

CONSTRUCTION IMPROVEMENTS: LAKE SKINNER RECREATION AREA SPLASH PAD EXPANSION

RIVERSIDE REGIONAL PARK AND OPEN-SPACE DISTRICT

Schmidt Design Group

Project No. 15-409

- F. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- G. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Label each end indicating destination.
- H. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
 - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

12.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

- 1. Excavate trench bottom to provide firm and uniform support for conduit.
- 2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand-tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling.
- 3. Install manufactured PVC 80 elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
- 4. Warning Tape: Warning tape shall be 5.5 mil composition film, 6 inches wide, containing one layer of metalized foil laminated between two (2) layers of inert plastic film, specifically formulated for prolonged use underground. Tape shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Warning tape shall bear a continuous printed message warning of the exact location of underground installations. The message shall be in permanent ink

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specifically formulated for prolonged use underground. Tape shall have black letters (minimum ½ inch high) on red background with the message "ELECTRICAL" printed on twelve (12)-inch centers for the entire length of the tape.

12.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

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

12.5 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 13 - GENERAL

13.1 RELATED DOCUMENTS

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

13.2 SUMMARY

- A. Section Includes:
 - 1. Identification for conductors.
 - 2. Warning labels and signs.
 - 3. Equipment identification labels.

13.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

13.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

13.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

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- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 14 - PRODUCTS**14.1 CONDUCTOR IDENTIFICATION MATERIALS**

- A. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.

14.2 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

14.3 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black except where used for color-coding.

14.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

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- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 15 - EXECUTION

15.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.

15.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less:
 - 1. Factory applied Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - a. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - b. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
- B. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches, control panels, control stations. Systems include power, lighting, control systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

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- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label] [Stenciled legend 4 inches (100 mm) high
- 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.

END OF SECTION 26 05 53

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SECTION 26 27 26 - WIRING DEVICES

PART 16 - GENERAL

16.1 RELATED DOCUMENTS

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

16.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.

16.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.

16.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

PART 17 - PRODUCTS

17.1 MANUFACTURERS

- A. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Wiring Systems
 - 2. Hubbel Incorporated
 - 3. Leviton
 - 4. Pass & Seymour
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

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17.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

17.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

17.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, non-feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

17.5 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant die-cast aluminum with lockable cover.

PART 18 - EXECUTION**18.1 INSTALLATION**

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:

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1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
3. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
4. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
5. Use a torque screwdriver when a torque is recommended or required by manufacturer.
6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
7. Tighten unused terminal screws on the device.
8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up.

F. Coordinate installation of receptacles at sports lighting poles with sports lighting manufacturer.

18.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles.

18.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

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18.4 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

B. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 19 - GENERAL

19.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 3, 27, 28 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Section 260500, "Common Work Results for Electrical".
 - 2. Section 260519, "Low Voltage Electrical Power Conductors and Cables".
 - 3. Section 260526, "Grounding and Bonding for Electrical Systems".
 - 4. Section 260553, "Identification for Electrical Systems".
 - 5.

19.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps and ballasts.

19.3 CODES, STANDARDS, AND REFERENCES

- A. American National Standards Institute (ANSI) – ANSI C78.42: American National Standard for Electric Lamps - Guidelines for High-Pressure Sodium Lamps.
- B. American National Standards Institute (ANSI) – ANSI C82.1: American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast.
- C. American National Standards Institute (ANSI) – ANSI C82.4: American National Standard for Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
- D. American National Standards Institute (ANSI) – ANSI C136.10: American National Standard for Roadway and Area Lighting Equipment - Locking-type Photo-control Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing.
- E. American National Standards Institute (ANSI) – ANSI/IESNA RP-8: American National Standard Practice for Roadway Lighting.
- F. ANSI/IEEE C2: National Electrical Safety Code (NESC).
- G. ANSI/IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.
- H. ANSI/NFPA 70 – National Electrical Code, with California amendments (CEC).

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- I. California Code of Regulations (CCR) Title 24, Part 6 California Energy Code.

19.4 DEFINITIONS

- A. CRI: Color-rendering index.
- B. Luminaire: Complete lighting fixture, including ballast housing, if provided.

19.5 SUBMITTALS

- A. Product Data: For each luminaire and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 6. Ballasts, including energy-efficiency data.
 - 7. Lamps, including life, output, and energy-efficiency data.
 - 8. Materials, dimensions, and finishes of poles.
 - 9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.

19.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and

PART 1 - PRODUCTS

1.1 MANUFACTURERS

- A. In other Part 2 articles, where titles below introduce lists, the following requirements apply to product selection:
- B. In Lighting Fixture Schedule, where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

1.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.

PART 2 - EXECUTION

2.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

2.2 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

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2.3 FIELD QUALITY CONTROL

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

END OF SECTION 26 56 00

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CSI Specifications

DIVISION 31-33

<u>DIVISION/Section</u>	<u>Description</u>	<u>Sheet</u>
DIVISION 31: EARTHWORK		
31 10 00	Site Clearing	
31 20 00	Earth Moving	
DIVISION 32: EXTERIOR IMPROVEMENTS		
32 05 00	Concrete Paving	
32 05 19	Concrete Paving Joint Sealants	
32 05 26	Landscape Synthetic Turf	
32 05 33	Playground Protective Surfacing	
32 05 53	Planting Irrigation	
32 27 26	Soil Preparation (Performance Specification)	
32 56 00	Turf and Grasses	
32 93 00	Plants	
DIVISION 33: EARTHWORK		
33 40 00	Storm Drainage System	

CSI Specifications

DIVISION 31-33

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Division 31

Earthwork

<u>Section</u>	<u>Description</u>	<u>Sheet</u>
3110 00	Site Clearing	4
31 20 00	Earth Moving	4

Division 31

Earthwork

Section	Description	Sheet
3110 00	Site Clearing	4
31 20 00	Earth Moving	4

DIVISION 31

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning or removing site utilities.

- B. Related Sections include the following:

1. Division 1 Section "Field Engineering" for verifying utility locations and for recording field measurements.
2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
3. Division 2 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and planting.
4. Division 3 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

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

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings according to Division 1 Section "Contract Closeout."
 - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
 - 1. Comply with Federal (NPDS).
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. 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 PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
 - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.

3.3 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be abandoned in place.
 - 1. Arrange to shut off indicated utilities with utility companies.
- B. 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 three days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 4. Use only hand methods for grubbing within drip line of remaining trees.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within drip line of remaining trees.
 - 3. Stockpile surplus topsoil and allow for reuse ..

