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CLEAR CREEK WELCOME CENTER
WEST TERRE HAUTE, INDIANA / INDOT

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ERIC HOLCOMB
GOVERNOR

SUZANNE CROUCH
LIEUTENANT GOVERNOR

DR. REBECCA HOLWERDA
COMMISSIONER, DEPARTMENT OF ADMINISTRATION

MICHAEL SMITH
COMMISSIONER, DEPARTMENT OF TRANSPORATION

BOB GROSSMAN
DIRECTOR, PUBLIC WORKS DIVISION

JANSSEN & SPAANS ENGINEERING
jsengr.com

synthesis

Applied
Engineering Services

RATIO

BLN
BEAM·LONGEST·NEFF

PROJECT MANUAL
For construction of:

Clear Creek Welcome Center
West Terre Haute, Indiana

Public Works Project
84003001-22-058-C1

For

Department of Transportation

Prepared by

Janssen & Spaans Engineering
9120 Harrison Park Court
Indianapolis, IN 46216

Synthesis, Inc.
251 N. Illinois St., Suite 200
Indianapolis, IN 446204

Applied Engineering Services, Inc.
5975 Castle Creek Pkwy. N. Dr. Suite 300
Indianapolis, IN 446250

Ratio
101 S. Pennsylvania St.
Indianapolis, IN 46204

BLN
505 S. Woodcrest Drive
Bloomington, IN 47401

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CERTIFICATION PAGE

OWNER:	**Indiana Department of Administration** **Public Works Division** **For** **Department of Transportation**
CIVIL ENGINEER:	**Janssen & Spaans Engineering** **9120 Harrison Park Court** **Indianapolis, IN 46216** **Phone: (317) 254-9686**
ARCHITECT:	**Synthesis, Inc.** **251 N. Illinois St., Suite 200** **Indianapolis, IN 446204** **Phone: (317) 951-9500** **Fax: (317) 951-9501**
ENGINEER:	**Applied Engineering Services** **5975 Castle Creek Pkwy. N. Dr., Suite 300** **Indianapolis, IN 46250** **Phone: (317) 810-4141**
LANDSCAPE:	**Ratio** **101 S. Pennsylvania St.** **Indianapolis, IN 46204** **Phone: (317) 238-4688**
SANITARY:	**BLN** **505 S. Woodcrest Drive** **Bloomington, IN 47401** **812-803-6227**

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PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture.

1. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures. Reinforcing shall be fabricated and placed only from drawings bearing the final stamp of approval of the Engineer. Shop drawing review will cover the size and arrangement of the principal and auxiliary members, and the strength of connections. An effort will be made to discover any errors in size of materials, general dimensions, and detail dimensions, but the responsibility for these remains with the Contractor. Shop drawings judged to be incomplete or materially incorrect will be returned without review for completion.
2. Shop drawings shall show all field dimensions related to the existing construction. Contractor to include field measurements in their scope of work.
3. Shop drawings shall be submitted in digital format. Format for submittals shall be PDF.
4. Shop drawings will be returned after review, in digital form, in pdf format.
5. Allow a minimum of fourteen (14) calendar days for review for each individual submittal package.

C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material certificates.

C. Material test reports.

D. Floor surface flatness and levelness measurements.

1.4 QUALITY ASSURANCE

A. 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."

B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
1. Build mockups for each type of Cast-in-Place (CIP) wall sizes approximately 48 inches long by 2 feet high by full thickness, including face joints, formliner patterns, finishes, and reinforcement.
2. Protect accepted mockups from the elements with weather-resistant membrane.
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.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

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

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I Type III,.

   a. Fly Ash: ASTM C 618, Class C.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, graded.

1. Nominal Maximum Aggregate Size: not to exceed maximum size permitted by ACI 301.
2. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

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.

2.5 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

2.6 CURING MATERIALS

A. Water: Potable.

B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, as needed to reduce the total amount of portland cement.

1. Fly Ash: 25 percent maximum.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Water-reducing admixture may be used in pumped concrete.

D. Footings: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 3000 psi.
2. Maximum Slump: 4 inches.

3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.

E. Slab-on-Grade: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Slump: 4 inches.

F. Foundation Walls and Piers: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4,000 psi.
2. Maximum Slump: 4 inches.

G. Submit field data showing that the proposed mix designs will produce the minimum required concrete strength. In the absence of such field data, water/cement ratios shall not exceed the following:

Minimum 28 Day Compressive Strength (psi)	Maximum Water/Cement Ratio (by weight)
4,000 psi AE	0.35
4,000 psi	0.44
3,000 psi AE	0.46
3,000 psi	0.58

H. Maximum Water-Cementitious Materials Ratio: 0.40 for concrete exposed to deicers or subject to freezing and thawing while moist.

I. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:

1. Air Content: 5.5 percent for 1-1/2-inch- nominal maximum aggregate size.
2. Air Content: 6 percent for 1-inch- nominal maximum aggregate size.
3. Air Content: 6 percent for 3/4-inch- nominal maximum aggregate size.

J. Do not air entrain concrete to trowel-finished interior floors. Do not allow entrapped air content to exceed 3 percent.

K. Aggregates: The proportion of fine aggregate to total aggregate shall fall within the limits of 35% and 45% unless otherwise expressly permitted by the Engineer.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

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.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

B. It shall be the responsibility of the Contractor to provide for and cooperate with other contractors in the installation of conduit boxes, sleeves, inserts, hangers, etc., required for their work; forms shall be cut out and framed as necessary for the installation of the work of other trades. At the same time, it shall be the responsibility of this Contractor to prevent groupings of sleeves or pipes through structural members, or cut outs not shown on the Drawings, which may affect the safety of the structure. When such problems arise, he shall immediately notify the Engineer for resolution. The same course shall be followed for pipes or sleeves, of whatever size, through beams and through slabs. Gauge metal sleeves may be used in slabs only where the Engineer’s approval is given.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Every bar shall be wired securely into position. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Reinforcing shall be set accurately in position according to the Drawings and placing plans. Every bar shall be wired securely in design position. Before concrete is placed, reinforcing shall be carefully checked and all bars displaced or bent during the course of the work shall be fully restored to their intended shape and position. There shall be no heating of bars for bending on the job. Beam, joist or slab bars hooked for anchorage in beams, walls or columns shall be positioned so that there is the minimum specified clearance between the hook and the far face of the beam, wall or column.

E. Concrete cover for reinforcing bars shall conform to the minimum requirements of the ACI-318. latest edition.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one and one-half mesh spacing or 12” minimum. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire. Welded wire fabric in slabs on grade shall be placed such that it’s final position is at the mid-depth of the slab thickness. During the course of the concrete slab placement, welded wire fabric shall be pulled up from the bottom of the slab to the mid-depth with a hooked hand tool, specifically designed for this purpose. Welded wire fabric shall be provided in flat sheets and not continuous rolls whenever possible.

H. Place an equivalent area of steel to that interrupted by an opening, pipe penetration, electrical conduit group or duct penetration around the opening or penetration. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

I. No reinforcing bars shall be welded either during fabrication or erection unless specifically called for on the Drawings, specified herein, or with prior written approval of the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for it shall conform to the AWS Structural Welding Code-Reinforcing Steel, AWS D1.4.

J. Tension lap splices shall be Class B lap splices, as defined in latest issue of ACI 318 unless indicated otherwise on the Drawings. Mechanical connectors shall not be used for reinforcing bar splices unless prior written approval is obtained from the Engineer. Mechanical connectors shall develop at least 125% of the specified yield strength of the bar.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. 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 concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

D. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen sub-grade or on sub-grade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

E. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. 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 to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep sub-grade uniformly moist without standing water, soft spots, or dry areas.

3.6 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.7 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

    a. Carpeted floors: Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15.
    b. Thin-set flooring or resilient floor covering for slabs-on-grade: Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17.
    c. Thin-set flooring or resilient floor covering for suspended slabs: Specified overall values of flatness, F(F) 30; and levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and levelness, F(L) 15.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

G. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of methods listed for “Unformed Surfaces”.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

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 for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

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.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.9 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each class of concrete, plus one set for each additional 50 cu. yd. or fraction thereof.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

a. Cast and field cure one standard cylinder for each composite sample.

C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

D. Strength of each concrete mix will be satisfactory if every 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.

E. Test results shall be reported in writing to Engineer, 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 inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer will not be used as sole basis for approval or rejection of concrete.

G. 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 Engineer. Testing and inspecting agency may conduct tests to

END OF SECTION 033000

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SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Architectural precast site features

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete" for installing connection anchors in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

C. Shop Drawings:

   1. Detail fabrication and installation of architectural precast concrete units.
   2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
   3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
   4. Indicate details at building corners.
   5. Indicate separate face and backup mixture locations and thicknesses.
   6. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
   7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
   8. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
   9. Include plans and elevations showing unit location and sequence of erection for special conditions.

10. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
11. Indicate relationship of architectural precast concrete units to adjacent materials.
12. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.

1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.

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

1. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator.

B. Welding certificates.

C. Material Certificates: For the following items:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Bearing pads.

D. Material Test Reports: For aggregates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

D. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of two sample panels approximately 16 sq. ft. in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

1. Locate panels where indicated or, if not indicated, as directed by Architect.
2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
4. Demolish and remove sample panels when directed.

E. Mockups: After sample panel approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup as indicated on Drawings including architectural precast concrete complete with anchors, connections, flashings, and joint fillers.
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 undamaged at time of Substantial Completion.

1.6 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.

B. Support units during shipment on nonstaining shock-absorbing material.

C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

D. Place stored units so identification marks are clearly visible, and units can be inspected.

E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Basis of Design for precast is Wausau tile. Provided either the named product or a comparable product approved in advance by Landscape Architect. Refer to front end specifications section 012500 Substitution Procedures for substitution process for additional comparable product approval process.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design architectural precast concrete units.

B. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

C. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:

    a. Upward and downward movement of 1/2 inch.

2. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F.

2.3 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2.4 REINFORCING MATERIALS

A. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.5 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

a. Gradation: Uniformly graded.

2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

2.6 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36.

B. Carbon-Steel-Headed Studs: ASTM A 108, Grade 1010 through 1020, cold finished, AWS D1.1, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A 283, Grade C.

D. Malleable-Iron Castings: ASTM A 47, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A 27, Grade 60-30.

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572.

G. Carbon-Steel Structural Tubing: ASTM A 500, Grade B or Grade C.

H. Wrought Carbon-Steel Bars: ASTM A 675, Grade 65.

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563; and flat, unhardened steel washers, ASTM F 844.

K. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123 or ASTM A 153 electrode position according to ASTM B 633, SC 3, Types 1 and 2.

1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.

2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC- Paint 20.

L. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate- free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

M. Welding Electrodes: Comply with AWS standards.

N. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.7 BEARING PADS

A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi, ASTM D 412.
2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.8 ACCESSORIES

A. Reglets: Specified in Section 076200 "Sheet Metal Flashing and Trim."

B. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.9 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

2.10 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use a single design mixture for units with more than one major face or edge exposed.
2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

2.11 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly chamfered.

2.12 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.

F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

G. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

H. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

K. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.

M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

N. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.13 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:

1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:

    a. 10 feet or under, plus or minus 1/8 inch.
    b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
    c. 20 to 40 feet, plus or minus 1/4 inch.
    d. Each additional 10 feet, plus or minus 1/16 inch.

2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:

    a. 10 feet or under, plus or minus 1/4 inch.

3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
4. Rib Thickness: Plus or minus 1/8 inch.
5. Rib to Edge of Flange: Plus or minus 1/8 inch.
6. Distance between Ribs: Plus or minus 1/8 inch.
7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches or 1/2 inch total, whichever is greater.
8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.
10. Dimensions of Haunches: Plus or minus 1/4 inch.
11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch.
12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch.
13. Bowing: Plus or minus L/360, maximum 1 inch.
14. Local Smoothness: 1/4 inch/10 feet.
15. Warping: 1/16 inch/12 inches of distance from nearest adjacent corner.
16. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
17. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.

C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.

1. Weld Plates: Plus or minus 1 inch.
2. Inserts: Plus or minus 1/2 inch.
3. Handling Devices: Plus or minus 3 inches.
4. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch.
5. Position of Sleeve: Plus or minus 1/2 inch.

2.14 FINISHES

A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample panels and as follows:
   1. Match Architects sample

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.

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

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.

   1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
   2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
   3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
   4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.

C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
4. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
5. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:

    a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
    b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
    c. Twist-off Tension Control Bolt: ASTM F 1852.
    d. Direct-Tension Control Bolt: ASTM F 1852.

3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.

F. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:

1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
2. Top Elevation from Nominal Top Elevation: As follows:

    a. Exposed Individual Panel: Plus or minus 1/4 inch.
    b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
    c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
    d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.

3. Support Elevation from Nominal Support Elevation: As follows:

    a. Maximum Low: 1/2 inch.
    b. Maximum High: 1/4 inch.

4. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
5. Plumb in Any 10 Feet of Element Height: 1/4 inch.
6. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
7. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
8. Maximum Joint Taper: 3/8 inch.
9. Joint Taper in 10 Feet: 1/4 inch.
10. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
11. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.

