pattern free of hollows and pockets.
 5. All planting soils shall be placed at a moisture content between 60% and 100% of optimum moisture content as determined by AASHTO T-99 for all planting soils except Sand-Based Structural Soil which shall be determined by AASTO T-180.
- D. Place Sand Based Topsoil as follows:

1. Spread in lifts not greater than eight inches and compact with a minimum of two passes of vibratory compaction equipment to a density of 85% plus or minus 1% of maximum density as determined by AASHTO T180.
2. The Contractor shall construct a Mock Up of the initial installation of Sand Based Structural Soil in the presence of SPW or its representative. The Mock Up may be part of the permanent installation. The Mock Up shall be conducted with the same equipment that will be used for the duration of the Sand Based Structural Soil installation. Mock Up must be conducted with compliant soil moisture conditions. A geotechnical testing agency shall be on site to conduct soil moisture and compaction/density tests for each lift installed during the Mock Up.

3.7 PROTECTION

- A. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials from other work.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace material to a depth as directed by SPW; reshape and re-compact at optimum moisture content to the required density.
- C. Where settling occurs, before final acceptance or during the warranty period, remove finish surfacing, backfill with additional approved soil, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

3.8 COORDINATION AND EXCESS MATERIALS

- A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- B. Excess Planting Soil Mixtures and Materials: Remove excess planting mediums and materials from the site.

3.9 POST-INSTALLATION TESTING

- A. In-place density testing shall be performed by the Contractor at a rate of 1 per 2000 square feet for each type of material placed. The standard test for surface and subsurface density shall be ASTM D 2922-01: Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 The quantity of SOIL PREPARATION (STRUCTURAL SOIL) to be paid for under this item shall be the number of CUBIC YARD furnished and installed in accordance with the plans, specifications and to the satisfaction of the Project Officer.
- 4.2 The unit price bid per CUBIC YARD of Soil Preparation (Structural Soil) shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, in accordance

with the plans and specifications, to the satisfaction of the Project Officer.

END OF SECTION 329113

SECTION 329300 - EXTERIOR PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Double Shredded Hardwood Mulch
 2. Canopy and Understory Trees
 3. Shrubs
 4. Herbaceous Perennials / Ornamental Grasses
- B. Related Sections:
1. Section 311000 Site Clearing, Demolition, and Removals
 2. Section 311300 Tree Protection and Root Pruning
 3. Section 312000 Earthwork
 4. Section 312500 Temporary Erosion and Sediment Control
 5. Section 329100 Planting Preparation
 6. Section 329200 Turf
- C. In addition to the specifications contained herein, Work shall be performed in accordance with the:
1. Drawings and general provisions of the contract, including general and supplementary conditions
 2. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code)
 3. Arlington County Department of Parks & Recreation Design Standards as shown on the plans and available online at:
 - a. <http://parks.arlington.us/design-standards/>

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Imported Topsoil: Soil obtained off-site that meets the specifications herein for topsoil and is suitable for use in planting soil/backfill soil mixture when existing soil quantities are insufficient. Refer to Section 329100 "Planting Preparation."
- 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. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

- F. ISA: International Society of Arboriculture.
- G. CBAY: Chesapeake Bay, typically referring to CBAY watershed.
- H. Urban Forester/County Urban Forester: Refers to the Arlington County Urban Forester.
- I. Landscape Architect: Refers to an Arlington County Landscape Architect or their designee.