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as 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 length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

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

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING**PART 1 GENERAL****3.8 RELATED DOCUMENTS**

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

3.9 SUMMARY

- A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
2. Excavating and backfilling for buildings and structures.
3. Capillary barrier course for floor slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course for asphalt paving.
6. Excavating and backfilling trenches within building lines.
7. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

- B. Related Sections include the following:

1. Division 1 Section "Unit Prices" for a schedule of unit prices.
2. Division 1 Section "Construction Facilities and Temporary Controls."
3. Division 3 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
4. Division 2 Section "Tree Protection and Trimming" for protecting and trimming trees to remain.
5. Division 2 Section "Excavation Support and Protection."
6. Division 2 Section "Foundation Drainage Systems" for drainage of footings, slabs-on-grade, and walls.
7. Division 2 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and plantings.
8. Division 3 Section "Concrete Floors" for granular course and vapor retarder.

3.10 UNIT PRICES

- A. Unit prices for rock excavation include replacement with approved materials.

3.11 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subbase course and paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Capillary barrier: Layer supporting floor slab-on-grade used to minimize capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- K. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

3.12 QUALITY ASSURANCE

- A. Geotechnical Testing Agency: The Owner will retain a testing agency qualified according to ASTM E 329 to conduct soil materials testing and inspection services.

3.13 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than three days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 4 - PRODUCTS

4.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 4 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
 - 1. Expansion Index: Not more than 20 as measured by UBC Std. 29-2 and ASTM D4829.
 - 2. Upper 18 inches of subgrade fill under landscaped areas: Soil containing not more than 10% stones or lumps larger than 1-1/2 inches.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols, or soil classified as expansive by UBC Std. 29-2 and ASTM D4829.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a

1-inch sieve and not more than 8 percent passing a No. 200 sieve. Pea gravel bedding shall be 3/8 inch.

- G. Capillary Barrier: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No. 4 sieve.

4.2 ACCESSORIES

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

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 5 - EXECUTION

5.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

5.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

5.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

5.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 2. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 3. Rock excavation includes removal and disposal of rock.

5.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.

5.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

5.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches on each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

5.8 APPROVAL OF SUBGRADE

- A. Notify Testing Agency when excavations have reached required subgrade.
- B. If Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by rain, accumulated water, or construction activities, as directed by Testing Agency.

5.9 UNAUTHORIZED EXCAVATION

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

5.10 STORAGE OF SOIL MATERIALS

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

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

5.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing and waterproofing.
2. Surveying locations of underground utilities for record documents.
3. Inspecting and testing underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

5.12 UTILITY TRENCH BACKFILL

- A. Place and compact 6 inch bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

1. Provide bedding for sanitary sewer in accordance with SDRSD S-4, type C. SDRSD S-4 shall be used for storm drain piping if PVC, HDPE or ABS material is specified. For RCP storm drain piping provide bedding per SDRSD D-60 except that $\frac{3}{4}$ crushed rock shall extend to pipe springline/centerline.
2. Sand bedding may be used for other than sewer piping.

- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; with concrete to elevation of bottom of footings.

- C. Provide concrete encasement per SDRSD S-7 for piping or conduit less than 24 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 6 inches of concrete before backfilling or placing roadway subbase.

- D. Place and compact initial pipe zone backfill, bedding, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit in accordance to section 306-1.2 of the SSDWC.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final subgrade.
- H. Install warning tape at the top of pipe zone or a max. 36" below finished grade, except 6 inches below subgrade under pavements and slabs.

5.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact satisfactory fill material in layers to required elevations.

5.14 MOISTURE CONTROL

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

5.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum density according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.

5.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1/2 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

5.17 SUBBASE COURSES

- A. Under pavements and walks, place subbase course on prepared subgrade and as follows:
 - 1. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum density according to ASTM D 1557.
 - 2. When thickness of compacted subbase course is 6 inches or less, place materials in a single layer.

3. When thickness of compacted subbase course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

5.18 CAPILLARY BARRIER

- A. Under floor slabs-on-grade, prior to placement of vapor barrier, place capillary barrier on prepared subgrade and as follows:
 1. Compact capillary barrier to required cross sections and thickness to not less than 95 percent of maximum density according to ASTM D 698.

5.19 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing. Refer to Section 01410.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 1000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 50 feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 50 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

5.20 PROTECTION

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

5.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION 31 20 00

Division 32

Exterior Improvements

Section	Description	Sheet
32 13 13	Concrete Paving	4
32 13 73	Concrete Paving Joint Sealants	4
32 17 23.28	Landscape Synthetic Turf System	4
32 18 16.13	Playground Protective Surfacing	4
32 84 00	Planting Irrigation	4
32 91 15	Soil Preparation (Performance Specification)	4
32 92 00	Turf Grass	4
32 93 00	Plants	4

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SECTION 32 13 13 - CONCRETE PAVING

PART 6 - GENERAL

6.1 RELATED DOCUMENTS

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

6.2 SUMMARY

- A. Section Includes Concrete Paving

- 1. Walks.

- B. Related Requirements:

- 1. Section 03 30 00 "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

6.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

6.4 PREINSTALLATION MEETINGS

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

- 1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Contractor's superintendent.

- b. Independent testing agency responsible for concrete design mixtures.
- c. Ready-mix concrete manufacturer.
- d. Concrete paving Subcontractor.
- e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

6.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.
- C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

6.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified [Installer of stamped detectable warnings] [ready-mix concrete manufacturer] [and] [testing agency].
- B. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or epoxy adhesive.
 - 8. Joint fillers.
- C. Material Test Reports: For each of the following:
 - 1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- D. Field quality-control reports.

6.7 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
 2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

6.8 PRECONSTRUCTION TESTING

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

6.9 FIELD CONDITIONS

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

PART 7 - PRODUCTS

7.1 CONCRETE, GENERAL

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

7.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

7.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from steel wire into flat sheets.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- C. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.
- D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.
- F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.
- G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 deformed bars; assembled with clips.
- H. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- I. Deformed-Steel Wire: ASTM A 1064/A 1064M.
- J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, plain.
- K. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

- L. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 plain-steel bars.
- M. Tie Bars: ASTM A 615/A 615M, Grade 60; deformed.
- N. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- O. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- P. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
- Q. Zinc Repair Material: ASTM A 780/A 780M.

7.4 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type II.
 - 2. Fly Ash: ASTM C 618, Class C or Class F.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 - 4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag cement.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, [Class 4S] [Class 4M] [Class 1N] <Insert class>, uniformly graded. Provide aggregates from a single source[with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials].
 - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C 260/C 260M.
- D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
1. Color: As selected by Architect from manufacturer's full range.
- F. Water: Potable and complying with ASTM C 94/C 94M.

7.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

7.6 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- D. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - 1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

7.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials:[Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.][Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:]
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Slag Cement: 50 percent.
 - 3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 5-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
 - 2. Air Content: 6 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
 - 3. Air Content: 6 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- G. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): As indicated.
 - 2. Slump Limit: 4 inches, plus or minus 1 inch.