3.4 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide and auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

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

1. APOC, Inc; a division of Gardner Industries.
2. Brewer Company (The).
3. ChemMasters, Inc.
4. Euclid Chemical Company (The); an RPM company.
5. Henry Company.
6. Karnak Corporation.
7. Mar-flex Waterproofing & Building Products.
8. Master Builder Solutions
9. W. R. Meadows, Inc

B. Trowel Coats: ASTM D 1227, Type II, Class 1.

C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.4 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

C. Patching Compound: of type recommended in writing by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.

1. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.

1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

C. Where dampproofing interior face of above-grade, exterior walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.

B. Concrete Backup for Stone Veneer Assemblies: Apply one brush or spray coat at not less than 1 gal./100 sq. ft..

3.5 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

3.6 PROTECTION

A. Correct dampproofing that does not comply with requirements; repair substrates, and reapply dampproofing.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Immersible joint sealants.

B. Related Requirements:

1. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. 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.

D. Joint-Sealant Schedule: Include the following information:

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 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 or are below 40 deg F.
2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, 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.

B. VOC Content: Verify sealants and sealant primers comply with the following:

1. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dowsil; 756 SMS.
b. GE Construction Sealants; Momentive Performance Materials Inc; SilPruf NB.
c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 295 FPS NB.
d. Pecora Corporation; 864NST.
e. Tremco Incorporated; Spectrem 2.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Construction Chemicals - Building Systems; Masterseal TX1.
b. Bostik, Inc.; 915
c. ER Systems, an ITW Company; Pacific Polymers Elasto-Thane 230 MP.
d. Pecora Corporation; Dynatrol I-XL.
e. Polymeric Systems, Inc.; Flexiprene 1000.
f. Schnee-Morehead, Inc., an ITW company; Permathane SM7108.
g. Sika Corporation U.S.; Sikaflex Textured Sealant.
h. Tremco Incorporated; Dymonic.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Construction Chemicals - Building Systems; Mastersreal SL 1.
b. Pecora Corporation; NR-201.
c. Polymeric Systems, Inc.; Flexiprene 952.
d. Schnee-Morehead, Inc.; an ITW company; Permathane SM7101.

e. Sherwin-Williams Company (The); Stampede 1SL.

C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. LymTal International, Inc.; Iso-Flex 888QC.

2.4 IMMERSIBLE JOINT SEALANTS

A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C 1247, Class 1; tested in deionized water unless otherwise indicated

B. Urethane, Immersible, S, P, 25, T, NT, I: Immersible, single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T, NT, and I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Sika Corporation U.S.; Sikaflex 1c SL.
b. Tremco Incorporated; Vulkem 45.
c. W.R. Meadows, Inc; Pourthane SL.

2.5 JOINT-SEALANT BACKING

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

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

a. BASF Construction Chemicals - Building Systems.
b. Construction Foam Products, a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by 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.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet 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.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below 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 sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
    b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

    a. Control and expansion joints in brick pavers.
    b. Isolation and contraction joints in cast-in-place concrete slabs.
    c. Joints between plant-precast architectural concrete paving units.
    d. Joints in stone paving units, including steps.
    e. Tile control and expansion joints.
    f. Joints between different materials listed above.
    g. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.

1. Joint Locations:

a. Joints in pedestrian plazas.
b. Joints in swimming pool decks.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Joints between plant-precast architectural concrete units.
c. Control and expansion joints in unit masonry.
d. Joints in dimension stone cladding.
e. Joints in glass unit masonry assemblies.
f. Joints in exterior insulation and finish systems.
g. Joints between metal panels.
h. Joints between different materials listed above.
i. Perimeter joints between materials listed above and frames of doors, windows] and louvers.
j. Control and expansion joints in ceilings and other overhead surfaces.
k. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems **on the following substrates:**

1. Exterior Substrates:

a. Concrete.

B. Related Requirements:
1. Section 099113 "Exterior Painting" for special-use coatings and general field painting.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data for LEED 2009 Credit EQ 4.2: For paints and coatings, include printed statement of VOC content.
2. Laboratory Test Reports for LEED 2009 Credit EQ 4.2: For paints and coatings, indicating compliance with requirements for low-emitting materials.

C. Samples for Initial Selection: For each type of topcoat product indicated.

D. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Label each coat of each Sample.
3. Label each Sample for location and application area.

E. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

1.4 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: **1 gal.** of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.

    a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

E. Hazardous Materials: Hazardous materials including lead paint [**are**] [**may be**] present in buildings and structures to be painted. A report on the presence of known hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified.
2. Perform preparation for painting of substrates known to include lead paint in accordance with EPA Renovation, Repair and Painting Rule and additional requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The)

B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:

1. Products are approved by manufacturer in writing for application specified.
2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
3. Provide products of same manufacturer for each coat in a coating system.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC content limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Floor Coatings: 100 g/L.
6. Shellacs, Clear: 730 g/L.
7. Shellacs, Pigmented: 550 g/L.

C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Service's "Standard Practice for the Testing of Volatile Organic Chemical Emissions from Various Sources Using Small Scale Environmental Chambers."

D. Colors: **As selected by Architect from manufacturer's full range**

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Report in writing conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Concrete: 12 percent.
b. Concrete Masonry: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of [1500 to 4000 psi (10 350 to 27 580 kPa)] [4000 to 10,000 psi (27 580 to 68 950 kPa)] at 6 to 12 inches (150 to 300 mm).
2. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."

E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, or alkalinity of surfaces or if alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of [100 to 600 psi (690 to 4140 kPa)] [1500 to 4000 psi (10 350 to 27 580 kPa)] at 6 to 12 inches (150 to 300 mm).

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces:
   1. Pigmented Polyurethane over High-Build Epoxy System:
      a. Prime Coat: Epoxy, gloss:
         1) S-W Macropoxy 646 B58 Series, at 5.0 to 10 mils0.127 to 0.254 mm dry, per coat.
      b. Intermediate:
         1) Polyurethane, gloss matching topcoat.
      c. Topcoat: Polyurethane, two-component, pigmented, gloss:
         1) S-W Pro Industrial Waterbased Acrolon 100 Polyurethane, B65-720 Series, at 2.0 to 4.0 mils0.051 to 0.102 mm dry, per coat.

END OF SECTION 099600

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dimensional characters.

    a. Cutout dimensional characters.

1.2 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 DIMENSIONAL CHARACTERS

A. Cutout Characters : Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows:

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

a. A.R.K. Ramos.
b. ACE Sign Systems, Inc.
c. APCO Graphics, Inc.
d. ASI Sign Systems, Inc.
e. Cosco.
f. Diskey Architectural Signage Inc.
g. Gemini Incorporated.
h. Inpro Corporation.
i. Matthews International Corporation; Bronze Division.
j. Metal Arts.
k. Metallic Arts.
l. Southwell Company (The).
m. Steel Art Company.

2. Character Material: Sheet or plate aluminum.
3. Character Height: As indicated on Drawings.
4. Thickness: Insert dimension.
5. Finishes:

a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color matching Architect's sample.

6. Mounting: Projecting studs.
7. Typeface: As indicated.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish devices unless otherwise indicated.

3. Sign Mounting Fasteners:

a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

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

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

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SECTION 107516 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

B. Owner-Furnished Material: Flags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For each flagpole.

1. Include the following

a. Plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
b. Section, and details of foundation system.

C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

D. Delegated Design Submittals: For flagpoles.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.

B. Seismic Performance: Flagpole assemblies to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Structural Performance: Flagpole assemblies, including anchorages and supports, to withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is 95 mph.
2. Base flagpole design on nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

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

a. Acme/Lingo Flagpoles, LLC.
b. American Flagpole.
c. Baartol Company.
d. Concord Industries, Inc.
e. Eder Flag Manufacturing Company, Inc.
f. Ewing Flagpoles.
g. Morgan-Francis Flagpoles and Accessories.
h. Pole-Tech Company Inc.
i. U.S. Flag & Flagpole Supply, LP.

B. Exposed Height: 25 feet.

C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Sleeve for Aluminum Flagpole: PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.

1. Flashing Collar: Same material and finish as flagpole.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch spun aluminum[, finished to match flagpole][with gold anodic finish].

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Stainless steel swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.

G. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

H. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION

SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes playground equipment as follows:

1. Freestanding playground equipment.
2. Composite playground equipment.

1.3 DEFINITIONS

A. Definitions in ASTM F1487 apply to Work of this Section.

B. IPEMA: International Play Equipment Manufacturers Association.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of playground equipment.

1. Include plans, elevations, sections, and attachment details.
2. Include fall heights and use zones for playground equipment, coordinated with the critical-height values of protective surfacing specified in Section 321816.13 "Playground Protective Surfacing."

C. Samples for Initial Selection: For each type of exposed finish.

1. Manufacturer's color charts.
2. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following products:

1. Include Samples of accessories to verify color and finish selection.
2. Posts and Rails: Minimum 6 inches long.
3. Platforms: Minimum 6 inches square.
4. Molded Plastic: Minimum 3 inches square.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer and testing agency.

B. Product Certificates: For each type of playground equipment.

C. Material Certificates: For the following items:

1. Shop finishes.
2. Wood-Preservative Treatment: Include certification by treating plant that states type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Provided either the named product or a comparable product approved in advance by Landscape Architect. Refer to front end specifications section 012500 Substitution Procedures for substitution process for additional comparable product approval process.

B. Playground equipment and components shall have the IPEMA Certification Seal.

2.2 PERFORMANCE REQUIREMENTS

A. Safety Standard: Provide playground equipment according to ASTM F1487.

2.3 PLAYGROUND EQUIPMENT

1. Refer to drawings for list of equipment and layout.

2.4 FABRICATION

A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.

B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

C. Wood Frame: Fabricate main-frame upright support posts from wood. Fabricate secondary frame members, bracing, and connections from wood, steel, or aluminum.

D. Composite Frame: Fabricate main-frame upright support posts from metal and plastic. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

E. Play Surfaces: Manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from perforated or expanded metal molded plastic plastic panel or plank polyethylene panel or plank wood plank made into floor units with slip-resistant finish. Fabricate units in modular sizes and shapes to form assembled play surfaces indicated.

F. Protective Barriers: Fabricate according to ASTM F1487. Extend barriers to height above the protected elevated surface according to requirements for use by age group indicated. Fabricate from one or more of the following:

1. Welded-metal pipe or tubing with vertical bars.
2. Steel sheet with openings for vision and ventilation.
3. Metal-pipe or -tubing frame with wire-mesh infill panels.
4. Opaque plastic panels with openings.
5. Vertical wood balusters with metal pipe or tubing or wood frame.
6. Wood panels with openings for vision and ventilation.

G. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails according to requirements for use by age group indicated.

H. Handrails: Welded metal pipe or tubing, maximum OD between 0.95 and 1.55 inches (24 and 39 mm) of 0.125 inch (3.2 mm).

1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F1487.

I. Signs: Manufacturer's standard sign panels, fabricated from HDPE opaque plastic with graphics, attached to freestanding, upright support posts or directly to playground equipment.

1. Text: Minimum informational content according to ASTM F1487, safety requirements for equipment with heat concerns, general playground rules of safety.
2. Colors: Standard colors from manufacturer as selected by the Landscape Architect.

2.5 MATERIALS

A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.

B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated, hot-dip galvanized.

C. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.

D. Wood: Manufacturer’s standard, surfaced smooth on all sides and all edges rounded.

E. Plywood: PS 1, Exterior grade; smooth surfaced with rounded edges; preservative treated after fabrication.

F. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.

G. Transparent Plastic: Abrasion-resistant, UV-stabilized polycarbonate sheet; clear, colorless; not less than 3/16 inch (5 mm) thick.

H. Suspension Chain and Fittings: ASTM A467/A467M, Class CS, 4/0 or 5/0, welded-straight-link coil chain; hot-dip galvanized zinc plated or PVC coated; with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and swing or ring hangers.

I. Suspension Cable: Manufacturer's standard hot-dip galvanized zinc-plated or PVC-coated cable; with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and swing or ring hangers.

J. Iron Castings and Hangers: Malleable iron, ASTM A47/A47M, Grade 32510, hot-dip galvanized.

K. Post Caps: Cast aluminum or color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene; color to match posts.

L. Platform Clamps and Hangers: Cast aluminum or zinc-plated steel, not less than 0.105-inch- (2.7-mm-) nominal thickness.

M. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.

N. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

2.6 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment: Pressure-treat wood products according to AWPA U1 and the following:

1. Use preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
2. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.

2.7 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" ACI 301/ (ACI 301M) for normal-weight, air-entrained concrete with

minimum 28-day compressive strength of 3000 psi (20.7 MPa), 3-inch (76-mm) slump, and 1-inch- (25-mm-) maximum-size aggregate.

B. Concrete Materials and Properties: Dry-packaged concrete mix complying with ASTM C387/C387M and mixed at site with potable water, according to manufacturer's written instructions, for normal-weight concrete with minimum 28-day compressive strength of 3000 psi (20.7 MPa), 3-inch (76-mm) slump, and 1-inch- (25-mm-) maximum-size aggregate.

2.8 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils (2 mm). Comply with coating manufacturer's written instructions for pretreatment and application.

2.9 IRON AND STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils (2 mm). Comply with coating manufacturer's written instructions for pretreatment and application.

2.10 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set on Subgrade: Level bearing surfaces with drainage fill to required elevation.

D. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" ACI 301 (/ACI 301M) for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts on concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
3. Finishing Footings: Smooth top, and shape to shed water.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Contractor responsible for engaging a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Perform inspection and testing for each type of installed playground equipment according to ASTM F1487.

