SECTION 022110
PROJECT SURVEY & LAYOUT

PART 1 GENERAL

1.1 SUMMARY

A. The contractor shall provide construction stakeout sufficient to construct the proposed improvement in accordance with the approved construction plans.

B. All stakeout services shall be completed under the direct supervision of a Professional Land Surveyor licensed in the State where the project is located.

C. The Owner shall provide the following prior to the commencement of any stake-out services:

1. Approved for construction site plans;

2. Approved for construction dimensional control plans including a fixed relationship to the site boundary or on-site fixed element;

3. Copies of the topographic survey that the approved site plans have been based on when available. The topographic survey shall include a minimum of two benchmarks, which shall be used for vertical control;

4. Copies of the boundary survey that the approved site plans have been based on when available. The boundary survey shall be closed and monumented. These monuments shall be used for horizontal control, or a monumented baseline (minimum of 3 points) related to the site boundary and the dimensional control plan.

1.2 RELATED SECTIONS

A. Related Sections Include:

1. Applicable sections of Division 31, 32, and 33.

1.3 EXECUTION

A. Work shall be performed by a Professional Land Surveyor, licensed in the State where the project is being completed, or under his direction:

B. Playground Equipment Layout - Offset stakes will be located at post locations.

C. Storm drainage and sanitary sewer lines (including manholes and catch basins). Stakes will be located @ 50 ft. stationing along the centerline of the utility line @ 15 ft. offsets. Manholes and catch basins will have 2 offsets per structure. Cut sheets shall be provided to the contractor by the surveyor.

D. Water Layout - Offset stakes will be located at deflections and at hydrant locations. Hydrant elevations will be to grade ring.

E. Lighting Layout - Centerline of lighting structure with 5 ft. offsets and finished grade elevations.

F. Grade Stakes - Stakes will be located as needed to provide elevation references.

G. Contractor will field verify the utility location, size and invert elevations at points of connection in area of conflict, prior to construction and protect them from damage.

H. Notify engineer, if it is necessary to destroy or remove control points and/or benchmarks due to construction. Contractor shall be responsible for cost of relocation.

I. Advise engineer of any discrepancies between plans and field layout.

1.04 REFERENCE STANDARDS

A. In accordance with local rules and regulations.

1.05 QUALITY ASSURANCE

A. All construction layout work shall be performed under the direction of a Professional Land Surveyor.

B. The survey crew will discuss all layout procedures with the contractor's supervisor prior to commencing work.

C. The survey crew daily report shall be filled out and signed by the contractor's supervisor at the end of that day's layout.

D. Copies of sketches, cut sheets, etc. shall be provided to the contractor by the end of the next workday.

E. All costs related to re-staking due to construction or contractors' work resulting in destruction or movement of stakes shall be paid for by the contractor and at no additional expense to the owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. The contractor/surveyor shall supply all stakeout materials.

2.02 EQUIPMENT

A. The Contractor/Surveyor shall supply all equipment necessary to accomplish the work.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 024100
SITE DEMOLITION

PART 1 GENERAL

1.1 GENERAL

A. The Contract Drawings and all other specification sections along with all provisions included within this Contract package, Instructions to Bidders, and other General Conditions apply to this section. The Contractor must accept the site as is and shall be deemed to have inspected the site and reviewed all Contract Documents prior to submitting a bid.

1.2 SUMMARY

A. Overall work under this Contract shall include all labor, materials, equipment, supervision, coordination efforts, permitting costs, certificate costs, services, filing fees, testing costs, security, insurance and all other associated or related items specified herein that are necessary and are required to complete the Work. Work elements shall include, but not be limited to the following:

1. Installation and maintenance of soil erosion and sediment control measures.

2. Demolition and removal of all existing site structures including but not limited to all fencing, gates and playground equipment, as noted on the drawings. City of Philadelphia reserves the right to save any portions of the existing play equipment that may be able to be re-used on another site.

3. Removal of existing sidewalks, pavers, pavement, fences, benches, curbs, etc. as noted on contract documents and as required to complete the project.

4. Removal/Abandonment of existing above-ground and underground utilities and associated structures. It shall be the responsibility of the Contractor to accurately locate all facilities and to determine their extent. If such facilities obstruct the progress of the work and are not indicated to be removed or relocated, they shall be removed or relocated only as directed by the Owner. Contractor to certify that utilities have been disconnected prior to demolition.

5. Backfill of removed underground utilities.

6. Backfill to grade with compacted suitable on-site soils.

7. Removal from site and disposal of all excess and unusable material.

8. Removal of trees and plant material as noted on the drawings.

1.3 RELATED SECTIONS

A. Section 330110 - Protection of Existing Utilities

B. Section 312500 - Soil Erosion and Sediment Control

C. Section 312010 – Earthwork

D. Section 312310 – Excavation, Backfill and Subgrade Preparation for Pavement

E. Section 312320 - Trench Excavation and Backfill for Utilities

1.4 REFERENCE STANDARDS

A. National Association of Demolition Contractors (NADC) - Demolition Safety Manual, latest edition.

B. All applicable OSHA requirements and other Federal, State, and local codes, laws, ordinances, regulations, and guidelines for demolition and related work.

C. Section 3310 of the BOCA Code, latest edition.

1.5 QUALITY ASSURANCE

A. A qualified Engineer, selected and paid by the Owner, shall be retained to perform demolition inspection for the duration of the demolition operations to ensure compliance with this section.

B. An Independent Testing and Inspection Agency shall prepare field reports documenting the progress of the demolition operations and submit said reports to the Owner on a weekly basis.

C. The Owner reserves the right to direct any inspection that is deemed necessary. The Contractor shall provide free access to the site for inspection activities.

D. The Contractor shall provide and maintain a capable and experienced field person representing the Contractor to oversee all demolition operations. The representative shall be on site during all operating hours of the project.

E. The Contractor shall obtain and pay for any permits, bonds, licenses, etc., required for demolition work.

F. The Contractor shall conduct any work within street or highway right-of-ways in accordance with the requirements of the Philadelphia Streets Department or the governmental agencies having jurisdiction and shall not begin until these governing authorities have been notified. The Contractor shall restore to their present conditions any public right-of-way that is disturbed by the work under this section. All pavement restoration work in public rights-of-way shall be performed to the proper satisfaction of the Philadelphia Streets Department or the governmental agencies having jurisdiction.

1.6 SUBMITTALS

A. PERMITS

Prior to the commencement of work, the Contractor shall submit to the Owner record copies of all required permits and certificates obtained for the work in this section. The Contractor shall incur all fees and other requirements associated with obtaining the required permits and certificates.

1.7 WORKING HOURS

A. The Contractor shall limit all work for this project between 8:00 a.m. and 4:30 p.m. Monday through Friday or as limited by the City or the Owner. No work shall be done on Saturdays, Sundays or Holidays unless permission is given by the City and Owner and work on such days is not in conflict with local ordinance.

1.8 CONTRACT LIMIT LINE

A. The contract limit line for demolition work is shown on the Contract Drawings. No equipment, materials, and/or trailers shall be kept or stored outside the contract limit line.

B. Other trades and work may be ongoing onsite during demolition operations. The Contractor shall coordinate their work so as not to interfere with work of other trades.

1.9 UNACCEPTABLE PERFORMANCE

A. The Contractor shall remove from the project any individual employed by the Contractor who is performing work in an unacceptable manner as determined by the Owner. The Contractor shall not be allowed claims for delays or down time resulting from the removal of such employees.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Noise-producing activities shall be held to a minimum. Internal combustion engines and compressors, etc., shall be equipped with mufflers to reduce noise to a minimum. The Contractor shall comply with all noise abatement ordinances.

B. The work areas shall be sufficiently dampened to prevent dust from rising during demolition activities.

C. The Contractor shall see to it that trucks leaving the site shall do so in such a manner that mud and earth will not be deposited on adjacent street pavements. Any mud or earth deposited on street pavements shall be promptly removed by the Contractor.

1.11 TEMPORARY SHORING AND PROTECTION

A. Any damage done by the Contractor to existing pipe lines, utilities, etc., to remain shall be repaired by the Contractor and at his/her expense in a manner acceptable to the Owner of

the damaged property. The Contractor shall report any existing damage prior to his beginning work.

B. The Contractor shall provide necessary temporary shoring, bracing, etc., and maintenance thereto required in accordance with all applicable OSHA Standards for the completion of demolition work.

C. The Contractor shall insure the provisions of adequate bracing, shoring, lamps, fencing, warning signs, and flags as required by agencies having jurisdiction and as directed by the Owner. Remove same when necessity for protection ceases.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials are as specified on the Contract Drawings when applicable. See related sections for additional product specifications.

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor is responsible for the demolition of existing concrete slabs, walks, curbing, asphalt pavement, utilities, signs and miscellaneous items encountered. Concrete elements shall be subject to an on-site crushing process and asphalt pavement shall be milled. Crushed concrete and asphalt millings may be stockpiled separately on site for reuse on site. All materials that cannot be recycled for reuse on-site shall be disposed off-site in accordance with all applicable Federal, State, County and Local codes and regulation governing legal transportation and disposal of work.

B. The general scope of demolition work is shown on the site Demolition Plan. The Contractor shall include for all demolition work necessary to accomplish the construction project.

C. Backfill all open excavations, including trenching for utility and foundation removal.

3.2 SITE VISIT

A. The Contractor shall visit the site and verify the location of all pertinent items prior to submitting a bid so that the difficulties associated with execution of the contract are fully understood. No additional compensation will be allowed for failure to be so informed.

3.3 SOIL EROSION SEDIMENT CONTROL

A. GENERAL

1. The Contractor shall install all soil erosion and sediment control measures in accordance with the requirements indicated on the Contract Drawings, permit, and

specifications. All work shall be performed in accordance with the requirements of the PADEP.

2. The Contractor shall be responsible for maintenance of all soil erosion and sediment control measures during the Contract.

3. The Contractor shall keep all streets clear of dirt and sediment and shall be responsible for any cleaning of the streets necessary during the course of the project.

4. The Contractor shall, if necessary, obtain approval from and comply with all additional directives issued by the Philadelphia Water Department.

B. SEQUENCE OF CONSTRUCTION

1. The Contractor shall, if necessary, submit written notification to the Philadelphia Water Department at least 48 hours prior to the start of construction of any soil erosion and sediment control measures.

2. A temporary rock construction entrance, with wheel cleaning pad, shall be installed at the construction entrance/exits as shown on the Contract Drawings.

3. Filter fabric silt fence shall be installed and maintained at locations shown on the Contract Drawings.

4. All soil erosion and sediment control measures shall be maintained until all work under this Contract is completed.

5. The Contractor shall, as necessary, notify the Philadelphia Water Department upon commencement and completion of the project.

3.4 UTILITIES

A. GENERAL

1. Existing utilities service shall not be interrupted unless authorized in writing by authorities having jurisdiction and the owner of the utility. Any temporary interruption necessary shall be directly coordinated and supervised by utility company personnel. The Contractor shall provide temporary services during interruptions to existing utilities, as acceptable to governing authorities and the affected utility companies.

B. MAINTENANCE

1. The Contractor shall maintain and protect from damage all existing above and below ground utilities that are to remain. Other utilities to remain include, but are not necessarily limited to, above ground utility lines and transformers within the public right-of-ways. The Contractor shall immediately repair or have repaired by the appropriate utility company any damage incurred by utilities during demolition work

at no cost to the utility owner or the Owner. Prior to demolition, the Contractor shall be responsible for notifying and coordinating the shut-off of abandoned utilities with the appropriate utility companies.

C. ABANDONMENT/REMOVAL

1. The Contractor shall disconnect and cap/terminate all services including but not limited to water, storm and sanitary sewers, gas, electric, telephone, cable TV, etc. prior to demolition. The Contractor shall determine if utility laterals are direct and exclusive to the building before disconnection is performed.

2. Prior to removal, all utilities and sewers shall be properly purged and evacuated of all residual gases, oils, etc. or de-energized in the case of electric, telephone or other communications services. All purging and testing shall be approved by local utility companies and governing authorities having jurisdiction.

3. The Contractor or appropriate utility company (if required) shall seal and/or plug the ends of all disconnected utilities where indicated on the plan or, if not indicated, at the Contract limit line with lean concrete, gasketed blank steel seal plates, or other measures as recommended and required by the utility company or Consultant. All plugs shall be inspected by the Consultant and appropriate utility company prior to backfilling.

4. All utility disconnections shall be performed no later than 15 days prior to the scheduled start of demolition and must precede the demolition permit application procedure.

D. RESTORATION

1. All underground utility lateral removals shall be properly backfilled using suitable compacted on-site soils. All disturbed pavements within the public right-of-way shall be restored to their pre-demolition (existing) condition. This includes the restoration of concrete pavement, concrete curbing, and asphalt pavement within the public right-of-way. All pavement and curbing shall be saw cut prior to excavation in order to produce a clean and neat edge. Replacement pavement and curbing shall be equal in design performance to the existing condition and as directed by the Consultant and/or the local authority having jurisdiction. All restoration work shall be performed immediately following utility removal and backfill completion.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. GENERAL

1. The Contractor shall remove from the site all debris, rubbish and other materials resulting from demolition (except concrete and brick which may be re-used as backfill) and shall safely and legally dispose of all these items in accordance with applicable Federal, State and local codes and regulations.

2. Recycling of demolition debris is strongly encouraged. All recycling must be done in accordance with all currently applicable State waste flow regulations, County and City requirements. All solid waste as defined by PADEP criteria shall be removed from the site in accordance with all currently applicable land disposal regulations of the State, County, and local levels.

3. Burning of any demolished materials on-site shall not be permitted.

B. SUBMITTALS

1. Written permission shall be obtained from the property owner on whose property the demolition material is to be disposed. Copies of the agreements shall be furnished to the Owner prior to removing any materials from the demolition site.

2. The Contractor shall provide manifests for each truck that exits and enters the site with demolition and construction material to Gilmore and Associates and the Owner. These manifests shall indicate the following:
   - Date and time of departure from the demolition site
   - Type of material carted off-site or type of material brought on-site
   - Amount of material (in tons)
   - Truck I.D. number
   - Final destination of the excess material
   - Date and time of entry to the demolition site
   - Amount of material
   - Source of material brought on-site

C. REMOVAL

1. The Contractor shall legally and safely transport and dispose off-site all demolished materials in accordance with local, State and Federal regulations governing such operations.

2. The Contractor shall be responsible for locating and making arrangements for the safe, legal disposal of demolition material off-site during the entire course of the Contract.

END OF SECTION

SECTION 031100
CONCRETE FORMWORK

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.

B. ACI 301 – Structural Concrete for Buildings

C. ACI 318 – Building Code Requirements for Reinforced Concrete

D. ACI 347 -Recommended Practice for Concrete Formwork

1.2 SUMMARY

A. Section Includes:

1. This Work shall consist of Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

2. Openings for other work.

3. Form Accessories

4. Form Stripping

B. Related Requirements:

1. Section 032000 Concrete reinforcement

2. Section 033000 Cast in Place Concrete

3. Section 321313 Portland Cement Concrete Paving

C. Design Requirements

1. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

D. Quality Assurance

1. Perform Work in accordance with ACI 347, 301, and 318.

2. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Commonwealth of Pennsylvania

PART 2 – PRODUCTS

2.1 WOOD FORM MAERIALS

A. Form Materials: At the discretion of the Contractor.

B. Lumber: Hem-Fir species; #2 grade; with grade stamp clearly visible.

2.2 FORM ACCESSORIES

A. Form Ties: Looped snap-off type, galvanized metal, with 1-1/2" breakback incorporating a water stop washer (required for walls which are to retain liquids) or removable metal type of fixed length; free of defects that could leave holes larger than 1-1/4 inch in concrete surface.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Corners: Chamfered, wood strip type; 3/4 x 3/4 inch size, maximum possible lengths.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

E. Water stops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 6 inches wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; manufactured specifically as a water stop at a concrete cold joint.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTHFORMS

A. Earth forms are not permitted except for footings. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

F. Provide chamfer strips on external corners of walls.

G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

H. Coordinate this section with other sections of work which require attachment of components to formwork.

I. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.4 APPLICATION – FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate with work of other Sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops in accordance with manufacturer's instructions continuous without displacing reinforcement; heat seal joints watertight.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

A. Quality Control: Field inspection and testing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 032000
CONCRETE REINFORCEMENT

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.

B. ACI 301 – Structural Concrete for Buildings

C. ACI 318 – Building Code Requirements for Reinforced Concrete

D. ACI 347 -Recommended Practice for Concrete Formwork

E. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement

F. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement

G. ASTM A775 - Epoxy-Coated Reinforcing Steel Bars

H. ASTM D3963 - Epoxy-Coated Reinforcing Steel

I. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice

J. CRSI 63 - Recommended Practice for Placing Reinforcing Bars

K. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature

1.2 SUMMARY

A. Section Includes:

1. This Work shall consist of Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

2. Openings for other work.

3. Form Accessories

4. Form Stripping

B. Related Requirements:

1. Section 031100 Concrete Formwork

2. Section 033000 Cast in Place Concrete

3. Section 321313 Portland Cement Concrete Paving

4. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

C. Quality Assurance

1. Perform Work in accordance with ACI 347, 301, and 318.

2. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Commonwealth of Pennsylvania

1.3 SUBMITTALS FOR REVIEW

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer's data, and/or product data in accordance with the General Conditions, GC-4.11 and Supplementary Conditions, SC-19.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules and supporting and spacing devices.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, and ACI 318. Maintain one copy of each document on site.

B. Provide Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

C. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the Commonwealth of Pennsylvania.

D. Welders: Certificates: Submit Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 – PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, epoxy coated in accordance with ASTM D3963 and A775 finish.

B. Welded Steel Wire Fabric: ASTM A185 Plain Type in flat sheets, unfinished.

2.2 ACCESSORIES

A. Tie Wire: Minimum 16 gage annealed type, epoxy coated.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.

B. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Engineer.

PART 3 – EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Conform to ACI 318 code for concrete cover over reinforcement.

END OF SECTION

SECTION 033000 – CAST IN PLACE CONCRETE

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. This Work shall consist of Cast in Place Concrete for items including, but not limited to:

a. Floors and Foundations

b. Walkways, Curbs and Stairs

c. Control, expansion and contraction joint devices associated with concrete work, including joint sealants.

d. Equipment pads, light pole foundations and thrust blocks.

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Dept. of Transportation Publication 408 Specifications

2. ACI 301 – Structural Concrete for Buildings

3. ACI 302 – Guide for Concrete Floor and Slab Construction

4. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

5. ACI 305R – Hot Weather Concreting

6. ACI 306R – Cold Weather Concreting

7. ACI 308 – Standard Practice of Curing Concrete

8. ASTM C31 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

9. ASTM C33 – Concrete Aggregates

10. ASTM C39- Test Method for Compressive Strength of Cylindrical Concrete Specimens

11. ASTM C42 - Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

12. ASTM C94 – Ready Mixed Concrete

13. ASTM C150– Portland Cement

14. ASTM C172 - Method of Sampling Fresh Mixed Concrete

15. ASTM C260 - Air Entraining Admixtures for Concrete

16. ASTM C494 - Chemical Admixtures for Concrete

17. ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

18. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

B. Related Requirements:

1. Section 031100 Concrete Formwork

2. Section 032000 Concrete Reinforcement

3. Section 321313 Portland Cement Concrete Paving

C. Quality Assurance

1. Perform Work in accordance with ACI.

2. Perform Work in accordance with PennDOT 408.

3. Acquire cement and aggregate from same source for all Work.

4. Conform to ACI 305R when concreting during hot weather.

5. Conform to ACI 306R when concreting during cold weather.

1.4 SUBMITTALS FOR REVIEW

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer’s data, and/or product data in accordance with Division 01.

B. Accurately record actual locations of embedded utilities and components which are concealed from view.

C. Concrete mixtures.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I – Normal or Type III – High Early Strength, Portland type.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.2 ADD MIXTURES

A. Air Entrainment: ASTM C260

B. Chemical: ASTM C494 – Type A – Water Reducing, Type C – Accelerating, Type E – Water Reducing and Accelerating.

C. Fly Ash: ASTM C618

2.3 ACCESSORIES

A. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 inch thick; tongue and groove profile.

2.5 CONCRETE MIX

A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.

B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.

C. Provide concrete to the following criteria:

1. Comprehensive Strength (28 Days): 4,500 psi (for footings and pedestals), 4,000 psi (for reinforced concrete slab-on-grade, paving, stairs, and cut-off walls)

2. Water/Cement Ratio (maximum): 0.45 by weight (mass)

3. Aggregate Size (maximum): Conform to ASTM C33

4. Air Entrained: 5-7 percent

5. Slump-Plus or minus 1 inch (25 mm): 4 inches

D. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Use calcium chloride only when approved by Engineer.

F. Use set retarding admixtures during hot weather only when approved by Engineer.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.
B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 304.

B. Notify Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

D. Place floor slabs in checkerboard or saw cut pattern indicated.

E. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.

F. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

G. Screed walkways and other concrete walking surfaces to slopes as indicated on the plans, but not to exceed 1/4 inch per 1 foot (2.0%) cross pitch in the direction of travel. Maintain surface flatness of maximum 1/4 inch in 10 ft.

3.4 CONCRETE FINISHING

A. Provide formed concrete walls with smooth rubbed finish.

B. Finish concrete floor surfaces in accordance with ACI 301.

C. Steel trowel surfaces which are scheduled to be exposed.

D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.5 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 308.

3.6 FIELD QUALITY CONTROL

A. Quality Assurance: Field inspection and testing.

B. Provide free access to Work and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to Engineer and inspection and testing firm for review prior to commencement of Work.

3.7 FIELD TESTS OF CONCRETE DURING CONSTRUCTION BY CONTRACTOR

A. Contractor shall obtain the following tests and provide testing data to the Owner and Engineer

A. Sample concrete in accordance with ASTM C172. One test for slump, air entrainment and air and concrete temperature will be taken for each set of test cylinders taken.

B. A minimum of six (6) – 6”x12” or nine (9) – 4”x8” concrete test cylinders will be prepared and cured in accordance with ASTM C31 for every 50 or less cubic yards of each class of concrete placed.

C. Cylinders shall be tested in accordance with ASTM C39 at the following schedule:

1. 2 @ 7 days, 2 @ 28 days and 2 held in reserve for 6”x12” cylinders and;

2. 3 @ 7 days, 3 @ 28 days and 3 held in reserve for 4”x8” cylinders.

D. A minimum of one (1) additional set of test cylinders will be taken during cold weather or hot weather concreting or if high-early strength concrete is used and be cured on job site under same conditions as concrete it represents.

E. If test cylinders fail to meet strength requirements, the Engineer may require core tests in accordance with ASTM C42 at the expense of Contractor.

F. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

3.8 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections in accordance with ACI 301.

D. Remove or break off form ties for walls and seal openings with non-shrink grout providing a smooth finish.

3.9 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

SECTION 055213
PIPE AND TUBE RAILINGS

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. Steel pipe railings.

B. Related Sections:

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Concentrated load of 200 lbf (0.89 kN) applied in any direction.

2. Infill of Guards:

   a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
   b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. 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 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products, including MSDS

B. Sustainable Design Submittals:

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Laboratory Test Reports: For primers, documentation indicating that products 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."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer and testing agency.

B. Welding certificates.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION AND SCHEDULING

A. Coordinate installation of railing with installation of concrete stairs and walls.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

C. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.2 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.3 FASTENERS

A. General: Provide the following:

1. Hot-Dip Galvanized Railings: Hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of

construction indicated and capable of withstanding design loads, and compatible with materials being joined.

C. Provide hot-dip galvanized 1” round washers all bolted connections.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 and, where indicated, flat washers. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Anchors capable of sustaining, 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/E 488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete at stair nosings and top of stem walls: Either threaded type or wedge type unless otherwise indicated; 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, all hot-dip galvanized per ASTM F 2329.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3500 psi

2.4 MISCELLANEOUS MATERIALS

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

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.5 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage**,** but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. 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.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form changes in direction as follows:

1. As detailed.
2. By bending

J. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes..

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
4. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS.

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations no farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.3 ANCHORING POSTS

A. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

B. Anchor posts to concrete with sleeves with pourable grout.

1. Install sleeves in concrete formwork. Set post in sleeve and pour grout to surface.

3.4 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.5 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 079200
JOINT SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 SECTION DESCRIPTION

A. The Work of this Section Includes:

1. Providing all materials, labor and equipment to seal and caulk all joints related to new work (paving, walls, etc.) as indicated on the Drawings and Specifications.

1.2 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Section 033000 Cast-In-Place Concrete

2. Section 321313 Portland Cement Concrete Paving

1.3 REFERENCES

A. American Society for Testing of Materials (ASTM)

1. ASTM C920 – Standard Specification for Elastomeric Joint Sealants

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be thoroughly trained, experienced and completely familiar with the specified requirements and methods needed for proper performance of the work of this section.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer. The same sealant product shall be used for all exterior joints.

1.5 SUBMITTALS

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer’s data, and/or product data in accordance with Division 01.

B. Product Data: For each joint-sealant product indicated in this Section and other Sections.

C. Color Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view. Landscape Architect shall select sealant colors for various applications for the project from the manufacturer’s full range of colors.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. Warranties: Special warranties specified in this Section.

F. Samples: Submit samples of each sealant and each backing material to be used.

1.6 PRODUCT HANDLING

A. Ship and store materials in manner to prevent damage to containers and materials.

B. Do not use material which has exceeded the shelf life recommended by its Manufacturer.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and/or substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 SEALANTS

A. Provide sealants meeting ASTM C920 and with the following criteria:

1. Type: Two-Part or Multi-Component Urethane

2. Grades: P (Pourable) or NS (Non-Sag)

3. Capability Class: Class 25

4. Uses:

a. Paving: T (Traffic)

b. Structure/Masonry/Walls: NT (Non-Traffic) or M (Mortar)

B. Approved manufacturers and products:

1. Tremco Incorporated:

a. Paving: THC –900/901.

b. Structure/Masonry/Walls: Dymeric™ 240FC

2. Sika Corporation:

   a. Paving: Sikaflex®-2 C NS TG

   b. Structure/Masonry/Walls: Sikaflex®-2 C NS EZ Mix

3. Or approved equal.

C. Colors: Colors for each sealant installation will be selected by Landscape Architect from manufacturer's full range of colors.

2.2 PRIMERS

A. Use only those primers which have been tested for durability on the surfaces to be sealed and are specifically recommended for this installation by the Manufacturer of the sealant used.

2.3 BACKUP MATERIALS

A. Use only those backup materials which are specifically recommended for this installation by the Manufacturer of the sealant used, which are non-absorbent, and which are non-staining.

2.4 MASKING TAPE

A. For masking around joints, provide an appropriate masking tape which will effectively prevent application of sealant or surfaces not scheduled to receive it, and which is removable without damage to substrate.

2.5 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by Contractor and recommended by the Manufacturer subject to the approval of Landscape Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected. Proceeding with the installation will be considered an acceptance of the surfaces.

3.2 PREPARATION

A. Do all surface preparation and priming required and recommended by the Manufacturer.

3.3 INSTALLATION OF BACKUP MATERIAL

A. When using backup of tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock. Install in accordance with the Manufacturer's recommendations.

3.4 PRIMING

A. Use only the primer approved by Landscape Architect for the particular installation, applying in strict accordance with the Manufacturer's recommendations as approved by Landscape Architect.

3.5 BOND-BREAKER INSTALLATION

A. Provide an approved bond-breaker where recommended by the Manufacturer of the sealant, and where directed by Landscape Architect, adhering strictly to the Manufacturer's installation recommendations.

3.6 INSTALLATION OF SEALANTS

A. Prior to start of installation in each joint, verify the joint type according to details on the Drawings, or as otherwise directed by Landscape Architect, and verify that the required proportion of width of joint to depth of joint has been secured.

B. Equipment:

1. Apply sealant under pressure with power-actuated hand gun or manually operated hand gun, or by other appropriate means.

2. Use gun with nozzle of proper size, and providing sufficient pressure to completely fill the joints as designed.

C. Thoroughly and completely mask joints where the appearance of primer or sealant on adjacent surfaces would be objectionable.

D. Install the sealant in strict accordance with the Manufacturer's recommendations, thoroughly filling joints to the recommended depth.

E. Tool joints to the profile shown-on the Drawings, or as otherwise required if such profiles are not shown on the Drawings. Hollow joints will be rejected. Finished caulking beads shall be free of wrinkles, runs and similar surface imperfections.

F. Clean Up:

1. Remove masking tape immediately after joints have been tooled.

2. Clean adjacent surfaces free from sealant as the installation progresses, using solvent or cleaning agent recommended by the Manufacturer of the sealant used.

3. Upon completion of the work of this Section, promptly remove from the job site all debris, empty containers, and surplus material derived from this portion of the Work.

END OF SECTION

SECTION 116500
PLAY AREA EQUIPMENT

PART 1 - GENERAL

1.1 Description:

Furnish all labor, materials and equipment required to install the play equipment and structures as indicated on the drawings or as approved and specified herein. The work shall include any incidentals required to provide a finished job. The play equipment is being provided by the City of Philadelphia. The contractor shall take delivery of such equipment, store it, and protect it until it is installed by the contractor.