1.3 SUBMITTALS

- A. All submittals specified in Section 329100 "Planting Preparation" shall be provided to Project Officer for approval with confirmation by Landscape Architect or Urban Forester. All approvals shall be in writing.
- B. Product Data: For each type of product indicated.
- C. Product certificates: Contractor shall submit for each type of manufactured product, to be approved by the Project Officer and complying with the following:
 - 1. Manufacturer's certified analysis for standard products.
- D. Refer to Section 329100, "Planting Preparation" for soil test requirements.
- E. Contractor shall submit State Nursery inspection certificates to the Project Officer.
- F. Contractor shall submit to Project Officer the verification of Landscape Industry Certified Technician and Landscape Industry Certified Officer certificates for those responsible for plant installation.
- G. Planting Schedule: Contractor shall submit the planting schedule to the Project Officer for approval with confirmation by the Landscape Architect. The plant schedule will indicate anticipated planting dates for exterior plants. Contractor shall be responsible for furnishing and installing all plant material shown on the drawings and plant list, as submitted with the contract. Contractor shall have investigated the sources of supply and satisfied himself/herself that he/she can supply all of the plants specified on the drawings in the size, variety, quantity and quality noted prior to submitting the bid. Failure to take this precaution will not relieve the successful bidder from the responsibility of furnishing and installing all of the plant material in strict accordance with the contract documents.
- H. Substitutions:
 - 1. The Contractor shall submit a written request for a substitute plant a minimum of NINETY (90) calendar days prior to planting date if specific plants will not be available in time for the scheduled planting. Contractor shall submit the request to the Project Officer for approval with confirmation by the Landscape Architect or Urban Forester.
 - 2. Contractor shall be responsible for documenting any plant suitability or availability problems.
 - 3. If a substitute plant is offered to the County, it shall be of the same size, value and quality as the plant originally specified on the plan, as determined by the Landscape Architect or Urban Forester. If the County does not accept the substitute plant, the Contractor shall provide the type and size of plant material specified on the plans, or a substitute requested by the Landscape Architect or Urban Forester.

- I. Maintenance Instructions: Recommended procedures to be established by Project Officer for maintenance of exterior plants during a calendar year.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer who maintains an experienced full-time supervisor on Project site when exterior planting is in progress.
 - 1. Shall possess a "Landscape Industry Certified Technician" certificate, certified by the Professional Landcare Network (PLANET).
 - 2. The Contractor shall identify to the Project Officer at least one full-time on-site supervisor who is the Contractor's competent, qualified, and authorized person on the Project Site and who is, by training or experience, familiar with the policies, regulations and standards applicable to the work being performed, and capable of sufficiently communicating with the Project Officer.
 - 3. Crew leader and supervisor may be the same individual.
- B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.
- C. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in the most current version of ANSI Z60.1, "American Standard for Nursery Stock." Plants shall be nursery grown stock and conform to the requirements described in the most current issue of the American Standard for Nursery Stock (ANSI) published by the American Nursery and Landscape Association. The Landscape Architect or Urban Forester may reject any non-conforming stock and has the option to field-select plant materials prior to purchasing.
- D. Collected material may be used only when approved by the Arlington County Urban Forester and/or DPR PNR Natural Resource Manager.
- E. Nomenclature shall be in accordance with *Hortus III*, by L.H. Bailey. All trees and shrubs shall be labeled with a securely attached, waterproof tag bearing legible designation of botanical and common name. Perennials and groundcovers shall be clearly identified with a waterproof tag bearing legible designation of botanical and common name within the container.
- F. Preinstallation Conference: Conduct conference at Project Site with Project Officer, Arlington County Urban Forester and/or Department of Parks and Recreation (DPR) representative and County Landscape Architect.
- G. Urban Forester Notification: Notify the Project Officer at least 72 hours prior to commencement of tree planting operations, so that the County's Urban Forester can be present on-site to supervise the work.
- H. The Contractor shall provide a minimum of seven (7) business days' notice to the Project Officer prior to installing the plant material (this is not the same as inspection notification).
- I. At the request of the Project Officer in coordination with the Urban Forester or Landscape Architect, the Contractor shall supply information specifying the provenance of the plant material. Provenance is the geographical origin of the seed or cutting used in propagation and can have a direct effect on plant vigor and survivability.

- J. Inspections:
1. Urban Forester may perform periodic inspections to check on tree plantings.
 2. Contractor shall arrange a meeting on the Project Site with the Project Officer in coordination with the Urban Forester and Landscape Architect to perform final inspection of plantings. Refer to section 1.07 "Final Inspection."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
- B. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1.6 WORKMANSHIP