C. Playground equipment items will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

E. Notify Architect and Owner 72 hours in advance of date(s) and time(s) of testing and inspection.

END OF SECTION 116800

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Benches, chairs, and tables.
2. Litter receptacles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of exposed finish, not less than 6-inch- long linear components and 4-inch- square sheet components.

C. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings manufactured with preservative-treated wood.

1. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 Basis-of-Design Product: Provided either the named product or a comparable product approved in advance by Landscape Architect. Refer to front end specifications section 012500 Substitution Procedures for substitution process for additional comparable product approval process.

2.2 BENCHES, TABLES, CHAIRS

A. Refer to plans for product information.

2.3 LITTER RECEPTACLES

A. Refer to plans for product information.

MATERIALS

B. Steel and Iron: Free of surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A36/A36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A53/A53M, or electric-resistance-welded pipe complying with ASTM A135/A135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A500/A500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A513/A513M, or steel tubing fabricated from steel complying with ASTM A1011/A1011M and complying with dimensional tolerances in ASTM A500/A500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A1011/A1011M.
6. Malleable-Iron Castings: ASTM A47/A47M, grade as recommended by fabricator for type of use intended.
7. Gray-Iron Castings: ASTM A48/A48M, Class 200.

C. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated by manufacturer.

D. Anchors, Fasteners, Fittings, and Hardware: Stainless steel; commercial quality, tamperproof, vandal and theft resistant.

1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on-grade substrate; extent as indicated.
2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; two per unit.

2.4 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

E. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.5 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION 129300

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

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

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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

1.5 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.

1.6 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 or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

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

2.2 COLD-APPLIED JOINT SEALANTS

A. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade P, Class 25, for Use T.

1. Basis of Design: Sika Corporation, Sikaflex-2C SL.

2.3 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.

2.4 PRIMERS

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

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 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 C1193 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.

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.

3.4 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.

END OF SECTION 321373

SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete pavers.

B. Related Requirements:
   1. Section 033000 "Cast in Place Concrete" for concrete base under unit pavers

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.3 ACTION SUBMITTALS

A. Product Data:

   1. For materials other than water and aggregates.
   2. For the following:

      a. Pavers.
      b. Bituminous setting materials.
      c. Edge restraints.

B. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C136.

C. Samples for Initial Selection: For each type of unit paver indicated and the following:

   1. Joint materials involving color selection.
   2. Exposed edge restraints involving color selection.

D. Samples for Verification: For full-size units of each type of unit paver indicated. Assemble no fewer than five Samples of each type of unit on suitable backing and grout joints. Include Samples of the following:

   1. Joint materials.
   2. Exposed edge restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified unit paving installer. Installer's field supervisor personnel assigned to the Work must have Concrete Paver Installer Certification from the Interlocking Concrete Pavement Institute (ICPI) with the following designations:
   1. Commercial Paver Technician Designation.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store asphalt cement and other bituminous materials in tightly closed containers.

1.7 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Bituminous Setting Bed:

   1. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry.
   2. Apply asphalt adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Basis-of-Design Product: Basis of Design for pavers are Wausau tile. Provided either the named product or a comparable product approved in advance by Landscape Architect. Refer to front end specifications section 012500 Substitution Procedures for substitution process for additional comparable product approval process.

2.2 CONCRETE PAVERS

A. Concrete Pavers, Solid Paving Units, Normal-Weight Concrete: Solid paving units made from normal-weight concrete with a compressive strength not less than 5000 psi [water absorption not more than 5 percent according to ASTM C140, and no breakage and not more than 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C67.

1. Thickness: Refer to paving plans
2. Face Size and Shape: Refer to paving plans

3. Color: Refer to paving plans

2.3 CURBS AND EDGE RESTRAINTS

a. Per details

2.4 BITUMINOUS SETTING-BED MATERIALS

A. Fine Aggregate for Setting Bed: ASTM D1073, No. 2 or No. 3.

B. Asphalt Cement: ASTM D3381/D3381M, Viscosity Grade AC-10 or Grade AC-20.

C. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos.

D. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.

1. Provide sand of color needed to produce required joint color. Submit sand color samples to Landscape Architect for approval prior to installation.

2.5 BITUMINOUS SETTING-BED MIX

A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate unless otherwise indicated. Heat mixture to 300 deg F (149 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

1. For concrete pavers, a block splitter may be used.

D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

E. Joint Pattern: Refer to Paving Plans

F. Tolerances:

1. Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) or 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

G. Expansion and Control Joints:

H. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch (25 mm) below top edge.

3.4 BITUMINOUS SETTING-BED APPLICATIONS

A. Prepare for setting-bed placement by locating 3/4-inch- (19-mm-) deep control bars approximately 11 feet (3.3 m) apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated.

B. Place bituminous setting bed where indicated, in panels, by spreading bituminous material between control bars. Spread mix at a minimum temperature of 250 deg F (121 deg C). Strike setting bed smooth, firm, even, and not less than 3/4 inch (19 mm) thick. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill depressions that remain after removing depth-control bars.

C. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.

D. Joint Treatment: Place unit pavers with hand-tight joints. Fill joints by sweeping sand over paved surface until joints are filled. Remove excess sand after joints are filled.

3.5 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

END OF SECTION 321400

PART I: GENERAL

1.1 DESCRIPTION:

A. Seamless, hand-troweled, unitary playground safety surface. Bidder shall provide all materials, installation details, labor, and equipment required to properly install the poured-in-place (PIP) system.

1.2 QUALITY ASSURANCE:

A. Qualifications
1. IPEMA Certification: Products must be IPEMA certified (go to www.ipema.org for certificate)
2. The PIP system shall be warranted by Fibar for any defects in materials and workmanship for five (5) years and for impact attenuation to ASTM F1292 (less than 1,000 HIC and 200G) for a period of three (3) years from the date of completion. See Limited Warranty for details and restrictions.
3. Test results showing compliance with various playground surfacing standards as per section 1.4 – Submittals together with other Bidder requirements.

B. Design and Detailing
C. The PIP system is utilized when an impact-absorbing surface is required within the Use Zone of playground equipment. Each system is engineered to meet CPSC Guidelines, ASTM F1292 Impact Attenuation, ASTM F1951 wheelchair mobility criteria, and complies with ASTM F2223 *Standard Guide for ASTM Standards on Playground Surfacing.*
D. Substrates over which PIP may be installed include concrete, asphalt, or compacted aggregate.

1.4 SUBMITTALS:
A. Product Data
B. Bidder must submit test results from an independent, qualified laboratory showing that PIP product passes:
1. ASTM F1292 Standard for Impact Attenuation
2. ASTM F1951 Standard for ADA compliance
3. ASTM D2859 Standard for Flammability
4. CPSC-CH-E1002-08.3 2012 – CPSIA Total Lead in Accessible Substrate Material: Non-Metal Children's Products

C. Independently Tested For:
1. Tear Strength (for durability) according to ASTM D624-00el Standard
2. Tensile Strength (for durability) according to ASTM D412-02

3. Coefficient of Friction (for slip resistance) according to ASTM D2047
4. Surface Friction (for slip resistance) according ASTM E303
5. Abrasion (for durability) according to ASTM C501 Taber Abrasion Test

D. Plus, additional benefits:
1. IPEMA Certification
2. Five-year Limited Warranty on Durability and 3-year Limited Warranty on impact attenuation to ASTM F1292
3. $10 million product liability insurance certificate with project owner named as certificate holder
4. Detailed Maintenance Instructions

1.5 INSTALLATION RECOMMENDATIONS:

A. It is recommended that the air temperature be greater than 45° F during the installation process. Lower temperatures may affect the polyurethane curing process. If the temperature is below 45°, professional judgment must be used to weigh the risk of installing the surface versus leaving the play equipment without safety surfacing.

PART 2: PRODUCTS

2.1 BASIS OF DESIGN

A. Basis-of-Design Product: Provided either the named product or a comparable product approved in advance by Landscape Architect. Refer to front end specifications section 012500 Substitution Procedures for substitution process for additional comparable product approval process.

2.2 PRODUCT:

A. FibarPIP Poured-In-Place is available from your local Representative

Or directly from The Fibar Group, LLC
80 Business Park Drive, Suite 300, Armonk, New York 10504-1705
Telephone: 800-342-2721 • 914-273-8770 • Fax: 914-273-8659 •
Email: Info@Fibar.com

2.3 DEPTHS AND RECOMMENDED FALL HEIGHTS:

A. The depths of FibarPIP Poured-In-Place necessary for specified Fall Heights are as follows:

Critical Fall Height	Depth of Surfacing	Critical Fall Height	Depth of Surfacing
3 feet	1.75”	7 feet	3.50”
4 feet	2.00”	8 feet	3.75”
5 feet	2.50”	9 feet	4.25”
6 feet	3.00”	10 feet	5.00”

2.4 MATERIALS:

A. Primer: A single-component, moisture-cured polyurethane

B. Binder: Aromatic or Aliphatic - An MDI-based, free of solvent and TDI Monomers, elastomeric, polyurethane pre-polymer with low odor, clear in color and exceptional weathering and binding attributes. Aliphatic binder is a UV stabilized, non-yellowing moisture curing binder to preserve color fastness. The binder is specifically formulated for compatibility with SBR and EPDM/TPV granules.

C. SBR Black Base Layer:
1. Recycled SBR rubber buffings
2. 3/8” sieve with less than 4% dust (6-16 mesh)
3. Containment Bags shall provide ample moisture protection.

D. EPDM/TPV Wear Surface:
1. ½” EPDM/TPV cap thickness
2. Ultra-violet light-stabilized virgin EPDM/TPV rubber (excluding black)
3. EPDM/TPV shall be full color. No coated rubber is permitted.
4. Sieve sizes of 1.0 mm – 3.5 mm

2.5 MIXING AND PREPARATION:

A. Binder/SBR and binder/EPDM/TPV mix ratios shall be determined by the specified system.

PART 3 – EXECUTION

3.1 POURED-IN-PLACE SYSTEM:

A. Primer: When required, apply primer using a 3/8” napped roller at a rate of 300 square feet per gallon. Do not apply over crushed stone base. Prime all vertical interfaces of curbs, etc.

B. Owner/Operator understands that if FibarPIP Poured-In-Place is placed near a sand play area, impact attenuation of the FibarPIP Poured-In-Place may be adversely affected.

C. SBR Base Layer

1. Binder-to-rubber ratio shall be 15% by weight of rubber to achieve proper resiliency
2. Mix binder and SBR rubber in a paddle-type mixer for 1 to 2 minutes or until rubber particles are encapsulated.
3. Spread this mix to the desirable thickness using a screed bar.
4. Using a steel trowel, uniformly compact the mix. Periodically lubricate the trowel with mineral spirts as work progresses. Do not saturate the rubber surface with cutting agents.
5. Allow base layer to cure to the point of supporting foot traffic without deforming the base layer and before proceeding with the EPDM/TPV wear surface.

D. EPDM/TPV Wear Surface

1. Binder-to-rubber ratio shall be 20% by weight of rubber to achieve maximum durability
2. Mix EPDM/TPV and binder in paddle-type mixer for 1 to 2 minutes or until materials are thoroughly encapsulated. Using a screed bar, level the mix over the base layer.
3. Using a steel trowel, uniformly compact the mix. Periodically lubricate the trowel with soapy water as work progresses. Do not saturate the rubber surface with cutting agents.
4. Allow wear surface to cure 24 to 72 hours before opening the area for play. The surface must be tack-free before attempting to walk on the surface.

3.2 CLEAN-UP:

A. Clean all tools with mineral spirits.

3.3 GENERAL PRECAUTIONS:

A. Wear protective clothing and safety glasses when handling materials. Follow all safety precautions listed on packaging labels. Refer to Material Safety Data Sheets for safety information.

3.4 VISUAL INSPECTION

A. Sand, mud, pea gravel, etc. will need to be removed to prevent loss of impact attenuation. These particles will require the use of a vacuum with sufficient strength to penetrate the depth of the surface. At no time should the surface be pressure-washed.

B. Remove debris such as stones, broken glass, contaminants, or other foreign objects. In heavily used parks, inspect daily.

C. The maintenance procedures and costs should be known and provided for prior to purchase to ensure the performance and longevity of the surfacing and the playground.

D. Cleaning – Surface may be cleaned with a broom, blower, or street-pressure hose.

E. Vandalism – Any acts of vandalism that alter the original surface must be repaired.

3.5 INSPECTION AFTER INSTALLATION

A. Contractor shall test installed product to verify it meets the required fall attenuation ASTM F1292. Contractor shall submit test data to landscape architect and owner for review. If installed product does not meet ASTM F 1292 the contractor shall remove and reinstall the product at no cost to the owner. The owner will only sign off on the project after it is demonstrated the product meets ASTM F1292.

3.6 CLOSE OUT SUBMITTALS

A. Inspector review from a Certified Playground Safety Inspector with a statement indicating approval utilizing an approved Playground Safety Compliance Audit Form from International Playground Safety Institute or equal.

END OF SECTION

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SECTION 323116 – WELDED WIRE FENCES AND GATES

PART I - GENERAL

1.01 SCOPE OF WORK

A. Work described in this section includes materials, equipment, labor costs, including shipping of fences, gates and accessories.