1.2 Related Sections:

A. Applicable Sections: Division 1

B. Section 321210 - Poured-In-Place Safety Surfacing

C. Section 033000 - Cast-In-Place Concrete

1.3 Submittals:

A. None.

1.4 Guarantee:

A. The contractor shall guarantee the materials and workmanship for the installation of the play equipment for 12 months.

1.5 Safety Guidelines and Standards:

A. All materials and equipment shall conform to the current issue of the "*Handbook for Public Playground Safety*" published by the Consumer Product Safety Commission (C.P.S.C.) and ASTM F1487-01. The manufacturer and installation contractor shall be responsible for correcting any product violations of the C.P.S.C. Guidelines and ASTM F1487-01, to the satisfaction of the Engineer, should they be found after installation.

B. ADA Accessibility Guidelines (ADAAG) Section 15.6 Play Areas.

1.6 Quality Assurance:

A. The Contractor installing the play equipment and structures must be experienced in the installation of play equipment with the personnel, facilities, and equipment adequate for the work specified, and shall, within 48 hours of the Design Professional’s request, produce written proof of such.

PART 2 - PRODUCTS

2.1 General:

A. Play equipment is to be provided by the City of Philadelphia.

2.2 Concrete:

A. Furnish and install concrete footings for the play equipment structures as indicated on the drawings.

B. Concrete footings shall have a minimum strength of 3,000 psi at 28-days.

2.3 Additional Hardware:

A. Additional hardware shall be provided in sufficient quantity to complete assembly of the play equipment. All hardware shall be non-ferrous or if ferrous material is used shall be galvanized, electrostatic zinc plated or polyester powder coated in accordance with the approved manufacturer's standard. Provide the Design Professional with any and all maintenance and repair supplies installation manuals, tool kits and materials shipped with each product for the Owner's inventory.

PART 3 - EXECUTION

3.1 Play Equipment Delivery and Storage:

A. The play equipment as noted on the drawings is being provided by the City of Philadelphia.

B. The Contractor will take receive and take delivery of the play equipment and associated accessories from the manufacturer.

C. The Contractor, after receiving the play equipment, will store and protect the play equipment and accessories until such time as it can be installed at the project site. If the play equipment is to be stored at a location off of the project site, the contractor shall include the delivery of the play equipment and accessories from the storage location to the project site.

3.2 Examination of work area - Examine the areas and conditions under which work of this Section will be performed. Verify safety zones of all equipment before setting posts in concrete footings. Do not proceed until conditions detrimental to proper and timely completion of the work have been satisfactorily corrected and thus meet the manufacturer's instructions and the requirements of paragraph 1.5 above. Beginning work constitutes acceptance of conditions as satisfactory.

3.3 Installation of Compound Structures and Independent Activities:

A. Conform strictly to manufacturer's instructions using all appropriate materials, tools, and accessories as required. Use only experienced personnel trained in play equipment construction. Layout all equipment prior to construction to ensure compliance with safety zone clearances.

B. Provide all concrete footings as required to properly place the equipment components. It is the Contractor's responsibility to adjust drainage pipe or other new utility locations to accommodate the equipment footings.

3.4 Protection:

A. During construction of the play equipment structures, provide PVC web fence material in sufficient quantities and wrap the structures to prevent public access onto the equipment. Maintain the fencing wrap after completion of the play equipment and safety surfacing installation through Physical Completion of the project.

3.5 Inspection:

A. Following the Design Professional's inspection of the completed play equipment installation, perform repairs as necessary to meet or exceed the Design Professional's requirements for fit and finish and the specifications and guidelines as referenced in 1.5 Safety Guidelines and Standards, above.

3.6 Guarantees:

A. The Contractor shall guarantee that all work performed under this section shall be free from any defects in materials and workmanship. Upon notice in writing from the Design Professional to the Contractor within two (2) years of Physical Completion of the project, the Contractor shall, at no cost to the Owner, make all necessary repairs or replacements of the defective work in question. During this period of guarantee, the Owner shall perform normal maintenance and cleaning of the play area equipment.

END OF SECTION

SECTION 129300
SITE FURNISHINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Benches
2. Game Tables
3. Trash Receptacles
4. Bollards

1.3 SUBMITTALS

A. Product data for each item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, and finishes.

B. Physical component samples of materials and finishes for each type of site furnishing.

C. Samples of trash receptacles with modifications as indicated on drawings if a selected alternate.

1.4 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry for freestanding benches and trash receptacles. Coordinate delivery with other work to avoid delay.

B. Single-Source Responsibility: Provide products of same manufacturer for each type of site furnishing.

1.5 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of items.

PART 2 PRODUCTS

2.1 BENCHES

A. 6’ BACKED BENCHES: Model #69-860-3ART, with center armrest with “Fairmount Park” metal panel in center armrest as manufactured by DuMor, Inc, Mifflintown, PA, Phone: (800) 598-4018, www.dumor.com, or approved equal. Provide as shown on plans and details. Benches shall be anchored to concrete pad or footing (as indicated) using manufacturer’s recommended anchors/bolts. Steel shall be polyester powder coated Black.

B. 6’ UNBACKED BENCHES: Model #69-863-3AR, with center armrest with “Fairmount Park” metal panel in center armrest as manufactured by DuMor, Inc, Mifflintown, PA, Phone: (800) 598-4018, www.dumor.com, or approved equal. Provide as shown on plans and details. Benches shall be anchored to concrete pad or footing (as indicated) using manufacturer’s recommended anchors/bolts. Steel shall be polyester powder coated Black.

2.2 PEDESTAL TABLES

A. 3-SEAT PEDESTAL TABLES – Model #101-30 42-inch diameter steel pedestal table with 3 steel chairs attached, as manufactured by DuMor, Inc, Mifflintown, PA, Phone: (800) 598-4018, www.dumor.com, or approved equal. Provide as shown on plans and details. Tables shall be anchored to concrete pad or footing (as indicated) using manufacturer’s recommended anchors/bolts. Steel shall be polyester powder coated Black.

B. 4-SEAT PEDESTAL TABLES – Model #101-40 42-inch diameter steel pedestal table with 4 steel chairs attached, as manufactured by DuMor, Inc, Mifflintown, PA, Phone: (800) 598-4018, www.dumor.com, or approved equal. Provide as shown on plans and details. Tables shall be anchored to concrete pad or footing (as indicated) using manufacturer’s recommended anchors/bolts. Steel shall be polyester powder coated Black.

2.3 TRASH RECEPTACLES

A. 32 GALLON TRASH RECEPTACLE – Model #157-32, as manufactured by DuMor, Inc, Mifflintown, PA, Phone: (800) 598-4018, www.dumor.com, or approved equal, or approved equal. Provide as shown on plans and details. Trash receptacles shall be anchored to concrete pad or footing (as indicated) using manufacturer’s recommended anchors/bolts. Steel shall be polyester powder coated Black.

2.4 COURT BENCHES

A. 6’ ALUMINUM COURT BENCH WITHOUT BACKREST AND IN-GROUND MOUNTING – Model #BE-DD00600 as manufactured by National Recreation Systems, Inc., 1300-D Airport North Office Park Fort Wayne, IN 46825Manufacturing, Phone 888-568-9064, Web: https://bleachers.net, or approved equal. Provide as shown on plans and details. Benches shall be anchored to concrete pad or footing (as indicated) using manufacturer’s recommended anchors/bolts.

1. Framework:

a. Aluminum: Structural fabrication with aluminum alloy 6061-T6 mill finish. Each frame shall be unit-welded, using gas metal arc welding (GMAW) according to AWS specifications (D1.1). After fabrication all steel is hot dipped galvanized to ASTM A-123 specifications.

2. Extruded Aluminum:

a. Seat planks: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II with a wall thickness nominally .078" for impact and deformation resistance.

3. Accessories:

a. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1,AA-M10C22A31,Class II.

b. Hardware: Bolts and Nuts shall be hot dipped galvanized.

c. Hold Down Clip Assembly: Aluminum alloy 6063-T6 mill finish.

2.5 FABRICATION

A. No names or labels are permitted on exposed faces of units. On either interior surface not exposed to view or on back surface, provide identification of item either by a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product model number.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install site furnishings according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

3.2 ADJUSTING AND CLEANING

A. Adjust site furnishings for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION

SECTION 311000
SITE PREPARATION

PART 1 GENERAL

1.1 SUMMARY

A. The work in this section includes:
1. Protecting existing vegetation to remain
2. Removing existing vegetation
3. Clearing and grubbing
4. Stripping and stockpiling topsoil for
5. Removal and disposal of above grade site improvements
6. Salvage of above and below grade site improvements
7. Coordinate wit the owner disconnecting, capping or sealing, removing site utilities or abandoning site utilities in place

1.2 RELATED SECTIONS

A. Section 312010 Earthwork
B. Section 312210 Topsoiling and Finish Grading
C. Section 312310 Excavation, Backfill and Subgrade Preparation for Paving
D. Section 321310 Asphalt Paving
E. Section 321320 Concrete Paving
F. Section 329300 Landscape Planting
G. Section 330110 Protection of Existing Utilities

1.3 JOB CONDITIONS

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

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

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

C. Do not commence site preparation operations until temporary erosion and sediment control and plant protection measures are in place.

1.4 DEFINITIONS

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

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

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in- place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

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

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

F. Demolish: Completely remove and legally dispose of off-site.

G. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.

H. Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

PART 2 PRODUCTS

2.1 MATERIALS

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

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 EXECUTION

3.1 PREPARATION

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

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.

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

3.2 TREE AND PLANT PROTECTION

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

1. Comply with City of Philadelphia Landscape Standards.

2. Maintain fenced area is free of weeds and trash.

C. Do noT excavate within tree protection zones, unless otherwise indicated.

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

1. Cover exposed roots with burlap and water regularly.

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

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

4. Backfill with soil as soon as possible.

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

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

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

3.3 EXISTING UTILITES

A. Coordinate the work of other Contracts with the Owner regarding disconnecting and abandoning existing utilities.

1. Coordinate with the Owner and utility companies to deactivate utilities affected by the work of this Contract.

2. Confirm the Owner has coordinated with Facilities Management, The City of Vermillion and private utility companies to shut off all other utilities which may be indirectly impacted by the work of this contract.

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

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 Owner not less than [seven (7) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.
3. Coordinate with the Owner the relocation of the existing utilities which run under the building slab.
4. Coordinate with the Owner the relocation of electrical service to the well house; relocated service will be provided by the Owner.

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

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 below exposed subgrade for existing plants occurring in areas outside of proposed building and paving areas.
   2. All stumps and roots occurring in areas of the proposed building and pavements are to be completely removed.
   3. Chip removed woody materials and dispose of off-site, or to an on-site stockpile location identified by the Owner.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground

3.5 TOPSOIL STRIPPING

A. After mowing the area within the Contract Limits to a height of 3 inches and removing accumulated organics from the site.

C. Strip topsoil to a minimum depth of six (6) inches.

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

   2. Stockpile topsoil adequate to install a compacted, uniform depth of eight inches (8”) of topsoil in all finished lawn areas and all designated plant bed areas.

D. Stockpile topsoil materials away from the edge of excavations.
   1. Do not intermix topsoil with subsoil
   2. Grade and shape topsoil stockpiles to drain surface water
   3. Install silt fence around stockpile and cover stockpile to prevent wind erosion.
   4. Limit height to width ratio of topsoil stockpiles to prevent sloughing
   5. Do not stockpile topsoil within tree protection zones
   6. Coordinate removal of excess topsoil with owner
      a. Transport excess topsoil to site designated by Owner
      b. Or dispose of excess topsoil as specified for waste material disposal

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

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

2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions.

3.7 SALVAGE

A. Salvage existing above- and below-grade improvements as indicated on the drawings.

B. Deliver all savaged above- and below-grade improvements to a storage location designated by the Owner.

3.8 DISPOSAL OR SURPLUS AND WASTE MATERIALS

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

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION 312010
EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Earthwork, excavation, fill placement and grading to required lines, dimensions, contours and elevations for proposed improvements.

B. Scarifying, compaction, moisture content control and removal of unsuitable material to ensure proper preparation of areas for the proposed improvements.

1.2 RELATED SECTIONS

A. Section 330110 – Protection of Existing Utilities

B. Section 312210 – Topsoiling and Finish Grading

C. Section 312310 – Excavation, Backfill and Subgrade Preparation for Pavement

D. Section 312320 – Trench Excavation and Backfill for Utilities

E. Section 312500 – Soil Erosion and Sediment Control

1.3 REFERENCE STANDARDS

A. ASTM International - latest edition

1. ASTM Standard D422, "Standard Test Method for Particle Size Analysis of Soils," ASTM International West Conshohocken, PA, www.astm.org.

2. ASTM Standard D698, "Standard Test Methods for Laboratory Compaction Characteristics of Soils using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3))," ASTM International, West Conshohocken, PA, www.astm.org.

3. ASTM Standard D1557 "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700kN-m/m^3))," ASTM International, West Conshohocken, PA, www.astm.org.

4. ASTM Standard D2216 "Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass," ASTM International, West Conshohocken, PA, www.astm.org.

5. ASTM Standard D2487 "Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)," ASTM International, West Conshohocken, PA, www.astm.org.

6. ASTM Standard D4253 "Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table," ASTM International, West Conshohocken, PA, www.astm.org.

7. ASTM Standard D4254 "Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density," ASTM International, West Conshohocken, PA, www.astm.org.

8. ASTM Standard D4318 “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils,” ASTM International, West Conshohocken, PA, www.astm.org.

9. ASTM Standard D6938 “Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth),” ASTM International, West Conshohocken, PA, www.astm.org.

1.4 QUALITY ASSURANCE

A. The Contractor shall provide at least one supervisory person who shall be present at all times during execution of the work and who is thoroughly familiar with the type of work being performed and its best methods for completion. This person shall have the authority act on behalf of the Contractor.

B. The Contractor shall comply with any provisions of all applicable codes, regulations and standards.

C. A Geotechnical Engineer, selected and paid by the Owner, shall be retained to perform construction inspection on site based on field testing, visual observation, and judgment. This inspection will not relieve the Contractor from his responsibility to complete the work in accordance with the plans, specifications and recommendations presented in the geotechnical engineering study.

D. Visual field confirmation and density testing of subgrade preparation and fill placement procedures shall be performed by the field Geotechnical Engineer as part of the construction testing requirements.

E. The Geotechnical Engineer shall prepare field reports that indicate compaction test location, elevation data, testing results and acceptability. The Owner, Architect, and Contractor shall be provided with copies of reports within 96 hours of time test was performed.

F. All costs related to re-inspection due to failures shall be paid for by the Contractor at no additional expense to Owner. The Owner reserves the right to direct any inspection that is deemed necessary. Contractor shall provide free access to site for inspection activities.

1.5 SUBMITTALS

A. Within ten days after award of the contract, the Contractor shall submit to the Owner and Engineer a schedule detailing the sequence, and time of completion of all phases of work under this section.

B. At least two weeks in advance of imported fill use, the Contractor shall submit either the following laboratory test data or a 50-pound soil sample to the Geotechnical Engineer for each type of imported soil/gravel material to be used as compacted fill.

1. Moisture and Density Relationship: ASTM D1557.
2. Mechanical Analysis: ASTM D422
3. Plasticity Index: ASTM D 4318

C. Together with the above test data, the Contractor shall submit a 5-pound sample of each type of off-site fill material in an air tight container for the approval of the Geotechnical Engineer.

F. Submit the name of each material supplier and specific type and source of each material. The intended use of each material submitted shall be clearly identified on the Contractor submittal record (i.e. structural fill for building pads, drainage fill for site, general fill for landscaping, etc.). Any change in source or soil type throughout the job requires approval of the Owner and the Geotechnical Engineer.

1.6 ENVIRONMENTAL CONSIDERATIONS

A. Install erosion control measures in the sequence shown on the plans or as directed by either the engineer or regulatory agencies to protect adjacent properties and water resources from erosion and sediment damage. Erosion and control measures shall also comply with both the technical specifications and the Construction Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. On-site fill

1. On-site materials for use as fill may consist of excavated soil from other portions of the site. Refer to the geotechnical engineering study for appropriate uses of on-site materials for fill during construction.

2. Excavated material containing rock or stone greater than 4 inches in largest dimension is unacceptable as fill within the proposed building area.

3. Rock or stone greater than 2 inches in its largest dimension may be mixed with suitable material and used as fill up to 2 feet below beneath the proposed pavement subgrade elevation at the discretion of the Geotechnical Engineer. The fill must be mixed, placed and compacted such that voids will be minimized. All structural fill placed in the final 2 feet of building pads and roadways shall not contain any materials larger than 2 inches in its largest dimension.

4. Particle-size distribution, maximum dry density, plasticity index, and optimum water content soils' laboratory testing should be made on representative samples of all onsite materials proposed for use as structural, drainage and general fill onsite by the Contractor. All onsite fill is subject to inspection and approval by the on-site geotechnical engineer prior to reuse onsite. Components of the native soils deemed unsuitable by the on-site geotechnical engineer should only be used as directed by the geotechnical engineer.

5. Rock may be broken and/or crushed on-site to meet the above size requirements.

6. Prior to placement, on-site fill shall not contain:

a. Debris other than crushed concrete and brick meeting the above requirements.
b. Timber or Railroad Ties.
c. Organic Soils.

d. Hazardous substances, pollutants, and contaminants.
e. Other deleterious materials such as steel rails, rebar, trash, etc.

7. Unsuitable and deleterious materials and debris shall be disposed of off-site in accordance with all applicable regulations, at no cost to the Owner.

B. Off-site imported fill

1. If necessary, off-site fill shall be obtained and provided by the Contractor. Particle-size distribution, maximum dry density, plasticity index, and optimum water content soils' laboratory testing should be made on representative samples of all imported fill materials proposed by the Contractor. The Contractor should provide the Owner with proper certification that all imported fill is environmentally clean in accordance with appropriate and applicable local, state, and Federal statutes.

2. Material imported for use as "structural fill" should consist of a well-graded sand and/or gravel having less than 15% by dry weight passing the No. 200 sieve, have a maximum particle size of 2 inches, and be free of clay clods, organic materials, waste debris, or other deleterious material.

3. Materials imported for use as "general fill" should be granular soils with less than 25% by dry weight passing the No. 200 sieve, have a maximum particle size of 4 inches, and be free of clay clods, organic materials, waste debris, or other deleterious material.

4. "Drainage fill" should consist of clean ¾-inch crushed stone and be free of other deleterious materials. Excavated rock which has been crushed and processed on-site is not permitted for use as drainage fill.

5. A sample of any off-site fill material shall be provided to the Owner or his representative along with laboratory testing results and the Contractor shall obtain approval prior to moving material on-site.

6. Imported fill shall be free of all hazardous substances as listed by the Pennsylvania Department of Environmental Protection. Certification of compliance and, if requested, test results substantiating compliance shall be furnished to the Owner and Geotechnical Engineer by the Contractor not less than one week prior to its intended use.

7. The Owner reserves the right to test off-site imported fill material for conformance with these specifications.

C. Topsoil fill as specified in Section 312210 – Topsoiling and Finish Grading

2.2 EQUIPMENT

A. Compactor - Minimum 5 ton static drum weight vibratory roller (Hypac C830C, Caterpillar CS-54, Bomag BW177D-40, or approved equal).

B. Compactor – Smaller compaction equipment may be used where access or maneuverability is limited. However, the loose lift thickness of the fill must be reduced commensurate to the type and size of the compactor. The final lift thickness shall be determined by the on-site geotechnical engineer.

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to all work of this section, the Contractor shall become thoroughly familiar with the site, site conditions, and all portions of the work falling within this section.

B. The Contractor shall refer to the soil erosion and sediment control plans for staging of earthwork operations and for erosion control measures to be implemented prior to commencement of earthwork.

C. Identify existing utilities that are to remain and protect them from damage.

D. Notify utility companies to permit removal and/or relocation of any utilities that are in conflict with the proposed improvements.

E. Protect fences, structures, sidewalks, paving, curbs, etc. to remain from equipment and vehicular traffic.

F. Protect benchmarks, property corners and all other survey monuments from damage. If a marker needs to be relocated it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same licensed land surveyor at no additional cost to the Owner.

G. Remove from the site, material encountered in grading operations that, in opinion of Owner or Owners Site/Civil Engineer, is unsuitable or undesirable for backfilling in subgrade or foundation purposes. Dispose of in a manner satisfactory to Owner and in accordance with all applicable regulations. Backfill areas with layers of suitable material and compact as specified.

3.2 GENERAL

A. Identify required lines, levels, contours and datum to bring site grades to the proposed subgrade conditions indicated on the drawings.

B. Do not allow or cause any of the work performed or installed to be covered by work of this section prior to all inspections, tests and approvals.

C. By submitting his bid, the Contractor represents that he has reviewed the information provided and investigated the site to determine type, quantity, quality, and character of excavation work to be performed. All excavation shall be considered unclassified excavation.

D. Perform excavation using capable, well maintained machinery and equipment using methods acceptable to the Owner and governing agencies.

E. The Contractor shall provide adequate soil moisture to properly compact the soil. This may require either adding moisture if the soil is deficient or discing the soil if moisture is excessive.

F. Protect persons and property from damage and discomfort caused by dust. Water as necessary to subdue dust.

G. Allow no debris to accumulate on-site. Haul debris away from the site and dispose of at no cost to the Owner.

H. Dispose of excess earth material from the site at no cost to the Owner.

3.3 COMPACTION OF SUBGRADE SURFACES

A. All existing grades below building areas shall be proof-rolled and compacted with a minimum of 2 passes using a fully-loaded tri-axle dump truck with a carrying capacity of 12 to 15 cubic yards roller prior to placement of any subgrade fill, concrete footings, or slab-on-grade. Existing areas which exhibit "pumping" or "rutting" under the action of the dump truck shall be removed and replaced with suitable fill material, as directed by the Geotechnical Engineer.

B. Prior to preparing the subgrade in low-lying areas or deep excavations, perform the following procedures:

1. Drain standing water by gravity or with a pump. Drainage using wells/well points may be required where the water table is high. Water should not be discharged directly to a storm drain system.

2. After drainage of low area is complete, remove muck, mud, debris, and other unsuitable material using equipment and methods that will minimize disturbance to the underlying soils.

3. Thoroughly compact subgrade as described above.

4. If proposed for re-use as on-site fill, all muck, mud and other materials removed from above low areas shall be dried on-site by spreading in thin layers for observation by Owner or Owner's representative. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under the building area, within 30 feet of the perimeter of the building pad, or within 3 feet of the paving subgrade elevation. If, after observation by Owner or Site/Civil Engineer, material is found to be unsuitable, it shall be removed from the site at no cost to the Owner.

3.4 FILL PLACEMENT AND COMPACTION

A. No fill materials shall be placed during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until all saturated surficial soils are returned to satisfactory moisture content as determined by the Geotechnical Engineer.

B. Place and compact approved fill materials in 12-inch thick maximum loose lifts using a minimum of 6 passes with the previously specified 5-ton static drum weight compactor and achieve the minimum in-place density specified above. Smaller compaction equipment, together with thinner lifts, may be necessary at areas of limited maneuverability.

C. Visual confirmation of fill quality, lift thickness and compaction procedures, together with in-place density testing, shall determine the acceptability of fill. Any unsatisfactory material or soft areas exhibiting excessive weaving shall be immediately removed, replaced and re-compacted as stated above to the satisfaction of the Geotechnical Engineer.

D. No fill material shall be placed in areas that have not been approved by the Geotechnical Engineer.

3.5 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified by the Contractor to ensure proper elevation and conditions for construction above subgrade. Grade lawns, walks, and unpaved subgrades to tolerances of plus or minus 1 inch and pavements to plus or minus ½ inch.

B. Protect subgrade from excessive construction traffic and wheel loading. Protect subgrade from unfavorable weather such as precipitation or cold temperatures that will soften or freeze subgrades.

C. Remove areas of finished subgrade judged to be unsatisfactory to the depth necessary and replace in a manner that will comply with compaction requirements by use of material equal to or better than the best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section. See section 02920 Soil Preparation and Mixes for subgrade scarifying requirements in planting areas

3.6 FINISH GRADING

A. For setting and establishing finish elevations and lines, the Contractor will secure the services of a licensed land surveyor acceptable to the Owner and Engineer.

B. Provide elevation grade stakes and any other surveying necessary for the layout of the work. The Contractor shall conduct his work in such a manner that survey stakes will be protected as long as their need exists. Grade stakes, which are damaged or stolen, shall be replaced by the Contractor's surveyor at the Contractor's expense.

C. Graded areas shall be uniform, hard and smooth, free from rock, debris, or irregular surface changes. Finished subgrade surface shall not be more than ½-inch above or below the design finished subgrade elevation; any deviation shall not result in changes in drainage areas or ponding. All ground surfaces shall vary uniformly between indicated elevations. Finish drainage ditches shall be graded to allow for proper drainage without ponding and in a manner that will minimize the potential for erosion.

D. Areas having drainage slopes of one-quarter inch per foot or more shall have grade stakes, set with an instrument, at grid intervals of fifty (50) feet.

E. Areas having drainage slopes of one-quarter inch per foot or less shall have grade stakes, set with an instrument, at grid intervals of twenty-five (25) feet.

F. Correct all settlement and eroded areas for one year after date of project completion at no additional expense to Owner. Bring paved and landscaped areas to proper elevation. Replant or replace any grass, shrubs, bushes, or other vegetation disturbed by construction using corrective measures.

END OF SECTION

SECTION 312210

TOPSOILING AND FINISH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this Section includes, but is not limited to preparation of subgrade to receive topsoil, placing topsoil, and finish grading in preparation for lawn seeding, sodding, or planting.

1.2 RELATED SECTIONS

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

B. Related Specification Sections include:

1. Applicable Sections of Division 01
2. Section 312010 - Earthwork
3. Section 312500 - Erosion and Sediment Control
4. Section 311000 - Site Preparation
5. Section 312300 - Trench Excavation and Backfill for Utilities
6. Section 312310 - Excavation, Backfill & Subgrade Preparation for Pavement
7. Section 329300 - Landscape Planting
8. Section 329200 - Lawns and Grasses

1.3 QUALITY ASSURANCE

A. Testing Agency:

1. The Contractor has the option to use soil testing to justify decreasing lime and fertilizer rates. When soil testing is selected by the Contractor, the soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Landscape Architect.

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) International

1. ASTM D5268 – Standard Specification for Topsoil Used for Landscaping Purposes

B. Pennsylvania Department of Transportation:

1. Publication 408 Specifications

C. Commonwealth of Pennsylvania:

1. Agricultural Liming Materials Act of 1978, P.L. 15, No. 9 (3P.S. 132-1), as amended.
2. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended.'

1.5 SUBMITTALS

A. Samples:

1. When directed, furnish three strips of sod, 4-1/2 feet long by 12" wide, laid on 3" of topsoil and tamped in place in accordance with Section 01 33 00. The samples shall be representative of the sod and workmanship to be provided.

B. Certificates:

1. Prior to use or placement of material, submit certifications of material composition of the following for approval:

(a) Topsoil analysis

(b) If soil tests are performed to justify decreased liming and fertilizer rates, submit certified soil sample analyses, including laboratory's recommend soil supplement formulation.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Imported topsoil shall be installed within (3) days of delivery to the site. Protect imported topsoil stockpile from weather. Comply with erosion control requirements.

B. Division 01, also addresses Storage and Protection of Materials and Equipment.

PART 2 - **PRODUCTS**

2.1 TOPSOIL SOURCES

A. Existing on project site topsoil may be used for lawns, planting and transplanting work. Existing on project site topsoil shall be prepared as specified in other paragraphs in the Section or other related Sections.

B. Contractor shall determine if quantities of existing on site topsoil are sufficient to meet specified depths for proposed work. If quantities are insufficient contractor shall import screened topsoil as required to complete work from an off-site source approved by the Landscape Architect. Off project site topsoil shall meet the requirements as specified under paragraph 2.02.

2.2 TOPSOIL

A. Existing on project site topsoil: Natural, fertile soil not in frozen or muddy condition. Free from subsoil, clay, stones greater than 1-inch in diameter, lumps, live plants, foreign matter, and any material that may be harmful to plant growth.

B. Imported topsoil: Natural, friable loam typical of productive soils in the locality, capable of sustaining vigorous plant growth, from a well drained site free of flooding, not in frozen or muddy condition. Imported topsoil shall also meet the following criteria:

1. Not less than 2% nor more than 10% organic matter content as determined by AASHTO T194.

2. Have a pH value of 6.0 to 7.0.

3. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, foreign matter and any material that may be harmful to plant growth.

4. Free of pests, pest larvae, and matter toxic to plants.

5. Contains no stones greater than 1 inch in diameter.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE

A. "Hard pan" or heavy shale:

1. Plow to minimum depth of 6".
2. Loosen and grade by harrowing, discing, or dragging.
3. Hand rake subgrade. Remove stones over 1 inch in diameter and other debris.

B. Loose loam, sandy loam, or light clay:

1. Loosen and grade by harrowing, discing, or dragging.
2. Hand rake subgrade. Remove rocks over 1 inch in diameter and other debris.

3.2 PLACING TOPSOIL

A. Topsoil shall not be placed while the topsoil is in a frozen or muddy condition, when the subsoil is excessively wet or in a condition that may otherwise be detrimental to proper finish grading and seedbed preparation.

B. Replace topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation. Final compacted thickness shall be the following:

1. Seeded lawn: 6 inches.
2. Sodded lawn: 4 inches.
3. Vegetative planting beds: 6 inches.

C. Hand rake topsoil and remove all materials unsuitable or harmful to plant growth.

D. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry.