7.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 8 - EXECUTION

8.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 31 20 00 "Earth Moving."

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

8.2 PREPARATION

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

8.3 EDGE FORMS AND SCREED CONSTRUCTION

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

8.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

8.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 2. Provide tie bars at sides of paving strips where indicated.
 3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 1. Locate expansion joints at intervals of 30' on center spacing unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
 2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

8.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- D. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.
- G. Screed paving surface with a straightedge and strike off.
- H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- I. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

8.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true

planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

8.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by a combination of these as follows:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

8.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 1. Elevation: 3/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-feet-long; unlevelled straightedge not to exceed 1/2 inch.

4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

8.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and

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inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

8.11 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 9 - GENERAL

9.1 RELATED DOCUMENTS

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

9.2 SUMMARY

- A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
4. Hot-applied, fuel-resistant joint sealants.
5. Joint-sealant backer materials.
6. Primers.

- B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

9.3 ACTION SUBMITTALS

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

- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

- C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

9.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Certificates: For each type of joint sealant and accessory.

9.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.

9.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 10 - PRODUCTS

10.1 MATERIALS, GENERAL

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

10.2 COLD-APPLIED JOINT SEALANTS

- A. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
 - 1. As indicated on plans.

10.3 JOINT-SEALANT BACKER MATERIALS

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

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

10.4 PRIMERS

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

PART 11 - EXECUTION

11.1 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

11.2 PREPARATION

- A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

11.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

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1. Do not leave gaps between ends of joint-sealant backings.
 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
1. Place joint sealants so they fully contact joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
1. Remove excess joint sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

11.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

11.5 PAVING-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within concrete paving.
1. Joint Location:
 - a. Expansion and isolation joints in concrete paving.
 - b. Contraction joints in concrete paving.
 - c. Other joints as indicated.

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2. Joint Sealant: Multicomponent, nonsag, urethane, elastomeric joint sealant.
3. Joint-Sealant Color: Shall match adjacent concrete.

END OF SECTION 32 13 73

SECTION 32 17 23.28 – LANDSCAPE SYNTHETIC TURF SYSTEM

PART I – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section shall consist of furnishing all labor, materials, and equipment necessary to install, in place, all synthetic turf and other materials as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with these specifications, the manufacturer's instructions and in accordance with all details and shop drawings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications, preparation and installation instructions and recommendations
 - 2. All supplied and installed materials and products will meet or exceed the minimum specifications designated in this section. Sufficient data must be submitted to indicate compliance with the Contract Documents
 - 3. Submit instructions for installation.
- B. Test Results: The following test results, certified by a licensed independent testing laboratory, shall be submitted as outlined below:
 - 1. With the bid – Mandatory and minimum specifications as shown in Part 2. Bids not meeting the minimum specifications will be rejected.
 - 2. At completion of project – Dynamic Cushioning Test according to ASTM F1292 HIC Testing
 - 3. Title 22, Cam 17 – EPA Method 6020. Test reports required Synthetic turf fibers.

- C. Shop Drawings: Show fabrication and installation details for synthetic turf including, but not limited to:
1. Proposed locations of all seams in fabric surfacing. Show installation methods and construction.
 2. All submittals shall be provided within 14 days after Notice to Proceed
- D. With Bid - The Manufacturer / Installer shall provide the following samples of the artificial turf selected for this project
1. An 8.5-inch x 11-inch minimum sample of the exact synthetic turf system that is specified for this project.
- E. With the bid – Sample Warranty: with the bid. Policy must be in force at the time of the bid.
1. The Contractor shall provide a warranty to the Owner that covers defects in materials and installation workmanship of the turf for a period of eight (8) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements and any written directives. The manufacturer's warranty shall include general wear and damage caused from UV degradation. Other items that must be addressed include the following:
 - a. Acceptable uses for the field
 - b. Fading
 - c. Color match within specifications
 - d. Excessive fiber wear
 - e. Wrinkling and panel movement
 - f. Shock absorbency (HIC TESTING)
 - g. Seam integrity
 - h. Drainage (through the turf only)
 2. Exclusions shall include the following:
 - a. Vandalism
 - b. Acts of God beyond the control of the Owner or the Manufacturer

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications

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1. Shall own and operate its manufacturing plant in the United States. Plant must be capable of extruding texturized nylon monofilament RootZone™ fiber.
2. Shall be experienced in the manufacture and installation of the specified type of synthetic grass (including extrusion of RootZone™ fiber) for a minimum of five (5) years.
3. Shall have its own, in-house laboratory where samples of turf are retained and analyzed. Tests shall be performed at all levels of production from the extrusion process to the tufting process and through to the final stages before the turf is loaded onto the truck for delivery.
4. Shall provide third party certification confirming compliance with referenced standards including 10 lbs tuft bind.

B. Installer Qualifications:

1. Installation team shall be an established, insured installation firm experienced as a premium turf installer with suitable equipment and supervisory personnel, with a minimum of five years experience with 15 foot wide tufted materials.
2. Installation team shall be trained and certified, in writing, by the turf manufacturer, as competent in the installation of the specified material, including seaming and proper installation of the infill mixture.
3. Site superintendent shall have at least 10 installations similar to this type.

C. Source Limitations: Obtain synthetic turf through one source from a single manufacturer.

D. The turf fabric shall be produced by the manufacturer and installed by factory-authorized distributors directly employing the installation crew.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit synthetic turf work to be performed according to Contractor or Manufacturer's written instructions and warranty requirements.

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PART TWO – PRODUCTS

1.1 ACCEPTABLE MANUFACTURERS

A. Pre-Approved manufacturers:

1. SynLawn San Diego
 9350 Trade Place, Suite B
 San Diego, CA. 92126
 c. (858)527-2695 p. (858)566-7422 f. (858)689-9542
 Contact - Jamie Wittert

2. Alternate manufacturer is acceptable and must meet and/or be equivalent to all listed requirements, qualifications and specifications.