- A. Any tree pruning shall conform to the most current version of ANSI A-300 Standard Practices for Trees, Shrubs, and Other Woody Plant Maintenance. Do not prune trees and shrubs before delivery.
- B. Protect bark, branches, and root systems from sun-scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery. Plants shall not be bound with wire or rope at any time so as to damage the bark or break branches. Plants shall be handled from the bottom of the root ball only.
- C. All plants in transit shall be tarped or covered and shall be kept from drying out. Desiccation damage shall be cause for rejection. Plants damaged in handling or transportation may be rejected by the Project Officer with confirmation by the Urban Forester/Landscape Architect. Any tree or shrub found to have wounds over 12.5% of the circumference of any limb or trunk, or over 1 inch in any direction, whichever is smaller, shall be rejected.
- D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist. Plants shall not remain unplanted for longer than a three-day period after delivery. Any plants not installed during this time period shall be rejected, unless Project Officer and contractor provide otherwise by written agreement. All plants kept on Project Site for any period of time shall be watered and cared for using ANSI A300 standards.
- E. Plants shall be installed immediately following excavation of the hole. No holes shall remain open overnight. The Contractor shall cover and barricade any open holes to effectively prevent any danger of injury to pedestrians.

- F. During delivery and installation, the landscape contractor shall perform in a professional manner, coordinating his/her activities so as not to interfere with the work of other trades, and leaving his/her work area(s) clean of litter and debris at the close of each workday.
- G. During planting, all areas shall be kept neat and clean, and precautions shall be taken to avoid damage to existing plants, trees, turf and structures. Where existing trees are to be preserved, additional precautions shall be taken to avoid unnecessary accumulation of excavated materials, soil compaction, or root damage. The Contractor shall cover sidewalks or pavers with plywood, and cover turf with plywood, burlap or tarp during excavation.
- H. Any damaged areas caused by the Contractor shall be restored to their original condition at no cost to the County. All debris and waste material, including small stones and clumps of clay or dirt exceeding 1" by 1" in any direction, resulting from planting operations shall be removed from the Project Site, **legally disposed**, and the area cleaned up by the Contractor.
- I. Plants with soil covering the root flare, if not removed by Contractor, shall be rejected by the Landscape Architect or Urban Forester.
- J. Contractor shall take full responsibility for any cost incurred due to damage of utilities by their operations.
- K. The Contractor will not be held responsible for uncommon concealed conditions such as concrete/asphalt/stone spoils encountered in excavation work which are not apparent at the time of bidding. Rocks, tree roots and hard clay are common elements of "urban" soils and will frequently be encountered in the execution of the contract.
- L. No plants shall be planted in locations where drainage may, in the opinion of the Contractor, be unacceptable. Such situations shall be brought to the attention of the Project Officer before work continues and, if deemed necessary by the Project Officer with confirmation by the Landscape Architect/Urban Forester, the plants shall be relocated or the contract shall be modified to allow for drainage correction at a negotiated cost. Any such modification shall be in writing and signed by both parties.
- M. The Contractor shall layout plants according to the project's landscape plan. The Landscape Architect and Urban Forester shall approve the layout prior to plant installation. Plants installed without layout approval from the Landscape Architect are subject to removal and replanting by the Contractor at no additional cost to Arlington County.

1.7 WATER REQUIREMENTS

- A. Initial Waterings: The Contractor shall supply water for all plantings and shall water all plants at time of installation and 48 hours after installation, even if it is raining. Contractor shall then water plantings at least twice per week at amounts specified below until Final Completion of work. The bioretention facilities shall be watered by hand throughout the warranty period.
- B. Each watering shall consist of:
 - 1. 20 gallons per individual tree
 - 2. 4 gallons per individual shrub
 - 3. 1 gallon per 1 sq. yd. of shrub or perennial bed
 - 4. 1 gallon per 3 sq. yd. of seed or sod

1.8 FINAL INSPECTION

- A. Contractor shall schedule the final inspection with the Project Officer in coordination with the Urban Forester and/or Landscape Architect.
1. Contractor shall notify Project Officer at least one week in advance to arrange final inspection meeting with the Urban Forester and/or Landscape Architect.
 2. Contractor shall conduct the final inspection of the landscape materials no less than three months after the installation of the plants or Final Completion of construction work, whichever comes last, and in the presence of the Project Officer, the Urban Forester and/or Landscape Architect.
 3. The landscaping inspection will review all landscape work under the contract.
 4. All plants shall be alive and in good health at the time of final inspection.
 5. Any plant material that is 25% dead or more shall be considered dead and shall be replaced at no charge to the County. A tree shall be considered dead when the main leader has died back, or 25% of the crown is dead.
 6. It shall be the Contractor's responsibility to provide in writing the results of this inspection.
 7. The Contractor shall make replacements during the next planting period unless the County specifies an earlier date.
 8. The replacement plants will be reviewed for Final Completion no less than three months after installation. Contractor is responsible for maintenance and watering of replacement material per Section 1.7 and Section 1.9 after planting and until the replacement plantings are finally accepted by Project Officer.
 9. A replacement plant shall be of the same size as the original plant with no additional soil additives to be used.
 10. The Contractor will not be responsible for plants that have been damaged by vandalism, fire, removal or other activities beyond the control of the Contractor.