1.02 RELATED WORK

A. Division 03 – Concrete

B. Division 04 – Masonry

C. Division 31 – Earthwork

D. Division 32 – Exterior Improvements

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

1.03 REFERENCES

A. ASTM STANDARDS: American Society for Testing and Materials

1. A121 - 19 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
2. A123 / A123M - 17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products A153 / A153M - 16a Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3. A500 / A500M - 18 Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Round Shapes.
4. A505 - 16 Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, General Requirements A513/A513M - 19 Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing A641/A641M - 09a (2014) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
5. A653/A653M - 19 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
6. A659/A659M - 18 Standard Specification for Commercial Steel (CS), Sheet and Strip, Carbon (0.16 Maximum to 0.25 Maximum Percent), Hot-Rolled
7. A787/A787M - 15a Standard Specification for Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubing A853 - 24 (2017) Standard Specification for Steel Wire, Carbon, for General Use
8. A1008 / A1008M - 18 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High- Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
9. A1064 / A1064M - 18a Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
10. B6 - 18 Standard Specification for Zinc
11. B22 - 14 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars,

Rods, Wire, Shapes and Tubes. D2247 - 15 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

12. D2794 - 93 (2014) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact). D3359 - 17 Standard Test Methods for Measuring Adhesion by Tape.
13. F626 - 14 (2019) Standard Specification for Fence Fittings
14. F900 - 11 (2017) Standard Specification for industrial and commercial swing gates.
15. F934 - 96 (2017)Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials. F1043 – 18 Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework.
16. F1184 - 16 Standard Specification for industrial and commercial horizontal slide gates.
17. F2919 / F2919M - 12 (2018) Standard Specification for Welded Wire Mesh Fence Fabric (Metallic-Coated or Polymer Coated) with Variable Mesh Patterns or Meshes Greater than 6 in^2 in Panels
18. F2957 - 13(2019)e1 Standard Specification for Ornamental Aluminum Fence Systems

1.04 SUBMITTALS

A. Product Data: Material descriptions, dimension of individual components and profiles, and finishes for the following:

1. Fence, gate posts, brackets, rails and fittings.
2. Gates and hardware.

B. Shop Drawings: In accordance to Section 01 33 00

1. Show locations of fence, each gate, posts, rails, and details of gate swing direction, or other operation, hardware, and accessories.
2. Indicate materials, dimensions, sizes, weights, and finishes of components.
3. Include plans, elevations, sections, gate swing direction and other required installation and operational clearances, and details of post anchorage, attachment and bracing.
4. Installation recommendations and instructions by manufacturer describing all details for a typical fence and gates.

C. Verification Samples: For each finish product specified, two (2) samples, minimum size 6 in long, representing actual standard/optional color or color chips for custom color.

D. Qualification Data: For firms and persons specified in “Quality Assurance” article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Maintenance Data: Material Safety Data Sheet available upon request.

1.05 SUBSTITUTION OF PRODUCTS

A. Refer to front end specifications section 012500 Substitution Procedures for substitution process.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installations of fences and gates similar in material, design, and extent to those indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Fences and Gates: Obtain each color, grade, finish, type, and variety of components for fences and gates from one source with resources to provide fences and gates of consistent quality in appearance and physical properties.

C. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators serving as a required means of access.

1. Coordinate with door hardware and site security requirements.
2. Coordinate direction of entering and exiting traffic with life safety plans.

1.07 PROJECT CONDITIONS

A. 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 local utility making services before beginning work.
2. Unless otherwise indicated in the general provisions of the contract, notify the Architect no less than two (2) days in advance of proposed utility interruptions.
3. Do not proceed with utility interruptions without Architect's written permission.

B. Field Measurements: Verify layout information for fences and gates shown on drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Provide either the named Product/Manufacturer or a comparable product approved in advance by Architect. Refer to section 1.05 substitution of products.

OMEGA II FENCE SYSTEMS
A division of Metaltech - Omega Inc.
1735, St-Elzéar west
Laval (Quebec), Canada H7L 3N6
Tel: 800-836-6342 / 450-686-9600
Fax: 450-681-5318
Email: customerservice@omegatwo.com
Web site: www.omegatwo.com

2.02 COATINGS

A. Zinc coating:

1. Wire meshes are coated with 0.5 oz/ft^2 (150 g/m^2) zinc in conformity with ASTM A641 Class 1.
2. Square fence posts, swing gate frame and posts:

    a. Thickness of 11GA (0.120 in or 3.0 mm) or less: Zinc coated (pre-galvanized process) with a minimum of 0.9 oz/ft2 (275 g/m2) as per ASTM A653 Grade 90.
    b. Thickness over 1/8 in (3.2 mm): Coated with a minimum of 2.3 oz/ft^2 (705 g/m^2) zinc (hot-dip galvanizing) in conformity with ASTM A123 Grade 100.

B. Polyester Coating:

Polyester coating to be minimum 4 mils applied by an electrostatic process. Coating shall cover all surfaces of the wire and post sections. Coating shall be capable of withstanding the following tests:

1. Mechanical adhesion test as per ASTM D3359 - Method B.
2. Shock resistance tests as per ASTM D2794.
3. Salt spray testing with a minimum of 1 000 hours without red rust appearance, as per ASTM B117.
4. Humidity resistance in a weather meter chamber as per ASTM D2247.
5. Exposure to ultraviolet light with exposure of 1 000 hours using apparatus Type E and 63°C as per ASTM D1499.

C. Polyester Surface Coating Colors:

1. Standard Coating: Black, RAL 9004 (30% Gloss).
2. Chocolate brown, RAL 8017 (55%-60% Gloss).
3. Corten Steel Look: Dark Rust (± 2 years).

2.03 MATERIALS

A. Panel Height:
1. 4-foot-high nominal panels: 49-1/8 in
2. 6-foot-high nominal panels: 70-1/8 in

B. Model “OMEGA ARCHITECTURAL” – Steel Mesh Fence Panels:

1. 92-11/16 in wide, welded by resistance using 6 gauge (0.192 in or 4.9 mm) pre-galvanized steel wire, welded at each crossing to form rectangles 1-15/16 in x 6 in (50.0 x 152.4 mm).
2. Cold rolled annealed wire made of AISI Grade 1018 steel with tensile strength of at least 75 000 psi (515 Mpa) in accordance with ASTM A853.
3. One end of the vertical wires of the panel shall extend 1 in (25.4 mm) from the last or the first horizontal wire to create a spiked top or bottom depending on installed position. The other end is cut flush.
4. Panels shall have the following number of folds based on the panel height:

    a. 4-foot-high nominal panels: 2 folds.
    b. 6-foot-high nominal panels: 3 folds.

5. Panel camber may not exceed 0.094 in (2.5 mm).

C. Square Posts:

D. Cold rolled 1008 grade steel to meet ASTM A500 and ASTM A787 and the following maximum horizontal loads, length as required for installation type:

E. The length of the posts is minimum 36 in (914 mm) more than the actual height of the fence for installation in the ground depending on local land code requirements (frost line).

1. Installation

   a. In ground, post length as required for local frost line requirements
   b. Surface mounted, flanged

2. Post Size
   a. For 4-foot-high nominal panels

Post Size	Gauge	Maximum horizontal load
3 in x 3 in 76.2 mm)	11	383 pounds

   b. For 6-foot-high nominal panels

Post Size	Gauge	Maximum horizontal load
3 in x 3 in	11	922 pounds

F. Post Brackets:

1. Universal Collar Bracket Kit: Universal bracket for standard use on line or end posts 2 in or 3 in (50.8 mm or 76.2 mm). Includes the following: 14 gauge (1.9 mm) steel collar and wire retaining plate 1/4 in x 1 in (6.4 mm x 25.4 mm), nut, washer and carriage bolt 5/16 in x 1-1/2 in (7.9 mm x 38.1 mm), all galvanized steel.
    a. For 90º turn, use the same bracket
    b. For different angles, used the “Universal collar angle brackets”.
    c. For 4-foot-high nominal panels: Provide 4 brackets per panel.
    d. For 6-foot-high nominal panels: Provide 6 brackets per panel.

2. Spider Universal Bracket Kit: Universal bracket for face-mount installation on straight run or internal 90º corner. Designed for installation on 2 in (50.8 mm) and larger studs and consists of the following components: bent steel (3.2 mm thick x 47.6 mm wide x 25.4 mm) and a self-piercing steel screw (Ø 5.5 mm x 38.1 mm length).

    a. For 4-foot-high nominal panels: Provide 4 brackets per post.

    b. For 6-foot-high nominal panels: Provide 6 brackets per post.

3. The Special Panel Fitting – SPF: Enables a panel to be fastened to any vertical or horizontal surface, such as a steel, concrete beam or a wood post. All hot dip galvanized. When wanting to fasten the panel to something other than a post, [use one or more] of the (3) different models described below:

    a. The SPF-W Kit: For mounting on a vertical surface, consists of an L-shaped slotted plate, which accommodates a 1-3/4 in (44.5 mm) vertical adjustment and a retaining plate that hold two (2) vertical wires when bolted together.
    b. The SPF-C Kit: For horizontal surfaces, uses the same “L” shaped slotted plate and two (2) wire retaining plates.
    c. The SPF-P Kit: Connects two (2) panels together.
    d. The SPF-A Kit: For wall mount installation or posts 3 in (76.2 mm) and larger.

4. Eye-U-Shaped Bracket Kit: For use with existing round posts or new round posts installations of 2 in or 3 in (50.8 mm or 76.2 mm). Includes the following: Stainless steel U rod 5/16 in (8 mm) diameter, rear flange in PVC 1-1/2 in x 1-1/8 in (37.8 x 28.4 mm), forehead support in PVC 5/8 in x 1-1/16 (15.2 x 27.5 mm) cosmetic plastic caps and nuts (M8).

    a. For 4-foot-high nominal panels: Provide 2 brackets per post.
    b. For 6-foot-high nominal panels: Provide 3 brackets per post.

G. Post caps:

1. Aluminum alloy: For dimension posts 3 in x 3 in.

H. Polyester powder coating: (See article 2.02B).

2.04 SINGLE / DOUBLE SWING GATES

A. Configuration:

1. Single swing.
2. Double swing.
3. Swing as shown on Drawings.

B. Gate Frames:

1. Two (2) 1-1/2 in x 1-1/2 in (38.1 mm x 38.1 mm) horizontal tubes and two (2) 2 in x 2 in (50.8 x 50.8 mm) vertical tubes, all 16 gauge (1.6 mm) tubes, welded at intersections to create a rigid frame, in accordance with ASTM F900.

2. Installation:
   a. In ground, post length as required for local frost line requirements
   b. Surface mounted, flanged

3. Post size:

   a. For fences with 6-foot-high nominal panels:

Opening Dimension	Post Size
3 ft to 8 ft	3 in x 3 in 11 gauge
> 8 ft to 11 ft	4 in x 4 in 11 gauge
> 11 ft to 19 ft	6 in x 6 in 3/16 in

C. Gate Hardware:

1. Standard Hardware: Hot-dip galvanized steel in conformity with ASTM F900, sized to assure proper gate operation. Non- moving parts shall be powder coated.
   a. Hinge: Structurally designed to support all gates without deformation during opening and closing.
   b. Latch: Clamp-on gravity system that is self latching. Includes the following:
      - Self-locking Device: With padlock eyes as an integral part of latch.
2. Additional Hardware for Double Gates:
   a. Drop bar: Secure one gate in closed position, with stop pipe to engage the center drop rod.

b. Spring Hinge: For self-closing gate mechanism. [Replace Standard Hinge]
c. Panic Bar and Plate: (Dorex 8500). For quick unlocking during an emergency. [Replace Standard Latch]
d. Kick Plate: To prevent marring of the door by shoe marks.

D. Polyester Coating: (See article 2.02B)

E. Gate Single Openings:

1. Gates having 26 ft (7 925 mm) of opening or less include; two (2) truck assemblies with their support brackets, one (1) gate latch (if manually operated), one (1) gate catch, bottom stabilizing brackets and all hardware needed for installation.

Gate single opening	Overhang length	Overall length
4 ft (1 219 mm)	2 ft (609 mm)	6 ft (1 828 mm)
8 ft (2 438 mm)	4 ft (1 219 mm)	12 ft (3 657 mm)
16 ft (4 876 mm)	8 ft (2 438 mm)	24 ft (7 315 mm)
24 ft (7 315 mm)	12 ft (3 657 mm)	36 ft (10 972 mm)

F. Mesh section: Panels will be sized for the fence sections of the gate opening, put in place and secured using proper brackets and hardware (See article 2.03.1B).

G. Vertical Uprights are 2 in x 2 in (50.8 mm x 50.8 mm) 6061-T6 aluminum square extrusion. Their number and position will be determined by the opening.

H. Bracing will be done with 1 in x 2 in (25.4 mm x 50.8 mm) 6061-T6 aluminum rectangular extrusion. Their number and position will be determined by the opening.

I. Top Track is a 6061-T6 aluminum extrusion. It combines the necessary features for the gate to slide and to facilitate welding assembly. Track will resist a reaction load of 2 000 lb (907 kg).

J. Bottom Track is a 6061-T6 aluminum extrusion. It combines the necessary features for the gate to resist swaying and to facilitate welding assembly.

K. Truck Assembly: Swivel type, zinc plated body with four (4) sealed and lubricated ball bearings, 2 in (50.8 mm) in diameter by 9/16 in (14.3 mm) in width, and two (2) horizontal rolling wheels to ensure truck alignment in track. Trucks mount on post brackets using 3/4 in (19.1 mm) diameter machined stud with reduced shank. Truck assembly designed to withstand same reaction load as track.