1.2 PRODUCT SPECIFICATIONS

- B. The fabric shall possess the following minimum physical characteristics. ASTM testing shall be provided with the bid and any products not meeting the minimum physical characteristics will be rejected:

Product Specification:	Physical Characteristic	Method of Determination
Physical Property		
Yarn Type: Grass Zone™	Polyethylene	n/a
Yarn Type: Thatch Zone™	Texturized Polypropylene	n/a
Yarn Color: Grass Zone™	Field Green Olive	n/a
Yarn Color: Thatch Zone™	Turf Tan	n/a
Pile Height: Grass Zone™	1 3/4"	ASTM D 5823
Pile Height: Thatch Zone™	1 1/2" +/- 15%	ASTM D 5823
Pile Weight: Grass Zone™	54 oz./sy	ASTM D 5848
Pile Weight: Thatch Zone™	24 oz./sy	ASTM D 5848
Total Pile Weight:	78 oz./sy	ASTM D 5848
Yarn Denier: Grass Zone™	10,800/6 D	ASTM D 1557
Yarn Denier: Thatch Zone™	5040/12	ASTM D 1557
Primary Backing:	8.0 oz. Woven	ASTM D 5848
Secondary Backing:	16.0 oz. EnviroLoc™	ASTM D 5848
Secondary Cushion Weight:	n/a	ASTM D 5848
Total Fabric Weight:	102 oz./sy	ASTM D 5848
Fabric Width:	15 feet	n/a

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Tuft Gauge:	1/2"	ASTM D 5793
Tuft Bind:	> 8 lb.	ASTM D 1335
Flammability: (Pill Test)	Pass	ASTM D 2859
Flammability: (Critical Radiant Flux)	n/a	ASTM E 648
	n/a	ASTM F 355
Shock Absorbing Properties:	>30 inches per hour	ASTM F 1551
Water Permeability:	Compliant	ASTM F 2765-09

1.3 Pad

- A. System must be installed over a turf-manufacturer approved shock pad. Pad must meet all environmental and fall height requirements of surrounding structures and fall zones as indicated on the drawings for fall safety. Contractor to determine proper pad from adjacent structures as indicated on the drawings.

PART 3 – EXECUTION

1.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for visual installation tolerances. Proceed with installation only after satisfactory conditions have been corrected.
- B. The contractor/installer is required to install one mound of Owners selection to install first and only one mound prior to Owner aesthetic review prior to continuing to another mound. The review will be determine if the contractor has sufficiently installed the turf to the Owners acceptable aesthetic intentions of the project. The Owner at any time can have the turf removed and re-installed at the contractor's cost for any reason they so determine. The installer must have in writing from Owner's representation to continue with installation of the next mounds prior to continuing their scope of work. Failure to do so will mean full removal of the pad and turf that was installed prior to the review and written acceptance.
- C. Certification of prior work: The synthetic turf manufacturer and / or installation contractor shall perform a visual inspection of the field base onto which the pad and synthetic turf system is to be installed and to examine the finished surface for required compaction, and grade tolerances(through string line testing). After any

discrepancies between the required materials, application and tolerance requirements noted have been corrected, the synthetic turf installer should submit a written certification of VISUAL acceptance of the base for installation of the synthetic turf system. Any tests other than VISUAL tests (string line, water hose, etc...) shall be the responsibility of the General Contractor or Landscape Architect.

- D. Installation of all materials shall be performed in full compliance with approved project shop drawings. Only factory trained technicians skilled in the installation of athletic caliber synthetic turf systems, working under the direct supervision of the manufacturer's supervisors, shall undertake the placement of the turf system. The designated Supervisory personnel on the project must be certified, in writing by the turf manufacturer as competent in the installation of these materials, including proper seaming and proper installation. The manufacturer shall certify the installation and warranty compliance.

3.2 PREPARATION

1.2

- A. Inspect delivered surface fabric and components immediately prior to installation. Any damaged or defective items shall be rejected. Installed artificial system shall be inspected for, but not limited to, the following:

1. Uniformity of product and color
2. Surface bubbles
3. Field Edge installation
4. Pile height of each roll shall be measured. Any material(s) that does not meet minimum height and thickness specifications shall be rejected. Pile height shall be measured in its finished positions.

- A. Environmental Conditions: Weather conditions are important for the successful installation of the systems. No work under this section will proceed when:

1. Ambient temperatures are below 45 degrees F.
2. Material temperatures are below 45 degrees F.
3. Surfaces are wet or damp
4. Rain is imminent or falling.
5. Conditions exist or are imminent, which will be unsuitable to installation requirements of the systems specified herein. Humidity levels will be inside

the limits recommended by the adhesive manufacturer to obtain optimum bonding characteristics of the surfaces.

1.3 INSTALLATION OF THE SYNTHETIC TURF

- A. The carpet rolls are to be installed directly over the properly installed shock pad. Extreme care should be taken to avoid disturbing the pad and the base stone both in regard to compaction and planarity. A 2-5 ton static roller shall be on site and available to repair and properly compact any disturbed areas of the base stone while installing the pad.
- B. The full width rolls shall be laid out across the mounds. All work shall be such that the seams shall remain as required for the duration of the warranty period at a minimum. All seam widths are to be held to a minimum and shall be run north to south of the mound direction. Cross seams east to west will not be accepted. Seams shall be flat, tight and permanent with no separation or fraying.
- C. The perimeter of the field shall be firmly secured to the edge anchors for the life of the warranty and in accordance to project details.

1.4 FINAL ACCEPTANCE

- A. Prior to final acceptance, the Contractor shall submit to the Owner three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system.
- B. The finished shall be visual accepted by the Owner or Owners representation. The Owner at any time can reject the workmanship for any reason that effects the visual appeal of the turf installation.

1.5 CLEANING

- A. Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items. All usable remnants of new material shall become the property of the Owner. The Contractor shall keep the area clean throughout the project and clear of debris. Surfaces, recesses, enclosures, etc...

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shall be cleaned, as necessary, to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION 32 17 23.28

SECTION 32 18 16.13 - PLAYGROUND PROTECTIVE SURFACING

PART 12 - GENERAL

12.1 RELATED DOCUMENTS

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

12.2 SUMMARY

- A. Section Includes:
 - 1. Unitary, seamless surfacing.

12.3 DEFINITIONS

- A. Definitions in ASTM F 2223 apply to Work of this Section.
- B. Critical Height: Standard measure of shock attenuation according to ASTM F 2223; same as "critical fall height" in ASTM F 1292. According to ASTM F 1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."
- C. SBR: Styrene-butadiene rubber.
- D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F 2223.

12.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of protective surfacing and exposed finish.
 - 1. Include Samples of accessories to verify color and finish selection.
 - 2. Unitary, Seamless Surfacing: Minimum 6 by 6 inches.
 - 3. Unitary, Tile Surfacing: Minimum 6 by 6 inches.
 - 4. Loose-Fill Surfacing: Minimum 1 quart.
 - 5. Edging: 6 inches long by full width and cross section.
 - 6. Stabilizing Mats: Minimum 12 by 12 inches
 - 7. Drainage/Separation Geotextile: Minimum 12 by 12 inches.
 - 8. Drainage Panel: Minimum 6 by 6 inches.
 - 9. Weed-Control Barrier: Minimum 12 by 12 inches

- C. Product Schedule: For protective surfacing. Use same designations indicated on Drawings.

12.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Material Certificates: For each type of loose-fill surfacing.
- C. Product Certificates: For each type of unitary surfacing product.
- D. Field quality-control reports.
- E. Sample Warranty: For manufacturer's special warranty.