1.9 WARRANTY

- A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.
1. Warranty Period for Trees and Shrubs: One year from date of Final Completion.
 2. Warranty Period for Ground Cover and Plants: One year from date of Final Completion.

1.10 MAINTENANCE

- A. Trees and Shrubs: Maintain during warranty period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease.
- B. Ground Cover and Plants: Maintain during warranty period by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings.

- C. Pruning: Remove all sucker growth, dead or broken branches at initial planting and as needed during the warranty period. Pruning will conform to ANSI-300 Tree Pruning Standards.
- D. Fertilizing: No plants shall be fertilized without prior approval of Project Officer with confirmation by the Urban Forester or Landscape Architect.
- E. Mulching: Contractor shall re-mulch areas to a depth of two to three inches prior to Final Completion if the time between planting and Final Completion extends beyond six months. Mulch will be of the same quality as mulch provided at the time of planting. Keep mulch six-inches away from trunks of trees and shrubs.
- F. Weeding: Contractor shall perform weeding until Final Completion to keep the planting area as free of weeds as possible. A minimum of one weeding per month from April through October is required if time between planting and Final Completion extends through any months of the growing season.
- G. Stakes, Guy Supports,: Where installed, Contractor shall monitor and adjust all stakes and guy supports until Final Completion.

PART 2 - PRODUCTS

2.1 EXTERIOR PLANTS

- A. Contractor shall select plants only from nurseries that have been inspected by state or federal agencies and shall have been grown in USDA Plant Hardiness Zones 4, 5, 6, or 7, and in one of the following states: Maryland, Virginia, Delaware, New Jersey, North Carolina or Pennsylvania.
- B. Tree and Shrub Material: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - 1. Provide balled and burlapped or container-grown trees and shrubs, as indicated on the Drawings.
 - 2. Balled and Burlapped (B&B) plants shall be dug with firm root balls of earth and free of noxious weeds. There shall be no extra soil on top of the root ball or around the trunk. Balled and burlapped trees shall be securely held in place by untreated burlap and stout rope. Nylon rope is NOT acceptable. Loose, broken or manufactured balls are unacceptable.
 - 3. Ball sizes shall be in accordance with current ANSI standards.
 - 4. In size-grading B&B single stem trees, caliper shall take precedence over height. For multiple-trunk trees, height measurement shall take precedence over caliper.
 - 5. Trees over 1" in caliper shall have a strong central leader (free and clear of branches or splits in the trunk) from the top of the root ball to a height of at least 6'-6". Only minimal

bends in the trunk will be acceptable. Co-dominant stems and V-crotches shall be cause for rejection.

6. The root system of container-grown plants shall be well developed and well distributed throughout the container.
 7. All container-grown trees and shrubs that have circling and matted roots shall be rejected.
 8. Field grown trees and shrubs shall be grown in soils of the Piedmont region, or west of that region in the above approved states and zones.
- C. Perennials/Groundcovers/Grasses: Provide healthy, field-grown plants or bulbs (as indicated) from a commercial nursery, of species and variety shown in the Drawings. All container grown plants shall be healthy, vigorous, well rooted and established in the container in which they are growing. A container grown plant shall have a well-established root system reaching the sides of the container to maintain a firm root ball but shall not have excessive root growth outside the container.
- D. All plant materials shall be labeled by grower to identify genus, species, and cultivar, if applicable, in accordance with Section 1.04 "Quality Assurance," above.
- E. Plant Materials for ecologically sensitive areas: Plant materials identified on planting plan as being located within an Arlington County Natural Resource Conservation Area (NCRA) shall be native species of local provenance.