L. Gate accessories and Hardware: Malleable iron or steel, galvanized after fabrication. Latches provide the possibility for padlocking.

M. Bottom Guide: Each assembly shall consist of one (1) 2 in (50.8 mm) diameter ball bearing hidden inside the bottom track, adjustable in height to maintain gate frame plumb and in proper alignment.

N. Coatings:

1. Paint primer:
    a. Epoxy-vinyl paint primer is applied to cantilever gate aluminum frame in 1 layer by spray paint process. Primer shall cover all visible surfaces.
2. Paint Frame coat:
    a. The acrylic surface coating color shall be standard black or any optional color, see Omega Web site – or color chart as per RAL code.
    b. Acrylic coating is applied in 1 layer by spray paint process.
3. Panel coat: (See article 2.02B)

PART III - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

B. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

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

3.02 PREPARATION

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

3.03 IN-GROUND CONCRETE INSTALLATION

A. Install fencing on established boundary lines inside property line

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.

C. Post Setting: Set posts in concrete footing. Protect portion of posts above ground from concrete splatter. Place concrete around posts and consolidation. Using mechanical devices to set posts is not permitted. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.

1. Dimensions and Profile: As indicated on Drawings.
2. Space line posts uniformly at center to center.
3. Exposed Concrete Footings: Extend concrete 2 in (50.8 mm) above grade. Smooth and shape to shed water.
4. Concealed Concrete Footings: Stop footings [2 in (50.8 mm) <Insert dimension> below grade [as indicated on Drawings] to allow covering with surface material.
5. Posts Set into Concrete in Sleeves: Use steel pipe sleeves pre-set and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with [non shrink, non-metallic grout,] [anchoring cement,] mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
6. Posts Set into Concrete in Voids: Form or core drill holes not less than 5 in (125 mm) deep and 3/4 in (19.1 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill granular space between post and concrete with [non- shrink, non-metallic grout,] [anchoring cement,] mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
7. Flange Post Installation: Bolt mounting plates attached to each post to slab or structure as indicated, using expansion bolts.

3.04 FENCE INSTALLATION – Model “OMEGA ARCHITECTURAL”

A. Install the fence along the specified layout according to the drawings. The fence panel shall be installed to maintain a clear minimum distance of 1-1/4 in (31.8 mm) and a maximum distance of 2 in (50.8 mm) from the ground surface. Holes for posts shall be at least 8 in (200 mm) in diameter and at least 42 in (1 070 mm) deep.

B. Posts shall be adequately supported within the concrete forms to maintain the required positioning and prescribed level until concrete has set. All necessary anchors and posts shall be at a minimum depth of 36 in (914 mm) into the ground.

C. Square Post Installation: Once the concrete is set, the fence sections are fastened to the posts with the desired bracket type.

1. Universal Collar Bracket Kit: Brackets slot allows for adjustments of ± 1-1/2 in (38.1 mm) on each side. Always install the brackets flush with horizontal wire of the panel (no gap).

Post Size	Post Spacing C/C
3 in x 3 in (76.2 mm x 76.2 mm)	98-11/16 in (2 507 mm)

D. For the fence to follow slopes, it is required to step the fence sections. The Universal bracket on square posts can be slid along the post at the desired height and should always be install flush with horizontal wire (no gap). When faced with a steep slope, it will be necessary to order longer posts and panels cut in half as to keep the gap under the panel to a minimum.

E. Upon cutting or trimming a post or a wire mesh section, apply a zinc rich primer to the exposed

ends and finish with the matching touch-up paint supplied by the manufacturer.

F. Panels must be installed as instructed by client:
   1. Spikes pointing up or down for safety
   2. Bents facing inwards or outwards the field

3.05 CAST-IN-PLACE CONCRETE

A. General: Comply with ACI 301 for cast-in-place concrete.

B. Materials: Portland cement complying with ASTM C150 <Insert type if required>, aggregates complying with ASTM C33, and potable water [for ready-mixed concrete complying with ASTM C94]. [Measure, batch, and mix Project-site-mixed concrete according to ASTM C94.]

C. Concrete Mixture: Normal-weight concrete with not less than 3 000 psi (20.7 Mpa) compressive strength (28 days), 3 in (76.2 mm) slump, and contain “coarse aggregate” of a minimum diameter of 1/5 in (5.1 mm) to a maximum of 3/4 in (19.1 mm) maximum size aggregate. A 5% to 7% air entrained or according to recommendation of section 03 00 00.

D. Materials: Dry-packaged concrete mix complying with ASTM C387 for normal-weight concrete mixed with potable water according to manufacturer's written instructions.

3.06 GROUT AND ANCHORING CEMENT

A. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior applications.

3.07 GATE INSTALLATION AND ADJUSTMENT

A. Install gate posts in accordance with manufacturer's instructions.

B. Concrete Set Gate Posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have a diameter 4 times greater than outside dimension of post, and depths approximately 6 in (150 mm) deeper than frost level. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36 in (914 mm) below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish around post and slope to direct water away from posts. Check each post for vertical and top alignment and maintain in position during placement and finishing operations.

C. Install gates perfectly horizontal and levelled (at junction), plumb, and secure for full opening without interference.

D. Attach hardware so to have the nuts inside the property thus making the assembly tamper-proof which will prevent unauthorized removal. Install ground-set items in concrete for anchorage.

E. Adjust hardware for smooth operation and lubricate where necessary to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.10 SITE CLEANING

A. Clean and adjust soil disturbed during work. Get of all surplus and waste materials and replace damaged turf in accordance with directives of Engineer and Consultant.

END OF SECTION 21045

SECTION 32 84 00.01 – IRRIGATION (Clear Creek)

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Install Irrigation System.

B. Modify existing irrigation systems.

1.2 RELATED WORK

A. Excavation, Soil Installation, Grading and seeding.

B. Fence removals

C. Water Meter

D. Roadway Augering

1.3 SUBMITTALS

A. Make submittals under provisions of Division 1.

B. Submit schedule of activities of sequence and time of work in this section.

C. Submit written itemized statement to Owner of work completed when requested during construction

D. Submit written itemized statement to Owner of work completed at the end of the construction period.

E. Submit Irrigation System Audit Report completed by irrigation consultant for all areas of installation completed.

1.4 QUALITY ASSURANCE

A. Work in this section shall be accomplished by a recognized Irrigation Contractor with a minimum of ten (10) years' experience.

B. Installation processes shall be applied to all local codes.

C. Irrigation contractor personnel shall provide documents demonstrating that he/she is a ***"Certified Irrigation Contractor"*** in accordance with the International Irrigation Association requirements and have passed all testing related to this. Submission of certificate is required with the bid documents.

D. Irrigation contractor personnel shall provide documents demonstrating that he/she is a ***"Certified Irrigation Auditor"*** in accordance with the International Irrigation Association requirements and have passed all testing related to this. Submission of certificate is required with the bid documents.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Division 1.

B. Deliver products in waterproof containers showing weight, chemical analysis, and name of manufacturer. Damaged containers are unacceptable.

C. Store and protect products under provisions of Division 1.

1.6 EXISTING CONDITIONS

A. Beginning work of this Section means acceptance of existing conditions.

B. Sprinkler installation shall not begin without a walk through provided with the irrigation consultant verifying conditions are truly ready for mainline, wire, valve and sprinkler installation

1.7 JOB CONDITIONS

A. Begin system management immediately upon substantial completion of work in each area completed and demonstrated to the irrigation Consultant

B. Sustain irrigation system management throughout the entire growing in period so landscape establishment will not be hindered from any workmanship issues related to irrigation system construction or other factors influencing the operation of the irrigation system.

1.8 PROTECTION

A. Protect landscaping and other features remaining as final work.

B. Protect existing structures, fences, roads, sidewalks, paving and curbs.

1.9 REGULATORY REQUIREMENTS

A. Comply with regulatory requirements related to construction process and water system connections.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not solvent weld piping when ambient temperatures are below 45 degrees F.

B. Do not perform final compaction of piping, sprinklers, valves, quick couplers and related valve boxes in muddy conditions.

1.11 SEQUENCING AND SCHEDULING

A. Coordinate all irrigation construction with other site contractors.

B. Irrigation contractor will be fully responsible for all installations, for their integrity and operations during all periods of construction by all trades assigned to this project.

1.12 DEFINITIONS

A. **Sprinklers**: Manufactured devices that distribute water to an assigned area of the landscape

B. **Drip Tubing**: Manufacturer tubing that is placed within the planting beds at 8” depth to provide water to the root systems as the controller is programmed.

C. **Electric Valves**: Manufactured devices that release water to assigned sprinklers after receiving a signal from a controller.

D. **Isolation Valves**: manufactured devices that isolate sections of piping or valves from piping

E. **Valve Boxes**: Manufactured devices that have a cover flush mounted with grade with a box or series of boxes that extend down to an electric valve, isolation valve, wire splice or Quick Coupler

F. **Controller**: Manufactured devices that control which electric valves operate and in what sequence

G. **Grounding**: the placement of required devices (grounding rod, grounding plate and bare #4 wire) for the purpose of protecting the control system and pumps

H. **Mainline Piping**: The piping system that carries the water supply form the city water source to designated electric valves throughout the site

I. **Lateral Piping**: The piping system that carries water from the electric valve to assigned sprinkler downstream of the electric valve to which it is attached

J. **24 Volt Wiring**: The wiring system from the Controller to the electric valves which is to be placed alongside and below the mainline

1.13 WARRANTY, MAINTENANCE, AS-BUILTS

A. Warranty:

1. TWO years from the date of final approvals. This final approval will only come after an Irrigation System Audit conducted by the Irrigation Consultant and the irrigation contractor follows up to correct noted irrigation system defects, related corrective measures and compliance is verified.
2. Two written Irrigation System Management Reviews (Spring and Fall) under the supervision of the Irrigation Consultant each year. Needed corrective measures will be outlined in the report and correction made by contractor with 48 hours from time of report distribution.
3. Any site system repairs that are necessary due to warranted equipment failure or other construction damage will be corrected within a 48 hour period after notification.
4. Fall of 2024 & 2025 Winterization and Spring of 2025 & 2026 system activation will be required as well as Site Reviews for June & September of each years (2024 & 2025)

B. Written Site Seasonal Management Process

1. **Irrigation Water Management Services:**

1) Qualified Water Management Technicians have the responsibility for two full seasons of irrigation system management services:

1) **Spring Turn On** - seasonal system activation in Spring (May)

2) **Irrigation System Operations Management Review** (OMR) – (Mid-June & Mid-September)
3) **Irrigation System Winterization--** seasonal system deactivation in Fall (November)
4) **T & M Irrigation System Service Requirements** - repairs related to corrections to system malfunctions (Non-Construction related)

2. **Spring Turn On**

1) Qualified Water Management personnel have the responsibility of:

1) Walking the irrigation mainline for any obvious items of concern,
2) Opening valve boxes to verify the quality of wire splices and valve condition, and
3) Reviewing the water source and related components for functionality.

2) Once those items are finished and documentation is completed, personnel will slowly start up the irrigation mainline, activate all zones, review mainline operations, test and tag backflow preventer, and flush all components necessary to ensure total system continuity.
3) All system elements will be reviewed for winter damage. A report outlining any and all immediate T&M repair needs will be forwarded to the client as a Work Order needing approval before proceeding with the repairs.
4) A minimum of 2 DATA sheets per Spring Turn On per year must be completed as part of the Spring Turn on requirements:

1) Water Source & Zones
2) Electric valves & Controller & Sensor
3) Mainline, Isolation Valves
4) Manual Outlets

3. **Irrigation System Operations Management Reviews**

1) Qualified Water Management personnel have responsibility for:

1) System operational management reviews related to:

a) Monthly Review of Controllers

- Rewriting & Updating Water Schedules
- Checking All Controller Operations

b) Seasonal Review of Irrigation Soils (2 Times)

- Moisture Levels to 6”
- Soil Profile Analysis to 6”

c) Seasonal Review of Turf Root Systems (2 Times)

- Density & Health Condition

d) Planned Grid Routes for:

- Correcting Sprinkler Compaction
- Correcting Sprinkler Adjustments
- Correcting Sprinkler Nozzle Misuse
- Valve Box Wire Splice Improvements
- Valve Box Cleaning

4. **Irrigation System Winterization**

1) Qualified Water Management personnel have responsibility for:

1) Shut downing the irrigation system using compressed air (365 CFM @ 40 PSI compressor settings required)
2) 1.5” Compressor hose, quick coupler key connection and pressure regulator required
3) Deactivation of in ground irrigation equipment to reduce the opportunity for winter damage to the system.

2) **S**ystematically:

1) Shut off water at its source.
2) Remove or Winterize the Back-Flow Preventer (BFP)
3) Walk Mainline looking for obvious damage that would hinder the winterization process.
4) Perform several activities related to mainline winterization:

a) Install Quick Coupler Keys in Mainline for air purging in the mainline-at ends also.
b) Start Air Compressor and Fill mainline with air—Mainline ONLY
c) When mainline is completely purged—run each zone to purge of water (farthest away from water source first

5) Shut off controller.
6) Tag BFP/Water Tap & Controller “Winterization Complete”

C. AS-BUILTS & Documentation:

1. As-Built drawings will be turned in on electronic format that includes all aspects of the irrigation system construction.
2. This includes but is not limited to sprinklers, lateral piping, electric valves, isolation valves, quick couplers, wire splice boxes, mainlines, boring locations, sleeve sizes and locations of all, controller locations, valve numbering, wire routes in existing areas, booster pump location, water tap location, connect points to existing systems, capped off areas from existing systems.
3. All product literature will be provided in four complete sets and will be complied to match every detail of the AS-BUILT drawings.
4. As-Built drawings and system documentation will be provided to the irrigation consultant for review before final completion can be proclaimed. Irrigation consultant will provide notes for corrections which will need to be made by Irrigation Contractor prior to declaration of final completion.