E. Do not handle topsoil when frozen or muddy.

3.3 FINISH GRADING

A. Remove unsuitable material larger than 1 inch in any dimension.

B. Uniformly grade surface to the required contours without the formation of water pockets.

C. Rework and re-rake areas which puddle by the addition of topsoil.

END OF SECTION

SECTION 312310
EXCAVATION, BACKFILL & SUBGRADE PREPARATION FOR PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Excavate and backfill to line, grade and configuration as shown in the plans and as described in these specifications for proposed pavement areas.

B. Proofrolling and removal of unsuitable material beneath proposed paved areas.

C. Remove existing pavement when necessary within the Work Area.

D. Proper compaction of subgrade materials as in accordance with Section 31 20 10 - Earthwork.

1.2 RELATED SECTIONS

A. Section 312500 - Soil Erosion and Sediment Control

B. Section 330110 – Protection of Existing Utilities

C. Section 312010 - Earthwork

D. Section 321210 – Poured in Place Safety Surface

E. Section 321310 – Asphalt Paving

F. Section 321320 – Concrete Paving

1.3 REFERENCE STANDARDS

A. ASTM International - latest edition

1. ASTM Standard D422, “Standard Test Method for Particle Size Analysis of Soils,” ASTM International West Conshohocken, PA, www.astm.org.

2. ASTM Standard D698, “Standard Test Methods for Laboratory Compaction Characteristics of Soils using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)),” ASTM International, West Conshohocken, PA, www.astm.org.

3. ASTM Standard D1557 “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700kN-m/m^3)),” ASTM International, West Conshohocken, PA, www.astm.org.

4. ASTM Standard D2216 “Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass,” ASTM International, West Conshohocken, PA, www.astm.org.

5. ASTM Standard D2487 “Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System),” ASTM International, West Conshohocken, PA, www.astm.org.

6. ASTM Standard D4253 “Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table,” ASTM International, West Conshohocken, PA, www.astm.org.

7. ASTM Standard D4254 “Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density,” ASTM International, West Conshohocken, PA, www.astm.org.

8. ASTM Standard D4318 “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils,” ASTM International, West Conshohocken, PA, www.astm.org.

9. ASTM Standard D6938 “Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth),” ASTM International, West Conshohocken, PA, www.astm.org.

1.4 QUALITY ASSURANCE

A. An Owner's Geotechnical Engineer may perform construction testing on filling operations and subgrade preparation as specified in section 312010 and described herein. Refer to Item 1.04 of Section 31 20 10for specific quality assurance requirements. This inspection will not relieve the Contractor from his responsibility to complete the work in accordance with the plans and specifications.

1.5 SUBMITTALS

A. Shop drawings or details pertaining to excavating and filling for structures are not required unless procedures contrary to the project documents are proposed.

B. Submit soil sample or laboratory test information of each type of off-site fill material that is to be used in backfilling as specified in Section 31 20 10 - Earthwork.

PART 2 PRODUCTS

2.1 MATERIALS

A. The fill material must meet the requirements of Section 31 20 10 – Earthwork and be approved by the Geotechnical Engineer.

2.2 EQUIPMENT

A. Excavation is to be performed using capable, well maintained equipment and methods acceptable to the Owner and the Contract Document requirements and schedule.

B. Compactor – Minimum 5 ton static drum weight vibratory (Hypac C830C, Caterpillar CS-54, Bomag BW177D-40, or approved equal).

C. Smaller compaction equipment may be used where access or maneuverability is limited. However, the loose lift thickness of the fill must be reduced commensurate to the type and size of the compactor. The final lift thickness shall be determined by the on-site Geotechnical Engineer.

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall cut or fill to the proposed subgrade elevations based on finished grades and the pavement thicknesses as shown on the Contract Drawings. Subgrade elevations shall be constructed to within ±0.1 feet of the proposed grades specified. Any deviation shall not result in changes to drainage areas or ponding.

3.2 EXCAVATION

A. Where existing grades are above proposed subgrade elevation, excavate materials in the pavement areas to line and grade as shown in the plans being careful not to over excavate beyond the elevations needed.

B. Excavated on-site organic soils shall be disposed of off-site in accordance with all Division 1 Specifications and jurisdictional regulations.

C. Excavated on-site soils, which meet the requirements of specification Section 31 20 10 of these Specifications and approved by the Owner's Geotechnical Engineer may be used as fill on-site.

D. Unsuitable material, such as wood and any other deleterious materials determined to be unsuitable by the Owner or Engineer for use as on-site fill shall be disposed of in accordance with all Division 1 Specifications and jurisdictional regulations

3.3 SUBGRADE PREPARATION

A. Existing grades below areas of proposed pavement shall be leveled prior to fill placement. The Contractor shall remove existing lawn and top soil in these areas prior to placement of any fill and dispose of this material off-site in accordance with all Division 1 Specifications and jurisdictional regulations.

B. All existing grades below areas of proposed pavement shall be proofrolled and compacted with a minimum of 6 passes using the vibratory drum roller specified in part 2.2 of this Section prior to placement of pavement subbase. Refer to Section 31 20 10 - Earthwork, for specific pavement subgrade preparation requirements. Existing areas which exhibit "pumping" or "rutting" under the action of the roller shall be removed and replaced with suitable fill material as specified in Section 31 20 10 of these Specifications, or as directed by the Engineer.

3.4 SUBGRADE FILL PLACEMENT AND COMPACTION

A. Rock larger than two inches (2") in any dimension shall not be part of pavement subgrade fill within 3 feet of pavement subgrade.

B. Fill material shall not be placed in areas that have not been approved by the Geotechnical Engineer.

C. Fill materials shall not be placed during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until all saturated surficial soils are returned to satisfactory moisture content as determined by the Geotechnical Engineer.

D. Moisture content of the fill material during placement shall be as specified by Section 31 20 10.

E. When significant precipitation is forecast, fill lift surfaces shall be made smooth and free from ruts or indentations at the end of any work day to prevent saturation of surficial fill material. Fill surfaces shall be graded to drain and sealed with a smooth drum roller at the completion of each work day.

F. Subgrade fill in paved areas shall be placed in uniform loose lifts and compacted in accordance with Section 31 20 10.

G. Wet, saturated material shall be removed and replaced or scarified and air dried as necessary to achieve the field densities specified in this Section. Drying may be assisted by discing, harrowing, or pulverizing until moisture content is reduced.

H. Prior to paving, the subgrade shall be proofrolled with a minimum of 6 overlapping coverages using a 5-ton static drum weight vibratory roller.

I. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace with suitable compacted fill as approved by the Owner or Owner's Geotechnical Engineer. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.5 QUALITY CONTROL

A. Compaction tests shall be performed as specified in Section 31 20 10 together with the following for areas of proposed pavement:

1. In cut areas, not less than one compaction test for every 10,000 square feet.
2. In fill areas, two tests for every 4,500 square feet for each lift.

B. Prior to paving, the finished subgrades shall be verified by the Contractor to ensure proper elevation and conditions for construction above subgrade.

C. Grading of paving areas shall be checked by string line from grade stakes set at not more than 50 feet, center to center. The subgrade tolerance is plus or minus 0.10 feet. Any deviation from the design grades shall not result in changes in drainage areas or ponding. The Contractor shall provide engineering and field staking necessary for verification of lines, grades, and elevations.

END OF SECTION 02227

SECTION 312320
TRENCH EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Excavating trenches for the installation of utilities.

B. Backfilling trench with bedding material as specified and finish filling trenches with suitable material to either proposed subgrade or proposed finished grade.

C. Compacting subgrade, bedding, and backfill materials in an acceptable manner.

D. Compliance with all environmental and health and safety regulations.+

1.2 RELATED SECTIONS

A. Section 31 20 10 – Earthwork

B. Section 31 25 00 – Soil Erosion and Sedimentation Control

C. Section 33 11 00 – Water Service

D. Section 33 30 10 – Storm Sewers

1.3 REFERENCES

A. ASTM International - latest edition

1. ASTM Standard D422, “Standard Test Method for Particle Size Analysis of Soils,” ASTM International West Conshohocken, PA, www.astm.org.

2. ASTM Standard D698, “Standard Test Methods for Laboratory Compaction Characteristics of Soils using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)),” ASTM International, West Conshohocken, PA, www.astm.org.

3. ASTM Standard D1557 “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700kN-m/m^3)),” ASTM International, West Conshohocken, PA, www.astm.org.

4. ASTM Standard D2216 “Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass,” ASTM International, West Conshohocken, PA, www.astm.org.

5. ASTM Standard D2487 “Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System),” ASTM International, West Conshohocken, PA, www.astm.org.

6. ASTM Standard D4253 “Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table,” ASTM International, West Conshohocken, PA, www.astm.org.

7. ASTM Standard D4254 “Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density,” ASTM International, West Conshohocken, PA, www.astm.org.

8. ASTM Standard D4318 “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils,” ASTM International, West Conshohocken, PA, www.astm.org.

9. ASTM Standard D6938 “Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth),” ASTM International, West Conshohocken, PA, www.astm.org.

1.4 QUALITY ASSURANCE

A Geotechnical Engineer, selected and paid by the Owner, shall be retained to perform construction inspection on site based on field testing, visual observation, and judgment. This inspection will not relieve the Contractor from his responsibility to complete the work in accordance with the plans, specifications and recommendations presented in the geotechnical engineering study.

1.5 SUBMITTALS

A. Shop Drawings or details pertaining to Site Utilities are not required unless use of materials, methods, equipment, or procedures contrary to the Construction Drawings or these specifications are proposed. No work shall be performed until shop drawings, if required, have been accepted by the Owner and Engineer.

B. The Contractor shall contact all utility companies and identify their requirements for protecting their utility. Contractor shall provide written confirmation of the status of all utility construction to the Owner at the time of the preconstruction conference or no later than 30 days following the project possession date.

C. Submit a sample of each type of offsite fill and/or bedding material that is to be used in backfilling in accordance with specification Section 31 20 10 - Earthwork.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of all subsurface utilities, structures and obstructions encountered.

B. Accurately record any as-built variation from the construction plans and specifications. The Contractor shall provide as-built drawings to the Owner within 30 days of project completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Bedding material shall be aggregate number 67 as defined in ASTM Standard D448, “Standard Classification for Sizes of Aggregate for Road and Bridge Construction (current edition),” ASTM International, West Conshohocken, PA, www.astm.org.

B. Backfill material as specified in specification Section 312010 - Earthwork and approved by the Owner and/or the Geotechnical Engineer.

2.2 EQUIPMENT

A. Excavation is to be performed using capable, well maintained equipment and methods acceptable to the Owner and the Contract Document requirements and schedule.

B. Compactors

1. Minimum 2.5-ton total-weight walk-behind vibratory roller (Wacker WDH-86-110, Ramax or equivalent).

2. Minimum 5 ton static drum weight vibratory roller (Hypac C830C, Caterpillar CS-54, Bomag BW177D-40, or approved equal).

C. Smaller compaction equipment may be used where access or maneuverability is limited. However, the loose lift thickness of the fill must be reduced commensurate to the type and size of the compactor. The final lift thickness shall be determined by the on-site geotechnical engineer.

PART 3 EXECUTION

3.1 GENERAL

A. Set all lines, elevations, and grades for utility and drainage system work and maintain for the duration of Work. Provide careful maintenance of benchmarks, property corners, monuments, or other reference points. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same at no cost to the Owner.

B. Protect and maintain in operating condition existing utilities encountered during utility installation. Repair any damage to surface or subsurface improvements shown on Drawings.

C. Verify location, size, elevation, and other pertinent data required to make connections between existing utilities and drainage systems, and proposed construction indicated on Drawings. Coordinate all building utility connection locations and elevations with site-civil, structural, landscape, lighting and architectural plans. Contractor shall comply with all Local codes and regulations.

D. Over-excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas shall be stabilized by using acceptable backfill materials and/or additional bedding material placed and compacted as specified to the satisfaction of Owner’s Geotechnical Engineer.

3.2 EXCAVATION

A. Contact local utility companies before excavation begins. Dig trenches at proper width and depth for laying pipe, conduit, or cable and in accordance with utility

company requirements. Cut trench banks for safety and remove stones as necessary to avoid point-bearing.

B. All trench excavation side walls shall be sloped, shored, sheeted, braced or otherwise supported by means of sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by Local ordinances.

C. Trench width requirements below the top of the pipe shall not be less than 12 inches nor more than 2 feet wider than outside surface of any pipe or conduit that is to be installed. All other trench width requirements for pipe, conduit, or cable shall be the minimum practical width that will allow for proper compaction of trench backfill and satisfy safety and utility company regulations.

D. Accurately grade trench bottom to an elevation 6 inches below the pipe, as per bedding details in construction drawings. Provide uniform bearing and support for each section of pipe on bedding material at every point along the entire length, except where necessary to excavate for bell holes, pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make the joint connection properly.

E. During excavation, stockpile excavated material suitable for backfilling in an orderly manner far enough from the trench to avoid overloading, slides, or cave-ins.

F. Stockpile excavated materials deemed by Geotechnical Engineer and Owner's Engineer to be geotechnical or environmentally unsuitable for backfill, as indicated Section 312010 - Earthwork of these Technical Specifications.

G. Any abandoned structures, utilities or debris discovered during excavation shall be removed and disposed of, abandoned in place by complete filling with grout or sand, or capped subject to review and approval by Owner's Geotechnical Engineer on a case-by-case basis.

H. Utility alignments have been designed to avoid expected obstructions wherever possible. If unanticipated significant obstructions are encountered during utility installation Work immediately notify Owner and Engineer.

I. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods. Coordinate dewatering with any established dewatering effluent limitations.

J. Utility installation shall meet the following minimum pipe installation depths, or applicable codes and ordinances, measured from finished grade or the paved surface.

1. Water Mains: Refer to Construction Drawings and also coordinate with the Philadelphia Water Department

2. Storm Sewer: Refer to Construction Drawings and also coordinate with the Philadelphia Water Department

3.3 LATERALS

A. All utilities shall be extended to in the direction and elevation to connect at those geometrical locations indicated or inferred on the drawings. All utility ends will be plugged and marked by a 2” x 4” piece of wood extending from the utility invert to 4 feet above final grade.

3.4 PIPE BEDDING

A. Accurately cut trenches for pipe or conduit to designated line and grade appropriate to accommodate the bedding thickness specified in the bedding details on Construction Drawings. Compact the disturbed surface of the subgrade. Use a minimum 2.5-ton total-weight walk-behind vibratory roller (Wacker WDH-86-110, Ramax or equivalent) Compaction should be performed under the direct supervision of the Owner’s Geotechnical Engineer.

B. Any loose, soft, or unstable areas shall be over-excavated and replaced with compacted structural fill as directed by the Geotechnical Engineer to provide a suitable base for continuous and uniform bedding.

C. Place bedding material and compact in 6 inch loose lifts to obtain at least 95% of the maximum dry density. Accurately shape bedding material to conform to lower portion of pipe barrel. After pipe installation, place and compact bedding material as specified above in maximum 6 inch loose layers to the height above the pipe, as shown on the plans.

3.5 BACKFILLING

A. After pipe or conduit has been installed, bedded and tested as necessary, backfill trench to finish grade in 8 inch thick loose lifts of approved fill soils, compacting and testing each lift as specified above and in specification Section 312010 - Earthwork.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces. Should these conditions exist, the areas should be removed, replaced and re-compacted per specification Section 312010 - Earthwork.

3.6 COMPACTION

A. All off-site materials used for backfill shall be tested in accordance with Section 312010 - Earthwork.

B. Exercise proper caution when compacting immediately over top of pipes or conduits.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Compaction of backfill shall be performed in accordance with the requirements of Section 312010 - Earthwork.

END OF SECTION

SECTION 312500
SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Temporary and permanent soil erosion control systems.

B. Slope Protection Systems.

1.2 RELATED SECTIONS

A. Section 312010 – Earthwork

B. Section 329300 – Landscape Planting

C. Section 329200 – Lawn and Grasses

D. Construction Drawings

1.3 REFERENCE STANDARDS

A. The PADEP, Erosion Sediment and Pollution Control Manual, latest version.

B. Philadelphia Water Department (PWD), Stormwater Management Guidance Manual, latest version.

1.4 QUALITY ASSURANCE

A. The Contractor shall implement soil erosion controls in a timely manner.

B. The Contractor shall carefully adhere to the construction sequence that is shown on the construction drawings.

C. The Contractor shall follow Soil Erosion and Sediment Control Notes that are shown on the construction drawings and which are dictated by the PADEP and/or the PWD.

D. The Contractor shall make frequent inspection of temporary soil erosion controls and maintain them in working order until permanent soil erosion controls are established.

1.5 ENVIRONMENTAL REQUIREMENTS

A. The contractor shall protect adjacent properties and water resources from soil erosion and sediment damage throughout construction.

B. Discharge from dewatering operations shall not be directed to surface waters.

PART 2 PRODUCTS

2.1 MATERIALS

A. Tree protection fencing as specified on Construction Drawings

B. Fibrous blankets by North American Green SC150BN, biodegradable (unless noted otherwise on Construction Drawings) or approved equal

C. Silt fence, Filtrexx Siltsoxx or Straw bale barrier siltation control as specified on the Construction Drawings

D. Filter fabric as specified on the Construction Drawings

PART 3 EXECUTION

3.1 PREPARATION

A. Review site conditions and sediment control plans.

B. Review the soil erosion and sediment control plans as they apply to current conditions. Any proposed deviation from the plans must be submitted to the engineer in writing 72 hours prior to commencing that work.

C. Notify the PADEP and the PWD by mail at least 48 hours prior to initial land disturbance.

3.2 SOIL EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place soil erosion control systems in accordance with the staging and features shown on the sediment control plans prior to any earthwork construction and immediately following the construction of any storm drainage devices.

B. Limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations by following construction phasing in the sediment control plans.

C. The Contractor will be required to incorporate all permanent soil erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical. Equip catch basins with filter fabric inlet protection immediately upon construction.

D. The temporary soil erosion control systems installed by the Contractor shall be maintained as directed by the engineer to control siltation at all times during the life of the contract. The Contractor must respond to any maintenance or additional work ordered by the Engineer within a 48 hour period.

E. Slopes that erode easily shall be temporary seeded as the work progresses with quick-growing grass grains of wheat, rye or oats (See Section 02930) unless otherwise specified.

F. All soil erosion control measures shall be maintained until all permanent improvements to the site are complete unless otherwise directed by the Engineer.

END OF SECTION

SECTION 320519
GEOSYNTHETIC FABRICS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work of this Section includes provision and installation of geosynthetic materials for separation, reinforcement or drainage control.

1. All materials shall be manufactured, supplied, stored and placed according to the latest referenced standards and as outlined herein.

2. The Contractor shall provide certification of the supplied material.

3. The materials shall be placed to the limits as specified in accordance with the manufacturer's instructions and as specified herein.

1.2 RELATED SECTIONS

A. Section 015713 Soil Erosion and Sediment Control

B. Section 312010 Earthwork

C. Section 334653 Subsurface Stormwater Storage

1.3 REFERENCE STANDARDS

A. ASTM International - Geotextiles

1. ASTM D3786 - Standard Test for Mullen Burst Strength

2. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus

3. ASTM D4491 - Standard Test for Water Parmeability

4. ASTM D4632 - Standard Test for Grab Tensile Strength

5. ASTM D4533 - Standard Test for Tear Resistance

6. ASTM D4833 - Standard Test for Puncture Resistance

7. ASTM D4873 – Standard Guide for Identification, Storage and Handling of Geosynthetics

8. ASTM D4751 - Standard Test for Apparent Opening Size (AOS)

9. ASTM D6241 - Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

B. ASTM International – Geomembranes-HDPE

1. ASTM D1603 - Standard Test for Carbon Black Content in Olefin Plastics

2. ASTM D4218 - Standard Test for Carbon Black Content in Polyethylene Compounds

3. ASTM D5596 - Standard Test for Carbon Black Dispersion in Polyolefin Geosynthetics
4. ASTM D5191 - Standard Test for Thickness Vapor Pressure of Petroleum Products
5. ASTM D1505 - Standard Test for Density
6. ASTM D792 - Standard Test for Density
7. ASTM D6693 - Standard Test for Tensile Properties
8. ASTM D1004 - Standard Test for Tear Resistance
9. ASTM D4873 – Standard Guide for Identification, Storage and Handling of Geosynthetics
10. ASTM D746 - Standard Test for Brittleness Temperature
11. ASTM D1204 - Standard Test for Dimensional Stability
12. ASTM D1693 - Standard Test for Environmental Stress Crack
13. ASTM D4833 - Standard Test for Puncture Resistance
14. ASTM D4437 - Standard Test for Integrity of Field Seams
15. ASTM D6497 - Standard guide for Mechanical Attachment of Geomembrane to Penetrations or Structures

C. Pennsylvania Department of Transportation Officials (PennDOT)

1. PennDOT Publication 408 – Highway Construction Specification

D. City of Philadelphia Quality Control Standards

1. QC 14 – City of Philadelphia Standard for Testing Geosynthetics (under development).

1.4 SUBMITTALS

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer's data, and/or product data in accordance with Division 01.

B. Submit complete shop drawings and product information for all items to be furnished under this Section upon receipt of notice to proceed and prior to construction.

C. Submit a mill certificate from the manufacturer certifying that the supplied material meets the chemical, physical and manufacturing requirements specified herein.

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary trades and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

1. The geomembrane shall be installed by crews experienced in the installation of HDPE/LLDPE sheet of the type and thickness specified. The installation supervisor shall have supervised in the field or installed at least five hundred thousand (500,000) square feet

of the geomembrane material being installed. All seamers shall have at least five hundred thousand (500,000) square feet of HDPE/LLDPE geomembrane seaming experience.

B. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction.

C. General material manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guidelines.

D. The Quality of the provided and placed material shall at a minimum comply with the following:

1. PennDOT Publication 408 – Highway Construction Specification

E. A competent laboratory shall be maintained by the manufacturer of the geosynthetics at the point of manufacture to ensure quality control in accordance with ASTM testing procedures. The laboratory shall maintain records of its quality control results and shall provide, upon request, a manufacturer's certificate that includes the following.

1. Name of manufacturer
2. Chemical composition
3. Product description
4. Statement of compliance to specification and verification test results
5. Signature of legally authorized official attesting to the information required

1.6 DELIVERY, STORAGE AND HANDLING

A. Geotextiles - All storage and handling of the geotextiles shall conform to ASTM D4873, "Standard Guide for Identification, Storage and Handling of Geosynthetics".

1. During all periods of shipment and storage, the geotextile shall be protected from moisture, direct sunlight, ultraviolet rays, temperatures greater than one hundred and forty (140) degrees F, mud, dirt, dust, and debris.
2. The geotextile shall be covered in an opaque and waterproof protective wrapping, prior to leaving the manufacturing facility. Each roll of geotextile in the shipment shall be labeled with the manufacturer's name, geotextile style and type, lot and roll numbers, and roll dimensions.
3. The geotextile shall be handled carefully both during shipment, initial unloading and handling in the work area. The Contractor shall provide sufficient manpower and equipment to ensure appropriate handling of the geotextile. If the geotextile is damaged during unloading, storage or onsite transportation, Owner's Representative shall determine the extent of the damage and the damaged material shall be rejected.
4. The geotextile shall be stored onsite at a location selected to minimize handling.

B. Geomembranes - All storage and handling of the geomembranes shall conform to ASTM D4873, "Standard Guide for Identification, Storage and Handling of Geotextiles". During transportation, the geomembrane shall be covered. The delivered rolls of finished material shall be marked to state the following minimum information:

1. Name of manufacturer
2. Product type
3. Product thickness
4. Manufacturing batch code
5. Date of manufacture
6. Physical dimensions (length and width)

C. The geomembrane rolls shall be stored onsite at a location that shall be selected to minimize onsite handling. The Contractor shall confirm that the material is stored in a secure area with provisions for protection from traffic, vandals, and adverse weather to avoid damage. Geomembrane rolls shall not be stacked in a manner that could cause damage to underlying rolls. The stacking of geomembrane shall not be higher than two rolls.

D. The material shall be inspected to confirm that it is not damaged, including but not limited to:

1. Punctures from handling, nails, splinters or other deleterious material
2. Tears from operation of equipment or inadequate packaging
3. Exposure to temperature extremes resulting in unusable material
4. Blocking resulting from the bounding together of adjacent membrane layers to excessive heat and pressure
5. Crumpling or tearing from inadequate packaging support

E. At the site, the geomembrane rolls shall be unloaded and placed on a smooth surface free of rocks, mud, debris, or any other protrusions that may damage the material. Materials shall not be stored directly on the ground. The Contractor shall provide adequate equipment and personnel at the time of each delivery to ensure that the geomembrane is not damaged. Personnel shall handle the geomembrane with care. Any extrudate delivered at the site prior to the installer's mobilization shall be kept covered and dry.

1.7 DEFINITIONS

A. MARV – Minimum Average Roll Value (MARV) is a manufacturing quality control tool used by all manufacturers to establish published values such that the user/purchaser will have a 97.7% confidence that the property in question will meet published values. MARV is calculated as the typical value minus two standard deviations.

1.8 INSPECTION AND MATERIALS

A. All materials shall be inspected upon arrival at the site to ensure they meet specified requirements and are free of any damage.

B. When damage to the surface of a roll has occurred, examination of the underlying material shall be conducted. If damage is found, Owner's Representative shall examine the entire roll for damage. Geomembrane materials showing damage shall be isolated, clearly labeled as damaged,

and removed from site, by the Contractor. The Contractor will be held responsible for geosynthetics damaged during the construction process and will be required to replace them.

PART 2 – PRODUCTS

2.1 GEOTEXTILES

A. Non-woven geotextile (drainage filter fabric) shall have the following properties at a minimum. Non-woven Geotextile shall be Mirafi 180N, US Fabrics US205NW, Propex Geotex 801, Thrace-LINQ 180EX, or approved equal.

1. Minimum flow rate 90 gal/min/ft² (ASTM D4491)
2. Minimum grab tensile strength 200 lbs (ASTM D4632)
3. Minimum CBR puncture strength 300 psi (ASTM D6241)
4. Minimum tear resistance 80 lbs (ASTM D4533)
5. Minimum UV resistance 70% retained strength (ASTM D4355)

B. Geotextiles associated with modular stormwater systems shall be as specified by the manufacturer. All geotextiles and geogrids to be employed are subject to approval by Engineer, and products approved in conjunction with modular stormwater systems (or other proprietary requirements) shall not be considered approved for any other use unless specifically noted.

2.2 GEOMEMBRANES

A. The geomembrane employed shall be a synthetic material that meets the physical, mechanical and chemical properties as set forth herein and as confirmed by the manufacturer. Material shall be resistant to mildew and rot, ultraviolet radiation, insects, and rodents.

B. Geomembrane material shall be smooth High Density Polyethylene (HDPE) or Linear Low Density Polyethylene (LLDPE) with a minimum thickness of 30 mil.

C. Smooth HDPE geomembrane shall conform to the physical requirements stipulated in the Geosynthetic Research Institute (GRI) – GM13 Standard Specification for HDPE geomembranes: https://geosynthetic-institute.org/grispecs/gm13.pdf.

D. Smooth LLDPE geomembrane shall conform to the physical requirements stipulated in the Geosynthetic Research Institute (GRI) – GM17 Standard Specification for LLDPE geomembranes: https://geosynthetic-institute.org/grispecs/gm17.pdf.

E. Project specific geomembranes shall be as dictated on the Contract Drawings or equivalent product as approved by Engineer.

F. Boot seals at pipe penetrations through geomembrane shall be secured to pipe with half-inch-wide stainless steel pipe clamps with neoprene rubber cushion. Double-sided butyl tape sealant and polyurethane, non-silicone caulk such as Sikaflex shall be used. For boot on corrugated pipe, a corrugated pipe adapter (Trelleborg CGA or approved equal) shall be used to provide a smooth outer pipe surface for clamps.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. All geosynthetic materials shall be placed at the lines and grades as shown on the Contract Drawings and as specified herein.

3.2 GEOTEXTILE INSTALLATION

A. During placement of the geotextile and overlying materials, no construction equipment of any kind should operate or be operated directly on the geotextiles.

B. The surface to receive fabric shall be prepared to a relatively smooth condition free of obstructions, depressions, sudden grade changes, debris, and soft or low density pockets of material. Fabric shall be laid smooth and reasonably free of tension, stress, folds, wrinkles, or creases. Geotextiles shall be cut using a manufacturer-approved geotextile cutter only.

C. The fabric shall extend a minimum of one (1) foot beyond the edge of the excavation if possible. At the time of installation, fabric shall be rejected if it has defects, rips, tears, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

D. The Contractor shall provide temporary wind anchorage during geotextile installation by means of tires, sandbags or other means submitted to Engineer for approval. These temporary anchors shall be removed prior to fill placement. The geotextile rolls shall be shingled and the direction of fill placement over them shall be in the direction of this shingling so that the fill placement does not disturb the overlaps. The geotextile shall be placed in such a manner that placement of the overlying materials shall not excessively stretch or tear the geotextile. At the discretion of Engineer, securing pins shall be used to hold the fabric firmly in place prior to placing aggregate, fill, or backfill.