2.2 PLANTING MATERIALS

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
1. Topsoil Source: Imported topsoil or manufactured topsoil from off-site sources
- B. Inorganic Soil Amendments:
1. Lime: ASTM C 602, Class T or O, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.
 2. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.
- C. Organic Soil Amendments:
1. 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-inch sieve.
 2. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
 3. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

D. Fertilizer:

1. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
2. 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:
 - a. Composition: 10 percent nitrogen, 6 percent phosphorous, and 4 percent potassium, by weight.

E. Wood Chip Mulches:

1. Organic Mulch: Shredded hardwood.
2. Compost Mulch: 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-inch sieve.

2.3 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:
 1. Planting Soil Mix: Shall be $\frac{3}{4}$ approved imported topsoil or manufactured topsoil, and $\frac{1}{4}$ approved organic material.
 2. Weight of Lime per 1000 Sq. Ft.: 90 lbs.
 3. Weight of Commercial Fertilizer per 1000 Sq. Ft.: 23 lbs.

PART 3 - EXECUTION

3.1 EXTERIOR PLANTING

- A. Contractor shall install plant materials in accordance with the current Arlington County Standard Planting Details as published on the Arlington County website and as specified below.
- B. Refer to Section 329100 "Planting Preparation" for specifications on soil amendments.
- C. Contractor shall install plantings in accordance with Arlington County DPR standard details available online at: <http://parks.arlingtonva.us/design-standards/>. Refer to plans for appropriate planting details.
- D. Handling: Prepare pit and/or planting bed per standards. Place plant in pit by carrying by the root ball (not by branches or trunk) and plant per the DPR Standards. Make sure the plant remains plumb during the backfilling procedure.
- E. Bed Establishment:
 1. Loosen subgrade of planting beds to a minimum depth of 8 inches.

2. 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.
 3. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 4. Placement of the planting soil mix shall be to a depth of 5 feet from finish grade unless otherwise indicated. Spread planting soil mix in 8 inch lifts compacting to 85% proctor. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 5. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- F. Plant Layout
1. The Contractor shall layout and space plants according to the project landscape plan.
 2. When the layout is complete, the Contractor shall notify the Project Officer for approval with confirmation by the Landscape Architect prior to installation of the plants. The County Landscape Architect reserves the right to be on the Project Site during plant layout to direct changes in the field.
- G. Trees and Shrubs:
1. Pits and Trenches: Excavate pits and trenches with sides sloped inward to the depth indicated. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation. Excavate approximately three times as wide as ball diameter.
 2. Set trees and shrubs plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.
 - a. Balled and Burlapped: Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - b. Container Grown: Carefully remove root ball from container without damaging root ball or plant.
 - c. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix. Never cover top of tree ball with soil.
 3. Organic Mulching: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches of trunks or stems.
- H. Tree and Shrub Pruning: Prune, thin, and shape trees and shrubs according to the most current version of ANSI A-300 Tree Pruning Standards. Prune trees to retain required height and spread. Do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning. Make all cuts back to a lateral branch or bud. Cuts should be perpendicular above branch collar. Final pruning shall be done after the tree is in place. Do not prune into old wood on evergreens.
- I. Ground Cover, Vine, and Perennials Planting:

1. Set out and space ground cover and plants as indicated.
 2. Dig holes large enough to allow spreading of roots and backfill with planting soil.
 3. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
 4. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
 5. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
- J. Planting Bed Mulching:
1. Completely cover area to be mulched, overlapping edges a minimum of 6 inches.
 2. Mulch backfilled surfaces of planting beds and other areas indicated. Apply 3-inch average thickness of mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.
- K. Contractor shall remove all tags, labels, strings and wire from the plants, unless otherwise directed.
- L. Plant Protection:
1. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting. Injured roots shall be pruned to clean ends before planting with clean, sharp tools per most current ANSI 300 specifications.
 2. Protect shrubs, groundcovers and perennials from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
 3. Install Temporary Plant Protection Fence at locations shown on Planting Plans. Final placement shall be approved by Landscape Architect.
 - a. Contractor shall remove temporary fence from Project Site at the end of the maintenance period, or when directed by Landscape Architect and Construction Manager.
- M. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- N. Staking and Guying Trees
1. Contractor shall stake and guy trees only if required by Urban Forester.
 2. If staking and guying is required, the Contractor shall provide and install stakes and guying in accordance with DPR standard staking details for deciduous and evergreen trees.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 The quantity of DOUBLE SHREDDED HARDWOOD MULCH to be paid for under this item shall be the number of CUBIC YARD furnished and installed in accordance with the plans, specifications and to the satisfaction of the Project Officer.
- 4.1.1 The unit price bid per CUBIC YARD of Double Shredded Hardwood Mulch shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, in accordance with the plans and specifications, to the satisfaction of the Project Officer.