PART 2 - PRODUCTS

2.1 REQUIRED USAGE

A. Products and installation configurations used will only be those listed and illustrated in this section:

1. Mid-Range Rotator Sprinklers

1) Hunter MP-Rotary Nozzle (Series 2000, 3000) installed with Rain Bird 1806 SAM PRS 45

1) *14' through 29' Radius*
2) *To be used in conjunction with Orbitz "Blu-Loc" Swing Pipe & fittings*
3) See Related Detail for full installation requirements.

2. ***Short Range Rotator Sprinklers***

1) Hunter MP-Rotary Nozzles (Series 1000 & Strip) installed with Rain Bird 1806 SAM PRS 45

1) *8' through 15' Radius*
2) *To be used in conjunction with Orbitz Blu-Loc Swing Pipe & fittings*
3) See Related Detail for full installation requirements.

3. ***Drip Tubing***

1) Netafim Techline TLCV4-1210 (12 O.C. .4 GPH, 8" burial)

- With 1" PVC Class 200 header from the control zone valve through the center of the drip zone assembly to the location attached directly to drip tubing
- Netafim Vacuum Relief Valve Guardian 65AR1A100 1" (1) Drip Zone
- Netafim TLFV-1 Insert Type Flushing Valves (2) Drip Zone
- Netafim TLCV001 Blank Drip Tubing

1) *Placed at 8" depth in planting beds*
2) *2' off turf edge or pavement*
3) *2.5' to 3' O.C. spacing between rows thereafter*

See Related Details for full installation requirements.

4. ***TRI-POD Sprinklers w Heavy Duty Hoses***

1) Irrigation Contractor is to provide to the landscape Contractor (fully Assembled):

1) ORBIT 58308 N Tripod Sprinklers Stand 10

2) HUNTER NODE 9V Battery Controller Single Station 10
3) Hose FLEXOGEN (3/4" x 50') 20
4) BUCKNER 261SDX ¾" Impact Sprinkler 06
5) HUNTER MP ROTATOR MP-3000 90-270 Adj. 04
6) NOTE:

   a) Each assembly is to include the HUNTER NODE 9V Battery Controller Single Station attached to a quick coupler key using a ¾" Brass Hose Swivel
   b) Each assembly is to have the HUNTER NODE 9V Battery Controller Single Station with brass adaptors that will allow for ¾" Brass Hose Swivel attachment both to the quick coupler and the discharge hose

7) NOTE:

   a) At the end of this project all TRI POD Sprinklers and associated hoses, timers, etc. will be given to the building mgmt. team for reuse as they deem necessary in future maintenance practices.

5. ***Electric Valves***

1) Rain Bird PESB 1"

   1) In conjunction with Long, Mid/Short Range Sprinklers
   2) See Related Detail for full installation requirements.

2) Rain Bird XCZ-100-PRB-MC Medium Commercial Control Zone Kit

   (Includes Rain Bird 1" PEB Electric Valve & 200 Mesh Pressure Regulating Basket Filter)

   1) *In conjunction with:*

      - Netafim TLCV4-1210 Techline
      - Netafim Vacuum Relief Valve Guardian 65AR1A100 1" (1) Drip Zone
      - Netafim TLFV-1 Insert Type Flushing Valves (2) Drip Zone
      - Netafim TLCV001 Blank Drip Tubing

      See related detail for full installation requirements.

6. Electric Valve Decoders

    1) Utilize

        1) Baseline Decoder Bi-coder BL-5201 1 Valve Decoder
        2) Baseline Decoder Bi-coder BL 5202 2 Valve Decoder
        3) Baseline Decoder Bi-coder BL 5204 4 Valve Decoder
        4) *In conjunction with:*

            a) *Placing the decoder just below the top cover of the valve box*
            b) *Using S.S. Screws to mount the decoder in this required location*
            c) See Related Detail for full installation requirement

7. ***Isolation Valves***

    1) *In conjunction w Mainline Installation Requirements*

        1) SPEARS True Union Ball Valves - 2" is required
        2) NOTE: PVC Sch 80 Fittings (Ells/Tees) are required at each isolation valve box location.

            a) If a 1" outlet for a Quick Coupler installation is shown at same location PVC Sch 80 Service Fittings (Ells/Tees) with 1" FIPT outlets provided are required w Thrust Blocking on back side of tee/el

        3) NOTE: Place ONE Trynex Fiberglass Marking stake SP-15 at every isolation valve location

            a) At the end of the grow in period either cut this to 2'H or remove from the site per Certified Consultants Ltd.

        4) *In conjunction w Mainline Installation Requirements*

            a) See Related Detail for full installation requirements.

8. ***Valve Boxes***

    1) *In conjunction with Electric Valve installations*

        1) MacLean HIGHLINE Standard Valve Boxes

        2) Different Box Combinations will be used at each site location

            a) *1 valve—12" Rectangular Box with Multiple Extensions*
            b) *2 valves—12" Rectangular Box with Multiple Extensions*
            c) *3 valves—Jumbo Rectangular Box with Multiple Extensions*

        3) NOTE:

            a) TURF Areas Require **GREEN** Valve Box Covers

b) PLANTING Areas Require Mulch **BROWN/BLACK** Covers
c) See Related Detail for full installation requirements.

See Related Detail for full installation requirements.

2) *In conjunction with Isolation Valve installations*

1) MacLean HIGHLINE Standard Valve Boxes

a) *1 valve—12" Rectangular Box with Multiple Extensions*

2) NOTE:

a) TURF Areas Require **GREEN** Valve Box Covers
b) PLANTING Areas Require Mulch **BROWN/BLACK** Covers
c) See Related Detail for full installation requirements.

3) *In conjunction with wire splice junction points*

1) MacLean HIGHLINE Standard Valve Boxes

a) *1 or more Splices—10" Round Box*

2) NOTE:

a) TURF Areas: Require GREEN Valve Box Covers
b) PLANTING Areas: Require Mulch **BROWN/BLACK** Covers
c) See Related Detail for full installation requirements.

3) NOTE: Valve box extensions will be required to maintain the required 3" of debris free areas below all the valve box assemblies (EV, IV, QC)
4) NOTE: All valve boxes placed within a planting bed will utilize a mulch brown valve box cover in all situations

a) All valve boxes placed within an area of mowed turf will utilize a dark green valve box cover in all situations.

9. ***Quick Couplers***

1) Rain Bird # 5 RC Quick Coupler

2) *Installed on 1" Lasco (Mipt x Mipt)* G13S-212 continuous pressure use rated.

a) *Install in 10" Round Valve box with Extensions.*
b) See Related Detail for full installation requirements.

2) NOTE:

a) TURF Areas Require GREEN Valve Box Covers
b) PLANTING Areas Require Mulch **BROWN/BLACK** Covers

3) See Related Detail for full installation requirements.

3) Rain Bird KEY # 55-K-1

1) 20 Keys are to be provided to Landscape Contractor by the irrigation contractor.

4) Rain Bird HOSE SWIVEL FIPT x 3/4" Hose Connection

1) 20 Swivels are to be provide to the landscape contractor by the irrigation contractor.

2) NOTE: Place ONE Trynex Fiberglass Marking stake SP-15 at every quick coupler valve location

a) At the end of the grow in period either cut this to 2'H or remove from the site per Certified Consultants Ltd.

3) NOTE:

a) At the end of this project all RAIN Bird Keys and Swivels, etc will be given to the site/building mgmt. team for reuse as they deem necessary in future maintenance practices.

10. ***Swing Joints***

1) Lasco (Mipt x Mipt) Swing Joints –G13S-212 continuous pressure use rated.

1) *Install in conjunction with 1" Quick Coupler valves.*

2) Orbitz Blue Loc swing pipe & fittings

1) *Install in conjunction with all Long, Mid/short range Rotator Sprinklers*
2) See Related Detail for full installation requirements.

11. ***24 Volt Wiring***

1) PER EACH WIRE ROUTE (4 Total):

1) PAIGE WIRE # 180162 12/2 2-Wire **BLUE** Path with
PAIGE WIRE # 180117 14/2 2-Wire **GREEN** Path (Spare)
(See mainline/quick coupler/electric valve locations for routings)

a) 4 - **BLUE** Active Paths (Paige Wire # 180162) with assigned 4- **GREEN** Spare Wire Path (PAIGE # 180117) will be directly attached to the controller, and all assigned automated zones, moisture sensors and grounding on this Controller A as outlined in specifications.

- Place separate wire pathways (4 Wire Paths-w a BLUE & GREEN 2-Wire in each pathway) as noted below:

NOTE:

There are to be no 2-Wire in field end of pathway connected "Loops." Each 2-wire route BLUE & GREEN is to be directly from the controller through the pathways to an assigned "end of wire route" location.

GREEN Path (Paige Wire 180117) will be directly placed alongside each BLUE Pathway (4 pathways) from the controller to identical assigned locations.

Made ready (SPARE) for additional future connection and utilization through leaving 3-5' wire loops within all electric valve, moisture sensor, and quick coupler boxes.

Wire Path -1 (12-2 BLUE & 14-2 Green Spare) – From Controller to:

- Turf Based EV-23,24,25,26,27,28,29,30,31,32,33,34,35,36
- Drip Based EV-1,2,3,4,5,6,8,9
- QC-1,2,3,4,10,11,12,13,14,15,16,17,18,19
- Grounding Grid – 2,3A,3B,3C,4,5,6
- Moisture Sensor – P-1, T-3, P-3

Wire Path - 2 (12-2 BLUE & 14-2 Green Spare) – From Controller to

- Turf Based EV-1,2,3,4,5,6,7,8,9,10,11,12,13,14,15 (looped with no splices) to 55,56,57,58,59,60 (looped with no splices) to 61,62 & looped with no splices) to 63,64,65,66,67)
- Drip Based EV- 13,14,15,16,17,18,19,20,21,22
- QC-5,6,7,8,63,62,61,60,59,58,57,56,55,54,53
- Grounding Grid-19,20,21,22,23,24
- Moisture Sensor – T-1, T-2, P-4, T-5

Wire Path -3 (12-2 BLUE & 14-2 Green Spare) – From Controller to:

- Turf Based EV 16,17,18,19,20,21,22 looped from QC10 with no splices),37,38,39,40,41,42,43,44,45,46,47,48,49,50,51
- Drip Based EV-12,11,10,9
- QC-9,10,20,21,22,23,24,25,26,27,28,29,30,31,32,40,43,44
- Grounding Grid – 7,8A,8B,9,10,11,12,13
- Moisture Sensor – P-2, P-5, T-4

Wire Path - 4 (12-2 BLUE & 14-2 Green Spare) – From Controller to

- Turf Based EV-52,53,54
- QC-42,41,39,38,37,36,35,34,33,45,46,47,48,49,50,51A,51B
- Grounding Grid- 14,15,16,17,18
- Moisture Sensor – P-6

See Related Detail for full installation requirements.

12. ***Wire Splices***

1) 3M DBYR-6 wire splices.

1) *Install 3M DBYR-6 splices in conjunction with ALL connection points (electric valves or at 24 Volt in field splice box locations)*

2) *Install 3M DBYR-6 splices in conjunction with all 12-2 & 14-2 connection points (electric valves or at 24 Volt in field splice box locations)*

3) *Install 3M DBRY-6 in ALL anticipated wire splice's locations being in a submerged location.*

See Related Detail for full installation requirements.

13. Controllers & Related Equipment

Irrigation Contractor (through PLATT Industrial Pump Station Manufacturer) is to provide and install all equipment listed in this section

This controller will be built within the PLATT Industrial Pump Station, w PLATT Industrial Pump Station Flow Meter/N.O. Master Valve which are part of the design package provided.

FIELD UNIT CONTROLLER A

Controller: Baseline BL-1000P
Modem: BL-CM4G-P-VZ
BL-BMW2-PLUS (*WEB SOFTWARE 1 YEAR (Free 1st year))*

NOTE: Base Manager WEB Assess Outline Requirements:

- Create the account when controller has been delivered to the contractor doing the install
- Set Up with Property Mgmt. Organization as Account owner
- Add Certified Consultants Ltd. As account user/administrator

- Add Irrigation Contractor (during warranty period) as an account user

NOTE:

Follow the BASELINE requirement related to Grounding at this pedestal location and according to provided details (ASIC Grounding Grid Required) GRID # GC-*1*

Confirm full operations of cellular service shown above for communication purposes prior to the purchase of the modem

See Related Detail for full installation requirements.

14. ***BASELINE BL-5315B Soil Moisture Sensor***

Locations for installation noted on the design provided.

Sensor locations include turf areas, parking lot areas, and planting areas (both irrigated & non-irrigated).

Use 10” round valve boxes over connection along the 2-Wire pathway (BLUE & GREEN) for each moisture sensor to be installed along those pathways.