E. The geotextile strips shall be placed to provide a minimum width of two (2) feet of overlap for each joint. In excavations that do not allow careful positioning and securing with a suitable overlap of at least two (2) feet, sections shall be joined by field sewing. The thread shall be capable of supplying seam strength of 80 percent of the required tensile strength utilizing a Type 401 two-thread chain stitch with a “J” seam. The stitches shall be a minimum of two (2) inches from the fabric edge.

F. The work shall be scheduled so that 14 calendar days do not expire between the placement of the geotextile and the covering of the geotextile with a layer of required material. If the 14-day maximum exposure period is exceeded, the geotextile shall be removed and replaced.

G. Any damage to the geotextile during installation or placement of cover material shall be immediately repaired. A geotextile patch shall be placed over the damaged area and extend three (3) feet beyond the perimeter of the tear, hole, or damage.

3.3 GEOMEMBRANE INSTALLATION

A. The geomembrane shall be installed in accordance with these Specifications and the manufacturer's recommendations, to the limits indicated on the Drawings. Installation work shall not begin until all required drawings and quality control data have been submitted to Engineer, and the installer has certified the acceptability of the receiving subgrade surface in writing.

B. Geomembrane liner materials shall be not placed until the receiving surface has been inspected by the installer and the installer certifies in writing that the surface on which the geomembrane shall be installed is acceptable. A walk-through inspection shall be performed by Engineer and the installation contractor prior to placing any geomembrane. It shall be the responsibility of the Contractor to keep the receiving surface in the accepted condition until the geomembrane installation is complete.

C. The geomembrane surface shall be inspected as it is unrolled. If damage or faults not previously observed are discovered, they shall be clearly marked and the respective sheet roll shall be set aside. Damaged areas shall be repaired, or the entire roll shall be removed from the site.

D. Extreme care shall be taken during installation of the geomembrane so that no damage is done to any part of the material. Smoking and use of glass containers by installation personnel shall be prohibited. All handling and installation procedures used by the Contractor shall not damage the liner. If damage occurs, changes in equipment and procedures may be required.

E. No construction equipment shall be allowed on the geomembrane. No gasoline driven generators or cans of gas or solvent shall be placed directly on the geomembrane material. Under no circumstances shall the geomembrane material be used as a work area to prepare patches or to store tools and supplies.

F. All rips, tears, punctures, or other injuries to the geomembrane shall be repaired the same day they occur in accordance with procedures as specified herein. Excessive patching, as determined by Engineer, shall result in removal and replacement of the affected geomembrane sheet, at no expense to the City.

G. Cleanup within the geomembrane area shall be an ongoing responsibility of the Contractor. Particular care shall be taken to ensure that no trash, tools, and other unwanted materials are dragged across or trapped beneath the geomembrane. Care shall be taken to ensure that all scraps of geomembrane material, extrudate, and other installation related debris are removed from the work area. The geomembrane shall be swept to remove debris and windblown soils.

H. Only geomembrane panels scheduled for each day's field seaming shall be spread each day. Panels shall be held in position by sandbags until field seaming is complete. Sandbags shall be close knit to prevent fine material from exiting the bag. Metal or wire ties shall not be used.

I. The geomembrane shall be placed in a manner to minimize the number and length of field seaming. All geomembrane panels over twenty-five (25) square feet in area shall be designated with a panel number. The Contractor shall be responsible for assigning the number, and shall locate the panel and roll numbers near the middle of panels less than fifty (50) feet in length, and at both ends of panels over fifty (50) feet in length. These numbers shall be noted on daily progress reports, and shall correspond to the drawings initially submitted by the Contractor. Panels under twenty-five (25) feet square shall be considered a patch and shall not require a panel number.

J. The installation shall allow for thermal expansion and contraction of the geomembrane. Adequate compensation for liner thermal affects and sheet stability shall be allowed for by the installer. Compensations strips shall be installed as required and shall be clearly noted on the progress reports. The Contractor shall install at each penetration or appurtenance sufficient

compensation to eliminate stress at the liner anchorages due to temperature and sheet stability contraction.

K. The Contractor shall provide temporary wind anchorage during geomembrane installation. Placement of overlying material shall be performed in a manner that shall not damage the geomembrane. Excessive wrinkling of the geomembrane shall not be permitted prior to or while covering the geomembrane. Permanent folds or wrinkles in the geomembrane shall not be permitted. Folds or wrinkles that occur shall be uncovered and inspected. Damage to the geosynthetic materials shall be repaired immediately.

3.4 GEOMEMBRANE SEAMING

A. Field seams shall be made by extrusion or fusion welding methods. Extrusion welding shall only be used in areas where fusion welding equipment cannot operate.

B. The installer shall use only welding apparatus that allow proper control of extrudate or wedge temperature, apparatus pressure, welding speed, width of weld, and sheet preheating temperature. Certification that the welding apparatus meets these requirements shall be submitted to Engineer before any field seams are made. Welding apparatus or employees shall not damage the geomembrane.

C. A seam numbering system compatible with a panel numbering system shall be established and submitted to Engineer prior to geomembrane installation. This information shall be included on the daily progress reports.

1. Test Welds - A test weld, approximately ten feet in length, a determination of sheet surface temperature, and visual inspection of the seam surface and cross-section shall be performed satisfactorily before any additional seam welding is begun each day. These requirements shall be the responsibility of the installer. Test welds shall be made under the same conditions as actual welded seams. Engineer may require a test weld be made at any time during seaming production to verify equipment, operator performance, and seam integrity.

2. Four one inch wide specimens shall be cut from the test weld, each having the seam centrally located. Using a field tensiometer Contractor shall test two specimens in peel and two in shear. If any sample fails in the seam, the operation shall be repeated, until the deficiencies are corrected and two consecutive successful test welds are achieved. After positive evaluation of the test weld, the production seaming shall begin.

3. Production Seaming - Before production seaming, the seam areas shall be cleaned of all dust, dirt, and other foreign material. A visual inspection of the seaming surface and cross-section shall be performed before any seam welding or equipment startup has begun. Welding shall not be performed unless the sheet is dry and the sheet temperature has been determined to be above thirty-two (32) degrees F and below one hundred and twenty-two (122) degrees F. The installer may propose seaming procedures for adverse weather conditions. Such procedures shall be submitted to Engineer for review and approval prior to use.

4. Extrusion seams shall be made by overlapping adjacent sheets a minimum of three inches (3”) and extruding a ribbon of hot fusion-joining resin no less than three-quarter inch in width between the overlapped sheets or over the seams between the overlapped sheets. Extrusion field seams shall be made only in areas where fusion seaming is not practical. The sheet surface for extrusion welding shall be roughened by an acceptable means before extrudate is

placed. Excessive grinding resulting in grooving of the liner or reducing liner thickness greater than ten (10) percent shall not be permitted. Grinding shall not be performed parallel to the seam.

5. Fusion field seams shall be made by overlapping adjacent sheets a minimum of three inches (3") and forming a double welded seam separated by an air space approximately 0.375 inch in width. Fusion welded seams shall be produced by a double hot shoe welder capable of maintaining a recordable temperature determined by onsite conditions and shall not vary more than ten (10) degrees C from the target temperature.

6. All attachments of geomembrane to penetrations or structures must be watertight and installed in accordance with ASTM D6497.

7. A boot seal must be used for all pipe penetrations through the geomembrane. Boot seal must be installed on the inside (stormwater storage side) of geomembrane liner. Pipe boot skirt shall be field welded to geomembrane liner using an extrusion weld joint gun. The seaming procedure shall consist of cleaning and roughening the surface, and softening the geomembrane material by application of heated air. Directly following the application of heat, a hot strip of geomembrane resin shall be extruded over the seam to produce the welded seam. Boot shall be secured to pipe with two (2) half-inch-wide stainless steel pipe clamps with a continuous strip of neoprene rubber as a cushion between clamps and boot. For boot on corrugated pipe, a corrugated pipe adapter shall be used to provide a smooth outer pipe surface for clamps. Double-sided butyl tape sealant shall be applied continuously between outer pipe surface and boot. End of boot shall be sealed with a continuous outer bead of caulk.

8. Repairs - Repairs of small holes (up to 1/2 inch diameter) in the geomembrane surface shall be made with an extrusion joint gun. Geomembrane materials shall be cleaned of all dirt, dust, and other foreign material, all HDPE surfaces roughened, heated to the prescribed temperature, and a hot strip of geomembrane resin extruded over the hole to produce a fusion-welded repair.

9. Larger holes shall be repaired with a patch and extrusion joint gun. A patch, meeting the requirements of the HDPE/LLDPE membrane, shall be placed over the hole. The patch shall completely cover the hole, with a minimum clearance between the hole and edge of patch of three inches (3"). Membrane and patch material shall be cleaned of all dirt, dust, and other foreign material. All geomembrane surfaces shall be roughened, heated to the prescribed temperature, and the patch extrusion welded to the membrane to complete the repair. All patches shall have rounded corners.

3.5 GEOMEMBRANE SEAM TESTING

A. A program of both non-destructive and destructive testing shall be performed by the Contractor to confirm geomembrane seam quality at the discretion of Engineer.

1. Non-destructive Vacuum Testing - Continuous vacuum box testing shall be performed on all extrusion welded seams and repairs. The vacuum box assembly shall consist of a rigid housing, a transparent viewing window, a soft neoprene gasket, a port hole or valve assembly, and a gauge to indicate chamber pressure. The vacuum box shall be in like new condition with an undamaged gasket and a clear and unobstructed viewing window. A soapy solution

shall be applied to the geomembrane seam over an area of approximately twelve inches (12") by forty-eight inches (48"). The vacuum pump shall be energized to reduce the tank pressure to approximately five (5) psi. Sufficient pressure shall be applied to the box to provide a leak tight seal. For a period of not less than thirty (30) seconds, the seam shall be examined by viewing through the transparent window. The box shall be moved over to the next adjoining area, with no less than three inches (3") of overlap, and the process shall be repeated. If no bubbles appear, the seam shall be considered to pass this non-destructive test. If bubbles do appear, the area shall fail the test, be marked, repaired and retested. Extrusion weld seams that do not permit vacuum box testing (on short slopes, corners, or details) shall undergo ultrasonic testing similar to the Ultrasonic Shadow Method. The Contractor shall be responsible for submitting the testing method to be used in these instances to Engineer.

2. Non-destructive Air Pressure Testing - Air pressure testing shall be performed on all double fusion welded seams. Prior to testing, both ends of the seam shall be sealed without cutting or damaging the parent material. A needle, or other approved pressure feed device, shall be inserted into the channel created by the double track fusion seam process. A protective cushion shall be placed between the air pump and the geomembrane. All forty (40) mil double fusion seams shall be tested at thirty (30) psi over the maximum uninterrupted panel seam length for five (5) minutes. If the pressure drop in the seam exceeds three (3) psi., or if the pressure fails to stabilize, the leak shall be located, repaired and retested. The installer, in the presence of PWD, shall verify that the air flows through the entire channel by removing the seal at the end of the channel away from the air source and observe the loss of pressure on the gauge. If it is determined that there is a blockage along the channel, the seam shall be repaired. Upon completion of this testing, the needles shall be removed from the seams, and the holes and any damage to the geomembrane be repaired.

3. Destructive Testing – Destructive testing shall be performed on samples of production seams to confirm seam quality. The location of the seam samples shall be selected by Engineer. A sample coupon of production seams approximately thirty-six inches (36") long by twelve inches (12") wide, shall be taken every four hundred feet (400') of seam. When the ambient temperature six inches (6") above the liner reaches one hundred (100) degrees F, shear and peel destructive tests shall be run at a frequency of every one hundred to two hundred (100-200) feet of seam, or as directed by Engineer. The sample coupon shall allow for a total of ten (10) one inch (1") wide production field seams to be tested. Five samples shall be tested for bonded shear strength and five samples shall be tested for seam peel adhesion in accordance with ASTM D4437, latest revision. All testing shall be performed at the installer's quality control laboratory.

4. The minimum seam strength values required for all samples obtained from fusion and extrusion welded seams shall be sixty pounds (60 lbs.) per inch for seams tested in peel, and sixty-six pounds (66 lbs.) per inch for seams tested in shear. All five (5) of the specimens tested in shear and four (4) out of five (5) of the specimens tested in peel shall fail in Film Tear Bond (FTB), that is, the break should occur in the parent geomembrane. The failure mechanism of the seam shall be ductile in nature, with no indication of crystallization.

5. If the sample proves defective additional testing shall be performed to determine the extent of the defect. A test section a minimum of ten feet (10') on both sides of the failed seam location shall be retested. If these tests pass, the weld between these areas shall be cap stripped. If failure occurs, the testing shall be continued until the extent of the defect is

established. All defects shall be repaired. Cap strip repairs shall be performed and tested according to the methods described above.

6. The geomembrane shall not be covered until acceptable destructive and non-destructive testing has been completed.

7. Contractor is to repair all geomembrane where samples were taken.

3.6 PLACEMENT OF OVERLYING MATERIAL

A. The placement of the overlying granular material shall be coordinated so that no more than 14 calendar days elapse following geotextile or geomembrane placement.

3.7 DOCUMENTATION

A. The Contractor shall perform a visual inspection on each sheet for puncture, tears, rips, or other injuries.

B. Contractor shall maintain daily installation progress reports and shall make them available to Owner's Representative upon request. Installation reports shall include the following:

1. Names and job description of personnel

2. Date

3. Weather conditions

4. Project location

5. Panels installed

6. Panels seamed, including panel and seam number

7. Repair (puncture, tears, rips, or other injuries, method of repair)

8. Field observations

9. Roll number of each panel

END OF SECTION

SECTION 321210
POURED IN PLACE SAFETY SURFACE

PART 1 GENERAL

1.1 SUMMARY

A. Poured-in-place safety surface shall consist of a polyurethane binder mixed with 100% recycled, shredded buffing which will make up the cushion layer. The cushion layer is capped with a TPV or Thermoplastic Aliphatic Urethane (TAU) rubber granules mixed with a polyurethane binder creating the wear course.

B. Provide labor, materials, equipment, services to install poured in place safety surface on aggregate base as indicated on the drawings and specified herein.

1.2 RELATED SECTIONS

A. Section 312310 – Excavation and Backfill & Subgrade Preparation for Paving

B. Section 321310 – Asphalt Paving

C. Section 321320 –Concrete Paving

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM-F1292 (Latest Edition) - Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment

2. ASTM-F2223 (Latest Edition) – Standard Guide for ASTM Standards on Playground Surfacing

3. ASTM-F1951 (Latest Edition) – Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment

4. ASTM-D2047 (Latest Edition) – Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine

5. ASTM E303 (Latest Edition) – Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester

6. ASTM D2859 (Latest Edition) – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials

7. ASTM D412 (Latest Edition) – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

8. ASTM D624 (Latest Edition) – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

9. ASTM C67 (Latest Edition) – Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile

10. ASTM D573 (Latest Edition) – Standard Test Method for Rubber—Deterioration in an Air Oven

B. U.S. Consumer Product Safety Commission (CPSC):

1. CPSC Handbook for Public Playground Safety

2. CPSC Document # 1005 – Playground Surfacing Materials

C. Americans With Disabilities Act (ADA)

1. Americans with Disabilities Act Accessibility Guidelines (ADAAG)

D. American National Standards Institute (ANSI)

E. International Play Equipment Manufacturers Association (IPEMA)

1.4 PERFORMANCE REQUIREMENTS

A. Area Safety: Poured in place surfaces within playground equipment use zones shall meet, or exceed, the performance requirements of the CPSC, ADA and, where applicable, Fall Height Test ASTM F 1292. The surface must yield both peak deceleration of no more than 200 G-max and a Head Injury Criteria (HIC) value of no more than 1,000 for a head-first fall from the highest accessible point of play equipment being installed, as shown on the drawings.

B. Accessibility: NOTE: Children's outdoor play areas shall be in compliance with the requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Poured in place surfaces intended to serve as accessible paths of travel for persons with disabilities shall be firm, stable and slip resistant, and shall meet the requirements of ASTM F 1951 and ASTM F 1292.

D. The finished Poured-In-Place Rubber surface shall meet the following ASTM requirements:

1. Dry Static Coefficient of Friction (ASTM D2047): 1.0

2. Wet Static Coefficient of Friction (ASTM D2047): 0.9

3. Dry Skid Resistance (ASTM E303): 89

4. Wet Skid Resistance (ASTM E303): 57

5. Flammability (ASTM D2859): Pass

6. Tensile Strength (ASTM D412): 60 psi

7. Tear Resistance (ASTM D624): 40% Elongation at break point (140% Original Size)

8. Weathering criteria - After being subject to a freeze/thaw cycle in accordance with ASTM C67 and after being subject to 200 degrees Fahrenheit for 7 days in accordance with ASTM D573, the same sample shall be retested in accordance with ASTM F1292 at 72 degrees Fahrenhiet only. Test values shall not exceed 200 g-max and 1000 HIC.

1.5 QUALITY ASSURANCE

A. Installers/Applicators: Minimum of 3 years successful experience in the installation of the type of equipment specified.

B. Safety surface shall be warranted by the manufacturer for a period of 5 years from the date of final acceptance by the Owner. Safety surface shall maintain required impact attenuation characteristics and be guaranteed against defects in workmanship and material. Warranty will be specific to maintenance requirements and performance standards of completed product.

C. Conditions of all substrates with respect to structural performance shall be evaluated and approved by the applicator prior to applying the system.

D. Contractor/applicator shall provide a minimum of one Fall Height Test per ASTM F 1292 from the highest accessible point of each piece of play equipment being installed.

1.6 SUBMITTALS

A. Three (3) original hard copies of the submittal package will be provided (Additional hard copies shall be made available upon request). This package shall include, but not be limited to, all specifications, manufacturer's name and product code for all materials (Cushion Layer, Binders and Wear Course), MSDS sheets for all products, details and testing data.

B. Certificate of Material Compliance should be provided to the owner before delivery and installation of the safety surface. Certificate should be sent to Owner directly by the manufacturer. See sample of Certificate at end of this Section.

C. Manufacturer's details showing depths of Wear Course and Cushion Layer together with sub-base materials, anchoring systems and edge details.

D. Upon request, a listing of at least five installations where products similar to those proposed for use have been installed and have been in service for a minimum period of 2 years. The list shall include owners and/or purchaser's name, address of installation, date of installation, contact person and contact information.

E. A signed statement from the manufacturer of the poured-in-place surfacing attesting that all materials under this section shall be installed only by the Manufacturer's Trained Installers.

F. A certificate of Insurance shall be provided by the manufacturer for poured in place surfacing for uses as a playground safety surfacing, with the limits equal to, or exceeding, levels as indicated in the specifications.

G. Three (3) 4-inch x 4-inch samples of the each color combination of the Wear Course as specified on the plan for approval.

H. Test report, from an independent testing laboratory, showing that the safety surfacing system meets or exceeds the test requirements and standards specified herein.

I. Certification by manufacturer's authorized representative that safety surfacing has been properly furnished and installed.

J. Maintenance Literature for all products used.

K. Installation instructions for all products used.

L. Technical data and product literature for all items used.

M. Product Warranties.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products of this Section as recommended by the Manufacturer, to prevent damage.

B. All materials shall be delivered in good conditions in original unopened packages with labels intact.

C. All materials shall be protected from weather and the binder shall be stored in temperatures 40°F (4°C) or higher.

1.8 SEQUENCING AND SCHEDULING

A. Poured in place surfacing must be installed after all playground equipment and other structural elements, such shade structures, signs and barriers. Surface installation shall be coordination by a manufacturer’s representative.

1.9 PROJECT SITE/JOB CONDITIONS

A. Poured in place surfacing must be installed on a dry sub-surface, with no prospect of rain within the initial drying period, and within the recommended temperature range of the manufacturer.

B. Installation in weather conditions where the temperature is less than 55 degrees Fahrenheit, and/or high humidity, may affect cure time, and the structural integrity of the final product. Contractor shall consult manufacturer for recommendations on installation during these conditions and adjust types and/or quantities of binding agents to compensate for weather conditions. At no time during the installation/application and curing period shall be less

than 40 degrees Fahrenheit and shall remain above 40 degrees Fahrenheit for at least 72 hours after completion.

C. Immediate surrounding sites must be reasonably free of dust conditions or this could affect the final look.

D. All materials shall be protected from weather and other damage prior to application, during application and while curing.

E. Barricade area to prohibit foot traffic on surface for the time specified by manufacturer, minimum of 48 hours after placement.

PART 2 PRODUCTS

2.1 GENERAL

A. Poured in Place Surface: The poured in place surface shall consist of 100% recycled shredded tire material mixed with a polyurethane and capped with either a TPV or Thermoplastic Aliphatic Urethane (TAU) granule and mixed with polyurethane.

B. It shall consist of a uniform material manufactured in such a way that the top portion meets the requirements specified herein for wear surface.

C. The type of safety surfacing shall be a poured-in-place system and shall be as indicated on the drawings.

D. Finished surface shall have been tested for shock attenuation under ASTM F 1292 G-Max and HIC

E. Finished surface shall be non-slip and porous.

2.2 CUSHION LAYER

A. Impact Attenuating Cushion Layer: Cushion layer consists of shredded styrene butadiene rubber (SBR) adhered with a 100% solids polyurethane binder to form a resilient porous surface.

B. Strands of SBR may vary from 0.5mm – 2.00mm in thickness and 3.0mm – 20mm in length. Binder will be 16% of the total weight of the granules used in the Cushion Layer and shall provide 100% coating of the particles.

C. Substitution of SBR Cushion Layer is noted to be a standard but must be pre-approved.

D. The Cushion Layer must be compatible with the Wear Course and must meet requirements herein for impact attenuation.

E. Cushion Layer must be guaranteed to be 100% metal free.

F. Depth of Cushion Layer shall be per the requirements of ASTM F1292.

2.3 WEARING COURSE

A. Wear Course shall consist of Colored Thermoplastic Plastic Vulcanized (TPV) or Thermo Plastic Aliphatic Urethane (TAU) granules with polyurethane binder formulated to produce an even, uniform, seamless surface. Approved TPV/TAU manufacturer(s):

1. Rosehill Polymers Ltd. – licensed United States manufacturer is American Recycling Center, Inc. - 655 Wabassee Drive, Owosso, MI 48867, Phone: (989) 725-5100, Fax: (989) 725-5122, Web: http://www.americanrecycling.com.

2. Approved equal.

B. TPV and TUA granules shall be angular or round in shape with a particle size of 1 – 4mm. Binder shall be not less than 19% of total weight of granules used in the wear surface, and shall provide 100% coating of the particles.

C. Thickness of Wearing Course shall be a minimum of ½ inch under all areas of the playground, except for the following:

1. Under swing zone for swing sets: ¾ inch minimum.

2. Under safety zone for all non-stationary or spinning play equipment: 3/4 inch minimum.

D. Color Mixtures:

1. As specified on the plans.

2. Use of Black is not permitted in Wearing Course.

2.4 POLYURETHANE PRIMER AND BINDER

A. Primer and Binder shall be a single component Polyurethane pre-polymer formulated using a polymeric foam of Dephenylmethane Diisocyanate (MDI).

B. No Toluene Diphenel Isocyanate (TDI) shall be used.

B. No filler materials shall be used in urethane such as plasticizers and the catalyzing agent shall contain no heavy metals.

C. Approved manufacturer’s and products:

1. Dow Chemical Company - Polyurethane Systems - North American Headquarters, 1881 West Oak Parkway, Marietta, Georgia 30062, Phone: (770) 428-2684, Fax: (770) 421-3216.

a. VORAMER® MDI Polyurethane Binders.

2. Stockmeier Urethanes USA, Inc., 20 Columbia Boulevard, Clarksburg, WV 26302 - 1456, USA, Phone: (304) 624 7002, Fax: (304) 624 7020, Web: www.stockmeier.com.

   a. Stobielast® MDI Polyurethane Binders.

3. Rosehill Polymers Ltd. – licensed United States manufacturer is American Recycling Center, Inc. - 655 Wabassee Drive, Owosso, MI 48867, Phone: (989) 725-5100, Fax: (989) 725-5122, Web: http://www.americanrecycling.com.

   a. FLEXILON MDI Polyurethane Binders.

4. Approved equal.

D. Weight of polyurethane shall be no less than 8.5 pounds/gallon and no more than 9.5 pounds/gallon.

E. Manufacturer is permitted to modify the type of urethane required to match the weather conditions, Substitutions must be equal to, or exceed, Voramer quality as manufactured by DOW Chemical. Substitutions will not be accepted unless pre-approved by the Owner.

2.5 GRAVEL SUBBASE

A. PennDOT 2A Modified Gravel compacted to 95%.

PART 3 EXECUTION

3.1 INSPECTION

A. Prior to application of the system, the substrate's structural performance shall be evaluated. Notify all contractors and architect of all discrepancies. Work shall not proceed until unsatisfactory conditions are corrected.

B. Finished grade: Verify that finished elevations of adjacent areas are as indicated on the drawings, that the appropriate sub-grade elevation has been established for the particular safety surface to be installed, and that the subsurface has been installed in a true, even plane, and sloped to drain as indicated in drawings

C. Sub Base: Tolerance of concrete or bituminous sub base shall be within 1/8 inch in 10 feet. Tolerance of aggregate sub base shall be within 3/8 inch in 10 feet. Verify that aggregate sub base has been fully compacted in 2" watered lifts to 95% or greater.

D. Curing of Asphalt and Concrete: If poured in place surfacing is installed, verify that concrete sub base has cured and that all concrete curing compounds and other deleterious substances that might adversely affect adhesion have been removed. Surface shall be clean and dry.

E. Drainage: Verify that subsurface drainage, if required, has been installed to provide positive drainage.

3.2 INSTALLATION

A. Perimeter of Safety Surfacing area shall meet flush with adjacent curbs and paving.

B. Safety Surfacing shall extend a minimum distance of 6'-0" in all directions from perimeter of playground equipment, and additional distance as indicated on the Drawings and as required to conform with specified standards, including guidelines contained in the CPSC Handbook for Public Playground Safety. Sloped border shall not be considered as part of the minimum safety surfacing area.

C. Poured in Place Surfacing: Components of the poured in place surfacing shall be mixed on site in a rotating tumbler to ensure components are thoroughly mixed and are in accordance with the manufacturer's recommendations and meet with the ratios indicated in section 2.07 above. Whenever practical, Installation of the surfacing shall be seamless up to 1,200 square feet per day and completely bonded to concrete of sub base. Material shall cover all foundations and fill around all elements penetrating the surface.

D. Cushion Layer: Whenever practical, cushion layer of surfacing material shall be installed in one continuous pour on the same day of up to 2,000 square feet. When the second pour is required, step the seam and fully coat the step of the previous work with polyurethane binder primer to ensure 100% bond with new work. Apply adhesive in small quantities so that new cushion layer can be placed before adhesive dries

E. Wear Course: Wear course must be either high quality peroxide cured TPV or TAU granules. Wear surface should be bonded to Cushion Layer. Additional primer will be used between the Cushion Layer and Wear Course. Apply adhesive to Cushion Layer in small quantities allowing the Wear Course to be applied before the adhesive dries. Surface shall be hand troweled to a smooth, even finish. Except where the Wear Course is composed of differing color patterns, pour shall be continuous and seamless whenever practical up to 1,200 square feet per day. Where seams are required due to color change, size or adverse weather, a step configuration will be constructed to maintain Wear Course integrity. The edge of the initial pour shall be coated with adhesive primer and wearing surface mixture immediately applied. Pads with multiple seams are encouraged to include a top cost of urethane before being placed into use. Butt joint seams are not acceptable except for repairs. Under special conditions and with the owner's written approval, seams may be permitted in same color pad.

F. Perimeter: Concrete/asphalt perimeter must be saw-cut to size indicated on plans, or formed during pour, with surfacing rolled down inside void. Primer adhesive must be applied to all sides of the void. When connecting to a concrete curb or border, the hardened edge shall be primed with adhesive and the final 2" shall be tapered to allow the Wear Surface material to be a minimum of 1" thick where it joins the concrete edge.

G. Thickness: Construction methods, such as the use of measured screeds thicker than the required surfacing depth, shall be employed to ensure that full depth of specified surfacing material is installed. Surfacing system thickness throughout the playground area shall be as required to meet the impact attenuation requirements specified herein.

H. Manufacturer's installers shall work to minimize excessive adhesive on adjacent surfaces or play equipment. Spills of excess adhesive shall be promptly cleaned.

J. Manufacturers/Installers Services: For poured in place safety surfacing, a manufacturer's and/or installer's representative who is experienced in the installation of playground safety surfacing shall be provided. The representative shall supervise the installation to ensure that the system meets impact attenuation requirements and has been installed using specified materials in the ratios indicated herein

3.3 CLEANING

A. Upon completion of installation of safety surfacing, clean all work thoroughly.

B. Remove debris and excess soil and pavement removals from site.

3.4 PROTECTION

A. The synthetic safety surface shall be allowed to fully cure in accordance with the manufacturer's recommendations.

B. The surface shall be protected by the General Contractor from all traffic during the curing period of 48 hours or as instructed by the manufacturer. Barricade area to prohibit foot traffic on surface for the time specified by manufacturer, minimum of 48 hours after placement.

3.5 FIELD TESTING

A. General Contractor to submit written Audit of the completed installed SAFETY SURFACE by an independent Certified Playground Safety Inspector (CPSI), after safety surface is completely installed. No additional compensation will be given for any necessary corrective work.