- 4.2 The quantity of TREE (LARGE & SMALL) to be paid for under this item shall be the number of EACH furnished and installed in accordance with the plans, specifications and to the satisfaction of the Project Officer.
- 4.2.1 The unit price bid per EACH Tree (Large & Small) shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, in accordance with the plans and specifications, to the satisfaction of the Project Officer.
- 4.3 The quantity of PERENNIAL/SHRUB/ORNAMENTAL GRASS to be paid for under this item shall be the number of EACH furnished and installed in accordance with the plans, specifications and to the satisfaction of the Project Officer.
- 4.3.1 The unit price bid per EACH Perennial/Shrub/Ornamental Grass shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, in accordance with the plans and specifications, to the satisfaction of the Project Officer.

END OF SECTION 329300

SECTION 334000 - STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Pipe and fillings
 - 2. Drain basins
 - 3. Trench Castings
 - 4. Pipe Connectors
 - 5. Polymer-Concrete Channel Drainage Systems
 - 6. Planter Box Impermeable Liner
 - 7. Mulch
 - 8. Choking Layer Stone
 - 9. Stone Jacket
 - 10. Underdrains
 - 11. Splash Block Rip Rap

1.2 RELATED SECTIONS

- A. Section 312000 – Earthwork

1.3 REFERENCE PUBLICATIONS

- A. Virginia Erosion and Sedimentation Control Handbook, Latest Edition
- B. Underground Utility Protection– Chapter 55 Arlington County Code
- C. Erosion & Sediment Control – Chapter. 57 Arlington County Code
- D. Arlington County DES Construction Standards and Specifications
- E. Construction Drawings

1.4 SUBMITTALS

- A. Product Data: For each type of product
- B. Shop Drawings: Provide shop drawings for drain basin installation.
 - 1. Drain Basins: Include plans, elevations, sections, details, frames, covers, and grates.
 - 2. Polymer-Concrete Channel Drainage Systems: include plans, elevations, sections, details, and grates.

1.5 PROJECT CONDITIONS

- A. Accurately record actual locations of pipe runs, connections, inlets, cleanouts, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

- C. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Project Officer no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Project Officer's written permission.
- D. Coordinate work with connection to existing storm sewer system.

1.6 QUALITY ASSURANCE

- A. A manufacturer's certification that the product was manufactured, tested, and supplied in accordance with this specification, together with a report of the test results, and the date of each test was completed, shall be signed by a person authorized by the manufacturer.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Type PSM Sewer Piping:
 - 1. Pipe: ASTM D3034, SCH 40, PVC Type PSM sewer pipe with bell and spigot ends for gasketed joints.
 - 2. Fittings: ASTM D3034, PVC with bell ends
 - 3. Gaskets: ASTM F477, elastomeric seals
- B. Adhesive Primer: ASTM F656
- C. Solvent Cement: ASTM D2564

2.2 DRAIN BASINS

- A. Lid and frame:
 - 1. Manufactured or supplied by the inlet manufacturer or equivalent per details shown on Construction Drawings.
 - 2. Shall be made specifically for each drain basin to provide a round bottom flange that closely matches the diameter of the surface drainage inlet.
 - 3. Iron used manufacture of the castings shall conform to ASTM A 536 grade 70-50-05 for ductile iron and shall be provided painted black.
- B. Drain Basins:
 - 1. Shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration, to be ADS or equivalent manufactured to dimensions specified on Construction Drawings.