NOTE:

- Follow installation details related to the overall requirements.
- Follow installation details related to overall depth.
  - Turf 4-5” over top of sensor
  - Parking Lot 7-8” over top of sensor
  - Prairie Area 5-6” over top of sensor
  - Perennials 8-10” over top of sensor
  - Trees 12-14” over top of sensor

NOTE:

Place ONE Trynex Fiberglass Marking stake SP-15 at every moisture sensor location.

NOTE:

Moisture Sensor locations are noted as shown in both turf and planting areas.

Moisture Sensors will be put in place to monitor water/air soil content in preparation for maintaining proper water/air/mineral balances:

At the end of the growth period either cut this to 2’H or remove from the site per Certified Consultants Ltd.

15. **Grounding Grids/Requirements- Baseline Controller A**

a) Baseline Controller Grounding Wire Entry/Connection Point is on power terminal strip within the controller A.

- Grounding of controller and field wiring is required on ALL installations to have reading of 10 OHMS or LESS

- Grounding Grid for controller A is to be completely separate from the 2-wire pathways

- Grounding Grid System that will include:

  - 4" x 96" CU Plate w 25' of # 4 Green Coated Copper Wire to be routed into the Grounding Connection Point within the Controller A. Paige # 1821991C
  - 5/8" x 8' Copper ROD (5/8" x 8') with 15' of 6 AWG to be routed into the Grounding Connection Point within the Controllers A. PAIGE # 1820001C6.
  - Power Set Earth Backfill required as noted on details provided around CU Plate. 2 Bags of Paige Power Set Earth Contact Backfill Ground Enhancing Materials (50 lbs.) Paige # 1820058

16. **Grounding and Surge Protection Grids/Requirements-2 Wire Path**

a) Baseline Surge Arrestor BL-LA01 provided at each Grounding Grid location as noted on design.

- Grounding of controller and field wiring is required on ALL installations to have reading of 10 OHMS or LESS

  - 4" x 96" CU Plate w 25' of # 4 Green Coated Copper Wire. Paige # 1821991C
  - 5/8" x 8' Copper ROD (5/8" x 8') with 15' of 6 AWG. PAIGE # 1820001C6
  - Power Set Earth Backfill required as noted on details provided around CU Plate. 2 Bags of Paige Power Set Earth Contact Backfill Ground Enhancing Materials (50 lbs.) Paige # 1820058
  - 10" Round Valve Box required for each BL-LA01 arrestor location along.
  - 10" Round Valve Box required for each Paige Re-Enterable Connector-3 Position. Paige # 270-RC3

b) Grounding Grids are locations will be noted on the design.

c) Full Grounding Grid ARE required for
- Ends of active BLUE 2 wire paths
- Every 390'-500' along each active BLUE 2 wire path

NOTE: Grounding Grids are marked on design to match up with each BLUE & GREEN 2 Wire Path

NOTE: OHMS Resistance Testing and Reporting In writing/photos to Certified Consultants Ltd. REQUIRED

NOTE: SPARE GREEN 2- Wire Path is not to be grounded as outlined above.

See Related Detail for full installation requirements.

17. ***PVC Pipe***

1) Class 200-SDR-21 Rated Pipe for all mainlines and laterals.
2) Lateral Piping- 1" Minimum Size

    1) *Solvent Weld Ends for 1" through 1.5"*
    2) Lateral Piping placed at a 12-18" trench depth (min/max)
    3) No 1.5" or 1" lateral pipe will be installed, or trenches placed within 5' of any tree root system (existing or newly planted) without direct authorization from the landscape contractor/architect. Designs may not reflex this placement, but onsite placement will be required.

3) Mainline Piping- 2.0" Minimum Size

    1) *Solvent Weld Ends for 2.0"*
    2) Mainline Piping placed at a 18-24"" trench depth (min/max). except through sleeving
    3) No 2" mainline pipe will be installed, or trenches placed within 5' of any tree root system (existing or newly planted) without direct authorization from the landscape contractor/architect. Designs may not reflex this placement, but onsite placement will be required.

    See Related Detail for full installation requirements.

18. ***Pipe Fittings***

1) *1" through 1.5" Pipe Sizes will utilize:*

    1) *Lasco, Spears and or Dura*
    2) **PVC Sch 40** Fittings on piping systems from 1" through 1½"

2) 2" Pipe Sizes will utilize:

    1) *Lasco, Spears and or Dura*
    2) **PVC Sch 80** Fittings on mainline piping systems of 2"
    3) In accordance with Pipe and Fitting Manufacturers recommendations
    4) *Thrust Blocks as detailed below will also be used in conjunction with all mainline fitting installations.*

    See Related Detail for full installation requirements.

19. ***Thrust Blocks***

1) Concrete Blocks with 3' Rebar in each opening and Sakrete in each opening. Landscape Fabric required between concrete block and fitting or pipe for protection.

See Related Detail for full installation requirements.

2.2 WATER SOURCE-BOOSTER PUMP STATION COMPLETE ASSEMBLY

A. WATER SOURCE

1. WATER CONNECTION POINT

1) Waterline connection will be in place and is provided by others with a 2" Copper FA just outside of building wall ready for connection to the Flanged Inlet Connection point on the PLATT Industrial Pump Station (about 18-30" above grade).

2) Place a 2" x 2" x 0.5" (SSFIPT) copper fitting just inside building wall for winter drainage of the upstream side of RPZ and building service line/isolation valve connection point. Provide a 0.5" FIPT threaded plug for use in this winter drainage fitting

See Related Irrigation Design Detail for full installation requirements.

2. **COMPREHENSIVE BOOSTER PUMP STATION** and related pump controls are provided by:

PLATT INDUSTRIAL CONTROL, INC.
3N 301 Ellsworth Ave.
Addison, IL 60101
630-833-4388

Rain Boy II Irrigation Pump Station

PLATT Industrial Booster Pump Station (*Rain Boy II Irrigation Pump Station)* Includes:

BACKFLOW PREVENTER

RPZ/BACKFLOW PREVENTER FEBCO 825Y-2.0"
Provided as part of the PLATT Industrial Pump Station.

FLOW METER & N.O. MASTER VALVE

Baseline 2.0" Normally Open Hydrometer # BL-BHM200-NO just passed the RPZ.

Baseline BiCoder that will then be wired (2-Wire Cable) back to the controller already mounted on the side of/part of the PLATT Industrial Pump Station.

Provided as part of the PLATT Industrial Pump Station

IRRIGATION CONTROLLER

Baseline Irrigation controller (Baseline BL-1000XS)

Cellular modem (Baseline BL-CM4G-X-AT)

INTERNAL BOOSTER PUMP STATION COMPONENTS

Rain Boy II Irrigation Pump Station
One pad mount, aluminum enclosure (1/8" thick, 44"H x 60"W x 36"D estimated) with pad locking access cover,
unpainted with 30 amp exterior mounted NEMA 3R main disconnect switch,
one 600V surge arrester,
one UL 508A control panel with drive line reactor,
variable frequency drive,
PLC and operator screen,
one 2” RPZ,
one close coupled pump (60GPM @ 50psi boost w/ suction of 30psi) & motor (5HP/460VAC/3phase/3450 RPM),
one check valve,
two isolation valves, 2” (suction & discharge),
one pressure transmitter,
one irrigation flow meter (Baseline compatible),
one N.O., 2” discharge electric valve (Baseline compatible),
one irrigation controller (Baseline BL-1000XS),
one cellular modem (Baseline BL-CM4G- X-AT),
one flanged painted steel drop pipe for suction piping,
one flanged painted steel drop pipe for discharge piping,
one flanged painted steel,
2”x 3ft. pipe spool,
one set of discharge and suction pressure gauges,
one ventilation fan with shutter and thermostat.

Input power is 460VAC/3 phase/8 FLA.

NOTE:

Refer to Irrigation Water Delivery Details for full data and information (Irrigation pump Station, pump intakes, and associated pipe)

Concrete pad is required as well as related conduit work

See Related Detail for full installation requirements.

BOOSTER PUMP STATION INPUT POWER

Input power is 480VAC/3 phase/8 FLA.

PLATT to provide start up and adjustments.

NOTE:

Refer to Irrigation Water Delivery Details for full data and information (Irrigation pump Station, pump intakes, and associated pipe)
120 Volt power will be provided through the PLATT Industrial Panel for the Baseline Controller units

Concrete pad is required as well as related conduit work

See Related Detail for full installation requirements.

2.3 SLEEVING LAYOUTS

A. SLEEVING- TYPE A:

1. 4” & 2” SCH 40 PVC Sleeves are to be in place and installed by the irrigation contractor under/across all sidewalks, pathways and roadways prior to the roadway & irrigation/landscape installation.
2. These TYPE A sleeves are intended to provide space for mainlines, lateral pipes, wiring and more.

B. SLEEVING- TYPE B:

1. 2” & 1” SCH 40 PVC Sleeves are to be in place and installed by the irrigation contractor across all sidewalks, pathways, and roadways prior to the irrigation/landscape installation.
2. These TYPE B sleeves are intended to provide space and routings for Drip Irrigation lateral piping and more.

See Related Detail for full installation requirements.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILLING

A. There shall be no irrigation installation in the new construction areas until all other construction trades are completed and verified.

B. Controller, Flow Meter, and related operational items are to be in place and fully operational before water is to be provided from this source.

3.2 ELECTRIC SOURCES

A. Electrical sources will be established and made functional outside of this contract.

B. Electrical sources will be established at Irrigation Controller location after excavation issues are cleared.

3.3 IRRIGATION MAINLINE

A. Irrigation Mainline installations can begin immediately only in areas agreed upon by the owner's representative/project director.

3.4 CONTROLLER (A)

A. The Irrigation Controllers A can be installed with proper grounding when the areas assigned are completely free of construction issues.

B. Once Controllers A is installed there will need to be a verification that communication with the Cellular Exchange is fully functional and operational

3.5 VALVES AND SPRINKLERS

A. Valves and sprinklers can not be installed in areas of construction until "final grade" has been established, Rock removal processes are completed, and no further soil additions or deletions are forth coming.

B. All sprinklers are to be installed will only be attached to other sprinklers with similar elevations. Once the sprinklers are flagged by the irrigation contractor, the contractor will work with Certified Consultants LTD for proper piping combinations back to each electric valve.

3.6 SYSTEM TESTING AND FULL OPERATION

A. System testing can occur at any time during the construction process.

B. Full operation of the irrigation system is required prior to seeding processes are to take place.

3.7 AS-BUILT DEVELOPMENT

A. Irrigation Consultant will be requesting marked up irrigation drawings at various stages of construction development.

B. Electronic CAD based final AS-BUILT will be required upon project completion.

3.8 FINAL APPROVALS

A. The Final Approval Process includes final walk through, irrigation system Audits, completion of punch lists with verification of punch list completion, As-Built drawing verification and modifications and Control system operational verification.

END OF SECTION

SECTION 329113 – SOIL PREPARATION

SECTION 329113
SOIL PREPARATION

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Prepare area for planting turf or sod.

B. Prepare planting beds for perennial, shrub and annual plantings.

1.02 RELATED WORK

A. Earthwork.

B. Seeding & Sodding

C. Trees, Shrubs, and Ground Cover.

1.03 REFERENCES

A. ASTM D2607 – Classification of Peat, Moss, Humus, and Related Products.

B. ASTM D5268 – Topsoil used for Landscape Purposes.

C. FSO-F-241 – Fertilizers, Mixed, Commercial.

1.04 SUBMITTALS

A. Make submittals as required under general specifications and as required below..

B. Submit original labels when required.

C. Submit analysis from certified labs. Email submittal is acceptable.

1.05 QUALITY ASSURANCE

A. Work in this section shall be accomplished by a recognized Landscape Contractor with a minimum of five (5) years' experience.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products in waterproof containers showing weight, chemical analysis, and name of manufacturer. Damaged containers are unacceptable.

B. Store and protect products until use to prevent damage from weather and other users of site. Storage for longer than two weeks on site is unacceptable unless written approval is granted.

1.07 EXISTING CONDITIONS

A. Beginning work of this Section means acceptance of existing conditions.

B. Contractor must notify owner if conditions are unacceptable prior to start of work.

1.08 JOB CONDITIONS

A. Proceed with and complete work rapidly as portions of site become available, working with seasonal and climatic limitations. Do not work topsoil, compost or existing soil in a wet or frozen condition.

B. Determine locations of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required. Maintain grade stakes set by others until removal is mutually agreed upon by partied concerned.

C. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions or obstructions, notify Landscape Architect before proceeding.

1.09 PROTECTION

A. Protect existing and new structures, fences, roads, sidewalks, paving, curbs, and landscaping and other features remaining as final work.

1.10 REGULATORY REQUIREMENTS

A. Comply with regulatory requirements related to fertilizer and amendment compositions.

B. Comply with regulatory requirements for licensing related to pesticide applications, general work & business licensing.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not work soil if muddy or frozen conditions exist.

1.12 SEQUENCING AND SCHEDULING

A. Coordinate the work of this section with installations of underground utilities, irrigation system and remainder of site work, including earth moving or grading.

B. Complete the work in this section prior to planting or seeding.

1.13 MAINTENANCE

A. Maintain surfaces and supply additional topsoil and amendments where necessary, including areas affected by erosion, until planting work begins. Planting shall not begin if eroded or improperly graded sections exist.

B. Maintain and protect stockpiles of bulk materials from erosion until stockpile is depleted or removed from site. Do not leave stockpiles uncovered during rainy or wet weather.