B. Audit parameters: The surface must yield both peak deceleration of no more than 200 G-max and a Head Injury Criteria (HIC) value of no more than 1,000 for a head-first fall from the highest accessible point of play equipment being installed, as shown on the drawings. Provide a minimum of three (3) drop tests in the safety zone of each play equipment.

END OF SECTION

Certificate of Material Compliance _____

Site Location:_____

Total Sq Footage: _____

Material Ship Date: _____ Installation Date:_____

The installing contractor certifies to the owner _____ that all materials used in the installation of the pour in place (PIP) surface noted below are of the same components and manufacturer that was approved by _____.

These materials consist of the following:

Cap Surface Material: _____ Binder Type_____
(Fill in product Name & Reference Number)

Cushion Material:_____ Binder Type_____
(Fill in product Name & Reference Number)

Color Percentages & Sq Footages

1.	2.
3.	4.

Binder % Ratios

CAP	Cushion

Contractor:

_____

Address:

_____

Contact Phone Number:

_____ Ext _____

Sign_____Date_____

Print _____

Material Supplier:

_____

Address:

_____

Contact Phone Number:

_____ Ext _____

Sign_____Date_____

Print_____

Authorization / Accepted (Sign)_____ Date_____

(Owner Representative) (Print Name) _____

SECTION 321310
ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Asphaltic concrete paving; surface course, binder course and base course.

1.2 RELATED SECTIONS

A. Section 312310 – Excavation, Backfill and Subgrade Preparation for Paving

B. Section 321320 – Concrete Paving

1.3 SUBMITTALS

A. Design Mix: Before any asphaltic concrete paving is constructed, submit actual design mix to the Owner's Civil Engineer for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, grade of asphalt cement used, Marshall Stability (lbs.), flow, effective asphalt content (percent), and direct references to the Standard Specifications sections for each material. The design shall be for a mixture listed in the current edition of the Standard Specifications. Mix designs over three years old will not be accepted by the owner.

B. Material Certificates: Submit materials certificate to the Owner's Civil Engineer which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

1.4 JOB CONDITIONS

A. Weather Limitations:

1. Apply prime and tack coats when ambient temperature is above 40°F, and when temperature has been above 35°F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, or during rain.

2. Construct asphaltic paving when atmospheric temperature is above 40°F.

1.5 REFERENCES

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

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

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

D. MS-19-Basic Asphalt Emulsion Manual per The Asphalt Institute (AI)

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

F. AASHTO M-226/ASTM D3381 Asphalt Cement

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

H. AASHTO M-117/ASTM D242 Mineral Filler

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

J. Pennsylvania Department of Transportation (PennDOT) Publication 408 Construction Specifcations

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide asphalt-aggregate mixture as shown on drawings. Use locally available materials and gradations, which meet the Standard Specifications and exhibit satisfactory records of previous installations.

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

Temperature Condition	Asphalt Grades
Cold, mean annual air temperature at 7 degrees C (45 degrees F) or lower	AC-10 85/100 pen.
Warm, mean annual air temperature between 7 degrees C (45 degrees F) and 24 degrees C (75 degrees F)	AC-20 60/70 pen.
Hot, mean annual air temperature at 24 degrees C (75 degrees F) or higher	AC-30

C. Prime Coat: A medium curing cut-back asphalt or an asphalt penetrating prime coat consisting of either MC-30 or SS-1h.

D. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or AASHTO M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.

E. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D 242, if recommended by applicable state highway standards.

F. Asphalt-Aggregate Mixture: Unless otherwise noted on the Drawings, the Design Mix shall have a minimum stability based on a 50-blow Marshall Mix Design Procedure complying with ASTM D 1559 of 1000 lb with a flow between 8 and 16. The Design Mix shall be within sieve analysis and bitumen ranges below:
SIEVE ANALYSIS OF MIX

Square Sieve	Total Percent Passing	Percent Tolerance
3/4”	100	7%
1/2”	80 - 100%	5%
3/8”	65 - 93%	4%
#8	40 - 55%	4%
#50	12 - 27%	2%
#200	0 - 10%	0%

Percent bitumen by weight of total mix: 5.0 - 8.5.
Air voids: 3-6%
Percent aggregate voids filled with asphalt cement: 70 - 82%.
Allowable variance of percent bitumen by weight of total mix = 0.4

2.2 EQUIPMENT

Maintain equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove loose material from compacted base material surface immediately before applying prime coat.

B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.

C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

3.2 APPLICATIONS

A. Prime Coat:

1. Apply bituminous prime coat to all base material surfaces where asphaltic concrete paving will be constructed.

2. Apply bituminous prime coat in accordance with APWA Section 2204 and applicable Standard Specifications.

3. Apply at minimum rate of 0.25 gallon per square yard over compacted base material. Apply to penetrate and seal, but not flood surface.

4. Make necessary precautions to protect adjacent areas from overspray.

5. Cure and dry as long as necessary to attain penetration of compacted base and evaporation of volatile substances.

B. Tack Coat:

1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphaltic concrete or into asphaltic concrete pavement.

2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth asphaltic concrete and sand asphalt bases and on surface of all such bases where asphaltic concrete paving will be constructed.

3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and Pennsylvania highway specifications.

4. Apply at minimum rate of 0.05 gallon per square yard of surface.

5. Allow to dry until at proper condition to receive paving.

3.3 ASPHALTIC CONCRETE PLACEMENT

A. Place asphaltic concrete mixtures on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:

1. When ambient temperature is between 40°F and 50°F, mixture temp. = 285°F

2. When ambient temperature is between 50°F and 60°F, mixture temp. = 280°F

3. When ambient temperature is higher than 60°F, mixture temp. = 275°F

B. Whenever possible, all pavement shall be spread by a finishing machine; however, inaccessible or irregular areas may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster that than can be properly spread. Workers shall not stand on the loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10’-0” wide.

D. Joints: Make joints between old and new pavements, or between successive days and work in a manner that will provide a continuous bond between adjoining work. Construction joints shall have same texture, density, and smoothness as other sections of asphaltic concrete course. Clean contact surfaces of all joints and apply tack coat.

3.4 ROLLING AND COMPACTION

A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.

B. The bituminous concrete pavement shall have a minimum thickness as specified on the contract drawings and should be compacted to a minimum of 96% of the maximum unit weight as determined by the Marshall Mix Design Procedures in accordance with ASTM D-1559.

C. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

D. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling with hot material.

E. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

F. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

G. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphaltic concrete. Compact by rolling to maximum surface density and smoothness.

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.5 FIELD QUALITY CONTROL

A. The Owner's Civil Engineer shall perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, compaction and surface smoothness. Asphaltic surface and base courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. However, no less than three cores in light duty areas and three cores in heavy-duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design.

B. Grade Control: Establish and maintain required lines and elevations.

C. Temperature: The Owner's Civil Engineer shall monitor the asphaltic concrete mixture on the paver immediately prior to spreading asphalt mixture to certify that the minimum temperature requirements of this section are met. Temperature measurement shall be taken on the average of one test per 20 tons of material.

D. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner; until specified thickness of the course is met or exceeded at no additional expense to the Owner.

E. Surface Smoothness: The Contractor shall perform testing on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and

at right angles to centerline of paved area. These tests shall be performed under the observation of the Owner's Civil Engineer. Surfaces will not be acceptable if the following 10' straightedge tolerances for smoothness are exceeded.

Base Course Surface: 1/4"
Wearing Course Surface: 3/16"

F. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.

G. Compaction: The Owner's Civil Engineer shall perform in place density tests as part of the construction testing requirements using the Nuclear Method in accordance with ASTM D-2922 Method B direct transmission. Field density tests shall be performed at the rate of one test per 20,000 square feet of pavement.

H. Laboratory Confirmation of Field Compaction: Density tests for in place materials shall be performed by examination of field cores in accordance with one of the following standards:

1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.

2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

END OF SECTION

SECTION 321320
CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. The work required under this Section consists of furnishing all labor, materials, equipment, services and related items necessary to complete all cast-in-place Portland cement concrete paving and curbing.

1.2 RELATED SECTIONS

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

B. The following related items of work are included under other sections:

1. Section 033000 – Cast-In-Place Concrete

2. Section 079210 – Joint Sealants

3. Section 311000 – Site Preparation

4. Section 312010 – Earthwork

5. Section 322310 – Excavation, Backfill and Subgrade Preparation for Pavement

1.3 QUALITY ASSURANCE

A. All definitions, details, or other factors entering into this work shall conform to the "Philadelphia Building Code Requirements Reinforced Concrete" (ACI-301 and "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI-315) of the American Concrete Institute, except where otherwise specified herein. Where these regulations or specifications conflict, the more stringent requirements will govern.

B. Codes and Standards

1. Comply with local governing regulations if more stringent than herein specified.
2. Comply with applicable standards of the American Concrete Institute.

C. Submittals

1. Furnish samples, submit data for all materials and items, including forming accessories, admixtures, patching compounds, joint systems, curing compounds, dry-shake finish materials, and others as required by the Owner.

D. Job Conditions

1. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

1. Use plywood with smooth plastic facing, “Finnply”, Class I, Exterior Grade or better, edge-sealed.

B. Form Coatings: Provide commercial formulation form-coating compounds on non-plastic faced plywood, that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.2 MATERIALS

A. Portland Cement: ASTM C 150, Type I, unless otherwise acceptable to the Project Consultant. The cement used in concrete below grade shall have a tricalcium aluminate content (C3A) of between 4% (min.) and 10% (max.).

1. Use one brand of cement throughout project, unless otherwise acceptable to the Project Consultant.

B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Project Consultant.

C. Water: Potable.

D. Air-Entraining Admixture: ASTM C 260.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
   a. "WRDA 19"; W.R. Grace.
   b. "Super P"; Anti-Hydro.
   c. "Sikament"; Sika Chemical Corp.
   d. "Eucon Super 37"; Euclid Chemical Corp.
   e. "Pozzolith 400"; Master Builders.

E. Water Reducing, Non-Chlorine Accelerator Admixture: ASTM C 494, Type E, and contain not more than 0.05% chloride ions.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
   a. "Accelguard 80"; Euclid Chemical Co.
   b. "Pozzolith 500"; Master Builders.

F. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.05% chloride ions.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
   a. "Pozzolith 300-R"; Master Builders.
   b. "Eucon Retarder 75"; Euclid Chemical Co.
   c. "Daratard"; W.R. Grace.
   d. "Plastiment"; Sika Chemical Co.

G. Bonding compound: Acrylic or Styrene Butadiene

1. Products: Subject to compliance with requirements provide one of the following:
   a. J-40 Bonding Agent; Dayton Superior Corp
   b. Everbond; LM Construction Chemicals
   c. Hornweld; A.C. Horn, Inc.
   d. Sonocrete, Sonneborn-Rexnord
   e. Acrylic Bondcrete; The Burke Co
   f. SBR Latex; Euclid Chemical
   g. Daraweld C; W.R. Grace
2. Prohibited admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 per cent chloride ions.

H. Certifications: Provide admixture manufacturer's written certification that chloride ion content complies with specified requirements.

I. Calcium chloride.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Remove loose material from compacted gravel base course surface immediately before placing concrete.

B. Proof-roll prepared gravel base course surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

C. All subgrades under paving and other work of this Section must be brought to maximum density before placement of any paving work or materials. Do not place any paving

materials until all subgrades over which they are to be installed have been brought to satisfactory density.

3.2 FORM CONSTRUCTION

A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Formwork for curved surfaces shall be set to form smooth continuous curves as indicated on the plans. Contractor shall score back of formwork, if required, to achieve and form smooth radii and curves as indicated on the plans. Contractor shall request approval from Landscape Architect of finished curved formwork prior to concrete pour. Contractor shall provide Landscape Architect a minimum of 24 hours notice.

C. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8" in 10'.
2. Vertical face on longitudinal axis, not more than 1/4" in 10'.

D. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 CONCRETE PLACEMENT

A. Pre-placement Inspection: Notify the owner's representative at least 24 hours before placing concrete, allow inspection and complete form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

C. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid included construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practice.

G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operations, within limits of construction joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

J. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in proper position during concrete placement operations.

L. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified. When air temperature has fallen to or is expected to fall below 40 F (4 C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 F l0 C), and not more than 80 F (27 C) at point of placement.

M. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

N. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

O. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

P. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 F (32 C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

Q. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

R. Use water-reducing retarding mixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

S. Do not place concrete until gravel base course and forms have been checked for line and grade. Moisten gravel base course if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

T. Place concrete using methods which prevent segregation of mix.

U. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of dowels and joint devices.

V. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

W. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

3.4 JOINTS

A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete.

Construct transverse joints at right angles to the centerline, unless otherwise indicated. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finish edges with a jointer.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such placements terminate at expansion joints. Construct joints as shown or, if not shown, use standard metal keyway-section forms.

D. Expansion Joints:

1. Provide closed cell polyethylene foam expansion joint filler and sealant backers for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.
2. Place expansion joints at 20'o/c maximum in sidewalk areas.
3. Extend joint fillers full-width and depth of joint, and trim to be slightly below finished concrete surface.
4. Furnish and install joint fillers as per manufacturer's recommendations.
5. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

3.5 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10' straight-edge. Distribute concrete as required to relieve surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, with a magnesium float finish. Provide steel trowel edging where shown on drawings.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Project Consultant.

3.6 CONCRETE CURING AND PROTECTION

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

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 30l procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

1. Provide moisture curing by following methods:
   a. Keep concrete surface continuously wet by covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Use membrane-forming curing and sealing compound or approved moist curing methods.

3.7 REPAIRS AND PROTECTIONS

A. Repair and replace broken or defective concrete, as directed by Project Consultant.

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

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

D. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION

SECTION 323110
CHAIN LINK FENCING

PART 1 - GENERAL

1.1 SUMMARY

A. The work required under this section consists of furnishing all labor, materials, equipment, services, and related items necessary to complete all the Chain Link Fencing work as indicated on the drawings and described in the specifications. The work includes, but is not limited to Chain Link Fencing.

1.2 RELATED SECTIONS

A. Section 312010 - Earthwork

1.3 QUALITY ASSURANCE

A. Provide chain link fences and gates from a single source including necessary erection accessories, fittings, and fastenings.

B. Perform work in compliance with applicable requirements of governing authorities having jurisdiction.

C. All material specified herein shall be full weight and first class in every respect. All fittings necessary to produce a complete installation shall be included even though not specifically mentioned.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for metal fencing, fabric, and accessories.

B. Shop drawings showing layout, fabrication, assembly, color, and erection details in accordance with the supplementary conditions shall be submitted to the Project Consultant for approval.

PART 2 - PRODUCTS

2.1 GENERAL

A. Dimensions indicated, for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.

B. Available Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Stevens Pipe and Steel, LLC
2. Allied Tube and Conduit Corp.
3. American Fence Corp.
4. Anchor Fence, Inc.

5. Owner approved equal.

2.2 STEEL FABRIC

A. Fabric: 1-1/4” BLACK & 2" BLACK mesh, with both top and bottom selvages to be knuckled. See drawings for call out of type.

1. Furnish one-piece fabric width.
2. Fabric Finish (See Drawings for type)
   a. 6 gauge Galvanized for all surfaces including cut ends, ASTM A 392, Class II, with not less than 2.0 oz. zinc per sq. ft. of surface.
   b. 6 gauge Aluminum-coated for all surfaces including cut ends, ASTM A491-63T. Weight of coating shall be determined in accordance with current ASTM Specification A 428.
   c. PVC-coated over galvanized wire: ASTM F 668, Class 2b, 7 mil (0.18 mm) thermally fused polyvinyl chloride in Black and Blue color. ASTM A 641, galvanized steel core wire, tensile strength 75,000 psi (571 MPa), with 9 gauge core wire.
3. All fabric shall have a tensile strength of 80,000 psi minimum, unless otherwise indicated on the drawings.
4. Certification of fabric is required.

2.3 FRAMING AND ACCESSORIES

A. Steel Framework, General (See Drawings for Type):

1. Galvanized steel, ASTM A 120 or A 123, with not less than 1-8 oz. zinc per sq. ft. of surface.

   a. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

2. Materials for aluminum-coated steel chain link fence shall conform to the requirements specified in the AASHTO. Designation M181-60, with the following amendments:

   a. Aluminum for coating shall conform to the requirements specified therefore in ASTM, Specification A491-63T. Weight of coating shall be determined in accordance with current ASTM, Specification A428.

3. PVC-Coated finish: In accordance with ASTM F1043, apply supplemental color coating of 10-15 mils (0.254 - 0.38 mm) of thermally fused PVC in Black color to match fabric. In areas where blue fabric is being used, framework will be galvanized steel and not PVC-Coated.

4. All coatings to be applied inside and out after welding.

B. Line, End, Corner and Pull Posts: Standard O.D. (as per schedule 40) pipe of nominal diameters shown on Standard Chain Link Fencing Table included at the end of this section.

C. Top Rail and Bottom Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint.

1. 1 5/8" O.D. pipe, .140" minimum pipe wall thickness; 2.27 lbs. per lin. ft.

D. Wire Ties: Shall be of nine (9) gauge galvanized steel spaced 1 ft. 2 in. apart on line posts and 2 ft. apart on top, bottom, and middle rails. Each end shall be wrapped around the chain link fabric at least 540 degrees.

E. Post Tops: Shall be a pressed steel or malleable iron, weather tight, closure cap. Provide one (1) through riveted cap for each tubular post.

F. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate corner and pull post, except where fabric is integrally woven into post.

G. Stretcher Bar Bands: Bands shall be 11 gauge spaced not over 14" o.c., to secure stretcher bars to end, corner, pull, and gate posts. Install stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 14" o.c.

2.4 CHAIN LINK SWING GATES (See Drawings for Type)

A. Gate frames: Fabricate chain link swing gates in accordance with ASTM F 900 using galvanized steel tubular members, 2@ (50 mm) square, weighing 2.60 lb/ft (3.87 kg/m). Weld connections forming rigid one-piece unit.(no substitution) Vinyl coated frames thermally fused with 10 to 15 mils (0.254 mm to 0.38 mm) of PVC per ASTM 1043.

B. Chain link fence fabric: PVC thermally fused to metallic coated steel wire, ASTM F 668, Class 2b, in Black color, mesh, and gauge to match fence. Install fabric with hook bolts and tension bars at all 4 sides. Attach to gate frame at not more than 15@ (381 mm) on center.

C. Hardware materials: Hot dipped galvanized steel or malleable iron shapes to suit gate size. Field coat moveable parts (e.g. hinges, latch, keeper, and drop bar) with PVC touch up paint, provided by manufacturer, to match adjacent finishes.

D. Hinges: As recommended by the fence manufacturer and structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180° inward or 180° outward. Provide 2 per gate leaf.

E. Latch w/ Padlock: Fulcrum type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate. Padlock & 4 keys – Master keyed for #2126

F. Transom: Provide a transom over gate to complete height of fence, using one top and bottom rail and fabric to match balance of fence.

2.5 PVC COATED ACCESSORIES (Where vinyl-coated fencing specified)

A. Chain link fence accessories: (ASTM F 626) Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

B. Post caps: Formed steel, cast malleable iron, or aluminum alloy weathertight closure cap for tubular posts. For each line post provide tops to permit passage of top rail.

C. Top rail and brace ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

D. Top rail sleeves: 7@ (178 mm) expansion sleeve with spring, allowing for expansion and contraction of top rail.

E. Wire ties and clips: 10 gauge 0.135@ galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge 0.092@ for rails and braces.

F. Brace and tension (stretcher bar) bands: Pressed steel. At square post provide tension bar clips.

G. Tension (stretcher) bars: One piece lengths equal to 2@ (50 mm) less than full height of fabric with a minimum cross-section of 3/16@ x 3/4@ (4.76 mm x 19 mm) or equivalent fiberglass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

H. Truss rods & tightener: Steel rods with minimum diameter of 5/16@ (7.9 mm). Capable of withstanding a tension of minimum 2,000 lbs.

I. Nuts and bolts are galvanized but not vinyl coated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Coordinate setting of posts with construction activities of other trades.

B. Line Posts: Posts shall be spaced not more than eight (8) feet on centers in line of fence. They shall be plumb with tops properly aligned, and embedded securely in concrete foundations as shown on drawings.

C. End, Corner and Pull Posts: Provide terminal post at each termination and change in horizontal or vertical direction of 30 degrees or more. All posts shall be plumb with tops properly aligned, and embedded securely in concrete foundations as shown on drawings.

D. Post Footings:

1. Drill holes in firm, undisturbed or compact soil. Gate post footings shall have a diameter not less than 12" in diameter. Holes shall have a depth approximately 6" deeper than post bottom. Excavate deeper, as required, for adequate support in soft and loose soils and heavy lateral loads.
2. Place concrete around posts in a continuous pour. Trowel finish tops of footings and slope or dome to direct water away from posts.

E. Stretcher Bars: Provide one stretcher bar for each corner and end post. Thread tension bar through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.

F. Top Rails: Run rails continuously through post caps. Provide expansion couplings as recommended by fencing manufacturer.

G. Bottom Rails: Attach to line or end posts with galvanized steel boulevard clamps.

H. Fabric:

1. Fabric shall be tied in such a manner as to be flush with the top of the top rails and the bottom of the bottom rails. The bottom rails shall be installed two inches above finish grade. Pull fabric taut and tie to posts, rails, and tension wires. Fabric shall be pulled tight in accordance with standard practice using "come along" or other approved method.
2. Where fencing encloses court game areas such as tennis or basketball, the fabric shall be installed on the inside, facing the court game area. In all other areas, unless otherwise indicated on the drawings or directed by the Project Consultant, the fabric shall be installed on the outside.

I. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends or wire to minimize hazard to persons or clothing:

1. Tie fabric to line posts, with wire ties spaced 14" o.c.

2. Tie fabric to rails and braces, with wire ties spaced 24".

J. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

K. Cleaning Up: The contractor shall remove from the vicinity of the completed work all unused material and debris of any nature.

L. Handling: Care shall be taken when handling and installing fence materials to avoid damage to materials. Any materials damaged shall be rejected from use in the finished installation.

END OF SECTION

SECTION 329200
LAWNS AND GRASSES

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. Provide seed, sod and related items. Seeding shall be where indicated and at a time allowed by environmental conditions, by adjacent construction operations, and as specified.

B. Review of conditions and materials affecting seed installations.

C. Maintenance of seeded or sodded areas.

1.2 RELATED SECTIONS

A. Applicable Sections: Division 1

B. Section 015710 – Environmental Controls

C. Section 312010 – Earthwork

D. Section 329300 – Landscape Planting

1.3 SUBMITTALS

B. Notices and Scheduling

1. Submit a schedule itemizing lawn and meadow work to be performed. This schedule shall be in addition to Project Contract Schedule(s) required by General Conditions and shall be submitted within 45 calendar days after Contract Notice to Proceed.

a. Include in this schedule anticipated dates for commencement and sequencing of lawn and meadow seeding, including but not limited to seed bed fertilizer and water applications, seeding, sodding and commencement of maintenance period.

b. Schedule shall also include, and relate to, work specified in other sections, such as subgrade preparations; landscape soil placements and grading; utility installations paving and site wall installations; and other elements of site. Obtain related scheduling information from General Contractor.

2. Prior to seed and sod installation, submit confirmation of understanding that the following elements of work have been inspected and approved prior to start of any work of this Section:

a. Complete placement of planting soil mix including verification of acceptability of grades, quality of soil mixes, and quality of material placement.

b. Confirm, also, that no construction access will be required across lawn or meadow areas.

C. Product Data:

1. Submit manufacturers or supplier's literature or tear sheets giving name of product, manufacturers or supplier's name and evidence of compliance with Contract Documents.

2. Commercial fertilizer

3. Herbicides, pesticides and fungicides

4. Mulch(s)

D. Certificates:

1. Submit certified analysis for each treatment, amendment, and fertilizer material specified and as used. Include guaranteed analysis and weight for packaged material.

2. Prior to the use on site of any chemical weed control materials, submit a list of the weed control materials and quantities per acre intended for use in controlling the weed types expected on the site. Submittal shall include data demonstrating the compatibility of the weed control materials and methods of installation or application with the intended planting and seed or sod varieties.

E. Test Reports: Submit written reports of each grass and meadow seed mixture or sod composition. Each report shall include the following as a minimum and such other information required specific to material tested:

1. Date issued;

2. Project Title and names of Contractor and supplier;

3. Testing laboratory name, address and telephone number, and name(s), as applicable, of each field and laboratory inspector;

4. Date, place, and time of sampling and test;

5. Location of material source;

6. Type of test;

7. Recommendations for soil additives, mix proportions, and methods of preparation, as applicable, for optimum lawn and meadow conditions;

8. Test for purity, proportion by weight, weed seed content and germination percentage of seed mixtures proposed for use.

9. No seed shall be delivered until the test reports are approved. Seed shall be tested within six months immediately proceeding date of sowing. Owner reserves the right to have seed tested independently.

F. Samples:

1. Mulch: Two-pound bag of each type, with manufacture's recommendations on application rate for Hydro mulch.

G. Statement(s) of Qualifications: Submit to confirm qualifications as specified in Article 1.4, herein.

H. Maintenance Program: Submit a program for continued maintenance of lawn and meadow areas after Substantial Completion. Program shall include a report of conditions unique to site that has been identified during Contractor's maintenance of lawn and meadow work (Article 3.6, herein). Refer also to Article 1.4, herein.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installation and maintenance foreman on the job shall be competent English-speaking supervisor(s), experienced in landscape installation and maintenance. Perform work with personnel totally familiar with lawn and meadow preparations and installations under the supervision of an experienced landscape foreman.

2. Exhibit and identify a record of at least three (3) lawn and meadow installations of similar scope or size to this Project.

B. Pre-installation Review of Related Work: Within 45 calendar days after Contract Notice to Proceed for seeding work or such later date as approved by Owner's Representative, but prior to first Pre-installation Conference, obtain data as necessary and review plant mix materials and soil amendments to be used for lawn and meadow areas of this Project. Become familiar with proposed plant mixes and on-site grading conditions. Reference Section 312210, Topsoiling and Finish Grading, and the design drawings.

1. Submit a report of acceptance of soil mixes as being appropriate for seed and sod installation and, if deemed necessary, recommendations for possible SOC adjustment of amendments.

2. Review conditions and coordinate findings of report at Pre-installation Conference.

C. Pre-Installation Conference: Prior to commencement of any of the work of this section, Contractor shall arrange a conference at the site of this Project with the Owner's

Representative, Construction Manager, and Landscape Architect. At least five-(5) working days notice shall be given prior to the conference.

1. Conference attendance will include the Contractor, the foreman appointed to oversee the work of this Section, the foreman responsible for soil preparation and mixes and soil placement, other representatives of Owner, and other persons as deemed appropriate for coordination of work and quality control.

2. At the conference, review lawn and meadow installation and sequence schedules, specification criteria and installation, procedures, outstanding submittals and approvals, and such other subjects necessary for coordination of Work.

3. Establish follow up meeting(s) as necessary including but not limited to a final pre-installation review of lawn and meadow area plant mix soil placement.

D. Inspection for Substantial Completion

1. Maintain all lawn and meadow areas until Substantial Completion. Maintenance will be in accordance with requirements specified in Article 3.6 of this Section.

2. The Landscape Architect will make an inspection for Substantial Completion of the work of this Section at the time of Substantial Completion of the entire Contract. The Contractor shall submit a full and complete written program for maintenance of the lawns and meadows for review by the Landscape Architect and Owner's Representative at the time of the request for substantial completion.

   a. Submit a written request for inspection at least 14 calendar days prior to the day on which the inspection is requested.

   b. Contractor shall prepare a list with status of items to be completed or corrected for review by the Landscape Architect, prior to inspection.

   c. At time of the Landscape Architect's inspection, all lawns and meadows shall show a uniform, thick, well-developed stand of plants. If the stand is unsatisfactory, as determined by the Landscape Architect, the Contractor's maintenance responsibility shall continue until an acceptable stand of plants is achieved.

   d. Upon completion of the inspection, the Landscape Architect will amend Contractor's list of items to be completed or corrected as determined necessary and will indicate the anticipated time period for their completion or correction.

3. Lawns and meadows will not be accepted until all items of lawn and meadow work have been completed or corrected. The Landscape Architect, after Contractor's completion of outstanding work, will recommend to the Owner, in writing, the Substantial Completion of the lawn and grasses work of this Section.

a. The Contractor's responsibility for maintenance, however, shall terminate only upon issuance of acceptance by Owner for Substantial Completion.

1.5 REFERENCES

A. SPN: "Standardized Plant Names," latest edition, by the American Joint Committee on Horticultural Nomenclature.

B. Association of Official Agricultural Chemists.

C. ASTM: American Society for Testing and Materials using test criteria as specified or required by other references.

D. AASHTO: American Association of State Highway and Transportation Officials.

1.6 REGULATORY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary to make Work comply with such requirements without additional cost to Owner.

B. Procure and pay for permits and licenses required for work of this section.

1.7 PROJECT/SITE CONDITIONS

A. Acquaintance With Existing Site Conditions:

1. Through study of all Contract Documents, and by careful examination of the site, become informed as to the nature and location of the Work, the nature of surface and subsurface soil conditions, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work.

2. Investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions, and other limitations affecting transportation to, ingress and egress of this work site. Conform to all governmental regulations in regard to the transportation of materials to, from, and at the job site, and secure in advance such permits as may be necessary.