12.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

12.7 MAINTENANCE MATERIAL SUBMITTALS

12.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.
 - 1. Build mockups for protective surfacing including accessories.
 - a. Size: 48 inches by 48 inches.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

12.9 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Reduction in impact attenuation as measured by reduction of critical fall height.
 - b. Deterioration of protective surfacing and other materials beyond normal weathering.
2. Warranty Period: Three years from date of Substantial Completion.

PART 13 - PRODUCTS

13.1 MANUFACTURERS

- A. Source Limitations: Obtain protective surfacing materials from single source from single manufacturer.
 1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

13.2 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: Critical fall height tested according to ASTM F 1292.
- B. Accessibility Standard: Minimum surfacing performance according to ASTM F 1951.

13.3 UNITARY, DUAL-DENSITY, SEAMLESS SURFACING

- A. Description: Manufacturer's standard, site-mixed and applied, two-layer material with wearing layer over cushioning layer, with combined, overall thickness as required, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.
 1. Wearing Layer: Formulation of EPDM rubber particles or polyurethane granules, binder, and other organic and inorganic components.
 2. Cushioning Layer: Formulation of recycled SBR particles and binder.
 3. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane.
 4. Lacquer Topcoat: Manufacturer's standard polyurethane-based formulation.
 5. Critical Height: Per play equipment manufacturers requirements.
 6. Overall Thickness: Not less than as required for critical height indicated.
 7. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
 8. Wearing Layer Color(s): As selected by Architect from manufacturer's full range.
 - a. Design: Where colored pattern is required, provide as indicated on Drawings.
- B. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by protective surfacing manufacturer.

13.4 GEOSYNTHETIC ACCESSORIES

- A. Drainage/Separation Geotextiles: Comply with Section 31 20 00 "Earth Moving."
- B. Drainage/Separation Geotextile: Nonwoven, needle-punched geotextile, manufactured for drainage applications and made from polyolefins or polyesters; with the following minimum properties:
 - 1. Weight: 4 oz./sq. yd.; ASTM D 5261.
 - 2. Water Flow Rate: 100 gpm/sq. ft. according to ASTM D 4491.
- C. Weed-Control Barrier: Composite fabric geotextile consisting of woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, weighing not less than 4.8 oz./sq. yd..

PART 14 - EXECUTION

14.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
- B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to protective surfacing manufacturer's written requirements for cross-section profile.
 - 1. Asphalt Substrates: Verify that substrates are dry, sufficiently cured to bond with adhesive, and free from surface defects, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond.
 - 2. Concrete Substrates: Verify that substrates are dry and free from surface defects, laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by protective surfacing manufacturer.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

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14.2 PREPARATION

- A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

14.3 INSTALLATION OF GEOSYNTHETIC ACCESSORIES

- A. Install geosynthetic accessories before edging and according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions and in a manner that cannot become a tripping hazard.
 - 1. Drainage/Separation Geotextile: Completely cover area beneath protective surfacing, overlapping geotextile sides and edges a minimum of 8 inches with manufacturer's standard treatment for adhesively bonded or taped seams.
 - 2. Weed-Control Barrier: Completely cover area beneath loose-fill installation, overlapping barrier edges a minimum of 8 inches with manufacturer's standard treatment for adhesively bonded or taped seams.

14.4 INSTALLATION OF SEAMLESS SURFACING

- A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
 - 1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
 - 2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
 - 3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
 - 4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with a minimum of cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
 - a. Design: Where colored pattern is required, place colored, design material as soon as previously placed material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.
 - 5. Lacquer Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
 - 6. Edge Treatment: Flush As indicated on Drawings. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

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14.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Perform the following tests[with the assistance of a factory-authorized service representative]:
 - 1. Perform "Installed Surface Performance Test" according to ASTM F 1292 for each protective surfacing type and thickness in each playground area.
 - 2. Perform installed-surface-performance tests at no less than one series of tests for each 1000 sq. ft. of each type and thickness of in-place protective surfacing or part thereof.
- C. Playground protective surfacing will be considered defective if it does not pass tests.
- D. Prepare test reports.

14.6 PROTECTION

- A. Prevent traffic over seamless surfacing for not less than 48 hours after installation.

END OF SECTION 32 18 16.13

SECTION 32 84 00 - PLANTING IRRIGATION

PART 15 - GENERAL

15.1 RELATED DOCUMENTS

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

15.2 SUMMARY

- A. Section Includes:
 - 1. Piping.
 - 2. Encasement for piping.
 - 3. Manual valves.
 - 4. Pressure-reducing valves.
 - 5. Automatic control valves.
 - 6. Automatic drain valves.
 - 7. Transition fittings.
 - 8. Miscellaneous piping specialties.
 - 9. Sprinklers.
 - 10. Quick couplers.
 - 11. Drip irrigation specialties.
 - 12. Controllers
 - 13. Boxes for automatic control valves.

15.3 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
- C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

15.4 PERFORMANCE REQUIREMENTS

- A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

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- B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.
- C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:
 - 1. Irrigation Main Piping: 200 psig.
 - 2. Circuit Piping: 150 psig.

15.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Wiring Diagrams: For power, signal, and control wiring.

15.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.
- B. Qualification Data: For qualified Installer.
- C. Zoning Chart: Show each irrigation zone and its control valve.
- D. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
- E. Field quality-control reports.

15.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sprinklers and automatic control valves to include in operation and maintenance manuals.

15.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Spray Sprinklers: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 5 units.
 - 2. Bubblers: Equal to 5 percent of amount installed for each type indicated, but no fewer than 5 units.

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3. Emitters: Equal to 5 percent of amount installed for each type indicated, but no fewer than 5 units.
4. Drip-Tube System Tubing: Equal to 5 percent of total length installed for each type and size indicated, but not less than 100 feet.
5. Rotors: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 5 units.

15.9 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers that include a [certified irrigation designer qualified by The Irrigation Association] [Professional Class member of the American Society of Irrigation Consultants] [Professional Technical Class member of the American Society of Irrigation Consultants] <Insert qualifications>.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

15.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

15.11 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
 2. Do not proceed with interruption of water service without Construction Manager's written permission.

PART 16 - PRODUCTS

16.1 PIPES, TUBES, AND FITTINGS

- A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- B. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.
 1. PVC Socket Fittings: ASTM D 2466, Schedule 40.

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2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
 3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.
- C. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21 and SDR 26.
1. PVC Socket Fittings: ASTM D 2467, Schedule 80.
 2. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

16.2 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

16.3 MANUAL VALVES

- A. Plastic Ball Valves:
 1. As indicated on plans
 2. Description:
 - a. Standard: MSS SP-122.
 - b. Pressure Rating: **[125 psig minimum] [150 psig]**.
 - c. Body Material: PVC.
 - d. Type: Union.
 - e. End Connections: Socket or threaded.
 - f. Port: Full.