- C. Structure construction in accordance with manufacturer's instructions and details shown on Construction Drawings.
1. The drainage pipe connection stubs shall be manufactured from PVC stock and formed to provide a watertight connection with the specified pipe system.
 2. The joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible electrometric seals.
 3. The pipe spigot shall be joined to the main body of the drain basin. This pipe stock used to manufacture the main body and pipe stubs of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings: ASTM F1336 Standard for PVC Gasketed Sewer Fittings.

2.3 TRENCH CASTING

A. Frame and Cover:

1. Shall be capable of supporting H-20 loading
2. Iron used to manufacture the castings shall conform to ASTM A48 Type 35-B heavy-duty for gray iron

2.4 PIPE CONNECTORS

A. Resilient Pipe Connectors: ASTM C1478

1. Hub Adaptor: ASTM D3034, SDR 26 HWS, PVC Type PSM
2. Rubber Gasket: ASTM 477, Elastomeric Seals
3. Securing Clamp
 - a. Band SS #301
 - b. Screw SS #305
 - c. Housing SS #301
 - d. Rubber Sleeve: ASTM 477, Elastomeric Seals

2.5 POLYMER-CONCRETE CHANNEL DRAINAGE SYSTEMS

A. Narrow, Sloped-Invert, Polymer-Concrete Channel Drainage Systems

1. Source Limitations: Obtain narrow, sloped-invert channel drainage systems from single manufacturer
2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
3. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps.
 - a. Include rounded bottom, with built-in invert slope of 1.0 percent and with outlets in number, sizes, and locations indicated.
 - b. Include extension sections necessary for required depth.
 - c. Dimensions: 4-inch inside width. Include number of units required to form total lengths indicated.
 - d. Frame: Not required.

4. Grates: Certified to EN1433 load Class A - 3,500 lbs. - 70 psi with slots or perforations, and of width and thickness that fit recesses in channel sections.
 - a. Material: Polypropylene
 - i. Locking Mechanism: Manufacturer's standard boltless locking system for securing grates to channel sections.
5. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.6 PLANTER BOX IMPERMEABLE LINER

- A. ASTM D7176, 30 mil minimum, non-reinforced Polyvinyl Chloride (PVC) geomembrane.

2.7 FILTER MEDIA

- A. Filter media to contain:
 1. 80-90% sand with greater than 75% being coarse to very coarse.
 2. 10%-20% soil fines.
 3. 3%-5% organic matter meeting Virginia Department of Environmental Quality (DEQ) 2013 Draft Design Specification No. 4, Soil Compost Amendment, Section 6.5, Compost Specifications.
- B. Media must be procured from Arlington County approved filter media vendors.

2.8 MULCH LAYER

- A. Aged, shredded hardwood bark mulch.

2.9 CHOKING LAYER

- A. Virginia Department of Transportation (VDOT) No. 8 coarse aggregate.

2.10 STONE JACKET FOR UNDERDRAIN AND/OR STORAGE LAYER

- A. VDOT No. 57 coarse aggregate.
 1. One-inch stone should be double-washed and clean and free of all fines.

2.11 UNDERDRAINS

- A. ASTM D1785 Schedule 40 PVC.
 1. 3/8-inch perforations at 6-inches on center, maximum of 3 rows.
 2. Slope must be 1% or 2%.

2.12 SPLASH BLOCK RIP RAP

- A. Material: Delaware River gravel, minimum of 5-inches, maximum of 8-inches in size.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 – Earthwork.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawings 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 according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping-NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with 24-inch minimum cover.
 - 4. Install piping according to ASTM D 2321.

3.3 DRAIN BASIN INSTALLATION

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Refer to Construction Drawings and manufacturer's instructions and requirements.

3.4 CONNECTIONS

- A. Make connections to existing piping per pipe connector manufacturer's instructions.
 - 1. Make branch connections from side into existing piping, by cutting into existing unit and creating an opening large enough to allow for installation of resilient connector.

3.5 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.6 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- 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.