B. Should the Contractor, in the course of Work, find any discrepancies between Contract Drawings and physical conditions or any omissions or errors in Drawings, or in layout as furnished by the Owner, it will be Contractors duty to inform the Landscape Architect (Design Consultant) immediately in writing for clarification. Work done after such discovery, unless authorized by the Landscape Architect, shall be done at the Contractor's risk.

C. Sequencing and Scheduling:

1. Adjust, relate together, and otherwise coordinate work of this Section with Work of Project and all other Sections of Specification.

2. Seed installations shall not begin until all other constructions, including installation of all utilities and placement of planting soil mixes, are complete and possibility from damage caused by operations does not exist.

D. Environmental Requirements:

1. Perform soil work only during suitable weather conditions. Do not disc, rototill, or work soil when frozen, excessively wet, or in otherwise unsatisfactory condition.

2. Place grass seed or sod only at seasonal times within appropriate temperature range and wind conditions for plant development as approved by Landscape Architect:

a. Acceptable Seeding Seasons/Times:

1) Spring: April 1st - June 15th

2) Fall: September 1st - October 15th

b. Seeding or sodding at any time other than within the above seasons shall be allowed only when the Contractor submits a written request for permission to do so and permission is granted in writing by the Owner. Newly seeded or sodded areas, if installed out of season, must be continuously watered according to best recommended and Landscape Architect approved practice. Contractor shall be responsible for providing an acceptable stand of grass as specified.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in unopened bags or containers, each clearly bearing the name, guarantee, and trademark of the producer, material composition, manufacturers' certified analysis, and the weight of the material.

B. Bulk Materials

1. Deliver bulk materials with each individual shipment accompanied by an affidavit from the vendor (supplier), countersigned by the Contractor upon receipt, identifying the material type, composition, analysis, and weight and certifying that the material furnished complies with specification requirements of this Project.

2. Affidavits shall be furnished in duplicate with one copy submitted to Construction Manager at the end of day of shipment receipt at the Project site and the second copy retained with material or on file with Contractor.

C. Mulch, amendment materials, or soil stored on site temporarily in stockpiles prior to placement shall be protected from intrusion of contaminants, erosion and from mechanical or environmental damage.

PART 2 - PRODUCTS

2.1 TEMPORARY TURF

A. Temporary turf seed mix shall be as specified on the Erosion Control Plans, Notes, and Details.

2.2 PERMANENT TURF

A. Permanent turf seed mix shall be the following:

Seed Type	Proportion by Weight	Minimum Purity	Minimum Germination
1. Turf-Type Tall Fescue	60%	95%	80%
2. Perennial Rye Grass	30%	95%	85%
3. Kentucky Blue Grass	10%	90%	80%

2.3 SOD

A. Nursery-grown and cultivated from certified seed containing seed mix as specified for Permanent Turf. Sod shall be from 11 to 36 months in age before lifting, uniform in density, natural green color, free of noxious weeds. Cut sod to a 3/4 inch depth. 1/8 inch tolerance plus or minus, with grass height at 1 1/2 inches to 2 inches, wetted before cutting. Obtain approval of sod and certify its grass types and percentages before cutting or delivery to Project Site.

2.4 TOPSOIL

A. Existing topsoil stripped from the project site, disturbed areas only, may be used for lawns, planting and transplanting work. Contractor shall verify if available project site topsoil is sufficient in quantity to perform the required work. If project site topsoil is insufficient the contractor shall provide topsoil from an approved off project site source(s) as required to complete work.

B. Topsoil to be imported to the project site shall be a sandy loam topsoil (as defined in USDA Soil Texture Classification) and be fertile, friable, well-drained, pH range of 6.0 to 6.5, free of subsoil, toxic substances harmful to plant growth, without clay lumps, stones, roots or debris. The imported topsoil shall have a mechanical analysis as follows:

1. Sand: 35 percent to 40 percent.
2. Clay: 15 percent to 20 percent.
3. Organic Matter: 2.5 percent.
4. Silt: Balance

2.5 FERTILIZER

A. Conforming to standards of Association of Official Analytical Chemists, delivered to Project Site in sealed and labeled bags, or in bulk with certification as to quality and analysis. Nitrogen source shall be at least 33 percent water insoluble. Fertilizer shall have the following formulations:

1. Basic Fertilizer: 10-10-10 or 10-6- 4 analysis.
2. Starter Fertilizer: 5-10-10 or 10-20-20 analysis.

B. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guaranteed statement of analysis or a manufacturer's certificate of compliance covering analysis shall be furnished to the Landscape Architect. Store fertilizer in a weatherproof place and in such a manner that it shall be kept dry and its effectiveness shall not be impaired.

2.6 LIMESTONE

A. Ground agricultural dolomitic limestone, 90 percent calcium carbonate equivalent, conforming to standards of Association of Official Analytical Chemists and applicable State and Federal Regulations. Material shall have a total of 100% passing the 10 mesh sieve, minimum of 90% passing the 20 mesh sieve, and a minimum of 60% passing the 100 mesh sieve.

2.7 SOIL-STABILIZING AGENT

A. For use in hydroseed mix only. Material shall be one (1) of the following:

1. "Verdyol Complex": Weyerhaeuser Company,
2. "Curasol": Wolbert Master Associates,
3. "Terra-Tack": Grass Growers, Inc,
4. "J-Tac": Reclamare Company,
5. Approved Equal.

2.8 MULCH MATERIALS

A. General Use: Straw, salt marsh hay, or a combination of both. Material shall be:

1. Reasonably weed free, not brittle or overly decomposed.
2. Cured to less than 20% moisture content by weight.
3. Contain no stems of tobacco, soybeans, or other coarse or woody material.

2.9 HYDROSEEDING MATERIALS

A. Fiber mulch shall be biodegradable, non-toxic green dyed-wood cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum mixture content of 15 percent and a pH range of 4.5 to 6.5.

B. Nonasphaltic tactifier shall be a colloidal tactifier recommended by the fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors. Material shall be one (1) of the following:

1. "Verdyol Complex": Weyerhaeuser Company,
2. "Curasol": Wolbert Master Associates,
3. "Terra-Tack": Grass Growers, Inc,
4. "J-Tac": Reclamare Company,
5. Approved Equal.

2.10 EROSION CONTROL BLANKET/FABRIC NETTING

A. Contractor shall provide and install where indicated on civil drawings “Curlex” blankets: by American Excelsior Company; “Polyjute” Style465 CT: by Synthetic Industries or approved equal.

B. The area to be covered shall be properly prepared, fertilized, and seeded before blanket is applied. When blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. In ditches, the blanket shall be applied in the direction of the flow of water, butted snugly at ends and side and stapled. On slopes, the blankets shall be applied either horizontally or vertically to the slope. Ends and sides shall be butted snugly and stapled. Staple to manufacturer’s recommendations.

2.11 WATER

A. Potable, clean, fresh and free from harmful material. Water shall be furnished by Owner as necessary for lawn installation and maintenance. Include all hoses and other irrigation equipment required for correct use of water without waste.

2.12 ACCESSORY MATERIALS

A. Herbicides: For possible use if there is seed germination in lawn areas after plant soil mix placement and prior to seed installation. Herbicides shall be approved before use for type and rate of application by the Landscape Architect and by local and state agencies with jurisdiction.

1. Post-emergent shall be Roundup, as manufactured by Monsanto Agricultural Products Company, C3NJ, St. Louis, MO 63166, or an approved equal.

B. Sod Stables: 11 Gauge steel wire staples, one (1) inch wide and six (6) inches long for securing sod to slopes 4:1 (25%) or greater.

A. Lawn areas shall have fertilizer applied in two (2) applications with a thorough watering immediately following application. The first application shall be one (1) week before the seeding at the rate of 35 pounds per 1,000 square feet harrowed into the top two inches (2”) of seedbed. The second application shall be done at the rate of 25 pounds per 1,000 square feet, immediately following the second mowing.

B. Commercial fertilizer for temporary turf seed areas shall be a 10-10-10-grade fertilizer (600lbs/acre).

PART 3 - EXECUTION

3.1 VERIFICATIONS

A. Prior to construction of lawn and meadow areas, ascertain the location of all electric cables, conduits, underdrainage systems and utility lines. Take proper precautions so as not to disturb or damage sub-surface elements. Contractor failing to take these precautions shall be responsible for making requisite repairs to damaged utilities at Contractors own expense.

B. Verify that required underground utilities are available, in proper location and ready for use. Coordinate with other trades.

C. Verify that all final grades blend with adjacent grades and that area(s) to be seeded is free from depressions and abrupt changes in slope and that all grades as placed have been approved by, and remain satisfactory to Landscape Architect.

D. Verify that all tree planting in lawn areas and all shrub beds adjacent to lawn areas have been installed, will remain as approved, and no further construction work will occur which will or may require access through lawns and meadows.

3.2 SUBSOIL PREPARATION

A. Inspect rough grade subsoil. Eliminate uneven areas and low spots. Remove, for example, debris, roots, branches and stones in excess of 2 inches in size. Remove subsoil which has been contaminated with petroleum, concrete spills, and toxic substances.

B. Bring subsoil to required levels, profiles and contours. Cut out areas to receive topsoil specified in this Section, and otherwise to subgrade elevations as specified in Section 02200 – Earthwork.

C. Cultivate subgrade to a depth of 6 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

D. Maintain during grading operations the specified compaction, restore previously compacted areas and test soil compaction according to Section 02200 - Earthwork.

3.3 TOPSOIL PLACEMENT AND LAWN BED PREPARATION

A. Inspect subsoil prior to placing topsoil to confirm subsoil conditions meet the requirements of this specification. If subsoil conditions do not meet the requirements repeat subsoil preparation work as specified under this Section.

B. Place topsoil in areas where seeding, sodding and planting are to be performed. Place to the following minimum depths, up to finished grade elevations: Six (6) Inches for seeded and sodded areas.

C. Incorporate the following materials uniformly throughout entire depth of topsoil:

1. Limestone: 100 pounds per 1,000 square feet or as determined by agricultural soil test reports.
2. Basic Fertilizer: 3 pounds per 1,000 square feet or as determined by agricultural soil test reports.

D. Use topsoil in relatively dry state. Place during dry weather. Do not spread wet or clumpy topsoil.

E. Fine grade topsoil to the required levels, profiles and contours. Eliminate rough and low areas to ensure positive drainage. Establish proper flowline gradients and profiles for swales and other storm management features. Drag smooth and hand rake topsoil to final grade elevations. Roll if necessary to stabilize in order to commence seeding. Remove all ruts, mounds, and ridges on surface of topsoil. Remove all stones greater than 1 inch, roots, weeds, or other debris visible on soil surface. Resulting holes shall be filled with specified topsoil, leaving a uniform planar surface. Grade uniformly so soil surface does not have low spots which may collect water. Finish grades shall be within ¼ inch +/- tolerance of finish grades indicated on the plans.

F. Manually spread topsoil around trees, plants, and other construction to prevent possible damage by grading equipment.

G. Blend topsoil smoothly into undisturbed areas. Do not place topsoil on existing vegetation in undisturbed areas. Maintain required depth of topsoil at limit of grading line.

H. Lightly compact and roll placed topsoil.

I. Clean all paved and building surfaces and remove soil to maintain quality of finished surface.

J. Allow for and verify that planting soils of lawn and meadow areas, completed in placement with deficiencies corrected as necessary, to settle for a minimum fourteen (14) days prior to beginning of lawn and meadow installation.

K. Coordinated sequencing of work shall allow immediate seed and sod installation after completion of verifications and preparations. \

3.4 ADDITIONAL SEED AND SOIL AMENDMENTS

A. Starter fertilizer: Add starter fertilizer at the following rates to surface of seed bed or include as an ingredient in hydroseed mix: 40 pounds per 1,000 square feet.

3.5 SEEDING

A. Seeding shall be done between the following dates:

1. Permanent Seeding:

a. Spring Seeding: April 1 to June 15.
b. Fall Seeding: August 15 to November 1.

2. Temporary (Non-Permanent) Seeding:

a. January 1 to December 31.

B. Prior to seeding contractor shall inspect surface soil bed conditions to assure they meet the requirements for receiveing seed. At minimum the soil bed surface shall be roughened to break-up large clods and surface crust, to scarify and fine rake to remove irregularities that will hold water.

C. Manual or mechanical sowing of seed may be by the following optional methods:

1. Mechanical Power-Drawn Seeder: Combination grass planter and land packer or pulverizer. Plant seed not deeper than [1/4 inch] {6 mm}. Keep seeding operation as close as possible to contours and not up and down slopes. After seeding, compact with land roller, such as a cultipacker. With proper equipment, sowing seed and cultipacking in one (1) operation is satisfactory.

2. Hopper Type Spreader: Manually-propelled or power-drawn hopper devices. Uniformly distribute seed by sowing half seed in one (1) direction and remainder at right angles to direction of first sowing. Cover seed an average depth of [1/4 inch] {6 mm} by means of chain harrow, cultipacker, or other approved method.

D. Hydroseeding: Mix specified seed, fertilizer and fiber mulch in water using clean, washed equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into a homogenous slurry suitable for hydraulic application. Hydraulic broadcasting of prepared material.

1. Hydroseed at the following rates per acre:

a. Water: As specified.
b. 1,500 pounds of wood cellulose, plus 15 percent for slopes 5 percent and steeper.
c. Fertilizer: As specified for starter fertilizer. Starter fertilizer may be added to surface of seed bed.
d. Soil stabilizer of type and at rate recommended in writing by manufacturer.
e. Seed Mix: As specified.
f. For a 3,000 gallon tank, multiply specified quantities by 0.75. Mix and agitate all materials, except wood cellulose, in 2,200 gallons of water; then add wood cellulose, fill tank with water and continue agitation. Seed promptly, under constant agitation of mix, beginning when

complete mix is a uniform slurry. Limit coverage for 3,000 gallon tank to 0.75 acre.

g. Take precautions against overspray onto roads, curbs, sidewalks, building walls, and other surfaces except ground areas. Contractor shall promptly clean all areas of overspray to satisfaction of Owner's Representative and Landscape Architect.

3.6 SODDING

A. Provide sod as indicated on Drawings.

B. Place sod on topsoil bed prepared as indicated for seeded areas, including lime, basic fertilizer and starter fertilizer applied to bed surface. At time sod is placed, topsoil shall be in a damp, friable, loose condition, with no surface crust.

C. Retain sod on slopes equal to or steeper than four (4) horizontal to one (1) vertical and in drainage swales, using sod staples driven into sod until top is flush with sod.

D. In placing sod, keep rows parallel with contour lines. Keep Work true to finished grade, and tamp or roll to establish firm contact with topsoil bed. Butt pads tightly and stagger ends with those in adjacent rows. If sod separates less than [1/2 inch] {13 mm}, backfill with topsoil flush with sod and overseed. If sod separates [1/2 inch] {13 mm} or greater, overlay with sod and spade cut to fit.

3.7 MULCHING

A. Except hydroseeded areas, seeded areas sloped four (4) horizontal to one (1) vertical or greater, and areas where lawn would be difficult to establish, shall be mulched at rate of 1.5 tons per acre.

B. Use wood fiber mulch or soil stabilizing agents, hydraulically applied in water at rate of 1,500 pounds of wood fiber per acre, plus l5 percent on slopes greater than four (4) to one (1).

C. For dry-mulched areas, spray with soil-stabilizing agent/tackifier material immediately after spreading straw or salt marsh hay or both, at rate of 200 gallons of asphalt per acre, in a method to bind mulch to soil and inhibit wind loss of mulch. Do not apply soil-stabilizing agent/tackifier material within when ambient temperature is below 55 degrees F. Clean off misplaced spray from building walks, paving, light standards and bases, and other surfaces to satisfaction of Owner's Representative or Landscape Architect.

3.8 WATERING

A. Keep newly sodded areas moistened until grass becomes well established and have shown signs of knitting with topsoil.

B. In event of insufficient rainfall, moisten areas every two (2) or three (3) days until sod becomes established. Thereafter, water in absence of rain every seven (7) to ten (10) days. When watering sod, make sure that water soaks through sod into topsoil bed below.

3.9 PROTECTIVE WORK

A. Provide materials and Work necessary to protect Work from damage. Prevent damage to Owner's property and Work specified in other Sections during these operations.

B. Protective Work shall include wire line and stakes along walkways with cloth strips at 4 feet intervals as evidence of wire and also "KEEP OFF" signs.

C. Defer Work when continuation of construction Work must occur over certain lawn areas.

3.10 MAINTENANCE PRIOR TO ACCEPTANCE

A. Maintain all sodded areas by properly mowing, watering, weeding, and similar care to keep Work in a clean and neat condition at all times. Advise Owner's Representative, in writing, when Work is in condition to meet acceptance.

3.11 CONDITIONS OF ACCEPTANCE

A. Fine Lawns shall be approved to begin one (1) year Maintenance and Guarantee Period based on the following requirements:

1. Bare spots, not greater than 1 square foot, shall be permitted up to a maximum of 3 percent of Fine Lawn Area.

B. Sod Areas shall be approved to begin one (1) year Maintenance and Guarantee Period based on the following requirements:

1. Sodded areas shall have been mowed at least twice since time of installation.
2. Sod shall have shown signs of knitting with topsoil layer and adjoining sod pads. Open joints between sod pads nor sod slippage on slopes shall not be accepted.
3. Sod shall be in a thriving and vigorous condition exhibiting a healthy green color. Bare spots or brown spots shall not be accepted.

C. During one(1) year Maintenance and Guarantee Period, Owner shall do no Maintenance Work, watering or cutting of lawns provided under this Contract.

D. Contractor may use existing underground irrigation systems if available.

E. When Work meets conditions specified above, Date of Acceptance shall be Date that Guarantee Period commences. Design Professional shall notify Contractor in writing of said Date.

3.12 MAINTENANCE AND GUARANTEE OF LAWN AREAS AND SODDED AREAS

A. Provide all Maintenance Work throughout Guarantee Period, which shall be one (1) year from Date of Acceptance.

B. Guarantee Work to be in vigorous and thriving condition by end of Guarantee Period, free of objectionable quantities of weeds and other undesirable growth. Maximum percentage allowed for scattered bare spots shall not exceed 3 percent of fine lawn area. Each bare spot shall not be larger than 1 square foot.

C. Maintenance Work shall include watering, remedial Work such as repair of eroded areas, and resodding if required. Provide general cleanup of stakes, strings, temporary signs, and sweeping of paving and sidewalks. Cut grass a minimum of 26 cuttings a year. Include other Work as maintenance as necessary, for example, lawn feeding, grub control and weeding, broadleaf weed control as deemed required by Contractor in support of Guarantee, or as may be brought to his/her attention during Guarantee Period.

D. Additional fertilization and limestone shall be required. Spread one (1) additional application of 10-6-4 fertilizer evenly over fine lawn area at rate of 25 pounds per 1,000 square feet and spread one (1) additional application of limestone at rate of 100 pounds per 1,000 square feet. Complete applications in fall season of year approaching termination of Maintenance and Guarantee Period.

E. Cutting of fine lawn areas shall occur when grass is dry and to maintain a height of about 2 inches. Cut grass a maximum of 1/3 of total grass blade height. Maintain a neatly-trimmed edge condition throughout at all times.

F. During one (1) year Maintenance and Guarantee Period, Owner shall do no Maintenance Work, watering or cutting of lawns provided under this Contract.

3.13 FINAL INSPECTION AND ACCEPTANCE

A. Toward end of Maintenance and Guarantee Period, give notice in writing to Owner's Representative stating desired Date for Final Inspection.
B. At time of Final Inspection, lawn Work shall be in condition required by Maintenance and Guarantee Work indicated.
C. If Work is accepted at time of Final Inspection, Guarantee shall be considered fulfilled and terminated. Should any Work need replacement at time of Final Inspection, continue Guarantee Period until such replacements are made and deemed acceptable.
D. Design Professional shall notify Contractor in writing of Date of Final Acceptance.

END OF SECTION

SECTION 329300
LANDSCAPE PLANTING

PART 1 GENERAL

1.1. DESCRIPTION OF WORK:

A. The planting of trees, shrubs, ground covers, perennials, and ornamental grasses, with planting soil, topsoil, soil amendments, fertilizer, mulch, planting accessories and maintenance.

B. The Contractor shall furnish all materials and perform all work in accordance with these specifications, drawings, and instructions provided by the Landscape Architect or Owner's representative hereafter also referred to as Landscape Architect. The work shall include everything shown on the drawings and required by the specifications and everything to which in the judgment of the Landscape Architect is incidental to what is shown on the drawings or required by the specifications.

1.2 RELATED SECTIONS

A. Applicable Sections: Division 01.

B. Section 312010: Earthwork

C. Section 312320: Trench Excavation and Backfill for Utilities

D. Section 329200: Lawn and Grasses.

1.3 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Ground Ivy, Perennial Sorrel, and Brome Grass.

B. Plants: Living trees, plants, and ground cover specified in this Section.

1.4 REFERENCES

A Comply with the following references and standards:

1. American National Standards Institute (ANSI):

a. Z60.1 - American Standards for Nursery Stock

b. A300 – Standards for Tree Care Operations

2. United States Department of Agriculture (USDA)

a. Plant Hardiness Zone Map

3. United States Composting Council

a. Landscape Architecture Compost Use Specification

b. Test Methods for the Examination of Composting and Compost

1.5 REGULATORY REQUIREMENTS

A. Comply with Local, State or Federal Codes.

B. Comply with regulatory agencies for fertilizer and herbicide composition.

1.6 QUALITY ASSURANCE

A. All work completed and materials furnished and installed shall be of the best quality and shall be in strict accordance with the intention of the drawings, specifications and samples. The Contractor shall cooperate with the Landscape Architect so that no error or discrepancy in the drawings or specifications shall cause defective or inappropriate materials to be used or poor workmanship to be allowed and so that the work may proceed in the most efficient and effective manner. If there is a discrepancy between the graphic count of plants and the plant list count of plants on the Landscape Plan, the graphic count shall govern.

B. Before commencing work, all trees and shrubs which are to be saved must be protected from damage by the placement of fencing flagged for visibility or some other suitable protective procedure approved by the Owner's Construction Manager. No work may begin until this requirement is fulfilled.

C. In order to avoid damage to roots, bark or lower branches, no truck or other equipment shall be driven or parked within the drip line of any tree, unless the tree overspreads a paved way.

D. The contractor shall use any and all precautionary measures when performing work around trees, walks, pavements, utilities, and any other features either existing or previously installed under this Contract.

E. The Contractor shall adjust depth of earthwork and topsoiling when working immediately adjacent to any of the aforementioned features in order to prevent disturbing tree roots, undermining walks and pavements, and damage in general to any existing or newly incorporated item.

F. Where excavating, fill, or grading is required within the branch spread of trees that are to remain, the work shall be performed as follows:

1. TRENCHING: When trenching occurs around trees to remain, the tree roots shall not be cut but the trench shall be tunneled under or around the roots by careful hand digging and without injury to the roots.
2. CHANGING GRADES: Existing trees in areas where the new finished grade is to be altered more that 6” shall have regrading work done by hand to elevation as indicated. Roots as required shall be cut cleanly three inches (3”) below finished grade.

G. The Landscape Architect reserves the right to inspect and reject plants at any time and at any place, and reserves the right to inspect plants at the growing nursery.

H. The Landscape Architect shall have the final approval for acceptance of the landscape planting work.

I. The nursery(s) where plants will be harvested shall specialize in growing and cultivating the plants specified in this Section with minimum six (6) years experience.

J. The landscape installer shall be a company specializing in installing and planting the plants specified in this Section with minimum six (6) years experience.

K. All plant materials shall be free of disease or hazardous insects.

L. The thickness of each shrub shall correspond to the trade classification “No.1”. Single stemmed or thin plants shall not be accepted. The side branches must be generous, well twigged, and the plant as a whole well branched to the ground. The plants must be in healthy condition, free from dead wood, bruises or other root or branch injuries.

M. Where there is paving material that needs to be crossed by transporting plant material via machinery, the Contractor shall use any necessary form of reinforcement to ensure the paving does not crack, chip, break, or deform in any way.

1.7 SUBMITALS AND SAMPLES

A. It is the responsibility of the Contractor, before ordering or purchasing materials, to provide samples of those materials to the Landscape Architect for approval, if so requested.

B. The Contractor is to submit certification tags from trees, shrubs and miscellaneous materials verifying type, quality and purity.

C. Other submittals:

1. Planting Soil: ¼ Cubic foot.

2. Mulch: ¼ Cubic foot.

3. Organic Soil Amendment: Product data.

4. Fertilizer: Product data.

1.8 HARVESTING, DELIVERY, STORAGE, AND HANDLING OF MATERIALS

A. For balled and burlapped and bare root plant material dig plants in a manner to retain as many fibrous roots as possible. Spray trunks, twigs and foliage at the nursery with anti-desiccant in accordance with manufacturer's written recommendation.

B. Ball and burlap all plants, unless otherwise indicated, with firm natural ball of soil of sufficient breadth and depth to include roots. Minimum acceptable ball size shall be in accordance to sizes set forth in ANSI Z60.1 – American Standard For Nursery Stock for type and size indicated. Burlap and rope entire earth ball. Plants with mushy, badly cracked or frozen earth balls shall not be acceptable.

C. Container grown stock shall be grown in specified container long enough for root system to have developed sufficiently to hold soil together.

D. Prevent injury to plant material when digging, moving, transporting, and unloading.

E. Handle all balled and burlapped plants from root ball only.

F. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

G. During transport protect plants from wind by wrapping with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants.

H. Vehicles shall be adequately ventilated to prevent overheating of plants.

I. Protect plants until planted. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage. Protection includes, but is not limited to:

1. Protecting plant stems and trunks from damage and/or injury.

2. During harvesting, transport, and planting processes the plant stem and trunks shall be wrapped with a pervious protective cover. The protective cover shall be removed once the plant is installed and complete. Plants with injured stems will not be accepted.

3. Protecting plant branches from damage and/or injury.

4. Protecting plants from injury due to wind burn.

5. Protecting plants from drying out, plants and root balls shall be kept moist and fresh.

J. Deliver plant materials immediately prior to placement. Keep plant ball moist. If plant materials are not scheduled to be installed within one (1) day of delivery they shall be healed in with composted leaves and the balls kept moist.

K. Unless otherwise authorized by the Landscape Architect, the Contractor shall notify the Landscape Architect at least 48 hours in advance of the anticipated delivery date of any plant materials. A legible copy of the invoice, showing kinds and sizes of materials included for each shipment shall be furnished to the Landscape Architect.

I. The Landscape Architect reserves the right to reject plant materials not meeting the above requirements.

L. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage shall be cause for rejection.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install plants during freezing weather or when the ground is frozen.

B. Do not install plants during excessively wet conditions.

C. Do not install plants when wind velocity exceeds 30 mph.

D. Plants shall not be placed on any day in which temperatures are forecast to exceed 90 degrees unless the Landscape Architect approves otherwise.

1.10 SEQUENCING AND SCHEDULING

A. Coordinate and schedule work with other contractors and with the municipality.

B. Comply with planting periods as specified in this specification.

C. Notify the Landscape Architect and Owner's Representative at least three (3) business days in advance of start of Work.

1.11 GUARANTEE

A. Provide a guarantee on work of this Section for twelve(12) months. Commence warranty on date when work is accepted by Owner.

B. Guarantee: Include coverage of plants from death or unhealthy conditions.

C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new guarantee commencing on date of replacement.

D. The condition of all new plant materials is the responsibility of the Contractor and shall be approved by the Landscape Architect.

E. Until final approval, any replacement of plant materials that may be necessary shall be at the expense of the Contractor.

F. In addition to other standard provisions, the Contractor's bid amount shall also provide for the following:

1. Maintenance necessary during Establishment Period, through final acceptance.

2. Replacement in kind, or with a substitute acceptable to the Landscape Architect, of all plant materials not in a healthy growing condition or that has died back to the crown or beyond normal pruning limits.

3. The Contractor shall also be responsible for any damage caused by his operations and shall dispose of all rubbish and excess soil as directed.

1.12 MAINTENANCE

A. Maintenance services shall be performed by installer.

B. Plant care and maintenance shall begin immediately after each plant is satisfactorily installed and shall continue throughout the life of the contract until final acceptance of the Owner.

C. Maintenance to include:

1. Cultivation and weeding plant beds and tree pits.

2. Application of herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.

3. Application of pesticides in accordance with manufacturer's instructions.

4. Remedy damage from use of pesticides.

5. Watering or irrigating sufficient to saturate root system.

6. Trimming and pruning, including removal of clippings and dead or broken branches, and treatment of pruned areas or other wounds.

7. Disease control.

8. Maintaining guys, stakes, and strapping. Repair or replace accessories when required.

9. Replacing mulch that has been displaced by erosion or other means, repairing and reshaping water rings or saucers.

10. Performing any other work required to keep the plants in a healthy condition.

D. Contractor shall remove and replace all dead, defective and/or rejected plants as required before final acceptance.

PART 2 PRODUCTS

2.1 NURSERIES

A. Nursery shall be a member of American Association of Nurserymen and Pennsylvania Landscape and Nurserymen's Association (or other such State organization).