16.4 AUTOMATIC CONTROL VALVES

- A. Plastic, Automatic Control Valves:

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1. As indicated on plans.
2. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

16.5 TRANSITION FITTINGS

- A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings:
 1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- C. Plastic-to-Metal Transition Fittings:
 1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:
 1. Description: MSS SP-107, PVC four-part union. Include one brass threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

16.6 SPRINKLERS

- A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.
- B. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:
 1. Description: As indicated on plans.
 - a. Body Material: ABS.
 - b. Nozzle: ABS.
 - c. Retraction Spring: Stainless steel.
 - d. Internal Parts: Corrosion resistant.
- C. Plastic, Pop-up Spray Sprinklers:
 1. As indicated on plans.
 2. Description:
 - a. Body Material: ABS.
 - b. Nozzle: ABS.
 - c. Retraction Spring: Stainless steel.
 - d. Internal Parts: Corrosion resistant.
 - e. Pattern: Fixed, with flow adjustment.

16.7 QUICK COUPLERS

- A. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
1. Locking-Top Option: Vandal-resistant locking feature. Include two matching key(s).

16.8 DRIP IRRIGATION SPECIALTIES

- A. Drip Tubes with Direct-Attached Emitters:
1. Tubing: Flexible PE or PVC with plugged end.
 2. Emitters: Devices to deliver water at approximately 20 psig.
 - a. Body Material: PE or vinyl, with flow control.
 - b. Mounting: Inserted into tubing at set intervals.
- B. Application Pressure Regulators: Brass or plastic housing, NPS 3/4, with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig.
- C. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.
- D. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.
- E. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

16.9 CONTROLLERS

- A. Description:
1. As Indicated on Plans
 2. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.
 - a. Body Material: Stainless-steel sheet metal.
 - b. Mounting: Freestanding type for concrete base.
 3. Control Transformer: 24-V secondary, with primary fuse.
 4. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.
 - a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
 - b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.

- c. Surge Protection: Metal-oxide-varistor type on each station and primary power.
- 5. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
 - a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
 - b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
 - c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.
- 6. Concrete Base: Reinforced precast concrete not less than 36 by 24 by 4 inches thick, and 6 inches greater in each direction than overall dimensions of controller. Include opening for wiring.

16.10 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:

- 1. Carson Industries, LLC
 - 2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
 - a. Size: As required for valves and service.
 - b. Shape: Rectangular.
 - c. Sidewall Material: PE.
 - d. Cover Material: PE.
- 1) Lettering: As indicated on plans.

- B. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

PART 17 - EXECUTION

17.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."
- B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.
- C. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 24 inches below finished grade, or not less than 18 inches below average local frost depth, whichever is deeper.
2. Circuit Piping: 18 inches.
3. Sleeves: 24 inches.

17.2 PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

17.3 PIPING INSTALLATION

- A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.
- B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
- C. Install piping free of sags and bends.
- D. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- E. Install fittings for changes in direction and branch connections.
- F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.
- G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.
- H. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
- I. Install expansion loops in control-valve boxes for plastic piping.
- J. Lay piping on solid subbase, uniformly sloped without humps or depressions.
- K. Install ductile-iron piping according to AWWA C600.
- L. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.
- M. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.
- N. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
- O. Install piping in sleeves under parking lots, roadways, and sidewalks.

- P. Install sleeves made of Schedule 40 PVC pipe and socket fittings, and solvent-cemented joints.
- Q. Install transition fittings for plastic-to-metal pipe connections according to the following:
 - 1. Underground Piping:
 - a. NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
 - b. NPS 2 and Larger: AWWA transition couplings.
 - 2. Aboveground Piping:
 - a. NPS 2 and Smaller: Plastic-to-metal transition fittings.
 - b. NPS 2 and Larger: Use dielectric flange kits with one plastic flange.

17.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.

17.5 VALVE INSTALLATION

- A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.
- B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.
- C. Drain Valves: Install in underground piping in boxes for automatic control valves.

17.6 SPRINKLER INSTALLATION

- A. Install sprinklers after hydrostatic test is completed.
- B. Install sprinklers at manufacturer's recommended heights.
- C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

17.7 DRIP IRRIGATION SPECIALTY INSTALLATION

- A. Install drip tubes with direct-attached emitters below grade as indicated on plans.
- B. Install application pressure regulators and filter units in piping near device being protected, and in control-valve boxes.
- C. Install air relief valves and vacuum relief valves in piping, and in control-valve boxes.

17.8 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

- A. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.
 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Install control cable in same trench as irrigation piping and at least 2 inches beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

17.9 CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 11 13 "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.
- C. Connect wiring between controllers and automatic control valves.

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17.10 IDENTIFICATION

- A. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 31 20 00 "Earth Moving" for warning tapes.

17.11 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Any irrigation product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

17.12 STARTUP SERVICE

- A. [Engage a factory-authorized service representative to perform] [Perform] startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that controllers are installed and connected according to the Contract Documents.
 - 3. Verify that electrical wiring installation complies with manufacturer's submittal.

17.13 ADJUSTING

- A. Adjust settings of controllers.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

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- C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

17.14 CLEANING

- A. Flush dirt and debris from piping before installing sprinklers and other devices.

END OF SECTION 32 84 00

SECTION 32 91 15 - SOIL PREPARATION (PERFORMANCE SPECIFICATION)**PART 18 - GENERAL****18.1 RELATED DOCUMENTS**

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

18.2 SUMMARY

- A. Section includes planting soils specified according to performance requirements of the mixes.
- B. Related Requirements:
 - 1. Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.
 - 2. Section 32 92 00 "Turf and Grasses" for placing planting soil for turf and grasses.
 - 3. Section 32 93 00 "Plants" for placing planting soil for plantings.

18.3 ALLOWANCES

- A. Preconstruction and field quality-control testing are part of testing and inspecting allowance.

18.4 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

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- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

18.5 PREINSTALLATION MEETINGS

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

18.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.
 - 4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.

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- b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
- c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

- B. Samples: For each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

18.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For each testing agency.