PART 4 - MEASUREMENT AND PAYMENT

- 4.01 The quantity of SOLID SCHEDULE 40 PVC PIPE shall be the number of LINEAR FEET for each pipe size as delivered to the site, furnished, installed, maintained, and removed at project completion in accordance with the plans and specifications.
- 4.02 The price bid shall be a unit price per LINEAR FOOT of SOLID SCHEDULE 40 PVC for each pipe size and shall include the cost of all labor, materials, equipment and incidental expenses necessary to complete the work.
- 4.03 The quantity of UNDERDRAIN shall be the number of LINEAR FEET for each pipe size as delivered to the site, furnished, installed, maintained, and removed at project completion in accordance with the plans and specifications.
- 4.04 The price bid shall be a unit price per LINEAR FOOT of Underdrain for each pipe size and shall include the cost of all labor, materials, equipment, and incidental expenses necessary to complete the work.
- 4.05 The quantity of SOLID SCHEDULE 40 PVC 45° ELBOW shall be the number of EACH for each elbow size as delivered to the site, furnished, installed, maintained and removed at project completion in accordance with the plans and specifications.
- 4.06 The price bid shall be a unit price per EACH of Solid Schedule 40 PVC 45° Elbow, for each shall include the cost of all labor, materials, equipment, and incidental expenses necessary to complete the work.
- 4.07 The quantity of OBSERVATION WELLS IN SOIL shall be the total number at project completion show in units of each, in accordance with the plans and specifications.
- 4.08 The price bid shall be a unit price per EACH Observation Well in Soil and shall include the cost of all labor, materials, equipment and incidental expenses necessary to complete the work.
- 4.09 The quantity of 4" WIDE TRENCH DRAIN AT PLAYGROUND to be paid for shall be the number of LINEAR FEET furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.10 The unit price per LINEAR FOOT installed 4" Wide Trench Drain at Playground shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, including excavation, aggregate, filter fabric, drain pipe and compaction.
- 4.11 The quantity of #8 CHOKER STONE to be paid for shall be the number of CUBIC YARDS furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.12 The unit price per CUBIC YARD installed of #8 Choker Stone shall and shall include the cost of all labor, materials, equipment, and incidental expenses necessary to complete the work.
- 4.13 The quantity of WASHED GRADED #57 AGGREGATE to be paid for shall be the number of CUBIC YARDS furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.14 The unit price per CUBIC YARD installed Washed Graded #57 Aggregate and shall include the cost of all labor, materials, equipment, and incidental expenses necessary to complete the work.

- 4.15 The quantity of PVC GEOMEMBRANE LINER (SIDES AND BOTTOM) to be paid for shall be the number of SQUARE FEET furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.16 The unit price per SQUARE FOOT installed PVC Geomembrane Liner (Sides and Bottoms) shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, including excavation, aggregate, filter fabric, drain pipe and compaction.
- 4.17 The quantity of DRAIN BASINS to be paid for shall be the total number for each basin size, EACH furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.18 The unit price per EACH Drain Basin size installed shall include the cost of all labor, materials, equipment, and incidental expenses necessary to complete the work.
- 4.19 The quantity of SOLID TRENCH COVER & PERIMETER FRAME to be paid for shall be the number of LINEAR FEET furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.20 The unit price per LINEAR FEET installed Solid Trench Cover & Perimeter Frame shall include the cost of all labor, materials, and incidental expenses necessary to complete the work, including excavation, aggregate, filter fabric, drain pipe and compaction.
- 4.21 The quantity of FILTER MEDIA to be paid for shall be the number of CUBIC YARDS furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.22 The unit price per CUBIC YARD installed Filter Media shall and shall include the cost of all labor, materials, equipment, and incidental expenses necessary to complete the work.
- 4.23 The quantity of SPLASH BLOCK RIP RAP (DELAWARE RIVER GRAVEL, minimum of 5-inches, maximum of 8-inches in size) to be paid for shall be by the TON furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.24 The unit price per TON installed Splash Block Rip Rap (Delaware River gravel, minimum of 5-inches, maximum of 8-inches in size) shall and shall include the cost of all labor, materials, equipment and incidental expenses necessary to complete the work.
- 4.25 The quantity of PIPE CONNECTORS to be paid for shall be the total number for each connector size, EACH furnished and completely installed, in accordance with the plans, specifications, to the satisfaction of the Project Officer.
- 4.26 The unit price per EACH Pipe Connector size installed shall include the cost of all labor, materials, equipment, and incidental expenses necessary to complete the work.

END OF SECTION 334000