2.2 TREES, PLANTS, & GROUND COVERS

A. Trees, Plants, and Ground Covers: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work. Plant shall in all cases conform with requirements of the American Standard for Nursery Stock latest versions of rules and grading adopted by the American Association of Nurserymen, Inc., but upgraded to meet the following additional requirements.

B. Unless specifically noted otherwise, all plants shall be of selected specimen quality, exceptionally heavy, symmetrical, tightly knit, so trained or favored in their development and appearance as to be superior in form, number of branches, compactness and symmetry. All plants shall have a normal habit or sound, healthy, vigorous plants with well-developed root system.

C. Plants shall be free of disease, insect pests, eggs or larvae.

D. Plants shall not be pruned before delivery.

E. Trees with abrasion of the bark, sunscalds, disfiguring knots or fresh cuts of limbs over one and one-fourth inches (1-1/4") which have not completely calloused shall be rejected.

F. All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. All plants shall have been grown under climatic conditions similar to those in the locality of the site of the project under construction or have been acclimated to such condition for at least two (2) years.

G. The root system of each shall be well provided with fibrous roots. All parts shall be sound, healthy, vigorous, and well-branched.

H. All plants designated ball and burlap (B&B) must be moved with the root systems as solid units with balls of earth firmly wrapped with burlap. The diameter and depth of the balls of earth must be sufficient to encompass the fibrous root feeding systems necessary for the healthy development of the plant. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during the process of planting. The balls shall remain intact during all operations. All plants that cannot be planted at once must be heeled-in by setting in the ground and covering the balls with soil or mulch and then watering. Hemp burlap and twine is preferable to treated. If treated burlap is used, all twine is to be cut from around trunk and all burlap is to be removed.

I. The trunk of each tree specified as 'tree form' shall be a single trunk growing from a single unmutilated crown of roots. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety.

J. The thickness of each shrub shall correspond to the trade classification "No.1". Single stemmed or thin plants shall not be accepted. The side branches must be generous, well twigged, and the plant as a whole well branched to the ground. The plants must be in healthy condition, free from dead wood, bruises or other root or branch injuries.

K. Plants shall be measured when branches are in their normal position.

L. Shrubs shall meet the requirements for spread, height or container size stated in the Plant List. The measurements are to be taken from the ground level to the average height of the shrub and not to the longest branch. Height and spread dimensions specified refer to the main body of the trees (measured from the crown of the roots to the tip of the top branch) shall be not less than the minimum size designated.

M. Caliper measurements shall be taken at a point on the trunk six inches (6") above natural ground line for trees up to four inches (4") in caliper, and at a point 12 inches (12") above the natural ground line for trees exceeding four inches (4") in caliper.

N. If a range of size is given, no plant shall be less than the minimum size, and not less than 50% of the plants shall be as large as the upper half of the range specified.

O. The measurements specified are the minimum size acceptable and, where pruning is required, are the measurements after pruning.

2.3 TOPSOIL

A. Existing topsoil stripped from the project site, disturbed areas only, may be used for lawns, planting and transplanting work. Contractor shall verify if available

project site topsoil is sufficient in quantity to perform the required work. If project site topsoil is insufficient the contractor shall provide topsoil from an approved off project site source(s) as required to complete work.

B. Topsoil to be imported to the project site shall be a sandy loam topsoil (as defined in USDA Soil Texture Classification) and be fertile, friable, well-drained, pH range of 6.0 to 6.5, free of subsoil, toxic substances harmful to plant growth, without clay lumps, stones, roots or debris. The imported topsoil shall have a mechanical analysis as follows:

1. Sand: 35 percent to 40 percent.

2. Clay: 15 percent to 20 percent.

3. Organic Matter: 2.5 percent.

4. Silt: Balance.

2.4 ORGANIC SOIL AMENDMENT MATERIALS

A. Compost: A mixture of partially decomposed organic materials (chipped, shredded, or ground vegetation or waste or recycled wood products), leaf mold, mushroom soil/spent mushroom soil substrate (SMS), composted animal manure, or exceptional quality (Class A) composted bio-solids.

B. Compost shall be processed or completed to reduce weed seeds, pathogens, and deleterious material, and shall not contain paint, petroleum products, herbicides, fungicides, or other chemical residues that would be harmful to plant or animal life. Other deleterious material, plastic, glass, metal, or rocks shall not exceed 0.1 percent by weight or volume.

C. Compost produced from bio-solids (sewage/waste water sludge) shall be “Class A Grade” (exceptional quality) and meet US EPA’s 40 CFR Part 503 regulations.

D. Compost shall meet the following analysis:

1. Organic Matter Content: On dry weight basis, 40 to 75 percent.

2. Nitrogen Content: 1 to 2.5 percent.

3. Phosphorus Content: 1 to 2 percent.

4. Potassium Content: 0.5 to 1.5 percent.

5. Carbon – Nitrogen Ratio: 12 to 25:1

6. Moisture Content Range: 40 to 60 percent.

7. Moisture Absorbtion: 100 percent (Dry Weight Basis) Minimum.

8. pH Range: 6.0 to 8.0.

9. Bulk Density Range: 800 to 1,000 lbs. per cubic yard.

10. Soluble Salt Content: 5 dS (mmhos/cm) or less.

11. Trace Elements: Meet US EPA 40 CFR Part 503 requirements.

12. Particle Size: Must pass 1 inch sieve or smaller.

13. Stability Rating: Stable.

2.5 PLANTING SOIL MIXTURE

A. Tree Pits: Thoroughly mix planting soil mixture prior to installation in planting hole/tree pit.

B. Planting mix will consist of the following for trees and shrubs:

1. 3 Parts topsoil as specified.

2. 1 Part selected organic soil amendment.

D. Groundcover, Perennial, & Ornamental Grass Planting Holes/Beds: Install planting soil as described in Part 3.

1. 2 Parts topsoil as specified.

2. 1 Part selected organic soil amendment.

2.6 WATER

A. On-site water shall be furnished by the Owner. Hose and other watering equipment shall be furnished by the Contractor.

2.7 SOIL FERTILITY MATERIALS

A. Fertilizer (Trees & Shrubs): "Agriform", one (1) year duration controlled-released planting tablets manufactured by The Scotts Company, LLC, Marysville, OH, (800) 492-8255 or approved equal. Planting tablets shall be 20-10-5 formulation in 21 gram size. Apply fertilizer tablets in the following rates:

1. For trees: 2 tablets for each caliper inch.

2. For shrubs: 1 tablet for each 12 inches of plant height or spread.

B. Mycorrhizal Treatment for Trees & Shrubs: "Tree Saver"3-Ounce packet manufactured by Plant Health Care, Inc, 440 William Pitt Way, Pittsburgh, PA 15238; Phone: (412) 826-5488; Web: www.planthealthcare.com or approved equal. Install per manufacturer's instructions. Apply at the following rates:

1. For single stem trees: 1 Packet per inch of tree caliper, minimum of 1 packet.

2. For multi-stem stem trees: 1 Packet per each 12 inches of rootball diameter, minimum of 1 packet.

3. For shrubs: 1/3 Packet for each gallon of container size or for each 12 inches of plant height or spread.

C. Mycorrhizal Treatment (Perennials, Groundcovers, & Ornamental Grasses): "Flower Saver"manufactured by Plant Health Care, Inc, 440 William Pitt Way, Pittsburgh, PA 15238; Phone: (412) 826-5488; Web: www.planthealthcare.com or approved equal. Install per manufacturer's instructions. Apply at the following rates:

1. 6 Pounds per 100 square feet of planting bed.

2.8 HERBICIDE & PESTICIDE

A. Herbicide: As may be required with approval of Landscape Architect.

B. Pesticide: As may be required with approval of Landscape Architect.

2.9 MULCH MATERIALS

A. Wood Mulching Material: Double ground hardwood bark, brown in color, and free of growth or germination inhibiting ingredients. Contractor shall submit sample to the Landscape Architect for approval.

2.10 ANTI-DESICCANT SPRAY

A. Spray shall be an emulsion which will provide a protection fill over plant surfaces. It shall be permeable enough to permit transpiration such as "Wilt-Pruf", manufactured by Nursery Product Specialties Company, Croton Falls, New York, or other approved equal. It shall be delivered in the manufacturer's containers and mixed according to the manufacturer's instructions.

2.11 GUYING & STAKING MATERIALS

A. Stakes: Cedar, 2-inch square with pointed end.

B. Synthetic tree guy strapping: ArborTie® strapping as manufactured by Deep Root Partners, L.P. – 530 Washington Street, San Francisco, CA 94111; Phone:

(800) 458-7668; Web: www.deeproot.com or approved equal. Guy wire and rubber hose is not acceptable.

1. Material: Flat, woven polypropylene

2. Size: ¾ Inch wide

3. Color: White or Green

2.12 VERIFICATION

A. Provide certification of inspection by the Landscape Architect for confirming approval of plants supplied.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that Project Site is ready for planting prior to delivery of materials

B. Beginning of installation means acceptance of existing conditions.

3.2 PLANTING PERIODS

A. Planting shall be performed within the following periods:

1. From March 15 to June 15.

2. From September 1 to November 15.

B. Only with the approval of the Landscape Architect can planting occur for the period of after November 15 to March 15.

C. Planting between June 16 to August 31 is not permitted.

3.3 PREPARATION FOR PLANTING AREAS

A. Contractor shall locate plants by staking with stakes and flags as indicated on the Drawings for approval by the LANDSCAPE ARCHITECT.

B. For mass groundcover, perennial, or ornamental grass plantings excavate planting areas to depths as indicated and install planting soil in six inch maximum lifts. Once soil depth is achieved incorporate specified fertilizer/Mycorrhizal treatment into the soil mixture and roto-till entire planting bed to a depth of 12 inches. Planting mix shall be installed during dry weather and on dry unfrozen subgrade.

C. Grade planting to eliminate rough, low, or soft areas, and to ensure positive drainage.

3.4 PLANTING

A. Excavate circular plant pits with scarified vertical sides, except for plants specifically indicated to be planted in beds, to depths as indicated on the drawings. Provide planting pits at least twice the diameter of the root system or container. Depth of pit shall accommodate the entire root system. Scarify the bottom and sides of the pit to a depth of four inches. If groundwater is encountered upon excavation of planting holes, the Contractor shall promptly notify the Landscape Architect.

B. If plants are containerized, the containers shall be removed from the plants immediate prior to planting and in a manner that prevents damage to the root system. Containers may require vertical cuts down the full depth of the container to accommodate removal. All circling roots shall be loosened to ensure natural directional growth after planting.

C. Set plant material in the planting pit to proper grade and alignment. Set plant upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure. Set crown of plant material at the finish grade. No filling will be permitted around trunks or stems or above grafts on grafted trees.

D. Once plant material is set correctly in planting pit begin to backfill with specified planting mixture. Do not use frozen or muddy mixtures for backfilling. When planting hole depth is ½ full with planting soil, water soil in and lightly firm to remove voids and/or air pockets. After planting soil is watered and firmed for balled and burlapped plants remove burlap, rope/twine, and/or wire baskets from top 1/3 of rootball and tuck into planting hole. If burlap has been chemically treated (green color) or rope materials are plastic or not natural material remove from the planting pit.

F. Install fertilizer tablets and Mycorrhizal treatment packets as specified on firmed soil in planting pit. Tablets and packets shall be evenly distributed throughout the pit.

G. Continue backfilling planting hole to final grades as shown on the plans. Once backfilling is complete thoroughly water in planting soil and lightly firm to remove voids and/or air pockets.

H. Containerized shrubs shall follow same procedure as described above.

I. Containerized groundcover, perennials, and/or ornamental grasses shall be planted in a roto-tilled bed in holes same size as rootball. Once plant is placed lightly firm soil around rootball to ensure firmly placed in hole.

J. Space ground cover plants using triangular spacing in accordance with indicated dimensions. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants. Plant to within eighteen inches (18") of the trunks of

trees and shrubs within planting bed and to within twelve inches (12") of edge of bed.

3.5 MULCHING

A. Mulch tree and shrub planting pits and shrub beds with required mulch two inches (3") deep immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.

B. Mulch groundcover, perennial, and ornamental grass beds with required mulch two inches (3") deep immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.

3.6 STAKING/GUYING

A. Stake all deciduous and coniferous trees immediately after planting.

3.7 PRUNING

A. Prune all trees only to remove broken or damaged branches, or for aesthetic purposes as directed by the Landscape Architect. Branches will be pruned at the branch collar. Neither stubs nor flush cuts will be acceptable.

3.8 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from planting operations.

3.9 MAINTENANCE

A. Maintenance shall begin immediately after planting. Plants shall be watered, mulched, weeded, pruned, sprayed, fertilized, cultivated, and otherwise maintained and protected until provisional acceptance. Settled plants shall be reset to proper grade and position, planting saucer restored and dead material removed. Stakes and wires shall be tightened and repaired. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.

B. If a substantial number of plants are sickly or dead at the time of inspection, acceptance shall not be granted and the Contractor’s responsibility for maintenance of all plants shall be extended until replacements are made or existing plants are deemed acceptable by the Landscape Architect.

C. All replacements shall be plants of the same kind and size specified on the Plant List. They shall be furnished and planted as specified above. The cost shall be borne by the Contractor. Replacements resulting from removal, loss, or damage due to occupancy of the project in any part, vandalism, physical damage by

animals, vehicles, etc., and losses due to curtailment of water by local authorities shall be approved and paid for by the Owner.

D. Plants shall be guaranteed for a period of eighteen (18) months after inspection and provisional acceptance. This period is also called the Establishment Period.

E. At the end of the Establishment Period, inspection shall be made again. Any plant required under this contract that is dead or unsatisfactory to the Landscape Architect or Owner shall be removed from the site. These shall be replaced during the normal planting season.

F. At the end of the Establishment Period, contractor shall return to the site and remove staking and strapping materials.

3.10 FINAL INSPECTION

A. Inspection to determine completion and acceptance of planted areas will be made by the Landscape Architect and/or Owner's Representative, upon Contractor's request. Provide notification at least ten (10) business days before requested inspection date. Inspection comments will be submitted to contractor in writing.

B. Planted areas will be accepted provided all requirements, including the maintenance period have been complied with and plant materials are alive and in a healthy, vigorous condition.

C. Upon acceptance the OWNER will assume plant maintenance and the plant material warrantee period begins.

D. An additional inspection will be made near the end of the warrantee period to determine if plant materials need to be replaced. Plants shall be in a healthy, vigorous growing state and free of disease and insects.

END OF SECTION

SECTION 330110
PROTECTION OF EXISTING UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Identification and field mark out of all on-site utility lines to remain in operation during construction.

B. Submission of procedures to be used to ensure the safety of the utility.

C. Repair of any damage during construction operations.

1.2 RELATED SECTIONS

A. Section 024100 - Site Demolition

B. Section 311000 - Site Preparation

C. Section 312010 - Earthwork

D. Section 312320 - Trench Excavation and Backfill for Utilities

E. Contract Drawings

1.3 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of capped utilities and utility lines encountered during construction.

1.4 REGULATORY REQUIREMENTS

A. Contractor shall notify all affected utility companies, agencies, authorities, owners, etc. at least 48 hours prior to the commencement of work and shall comply with their requirements.

B. Contractor shall contact the PA ONE-CALL service for an official utility mark out.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

3.1 IDENTIFICATION

A. Locate all existing utilities which are to remain in service during construction as shown on the Construction Drawings.

3.2 PROTECTION

A. Flag, barricade or suitably protect existing utilities during construction operations and equipment movement.

B. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction.

3.3 LATERAL DISCONNECTION

A. Where a utility line is to be disconnected from portions to remain, the lateral pipes shall be cut and suitably plugged/capped in accordance with the Contract Drawings and applicable utility or agency requirements.

3.4 REPAIRS

A. Any damage to existing, operational utilities by the Contractor or his subcontractors during the on-going construction operation shall be immediately repaired to operational standards at the Contractor's expense. If the repairs are not immediately addressed by the Contractor, the utility owner and/or the Owner shall contract for the repair at the Contractor's expense.

END OF SECTION

SECTION 331153
OBSERVATION WELLS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work of this section consists of construction of observation wells to observe and record subsurface hydrology. This may include observation wells, peak gauges, and/or other monitoring methods. Construction may include excavation, PVC or HDPE piping, metal covers, stone fill, geotextile, and any and all incidental work required for the completion of the observation wells as shown on the Drawings.

1.2 RELATED WORK

A. Section 320519 Geosynthetic Fabrics

B. Section 334653 Subsurface Stormwater Storage

1.3 REFERENCE STANDARDS

A. ASTM International

1. ASTM A48 – Standard Specification for Gray Iron Castings.

2. ASTM A536 – Standard Specification for Ductile Iron Castings

1.4 SUBMITTALS

A. Submit shop drawings, samples, certificates, manufacturer's data, and/or product data in accordance with Division 01.

B. Submit a list of materials to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Observation wells

1. Observation wells shall be four-inch (4") inside diameter rigid Schedule 40 PVC pipe in upper section, with solid cap.

2. Slotted sections shall be four-inch (4") PVC slotted well with 0.01 slots and attached plug, Atlantic Screen and Manufacturing item # OES40400 or approved equivalent.

3. Covers for observation wells shall be lockable ductile iron with gray iron frames, East Jordan Ironworks product #00157026 or approved equivalent. Cover and/or frame shall be stamped "MONITORING WELL". Bolts shall be machine head stainless steel with hex key insert as appropriate. Bolts shall be installed clean and free of grit or debris and coated using white

lithium grease or equivalent metal-to-metal lubricant and rust protector prior to initial installation.

4. Protective casing for observation wells in unpaved areas that experience surface ponding shall be Plastech Plus built-in aluminum mounting casing, or approved equal.

B. Aggregate fill around observation wells shall be consistent with surrounding aggregate. In the case of a free-standing well which is not located within a given stormwater structure, the aggregate utilized shall be AASHTO #57.

C. Non-woven geotextile (drainage filter fabric) shall conform to the requirements specified under Section 320519 – Geosynthetic Fabrics.

PART 3 – EXECUTION

3.1 OBSERVATION WELLS

A. Observation wells are typically placed within a subsurface stormwater structure. The well shall be placed in a location in accordance with the Drawings. Relocation of a well shall require advance approval by the Engineer.

B. The well location shall be over-excavated twelve inches (12”) below the depth of the surrounding subsurface stormwater trench. This excavation shall be performed by hand, so as not to disturb the surrounding soils. Observation wells to be installed in geomembrane-lined systems shall be emplaced flush with the bottom of the trench and not over-excavated.

C. The slotted section of well shall be placed into the over-excavation, with the attached plug at the bottom. A minimum of six inches (6”) separation shall be maintained between the top of the slotted well section and the top of the subsurface stormwater structure. Well section length shall be field-adjusted to maintain this separation.

D. All well sections shall be installed vertically plumb (as verified by use of a hand level). The Contractor shall make every effort necessary to maintain this plumb condition until backfilling is complete. Wells found to be out of plumb shall be unacceptable and replaced at no additional cost to the Owner.

E. The over-excavation and area surrounding the well within the subsurface stormwater structure shall be backfilled with the same material as the stormwater structure (typically AASHTO #57 stone).

F. The well section from the slotted section ending six inches (6”) below the top of the stormwater structure to the top of the well within the cover shall be four-inch (4”) solid Schedule 40 PVC, attached to the slotted section by a PVC coupling.

G. The area surrounding the solid well section shall be restored in kind with the adjoining area over the subsurface stormwater structure. Any geotextile wrap separating the stormwater structure from the covering fill shall be cut and wrapped six inches (6”) up the solid well section.

H. The well cover shall be installed within the surface restoration as required, such that the cover plate is flush with the surrounding surface. Observation wells placed in unpaved areas located

within green stormwater infrastructure that will experience surface ponding of water shall extend three (3) inches above the maximum ponding depth.

I. A hexagonal key locking bolt should be used for the cover. Bolts shall be free of grit and debris and a lubricant listed in Products section above shall be used to coat the entire thread and thread hole prior to initial installation.

J. If the well cover is not installed into a concrete surface, it shall have a concrete ring or frame poured for support. This concrete ring shall be a minimum of six inches (6") wider in any dimension than the cover frame, of equal depth as the cover frame itself, and poured upon a minimum of six inches (6") of AASHTO #57 stone bedding. A frame conforming to these minimum dimensions may be circular or square. For locations in permeable pavement, frames and covers shall be located within the permeable pavement area surrounded by edge curb.

K. Observation wells that are not flush with the surrounding surface shall have a protective casing set into the concrete ring. The inner diameter of the protection casing shall be at least one inch (1") greater than the outer diameter of the PVC well screen.

L. The solid well section shall extend into the cover frame enough such that a bentonite seal can be placed around the well within the frame, and a solid slip-on cap can be fitted onto the pipe end.

M. The contractor shall demonstrate to the Owner that the cap is removable.

END OF SECTION

SECTION 334100
STORM DRAIN PIPE

PART 1 – GENERAL

1.1 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Storm sewer pipelines

1.2 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Section 015713 Soil Erosion & Sediment Control
2. Section 312010 Earthwork
3. Section 312320 Trench Excavation and Backfill for Utilities
4. Section 334211 Thermoplastic Drainage Pipe and Fittings
5. Section 334414 Storm Inlets and Drainage Structures
6. Section 334653 Subsurface Stormwater Storage
7. Section 334913 Storm Manholes

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M294 Specification for Corrugated Polyethylene Pipe, 12 to 60 Inch Diameter.
2. American Society for Testing and Materials (ASTM):
   a. A746 Standard Specification for Ductile Iron Gravity Sewer Pipe
   b. C14 Specification for Concrete Sewer, Storm Drain and Culvert Pipe.
   c. C76 Specification for Reinforced Concrete Culvert Storm Drain, and Sewer Pipe.
   d. C507 Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
3. American National Standards Institute (ANSI)/American Water Works Association (AWWA)
   a. ANSI C153/AWWA A21.53 Ductile Iron Compact Fittings - 4 to 64 Inches
4. Pennsylvania Department of Transportation:
   a. Publication 408 Specifications

1.4 SUBMITTALS

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer’s data, and/or product data in accordance with Division 01.

B. Manufacturer's Literature:

1. Submit manufacturer's descriptive literature for the following items in accordance with Division 1:

a. Pipe

b. Pipe fittings

c. Joints

2. Submit manufacturer's instructions and recommendations for the following items in accordance with Division 1:

a. Assembly of joints

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. During loading, transporting and unloading, exercise care to prevent damage to materials.

B. Do not drop pipe or fittings.

C. Other Requirements:

1. Division 1 also addresses transportation and handling along with storage and protection of materials and equipment.

PART 2 – PRODUCTS

2.1 REINFORCED CONCRETE PIPE (RCP)

A. Pipe and Fittings:

1. ASTM C76, Minimum Class III unless otherwise indicated on Drawings.

B. Joints:

1. Bell and spigot, or

2. Tongue and groove

2.2 ELLIPTICAL REINFORCED CONCRETE PIPE (ERCP)

A. Pipe:

1. ASTM C507, Minimum Class HE A or VE II unless otherwise indicated on Drawings.

B. Joints:

1. Bell and spigot, or

2. Tongue and groove

2.3 SMOOTH LINED CORRUGATED HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

A. Pipe

1. Section 601.2(a)6.d.&e., Publication 408 Specifications

2. AASHTO M294, Type C (Corrugated) and Type S (Smooth-lined)

B. Joints

1. Watertight Joints or approved equal

2.4 DUCTILE IRON PIPE (DIP)

A. Pipe

1. ASTM A746

B. Joints

1. ANSI C153/AWWA A21.53

PART 3 – EXECUTION

3.1 PREPARATION

A. Perform trench excavation to the line and grade shown on the Drawings and as specified in Section 312320.

B. Provide pipe bedding as specified in Section 312320 for each type of pipe used. Place aggregate in a manner to avoid segregation and compact to the maximum practical density so that the pipe can be laid to the required tolerances.

3.2 LAYING PIPE IN TRENCHES

A. Give ample notice to the Owner’s Representative in advance of pipe laying operations.

B. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.

C. Lay pipe proceeding upgrade with the bell or groove pointing upstream.

D. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings, and appurtenances.

E. Lay each section of pipe to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.

F. Clean and inspect each pipe and fitting before joining. Align pipe with previously laid sections.

G. Assemble joints in accordance with the pipe manufacturer's instructions. Pipe joints shall consist of a preformed rubber gasket or be mortared except for interlocking style pipe and pipe joined with bands.

1. For mortared joints, mortar the lower half of the joint before placing the succeeding pipe section to bring the inner surface of the abutting pipe flush. Before placing mortar, wet the pipe with as much water as it will readily absorb. Fill the outside of bell and spigot pipe joints with mortar, flush with the bell end. Fill tongue and groove pipe joints flush with the pipe's outside surface. On the inside of the pipe, fill the lower half of the joint flush with mortar, wipe clean, and finish smoothly. For pipes of 24inch diameter and larger, fill the joints for the entire inside periphery in the same manner. Fill voids for lift holes with mortar after pipe is placed.

H. Check each pipe installed as to line and grade in place. Correct deviation from line and grade immediately. A deviation from the designed grade as shown on the Drawings, or deflection of pipe joints, will be cause for rejection.

I. Place and compact sufficient backfill to hold each section of pipe firmly in place as the pipe is laid.

3.3 BACKFILLING TRENCHES

A. Backfill pipeline trenches only after examination of pipe laying by the Owner’s Representative.

1. If joints are mortared, backfilling may proceed immediately only if the operation will avoid joint damage, maintain pipe in proper alignment and grade, and provide satisfactory curing conditions for mortar.

B. Backfill and compact trenches as specified in Section 312320.

END OF SECTION

SECTION 334211
THERMOPLASTIC DRAINAGE PIPE AND FITTINGS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install solid and perforated corrugated high density polyethylene (HDPE), polypropylene (PP) pipe or polyvinyl chloride (PVC) pipe and/or structures and appurtenances as shown on the Drawings and as specified herein.

1.2 RELATED WORK

A. Section 312000 Earthwork

B. Section 320519 Geosynthetic Fabrics

C. Section 331153 Observation Wells

D. Section 334200 Storm Drain Pipe

E. Section 334414 Storm Inlets and Drainage Structures

F. Section 334653 Subsurface Stormwater Storage

G. Section 334654 Stormwater Surface Features

H. Section 334913 Storm Manholes

1.3 SUBMITTALS

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer's data, and/or product data in accordance with Division 01.

B. Submit a list of materials to be provided for work under this Section. Include the name and address of the materials producer, the location from which the materials are to be obtained, part numbers, and shop drawings.

C. Certificates of Compliance: Before installation of any Thermoplastic Pipe or Fittings, submit an acceptable Certificate of Compliance.

D. In the event of unavailability of a specified product from any and all approved manufacturers, submit both certification of unavailability and shop drawings showing details of pipe, fittings, joints and construction methods from an alternate source.

1.4 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M-252 - Standard Specification for Corrugated Polyethylene Pipe (4-in to 10-in)

2. AASHTO M-294 - Standard Specification for Corrugated Polyethylene Pipe (12-in to 36-in)

B. ASTM International

1. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Application.

2. ASTM F2306 – Standard Specification for 12 to 60 in. Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity- Flow Storm Sewer and Subsurface Drainage Applications

3. ASTM F2881 – Standard Specification for 12 to 60in Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications.

4. ASTM D3034 – Standard for Sewer PVC Pipe and Fittings

5. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

6. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

7. ASTM D1785 – Standard Specification for Polyvinyl Chloride (PVC) Pipe, Schedules 40, 80, and 120.

8. ASTM D638 - Test Method for Tensile Properties of Plastics.

9. ASTM D695 - Test Method for Compressive Properties of Rigid Plastics.

10. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

C. Philadelphia Water Department Quality Certification Standards (QC)

1. QC-2 Standards for Gray/Ductile Iron Castings

2. QC-13 Standards for Thermoplastic Pipe and Fittings

D. Where reference is made to one of the above standards the revision in effect at the time of bid opening shall apply.

1.5 QUALITY ASSURANCE

A. All pipe, fittings, cleanout covers, domed riser grates and frames, and other products shall be installed to ensure a minimum loading capacity in accordance with H-20 loading, as required by Philadelphia Department of Streets. Any deviation from manufacturer's specifications for product installation (without approval by manufacturer or signed and sealed statement of adequacy by Professional Engineer) is prohibited.

B. Thermoplastic pipe and fittings shall be provided by a certified manufacturer listed under PWD Quality Control Standard (QC) 13. In the event a specific part is neither available nor manufactured by the approved suppliers, shop drawings shall be submitted for approval by PWD prior to installation.

C. All pipe installed under this Section shall be clean at time of installation. The Contractor shall be responsible for ensuring no dirt, debris, or other foreign material is on any surface of the piping immediately prior to installation. Piping installed that is found to contain debris shall be refused, and (in the event of clean stone bedding) the entire trench shall be removed and replaced in its entirety at no cost to the City.

PART 2 – PRODUCTS

2.1 CORRUGATED HDPE OR PP PIPE AND PVC PIPE AND FITTINGS

A. Corrugated HDPE or PP pipe shall have an annular corrugated exterior and smooth inner wall (dual wall pipe). Pipe shall be manufactured by an approved supplier under QC-13.

B. Corrugated pipe shall be high density polyethylene or polypropylene of the size and type as shown on the Drawings, all manufactured by the same company and shall meet or exceed the following specifications as applicable: AASHTO M-252, AASHTO M-294, ASTM F2306, or ASTM F2881.