18.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

- 1. Laboratories: Subject to compliance with requirements, provide testing by the following:

- a. Sunland Analytical
11419 Sunrise Gold Circle #10
Rancho Cordova, CA 95742
Phone: (916)-852-8557

18.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil & imported soil
- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

18.10 SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by contractor under the direction of the testing agency.

1. Number and Location of Samples: Minimum of eight representative soil samples where directed by Landscape Architect for each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: According to USDA
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

18.11 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
 - a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
2. Bulk Density: Analysis according to core method and clod method of SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil fertility, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm and sodium absorption ratio.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, micronutrients and leaching.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. 1000 sq. ft. for 6-inch depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

18.12 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 19 - PRODUCTS

19.1 MATERIALS

- A. Regional Materials: Imported soil, manufactured planting soil, and soil amendments and fertilizers shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

19.2 PLANTING SOILS SPECIFIED ACCORDING TO PERFORMANCE REQUIREMENTS

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed. The quantities below are for bid purposes only.
- B. Planting-Soil Type: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
 1. Bid mix for turf and shrub areas. Soil amendments bid mix shall be the following per 1000 square feet:
 - a. 6 cu. Yds. Nitrogen stabilized organic amendment 'Humic Compost' by Agriservice or approved equal.
 - b. 40 lbs. Gro-power Plus
 - c. 100 lbs Gypsum
 2. Planting and backfill mix for planting pits and tablets shall be as follows per cubic yard:
 - a. 70% of native soil
 - b. 30% Nitrogen stabilized organic amendment 'Humic Compost' by Agriservice or approved equal.
 - c. 16 lbs. Gro-power Plus
 - d. 2 lbs. Ferrous Sulfate
- C. Planting-Soil Type: Imported top soil for community garden plots. Naturally formed soil from off-site sources and consisting of sandy loam soil according to USDA textures; and modified to produce viable planting soil.
 1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches 4 inches deep, not from bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or

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- obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and brome grass.
2. Additional Properties of Imported Soil before Amending: Minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
 3. Unacceptable Properties, clean soil to be of the following:
 - a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
 - b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
 4. Percentage of Organic Matter: Minimum 4 percent by weight.
 5. Soil Reaction: pH of 6 to 7.

D. Planting-Soil Type Biofiltration Soil:

1. The loamy sand filtration layer shall consist of the following components: Loamy Sand Soil Mix shall consist of an approximate ratio of 75%-90% sand, 5%-20% silt and <5% clay. The loamy sand soil mix shall be combined with organic matter at a rate of 65-70% loamy sand soil mix and 30-35% compost material per the product specifications described below, to create the loamy sand filtration mix. The final product shall provide a permeability rate of not less than 5" per hour or greater than 20" per hour. These ratios were selected to minimize filtration layer compaction, and formation of an anaerobic soil condition resulting in the formation of off-gas (methane) and bacterial growth.
2. The final loamy sand mixture shall have the following physical properties:

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Property	Test Method	
pH	5.5- 8.0 (6.0-7.5 is optimum) (ASTM D4972)	
Magnesium	32 ppm (use authorized soil test procedures)	
Phosphorous (phosphate P2O5)	Not to exceed 69 ppm (use authorized soil test procedures)	
Potassium (K2O)	Minimum 78 ppm (use authorized soil test procedures)	
Salt Concentration	< 4.0 mmhos/cm (use authorized soil test procedures)	
Permeability (Darcy's k)	2.3 x10^-2 centimeters per second, minimum (see sand mixture requirements)	
Permeability (Saturation Hydraulic Conductivity)	USDA Hydraulic Properties Calculator – 2006 2-6 inches per hour	
Maturity	80% or above (Minimum of 6 on the Stability/Maturity Scale) (TMECC 05.05-A for Germination and Vigor, Seed Emergence Seedling Vigor, % Relative to Positive Control)	
Carbon/Nitrogen Ratio	Less than 20:1 will indicate compost is stable (TMECC 05.02-A)	
Pathogen	Fecal Coliform Bacteria < 1000 MPN/gram dry weight (TMECC 07.01-B)	Salmonella < 3 MPN/4 grams dry weight (TMECC 07.01-B)
Physical Contaminants	Less than 1.0% No Sharps (Sewing needles, straight pins and hypodermic needles, TMECC 02.02-C), Glass, Plastic, Paper	
Organic Matter Content	30-70% Dry Weight Basis (50%-60% preferred) Loss-On-Ignition Organic Matter Method (LOI) (TMECC 05.07-A)	
Moisture Content	35-55% (40-50% preferred) Use authorized test procedures) (TMECC 03.09-A)	
NOTE: TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).		

3. If the pH of the final loamy sand mixture falls outside the acceptable range, it may be modified with lime (to raise) or iron sulfate plus sulfur (to lower). The lime or iron sulfate must be mixed uniformly into the soil mix prior to use in bio-retention areas.
4. Should the soil mix not meet the minimum requirement for magnesium, it may be modified with magnesium sulfate. Likewise, should the soil mix not meet the minimum requirement for potassium, it may be modified with potash. Magnesium sulfate and potash must be mixed uniformly into the soil mix prior to use in bio-retention areas.
5. Limestone shall contain not less than 85 percent calcium and magnesium carbonates. Dolomitic (magnesium) limestone shall contain at least 10 percent magnesium as magnesium oxide and 85% calcium and magnesium carbonates.
 - a. Limestone shall conform to the following gradation:
 - 1) Sieve Size - Minimum Percent Passing By Weight
 - 2) No. 10 - 100%
 - 3) No. 20 - 98%
 - 4) No. 100 - 50%

6. Iron Sulfate. Iron sulfate shall be a constituent of an approved horticultural product produced as a fertilizer for supplying iron and as a soil acidifier.
7. Magnesium Sulfate. Magnesium sulfate shall be a constituent of an approved horticultural product produced as a fertilizer.
8. Potash. Potash (potassium oxide) shall be a constituent of an approved horticultural product produced as a fertilizer.
9. The materials making up the loamy sand filtration mixture shall have the following properties:
 - a. Topsoil: The base topsoil shall be free of stones, stumps, roots, or other similar objects larger than 2 inches. The topsoil shall have less than 5% clay content and no more than 20% silt and shall meet the following requirements:
 - 1) pH range: 5.5 to 8.0
 - 2) Organic matter: >5%
 - 3) Carbon to Nitrogen Ratio: <20:1
 - 4) Moisture content: 25-55%
 - b. Sand: The sand used shall be clean sand (Unified Soil Classification System group SW or SP) that is free of organic and deleterious materials. The sand shall be classified as coarse or medium sand, with grain sizes falling between the #10 and the #40 sieve size. No more than 5% of the sand by weight shall pass through the #100 sieve. The sand mixture shall fall within the envelope presented in Figure 1, below. The contractor shall demonstrate that the sand has these geotechnical properties by conducting grain size distribution testing (ASTM D422-63) at a frequency of one per 20 cubic yards of material. The sand layer shall possess a minimum permeability of 2.0×10^{-2} centimeters per second. The contractor shall demonstrate that the sand material has this permeability through a constant head permeability test (ASTM D2434) at one test per 100 cubic yards of material.
 - c. Compost: The compost used must not be derived from mixed municipal solid waste and must be reasonably free of visible contaminants. The compost must not contain paint, petroleum products, pesticides, or any other chemical residues harmful to animal life or plant growth (less than 1% by dry weight basis). The compost must not possess objectionable odors. The compost shall have a grain size distribution where 98% is passing the 3/4" sieve and less than 25% passing the 3/8" sieve. The compost shall not have any materials larger than the 2" in length. The compost shall also meet the following requirements:
 - 1) pH: 5.5-8.0
 - 2) Moisture: 30-60% wet weight basis
 - 3) Organic Matter: 30-65% dry weight basis
 - 4) Stability (Carbon Dioxide evolution rate): >80% relative to positive control
 - 5) Maturity (Seed emergence and seedling vigor): >80% relative to positive control
10. The compost producer must be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate solid waste facilities. If exempt from State permitting requirements, the composting facility must certify that it follows guidelines and

procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

19.3 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
 - 2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
 - 3. Form: Provide lime in form of ground dolomitic limestone.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- E. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

19.4 ORGANIC SOIL AMENDMENTS

- A. Compost: The compost used must not be derived from mixed municipal solid waste and must be reasonably free of visible contaminants. The compost must not contain paint, petroleum products, pesticides, or any other chemical residues harmful to animal life or plant growth (less than 1% by dry weight basis). The compost must not possess objectionable odors. The compost shall have a grain size distribution where 98% is passing the 3/4" sieve and less than 25% passing the 3/8" sieve. The compost shall not have any materials larger than the 2" in length. The compost shall also meet the following requirements:
 - 1. pH: 5.5-8.0
 - 2. Moisture: 30-60% wet weight basis
 - 3. Organic Matter: 30-65% dry weight basis
 - 4. Stability (Carbon Dioxide evolution rate): >80% relative to positive control
 - 5. Maturity (Seed emergence and seedling vigor): >80% relative to positive control

19.5 FERTILIZERS

- A. Superphosphate: Commercial, phosphate mixture, soluble.

- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. 1 lb/1000 sq. ft. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 20 - EXECUTION

20.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

20.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

- A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

20.3 BLENDING PLANTING SOIL IN PLACE

- A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

- B. Preparation: Till unamended, existing soil in planting areas to a minimum depth 6 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
- C. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

20.4 BIOFILTRATION SOIL PLACEMENT

- A. The Contractor shall provide the Owner's Representative with the required material testing and manufacturer data for review and approval prior to delivery of the material to the site. Prior to blending the loamy sand filtration mixture, the Contractor shall provide particle size distribution for all material components, and shall provide an agricultural suitability test for the topsoil and compost at a rate of one test per 100 cubic yards of material. After blending the loamy sand filtration mixture, the Contractor shall provide a test of the blended product for approval prior to delivery. The Contractor shall also provide a quality control test at a rate of one test per 100 cubic yards of blended material upon delivery.
- B. Upon delivery, the materials shall be stored so that they are not exposed to the elements. All filtration mixture materials shall be kept dry during the storage and final application. The materials shall be stored to prevent contamination of fines and other deleterious materials. The loamy sand shall be thoroughly mixed prior to application. The loamy sand mixture shall be poured into the design area. The filtration layer shall not be compacted.
- C. The loamy sand filtration layer shall be overlain with 2 to 3 inches of a non-chemically treated mulch. Mulch shall be well-aged, shredded, or chipped woody debris (no redwood) or plant material. Well-aged mulch is defined as mulch that has been stockpiled or stored for at least twelve (12) months. This mulch is intended to help sustain nutrient levels, suppress weeds, and maintain infiltrative capacity. The mulch shall have a grain size distribution where 98% is passing the 3/4" sieve.

20.5 PROTECTION

- A. Protection Zone: Identify protection zones according to Section 01 56 39 "Temporary Tree and Plant Protection."
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Excavation or other digging unless otherwise indicated.

- C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Landscape Architect and replace contaminated planting soil with new planting soil.

20.6 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 32 91 15

SECTION 32 92 00 - TURF AND GRASSES

PART 21 - GENERAL

21.1 RELATED DOCUMENTS

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

21.2 SUMMARY

- A. Section Includes:

- 1. Sodding.
- 2. Turf renovation.

- B. Related Requirements:

- 1. Section 32 93 00 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

21.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 15 "Soil Preparation (Performance Specification)" and drawing designations for planting soils.
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

21.4 PREINSTALLATION MEETINGS

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

21.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.
- B. Product Certificates: For fertilizers, from manufacturer.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

21.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

21.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five years' experience in turf installation in addition to requirements in Section 01 40 00 "Quality Requirements."
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's field supervisor shall have certification in all of the following categories from the Professional Landcare Network:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Lawncare Manager.
 - c. Landscape Industry Certified Lawncare Technician.
 - 5. Pesticide Applicator: State licensed, commercial.

21.8 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation"

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sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

21.9 FIELD CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
1. Spring Planting: **<Insert dates>**.
 2. Fall Planting: **<Insert dates>**.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 22 - PRODUCTS

22.1 TURFGRASS SOD

- A. Turfgrass Sod: **[Certified] [Approved] [Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects]**, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.
- B. Turfgrass Species: **[Bermudagrass (Cynodon dactylon)] [Carpetgrass (Axonopus affinis)] [Centipedegrass (Eremochloa ophiuroides)] [St. Augustinegrass (Stenotaphrum secundatum)] [Zoysiagrass (Zoysia japonica)] [Zoysiagrass (Zoysia matrella)] <Insert species>**.
- C. Turfgrass Species: Sod of grass species as follows, with not less than **[85] <Insert number>** percent germination, not less than **[95] <Insert number>** percent pure seed, and not more than **[0.5] <Insert number>** percent weed seed:
1. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
 2. Sun and Partial Shade: Proportioned by weight as follows:

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- a. 50 percent Kentucky bluegrass (*Poa pratensis*).
 - b. 30 percent chewings red fescue (*Festuca rubra* variety).
 - c. 10 percent perennial ryegrass (*Lolium perenne*).
 - d. 10 percent redtop (*Agrostis alba*).
3. Shade: Proportioned by weight as follows:
 - a. 50 percent chewings red fescue (*Festuca rubra* variety).
 - b. 35 percent rough bluegrass (*Poa trivialis*).
 - c. 15 percent redtop (*Agrostis alba*).

22.2 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 1. Composition: [1 lb/1000 sq. ft.] <Insert value> of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

22.3 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 23 - EXECUTION

23.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

23.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

23.3 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 15 "Soil Preparation (Performance Specification)."
- B. Placing Planting Soil: [Place and mix planting soil in place over exposed subgrade] [Place manufactured planting soil over exposed subgrade] [Blend planting soil in place] <Insert requirement>.
 - 1. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Moistening prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.