C. Polyvinyl Chloride Pipe shall be Schedule 80 PVC or SDR-17 as a minimum pipe wall thickness.

D. Backfilling over the pipe shall be to ASTM D2321 or the pipe manufacturer's specifications, whichever is greater. Cover shall be compacted to at least 95 percent of its maximum dry density as determined by ASTM Test D1557, Method D.

E. Joints shall be watertight according to the requirements of ASTM D3212. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

F. Fittings shall be polyvinyl chloride (PVC) or high-density HDPE of the size and type as shown on the Drawings; all manufactured by the same company and shall meet or exceed the following specifications as applicable: AASHTO M-252, AASHTO M-294, ASTM F2306, and/or ASTM D3034. Fittings shall have bell and spigot connections that utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM D3212.

G. Perforated pipe shall have AASHTO Class II perforations. Class II perforations shall be located in the outside valleys of the corrugations, be circular and/or slotted, and evenly spaced around the circumference and length of the pipe. The opening area shall be no less than 0.945 square inches per linear foot (pipe diameters 4 through 10-inches).

2.2 CLEANOUTS

A. Cleanouts shall be PVC structures in all vertical sections, with adapters to horizontal dual wall corrugated HDPE pipe. Drain covers, grates, and frames shall be ductile iron and lockable. See detailed product information below.

1. PVC Schedule pipe - Harvel Plastics or approved equal.

2. PVC Fitting; Universal Bell Adapter - Nyloplast 7001-110-275 or approved equal.

3. PVC Fitting, 8” HDPE 1/8 Bend - Nyloplast 0894ST or approved equal.

4. PVC Fitting, 8” HDPE Wye to 6” PVC - Nyloplast 0802AG or approved equal

5. Frame and cover; Neenah Foundry Product #19750068 for frame and #19750070 for lid or approved equal. Frame and lid to be lockable by means of stainless steel bolts.

B. Locking bolts: Stainless steel machine head bolts with countersunk hex key. Bolts shall be installed clean and free of grit or debris and coated using white lithium grease or equivalent metal-to-metal lubricant and rust protector prior to initial installation.

2.3 DOMED RISER STRUCTURES

A. Domed riser structures shall be mated directly to HDPE/PP piping with watertight seals and fittings.

1. Nyloplast 12” Inline Drain, Part # 2712AG or approved equal. For domed riser with sump, Nyloplast 12” Drain Basin, Part # 2812AG or approved equal.

2. Neenah Inlet Frame and Beehive Grate, Part # R-2560-G/C, or Nyloplast Grate and Frame, Part # 1299CGD-L, or approved equal.

3. Locking mechanism: Steel cable with one looped end attached to grate bars and another looped end attached to eyebolt set in concrete ring.

    a. Stainless steel eyebolt, one-and-a-half-inch (1-1/2”) minimum eye inside diameter, three-inch (3”) shank length with washer and nut at end of shank set into concrete ring.

    b. 3/16-inch (3/16”) thick galvanized steel cable (W.W. Grainger, Inc. item no. 2TAE8 or approved equal). No frayed ends. Appropriate length to function per design plans.

    c. Loops at ends created by two sleeves (wire rope sleeve for wire rope dia. 3/16” Aluminum Alloy or similar).

4. For domed riser standpipe, riser sections shall be solid (non-perforated) within the stormwater soil section of the Stormwater Management Practice. Standpipe shall have perforated sump sections within the stormwater trench (uniformly graded stone) section of the Stormwater Management Practice. Length of perforated sump section shall be as shown on the Drawings, but not less than twelve-inches (12”). Perforations shall be one half-inch (0.5”) diameter, drilled vertically and radially two-inches (2”) apart, on center, and offset one-inch (1”) every other row. Bottom cap shall be a twelve-inch (12”) diameter solid HDPE cap.

2.4 PERMANENT DOMED RISER PROTECTION

A. Permanent domed riser (inline drain) protection shall be as indicated on the Drawings. If no permanent riser protection product is identified on the drawings, the permanent riser protection shall be the StormSack-PWD Round Grate Inlet Protection System, as manufactured by Fabco Industries/ACF Environmental, or approved equal. Product shall have the following properties (minimum):

1. Sediment bag for 12” domed riser grate:

    a. Filtered flow rate: 145 gallons per minute per square foot (gpm/sf)

    b. AOS: 40 (sieve size)

    c. Puncture Strength: 750 pounds

    d. Filtration Efficiency: 82%

    e. Mesh liner to guard against shovel strikes during cleanout operations

2. Frame

    a. Stainless steel construction

    b. Integral lifting points

    c. Expanding ring system to support inlet protection within inline drain

2.5 DETECTABLE UNDERGROUND TAPE

A. Detectable Warning Tape shall be six inches wide (6”), 5-mil thickness, with aluminum foil core. Tape shall be printed with an appropriate legend (“Caution: Buried Storm Sewer Below” or as

approved) and shall conform to the color standards of the APWA for buried utilities (green for sewer).

PART 3 – EXECUTION

3.1 INSTALLATION OF HDPE AND PP PIPE AND FITTINGS

A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than one-sixteenth of an inch (1/16") per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site.

B. All pipe shall be examined before laying and no piece shall be installed which is found to be defective. All piping shall be reasonably clean and free of dirt and debris prior to installation. All pipe and fittings shall be thoroughly cleaned before installation.

C. All piping shall be sound and clean before installation. When installation is not in progress for any length of time, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by the manufacturer.

D. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the City.

E. After the excavation is complete to normal grade of the bottom of the trench and bottom preparation according to the Drawings and Specifications is completed, crushed stone bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. The pipe shall be laid accurately to the lines and grades indicated on the Drawings.

F. HDPE pipe and fittings shall be installed in accordance with ASTM D2321 and the requirements of the manufacturer (see "Corrugated HDPE Pipe Installation Guide" from ADS), or as otherwise provided herein or on the Drawings. Blocking under the pipe is not permitted. Bedding shall be placed evenly on each side of the pipe to mid diameter and hand tools shall be used to force the bedding where needed to give firm continuous support for the pipe. AASHTO #57 aggregate shall then be placed to six inches (6") above the top of the pipe.

G. Detectable underground utility marking tape shall be installed over all pipe not otherwise marked. The initial three feet (3') of backfill above the bedding shall be placed in one-foot (1') layers and carefully compacted. Generally, the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial three feet (3') of backfill shall be as approved by the pipe manufacturer.

H. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it. The Contractor shall maintain close pipe joints (once made) at all stages of construction activities, such that post-construction inspection of all joints shall demonstrate them to be tight and properly seated. All necessary caution shall be exercised to prevent separation of the pipe joints during installation and backfilling.

I. Precautions shall be taken to prevent flotation of the pipe in the trench.

J. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below the top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, crushed stone shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.

K. The use of ninety-degree (90º) bend pipe fittings is not permitted in the installation of piping. The Contractor shall use minimum-angle fittings to construct the pipe layout diagrammatically shown in the Drawings. The maximum fitting angle approved for use is forty-five-degrees (45º), and fittings of lesser angles (22½º or 11¼º) are preferred for use where practical.

L. Anti-seep collars shall be employed as indicated on the Drawings. See Section 334653 Subsurface Stormwater Storage.

3.2 CLEANING PIPELINES

A. As pipe laying progresses and at the conclusion of the work, thoroughly clean all new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this cleaning, obstructions remain, they shall be removed prior to approval and acceptance of the pipe by Engineer.

B. All pipes shall be video inspected by Contractor prior to any pavement and restoration finishes. Any pipe found to be defective (crushed, open joints, blocked or compromised in any way) shall be removed and replaced as directed by Engineer at no additional cost to the City.

END OF SECTION

SECTION 334414
STORM INLETS AND DRAINAGE STRUCTURES

PART 1 – GENERAL

1.1 SECTION DESCRIPTION

A. The Work of This Section Includes, but is not limited to:

1. Storm drainage curb inlets
2. Storm drainage catch basins
3. Storm drainage junction boxes
4. Storm drainage pipe endwalls
5. Pipe culvert end sections

1.2 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Section 015713 Soil Erosion and Sediment Control
2. Section 033000 Cast-In-Place Concrete
3. Section 312010 Earthwork
4. Section 312320 Trench Excavation and Backfill for Utilities
5. Section 334100 Storm Drain Pipe
6. Section 334211 Thermoplastic Drainage Pipe and Fittings
7. Section 334414 Storm Inlets and Drainage Structures
8. Section 334653 Subsurface Stormwater Storage
9. Section 334913 Storm Manholes

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. A36 Specification for Structural Steel
   b. A47 Specification for Malleable Iron Castings
   c. A536 Specification for Ductile Iron Castings
   d. C32 Specification for Sewer and Manhole Brick
   e. C270 Specification for Mortar for Unit Masonry
2. Pennsylvania Department of Transportation

a. Publication 408 Specifications

b. Publication #72 Standards for Roadway Construction

B. Acceptable Manufacturers:

1. Precast structures, and frames and covers shall be provided by a firm regularly engaged in the manufacture of such products of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

2. Precast structures shall be provided by one of the following manufacturers or approved equal.

a. Monarch Precast Concrete Corporation

b. Modern Concrete Company

c. Oldcastle Precast Concrete Corporation

d. Approved equal

3. Frames and grates shall be provided by one of the following manufacturers or approved equal.

a. Neenah Foundry Company

b. East Jordan Iron Works, Inc.

c. Syracuse Castings Sales Corporation

d. Approved equal.

1.4 SUBMITTALS

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer's data, and/or product data in accordance with Division 01.

A. Submit detail shop drawings for the following items:

1. Inlet units, end walls, and end sections including reinforcing steel details.

2. Structure grates and covers.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Precast Concrete Units:

1. After fabrication and curing, transport the units to the job site. Protect until required for installation.

2. Handle to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

B. Other Requirements:

1. Division 1 also addresses transportation and handling along with storage and protection of materials and equipment.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Coarse Aggregate Subbase:

1. PADOT Number 2A, Type C, Section 703.2, Publication 408 Specifications.

B. Brick: ASTM C32, grade SS, solid

C. Masonry Mortar: ASTM C270, Type S

D. Malleable Iron Castings: ASTM A47, Grade 35018. Domestic

E. Ductile Iron Castings: ASTM A536, Grade 60 40 18. Domestic

F. Structural Grade Carbon Steel: ASTM A36

G. Concrete: Section 033000

2.2 FABRICATIONS

A. Precast Cement Concrete Units:

1. Comply with the requirements of Section 713.2(d), Publication 408 Specifications

B. Inlets and Catch Basins:

1. Comply with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC 34) for precast units.

C. End Walls:

1. Comply with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC-31) for precast units.

D. Pipe Culvert End Sections:

1. Comply with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC-33).

PART 3 – EXECUTION

3.1 EXCAVATION

A. Perform excavation in conjunction with storm pipe installation, Section 334100 and as specified in Section 312320.

B. Locate inlets, catch basins, junction boxes, endwalls and end section indicated on the Drawings.

3.2 CONSTRUCTION

A. Construct inlets and catch basins of either precast sections or of cast-in-place construction in compliance with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC 34).

   l. Place precast units on a 12" coarse aggregate subbase placed in 4" layers compacted to 95% of dry weight density.

   2. Construct cast in place units on undisturbed earth.

   3. Shape bottom of inlet boxes to channel flow of water to the outlet pipe and to prevent water from standing in box.

   4. Unless units are cast in place, use precast concrete sections or brick to adjust to grade. Mortar in place.

B. Construct endwalls of either precast units of cast in place construction in compliance with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC 31).

   1. Cast in place endwalls shall be monolithically cast reinforced concrete units.

C. Do not permit pipes to project more than 2" into inlets. Do not expose end of pipe through faces of endwalls.

D. Where indicated on the Drawings, provide pipe culvert end sections in compliance with the design and dimensions shown on the Drawings and in accordance with Publication #72 (RC 33).

3.3 BACKFILLING

A. Backfill structures only after examination by the Owner’s Representative.

B. Perform backfilling and compaction as specified in Section 312320.

END OF SECTION

SECTION 334653
SUBSURFACE STORMWATER STORAGE

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. In general, the work to be done under this section consists of construction activities pertaining to subsurface stormwater storage, including but not limited to earthwork and excavation, protection of existing features, preparation of subgrade, check dam construction, grading, sheeting and shoring, placement and compaction of clean stone, construction of infiltration columns, construction of stone and/or modular stormwater storage structures, sealing and waterproofing of intersecting structures and utilities, backfilling, and any incidental and related operations.

1.2 RELATED WORK

A. Section 015713 Soil Erosion and Sedimentation Control

B. Section 312010 Earthwork

C. Section 312320 Trench Excavation and Backfill for Utilities

D. Section 320519 Geosynthetic Fabrics

E. Section 331153 Observation Wells

F. Section 334200 Storm Drain Pipe

G. Section 334211 Thermoplastic Drainage Pipe and Fittings

H. Section 334414 Storm Inlets and Drainage Structures

I. Section 334913 Storm Manholes

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C117 - Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

2. ASTM C535- Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

3. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

4. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

5. ASTM F2418 - Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers

6. ASTM F2787 - Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers

7. ASTM A536 - Standard Specification for Ductile Iron Castings

8. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

9. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

10. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M-43 - Standard Specification for Sizes of Aggregate for Road and Bridge Construction

C. Other Agencies:

1. PennDOT Publication 408 - Specifications

2. Pennsylvania Test Methods (PTM), current published standards.

3. American Public Works Association (APWA) - Uniform Color Code.

1.4 SUBMITTALS

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer's data, and/or product data in accordance with the General Conditions, GC-4.11 and Supplementary Conditions, SC-19.

B. Submit a list of materials to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained. Include:

1. Aggregate: sieve analysis

C. Submit samples of coarse aggregates and sand.

1. Aggregate and sand: Samples of loose material in sealed bag labeled with name of material and manufacturer.

1.5 QUALITY ASSURANCE

A. All materials, methods of construction, and workmanship shall conform to applicable requirements of ASTM, PTM, PennDOT Standard Specifications and AASHTO Standards, unless otherwise specified.

B. Upon completion of relevant excavation work, and prior to placement of geotextile and aggregate, subgrade soil shall be inspected by the Engineer or the Owner's Representative. Survey or acceptable measurement by the Contractor shall verify the finished subgrade elevation in accordance with the construction plans.

C. Upon completion of placement of subgrade storage (stone fill or as otherwise specified) and geotextile, and prior to backfilling or surface restoration, the structure shall be inspected by the Engineer or the Owner's Representative. Survey or acceptable measurement by the Contractor shall verify the finished elevation(s) of the subsurface stormwater trench in accordance with the construction plans.

1.6 DELIVERY STORAGE AND HANDLING

A. Deliver, store, and handle all materials to ensure protection from damage.

B. The Contractor is reminded that unprotected stockpiles of materials may be considered as degraded condition by weathering and rendered unacceptable for use by the Engineer. In particular, clean washed stone may become contaminated if left unprotected onsite; the Owner reserves the right to require stockpile protection and/or replacement of damaged or compromised materials at no additional cost to the Owner.

PART 2 – PRODUCTS

2.1 AGGREGATE

A. Coarse aggregates shall meet the size and grading requirements as defined in Standard Sizes of Coarse Aggregate, Table 4, AASHTO Specifications, Part I, 19th Ed., 1998, or latest edition, unless otherwise specified.

1. Maximum wash loss of 1% (ASTM C117).
2. Maximum abrasion of 40% for 500 revolutions per ASTM C535 or C131 as appropriate to aggregate size.
3. All aggregate shall be clean and thoroughly washed.
4. Aggregate shall be 100% crushed material.

B. Unless otherwise approved by the Engineer, coarse aggregate for the stormwater trenches/basins shall be clean washed and uniformly graded as defined in Standard Sizes of Coarse Aggregate, Table 4, AASHTO Specifications, Part I, 19th Ed., 1998, or latest edition, unless otherwise specified.

1. Grading Requirements for AASHTO No 3 Aggregate

U.S. Standard Sieve Size	Percent Passing
2 ½” (63 mm)	100
2” (50 mm)	90-100
1 ½ “(37.5 mm)	35-70
1” (25 mm)	0-15
½” (12.5 mm)	0-5

2. Grading Requirements for AASHTO No. 57 Aggregate

U.S. Standard Sieve Size	Percent Passing
1 ½” (37.5 mm)	100
1” (25 mm)	95-100
½ “(12.5 mm)	25-60
No. 4 (4.75 mm)	0-10
No. 8 (2.36 mm)	0-5

3. Any and all other specified coarse aggregates shall conform in gradation and type to the current standards of PennDOT Publication 408, Section 703 Table C.

C. Crushed concrete shall not be an acceptable substitute for coarse aggregate.

2.2 SAND

A. Sand used to line the bottom of stormwater trenches shall be AASHTO M-43 No. 9 or 10.

1. Grading Requirements for AASHTO No 9

U.S. Standard Sieve Size	Percent Passing
3/8" (9.5 mm)	100
No. 4 (4.75 mm)	85-100
No. 8 (2.36 mm)	10-40
No. 16 (1.18 mm)	0-10
No. 50 (150 µm)	0-5

2. Grading Requirements for AASHTO No 10

U.S. Standard Sieve Size	Percent Passing
3/8" (9.5 mm)	100
No. 4 (4.75 mm)	85-100
No. 100 (300 µm)	10-30

2.3 BACKFILL MATERIALS

A. See Section 312000 Earthwork and Section 312320 Trench Excavation and Backfill for Utilities.

2.4 SPLIT PIPE UTILITY SLEEVE

A. Utility sleeves (i.e., pass-through conduit) on new or relocated utilities shall consist of Schedule 40 PVC pipe of adequate diameter to convey the utility within unless otherwise approved by the Engineer.

B. Utility sleeves on existing utilities shall be split pipe conduit, Model P6F as manufactured by Conduit Repair Systems or approved equal.

C. Utility sleeves used for prefabricated modular storage systems shall be in accordance with the manufacturer's instructions.

D. Split pipe utility sleeves shall be watertight and sealed at either end with non-shrink grout or sealant.

2.5 ANTI-SEEP COLLARS

A. Anti-seep collars shall be quarter-inch (¼") HDPE sheets cut to the dimensions indicated and installed per the Drawings. All metal fittings or attachments used shall be nylon or stainless steel (Grade 304 or better). Plastic sealant for weld shall be as suggested by manufacturer.

PART 3 – EXECUTION

3.1 EXCAVATION, SUBGRADE PREPARATION, AND GRADING

A. See Section 312000 Earthwork and Section 312320 Trench Excavation and Backfill for Utilities.

B. Subgrade of infiltration beds shall be level: Plus or minus one-half inch (+/- ½") is acceptable as level.

C. Grading shall be performed to the lines and grades shown on the Drawings. All objectionable material encountered within the limits indicated shall be removed and disposed of by the Contractor.

D. In excavation faces, all loose or protruding rocks shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the Drawings or as directed by the Engineer or Owner's Representative.

E. For subsurface systems that are designed to infiltrate, provide the following:

1. The bottom surface of any excavation for an infiltration system shall be uncompacted yet stable. The top three to six inches (3"-6") of remaining subgrade soils shall be scarified prior to installation of the system, unless otherwise directed by the Engineer or Owner's Representative.

3.2 INSTALLATION OF SAND LAYER

A. Sand layer, where specified in the Drawings, shall be installed across the bottom of the infiltration bed, immediately after approval of subgrade preparation (to include infiltration testing for infiltrating systems) by the Engineer. Sand shall be compacted in a single six-inch (6") lift, maximum, and be finished to a level surface.

3.3 GEOTEXTILES AND GEOMEMBRANES

A. See Section 320519 for installation of geotextiles and geomembranes.

3.4 INSTALLATION OF SUBSURFACE STONE STORMWATER TRENCHES AND BEDS

A. Observation wells shall be installed as indicated in the Drawings prior to placement of aggregates in the trenches. Care shall be taken to avoid compacting the bottom of the bed during the excavation necessary for observation well installation. All well covers shall be level with the finished grade upon surface restoration. Please see Section 331153.

1. When installed within a stormwater basin, such as a rain garden or stormwater bumpout, the PVC cap used in lieu of the well cover shall extend three inches above the maximum ponding depth, as indicated on Drawings. Contractor to cut final height of PVC after surface features have been installed at the designed elevations.

B. Install coarse aggregate in eight inch (8") maximum lifts. Lightly compact each layer with equipment, keeping equipment movement on storage bed subgrades to a minimum. Minimum compaction should be made with a standard walk-behind vibratory compactor; larger equipment may be approved on a case-by-case basis by Engineer. Hand compaction and settlement shall not be considered sufficient.

C. Continue placing and compacting aggregate lifts to the full depth indicated on the Drawings. Once aggregate is backfilled and compacted to grades indicated on the Drawings (and elevations

verified for the as-built drawings), geotextile shall be folded over and overlapped on top of the bed to prevent soil intrusion into the aggregate bed.

D. Install detectable underground utility warning tape at the perimeter on all sides of the subsurface stone storage trench.

E. Clean washed stone shall be protected from sedimentation at all times. Any stone left exposed (unprotected) during a rainfall event or at the end of any workday shall be considered compromised, and may be required (at the sole discretion of Owner's Representative) to be removed and replaced with new material at no additional cost to the City.

3.5 INSTALLATION OF SPLIT PIPE UTILITY SLEEVES

A. Where an existing utility lateral or branch main intersects the stone stormwater storage system, a pass-through conduit (split pipe utility sleeve) shall be constructed to convey the existing utility where possible.

B. The Contractor shall coordinate sleeving of all existing and intersecting utility lines with the owners/operators of said utility lines.

C. The Owner shall review and approve any pass-through conduits for utility lines not indicated on the Drawings in advance and any utility laterals that may be reconstructed such that a pass-through conduit is not necessary shall be so reconstructed. If, in the determination of Owner, a pass-through conduit is insufficient, a trench 'break' may be constructed at the direction of the Engineer, consisting of standard backfill to protect the existing utility. Any pass-through conduits for utilities not indicated on the Drawings found to be necessary upon excavation will be paid at a contingency price.

D. Pass-through conduits shall be constructed of an adequate diameter to convey the utility lateral within.

E. Anti-seep collars shall be installed at either end of the pass-through conduit, outside the geotextile wrap of the stone stormwater storage.

F. The conduit shall be of watertight construction and shall be sealed at either end around the existing pipe with non-shrink grout or sealant. The Engineer shall be allowed to inspect the watertight seal to determine its integrity. If deemed inadequate, the Contractor shall make any and all effort needed to ensure compliance with this requirement. Any standpipe, valve, or other vertical feature of the crossing utility shall be sufficiently isolated from the stormwater storage and remain accessible. This may be accomplished by creating a standpipe sleeve, or by excluding a small separation area around the vertical feature from the stormwater storage trench stone.

3.6 INSTALLATION OF ANTI-SEEP COLLARS

A. Anti-seep collars shall be employed as indicated on the Drawings. Anti-seep collars are typically used to prevent water from flowing along a pipe trench and impacting existing utilities.

B. Anti-seep collars shall be installed on pipes leading from stormwater storage areas to surrounding substances as depicted on the Drawings, or as directed by the Engineer. Geotextile liners, if in place at the anti-seep collar location, shall be minimally cut to allow for the pass-through section and then sealed within the joint between the solid external sheets of the anti-seep collar. All fittings and seals shall be installed to manufacturer's specifications for a watertight seal.

3.7 INSTALLATION OF PIPING

A. See Section 334211 Thermoplastic Drainage Pipe and Fittings for requirements for thermoplastic pipe installation, inspection, and cleaning.

3.8 BACKFILL AND COMPACTION

A. Follow requirements of Section 312010 Earthwork and 312320 Trenching Excavation and Backfill for Utilities.

END OF SECTION

SECTION 334913
STORM MANHOLES

PART 1 – GENERAL

1.1 SECTION DESCRIPTION

A. The Work of this section includes:

1. Precast Concrete Manholes
2. Concrete Manhole Bases
3. Manhole Steps
4. Manhole Covers and Frames

1.2 RELATED SECTIONS:

A. Related Work Specified Elsewhere:

1. Section 015713 Soil Erosion and Sediment Control
2. Section 033000 Cast-In-Place Concrete
3. Section 312320 Trench Excavation and Backfill for Utilities
4. Section 334100 Storm Drain Pipe
5. Section 334211 Thermoplastic Drainage Pipe and Fittings
6. Section 334414 Storm Inlets and Drainage Structures

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. Standard Specifications for Highway Bridges
2. American Society for Testing and Materials (ASTM):
   a. A48 Specification for Gray Iron Castings
   b. A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   c. C270 Specifications for Mortar for Unit Masonry
   d. C478 Specifications for Precast Reinforced Concrete Manhole Sections
   e. D4101 Specification for Propylene Plastic Injection and Extrusion Materials
3. Pennsylvania Department of Transportation Publication 408 Specifications

B. Acceptable Manufacturer:

1. The storm manhole structure, and frame and cover shall be provided by a firm regularly engaged in the manufacture of such products of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

2. Storm manhole structures shall be provided by one of the following manufacturers or approved equal.

    a. Atlantic Concrete Products, Inc.

    b. Monarch Precast Concrete Corporation

    c. Modern Concrete Company

    d. Old Castle Precast Concrete

    e. Approved equal.

3. Frames and covers shall be provided by one of the following manufacturers or approved equal.

    a. Neenah Foundry Company

    b. East Jordan Iron Works, Inc.

    c. Syracuse Castings Sales Corporation

    d. Approved equal.

1.4 SUBMITTALS

A. Submit shop drawings, samples, certificates, delivery tickets, manufacturer's data, and/or product data in accordance with Division 01.

B. Submit detail shop drawings for the following items:

1. Manhole sections and precast bases

2. Manhole frames and covers

3. Manhole steps

PART 2 – PRODUCTS

2.1 BASIC MATERIALS

A. Coarse Aggregate Subbase:

1. PennDOT No. 2A or AASHTO No. 8 in accordance with Table C, Section 703.2, Publication 408 Specifications.

B. Masonry Mortar: ASTM C270, Type S.

C. Concrete: PennDOT Class A, Section 03 30 53

2.2 FABRICATED PRODUCTS

A. Precast Concrete Manhole Sections: ASTM C478

1. 5.5% + 1% air entrained cement concrete.

2. Eccentric cone section (Type `A'), or top slab (Type `B'), minimum 24" access opening unless otherwise indicated.

3. Precast riser sections of length to suit.

4. Precast bases of a design similar to the precast riser sections.

B. Manhole Steps:

1. Forged aluminum alloy 6061 T6 with drop front and safe tread as manufactured by Alcoa (No. 16829) or approved equal; portion to be embedded in precast manhole wall shall be dipped in heavy bodied bituminous paint or else provided with plastic inserts; or

2. Steel reinforced copolymer polypropylene with serrated tread and end lugs. The copolymer polypropylene shall conform to ASTM D-4101 (PP200B33454Z02) propylene copolymers and shall completely encase a ½ inch deformed steel reinforcing bar which shall conform to ASTM A-615, Grade 60; manufactured by M.A. Industries, Inc. (Model PS2-PF) or approved equal.

C. Manhole Frames and Covers:

1. Domestic cast iron castings: ASTM A 48, Class 30 or better; free of bubbles, sand and air holes, and other imperfections.

2. Heavy duty traffic, AASHTO Highway Loading Class H 20 (16,000# wheel loading).

3. Frame and cover dimensions shall conform to the dimensions shown on the Drawings.

4. Contact surfaces machined and matched.

5. All manhole covers shall have as non-slip pattern and shall be inscripted as shown on the Drawings with raised letters. Letters shall have a height and width of not less than two (2) inches.

6. All manhole covers shall have two (2) concealed pick holes.

PART 3 – EXECUTION

3.1 EXCAVATION

A. Perform excavation to the line and grade shown on the Drawings and as specified in Section 312320.

B. Location and depth of manholes as shown on the Drawings.

3.2 CONSTRUCTION

A. Construct manholes of precast concrete sections and of the type shown on the Drawings.

B. Install precast base on a minimum of six (6) inches of coarse aggregate subbase.

C. Form flow channels in manhole bases as shown on the Drawings. Slope channels uniformly from influent invert to effluent invert. Slope bench towards channel at 1 inch per foot. Construct bends of the largest possible radius. Form channel sides and invert smooth and uniform; free of cracks, holes or protrusions.

D. Do not permit pipe to project more than 2" into the manhole.

E. Seal interior joints between precast concrete manhole sections with non shrink mortar.

F. Install manhole sections with steps in proper vertical alignment.

G. Use precast concrete grade manhole rings to achieve elevation shown for frame and cover. Do not adjust elevation more than one (1) foot with precast rings. Provide the exterior of the grade rings with a 1/2" thick coat of mortar.

H. Install manhole frames and covers.

1. Set top of frames at finished grade elevation or other elevation shown on the Drawings.

2. Anchor manhole covers at four (4) locations as shown on the Drawings.

3. Seal joint between manhole frame and manhole with non shrink grout.

3.3 BACKFILLING

A. Backfill only after examination of the manhole by the Owner's Representative.

B. Perform backfilling as specified in Section 312320.

3.4 SITE RESTORATION WORK

A. Once the manholes and related storm sewer construction has been completed in an area, the following site restoration work shall be completed in accordance with the Drawings and as specified.

B. Contractor shall stage site restoration work for a large project in accordance with the construction schedule approved by Engineer.

END OF SECTION