PART 2 – PRODUCTS

2.01.1 EXISTING SOIL

A. In areas where existing soil will be utilized, amendments shall be added per the recommendations of Certified Consultants Ltd. Each section of the site shall be amended per the recommendations for that site. Follow grading plan for this project. Apply and incorporate amendment materials prior to planting as outlined.

B. Follow recommendations found in Exhibit A at End of Section.

2.01.2 SOIL MATERIALS

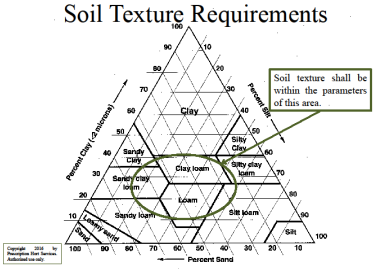
C. In areas where stockpiled soil materials are being placed, existing soil in place shall be ripped to 10” deep prior to placement of the stockpiled soil materials. Soil materials shall be placed to a minimum depth of 12”. Follow grading plan for this project. Avoid ripping where utility lines, irrigation lines or other permanent or temporary underground lines or systems are installed.

D. Soil materials utilized shall be loose friable soil of loamy character, free from compacted subsoil, clay clods, vegetation, debris, rocks larger than one inch in any dimension and

excessive amounts of smaller rocks or stones (no more than 2% of total volume), or other materials detrimental to proper vegetative growth. Soil materials shall NOT be from boggy locations on site.

E. Soil materials tested on site tests have the following conditions: Soil texture: Shall contain between 18%-28% clay, 18%-48% sand and 34%-60%% silt. Soil pH: Shows to be between 7.8 & 6.6. CEC (Cation Exchange Capacity) between 10.6 – 15.4

Soil Texture Requirements



F. In areas where stockpiled soil materials are being placed, the soil preparation contractor shall grade to final grade per engineer's drawings. No additional compaction of topsoil shall be accomplished once topsoil is placed in all horticultural areas, landscape beds or turf areas and graded to final grade.

G. Once approved soil materials is placed and final graded, the biological stimulation and mineral balancing amendments outlined for placement are to be placed and the soil preparation contractor shall take soil samples and submit to Certified Consultants Ltd. for testing.

Soil samples shall be obtained using approved procedures and at least one sample shall be submitted for turf areas, one for shrub/tree locations, one for perennial and non-woody shrub beds and one for annual beds. Submit additional samples for every 22,500sf of area to be tested.

Certified Consultants Ltd shall direct additional amendment requirements for imported topsoil based on soil test results. Additional amendments required shall be added prior to planting.

H. DISTRIBUTED SOIL AREAS – COMPACTION REQUIREMENTS

Except where more stringent requirements are defined in this specification. The following parameters shall define the general description of the threshold points of soil compaction in imported topsoil areas.

Soil prep contractor, in conjunction with Certified Consultants Ltd confirm that soil density/penetration resistance is not above or below these ranges of 100-175 psi.

Penetration Resistance Method-utilizing a qualified and approved device is required for the tracking of these readings.

Below 75 psi soil becomes increasingly unstable. Above 200 psi root growth development is limited with fewer and shorter and slower growing roots.

Penetration resistance shall be checked at least three locations for every 2,000 sf with a qualified soil penetrometer.

2.02 SOIL PREPARATION AMENDMENTS-GENERAL

AMENDMENTS TO EXISTING DISTRIBUTED SOIL-BIOLOGICAL STIMULATION

No plantings are to be incorporated until the Biological Stimulants and Mineral Balancers are in place and incorporated into the landscape-based soils for a minimum of 14 full days.

See Part 3 Execution section of this specification.

A. Biological Stimulation Process

Engineered Bio-Carbon

Product: **Biochar Now CHIP**

Product description:

Biochar (Chip) shall be obtained from thermochemical conversion of biomass in an oxygen- limited environment (pyrolysis) containing at least 80% carbon. Feedstocks shall be composed of wood or clean forest waste. Feedstock materials transported in salt water, painted, or treated with preservatives are not permitted. Ash content shall be less than 5%. pH shall be less than 8.5. Items listed in testing results per IBI standard testing shall not exceed standards for agricultural food production. Percent of carbon shall be listed on label or test results. Product shall be USDA certified Biobased.

Application rate: See Appendix for the rates listed from soil test recommendations provided through Certified Consultants Ltd.

Manufacturer:
Biochar Now, LLC
19500 County Road 7
Berthoud, CO 80513
970-593-9100

NOTE:
Final determination of Biological Stimulation Product use, quantities, and placement will be determined by Certified Consultants Ltd.

AMENDMENTS TO EXISTING SOIL-BIOLOGICAL STIMULATION

No plantings are to be incorporated until the Biological Stimulants and Mineral Balancers are in place and incorporated into the landscape-based soils for a minimum of 14 full days.

See Part 3 Execution section of this specification.

A. Mineral Balancing Product Process

Product 1: **CarbonPro-G** Granular Microbial & Carbon Plant Health Nutrient Optimizer

Product Description:

Granular Microbial & Carbon Plant Health Nutrient Optimizer that harnesses the power of carbon, plant-microbial interactions, and organic soil processes to maximize plant health and nutrition. Aids seed development and increases root mass and remediates high saline soils and salt toxicity.

Application rate: See Appendix for the rates listed from soil test recommendations provided through Certified Consultants Ltd.

Manufacturer:
LESCO
1385 East 36th Street
Cleveland, OH 44114-4114

Product 2: **DISPER-SUL PASTILLE** Soil Sulfur Martin Midstream Partners

Product Description:

Water Degradable Sulfur that is a 90% Sulfur product. Martin Midstream Partners uses purest sulfur combined with a special formulation of bentonite clay and wetting agents. When applied to the soil DISPERSUL breaks down into micro sulfur that becomes
available plant food during the growing season.

Application rate: See Appendix for the rates listed from soil test recommendations provided through Certified Consultants Ltd.

Manufacturer:
Martin Midstream Partners
580 East Shipyard
Phone: 815-357-6954

Product-3: **Landscape & Ornamental All-Purpose Fertilizer** 18-24-12 LESCO

Product Description:

The sources of nitrogen, phosphorus, and potassium have been polymer coated to provide a longer release than uncoated, quick release fertilizers.

Application rate: See Appendix for the rates listed from soil test recommendations provided through Certified Consultants Ltd.

Manufacturer: LESCO
1385 East 36th Street
Cleveland, OH 44114-4114

B. GENERAL APPLICATION of Biological Stimulants and Mineral Balancing Elements Amendments

Follow amendment recommendations found in Exhibit A at End of Section, utilizing appropriate amounts based upon topsoil that is to be in place.

Amend the approved quantities of soil amendments into the soil and incorporate into the top 12 inches of soil materials, then rake to finish grade.

No plantings and nutritional development amendments are to be incorporated until the Biological Stimulants and Mineral Balancers are in place and incorporated into the landscape-based soils for a minimum of 14 full days.

C. Inspections

Sustainability Consultant shall approve materials prior to use and shall ensure proper quantities of materials are incorporated per the above specifications.

Sustainability Consultant shall inspect amendments during amending operations and after all amendments are incorporated.

Provide 72-hour notice prior to commencing amending operations to arrange inspection time and location.

2.03 SOIL PREPARATION AMENDMENTS--NUTRITIOUS

A. Nutritional Development

Nutritional Development Product-1:
Landscape & Ornamental All-Purpose Fertilizer 14-14-14 ANDERSONS

Product Description:

The sources of nitrogen, phosphorus, and potassium have been polymer coated to provide a longer release than uncoated, quick release fertilizers. Normal feeding with this product will last 2-3 months.

This product is specifically being utilized in:

- Trees w Turfgrass ONLY,
- Turfgrass-Seed, &
- Turfgrass-Sod

This product is specifically to be incorporated into the soil just prior to planting.

Apply at rates listed from soil test recommendations provided through Certified Consultants Ltd.

Manufacturer: The Anderson's Inc.
P.O. Box 119
Maumee, OH 43537

Nutritional Development Product -2:

Ornamental Fertilizer 8-10-10 LESCO

Product Description:

The sources of Nitrogen, Phosphorus, Potash, Magnesium, Sulfur, Copper, Iron, Manganese, and Zinc have been coated with LESCO Poly Plus OPTI Polymer Coated Urea.

Derived from Polymer Coated Urea, Urea, Ammonium Sulfate, Diammonium Phosphate, Sulfate of Potash, Muriate of Potash, Sulfate of Potash-Magnesia, Magnesium Sucrate, Copper Sucrate, Iron Sucrate, Manganese Sucrate, and Zinc Sucrate., Muriate of Potash.

Total Nitrogen 8% (4% Ammoniacal Nitrogen & 4% Urea Nitrogen), Available Phosphate 10%. Soluble Potash 10%, Magnesium 2.25%, Sulfur 5.5%, Copper .05%, Iron 3%, Manganese 2%, and Zinc .1%.

This product is specifically being utilized in:

- Flowering Tree Areas,
- Medium Deciduous Trees Areas,
- Large Deciduous Tree Areas,
- Shrubs Areas,
- Ornamental Grasses & Perennial Areas,
- Dry Pond Mix Areas,
- Perennial Only Areas,
- Erosion Control-Seed Areas,
- Trees with Turfgrass Areas, &
- Trees w Perennial/Shrub Areas.

This product is specifically to be incorporated into the soil just prior to planting.
Apply at rates listed from soil test recommendations provided through Certified Consultants Ltd.

Manufacturer:
LESCO
1385 East 36th Street
Cleveland, OH 44114-4114

Nutritional Development Product-3:

Magnesium Sulfate Sulfate of Potash 0-0-50 Seed Ranch

Product Description:

Strengthens the plant making it less susceptible to disease and adverse conditions.

Soluble Potash @ 50%, Derived from Sulfate of Potash Chlorine (Cl) less than 2%, this product is to be incorporated into the soil just prior to planting

This product is specifically being utilized in:

- Flowering Tree Areas,
- Medium Deciduous Trees Areas,
- Large Deciduous Tree Areas,
- Shrubs Areas,
- Ornamental Grasses & Perennial Areas,
- Turfgrass (Seed) ONLY,
- Turfgrass (Sod) ONLY,
- Dry Pond Mix Areas,
- Perennial Only Areas,
- Erosion Control-Seed Areas,
- Trees with Turfgrass Areas, &
- Trees w Perennial/Shrub Areas.

This product is specifically to be incorporated into the soil just prior to planting.

Apply at rates listed from soil test recommendations provided through Certified Consultants ltd.

Manufacturer:
SEED RANCH
6777 Lutz Lake Fern Rd
Odessa, FL 33556

Nutritional Development Product-4:

PRO-SOIL ENHANCER CarbonizPN-Soil Mirimichi Green

Mirimichi Green PRO SOIL ENHANCER (CarbonizPN-Soil) is made from a professional blend of premium compost and USDA Certified Biobased Premium Biochar.

Product Description:
This product is specifically being utilized in:

- Flowering Tree Areas,
- Medium Deciduous Trees Areas,
- Large Deciduous Tree Areas,
- Shrubs Areas,

- Ornamental Grasses & Perennial Areas,
- Turfgrass (Seed) ONLY,
- Turfgrass (Sod) ONLY,
- Dry Pond Mix Areas,
- Perennial Only Areas,
- Erosion Control-Seed Areas,
- Trees with Turfgrass Areas, &
- Trees w Perennial/Shrub Areas.

This product is specifically to be incorporated into the soil just prior to planting.

Apply at rates listed from soil test recommendations provided through Certified Consultants ltd.

Manufacturer:
MIRIMICHI GREEN Express
418 Hermitage Rd
Castle Hayne, NC
28429

B. GENERAL APPLICATION of Nutritional Development Elements Amendments

Once:

- Site Soils are spread and installed according to specification with confirmation of adherence to specification
- Soils have been amended with the Biological and Mineral Balancing Amendments
- 14-day waiting period is finished.
- And Plantings are on site and ready for placement (except turf and turf with tree areas),

Follow Nutritional Development amendment recommendations found in Exhibit A at End of Section, utilizing appropriate amounts based upon topsoil that is in place ready for each of Planting Area Types outlined below.

Planting Area Types

FLOWERING TREES ONLY-- Application of Amendments for *flowering trees only areas.* Incorporate the approved quantities of Nutritional based soil amendments uniformly into the top 1’ (depth) in a 10’ x 10’ of the overall square footage for each “flowering tree only” planting area.

MEDIUM DECIDOUS TREES ONLY-- Application of Amendments for *medium deciduous trees areas.* Incorporate the approved quantities of Nutritional based soil amendments uniformly into the top 1’ (depth) in a 8’ x 8’ of the overall square footage for each “medium deciduous tree only” planting area.

LARGE DECIDOUS TREES ONLY-- Application of Amendments for *large deciduous trees areas.* Incorporate the approved quantities of Nutritional based soil amendments uniformly into the top 1' (depth) in a 10' x 10' of the overall square footage for each "large deciduous tree only" planting area.

SHRUB ONLY--Application of Amendments for *shrub only areas.* Incorporate the approved quantities of Nutritional based soil amendments uniformly into the top 1' (depth) in a 2' x 2' of the overall square footage for each "shrub only" planting area.

ORNAMENTAL EROSION CONTROL MIX--Application of Amendments for *Ornamental Erosion Control Mix.* Incorporate the approved quantities of Nutritional based soil amendments into the top 6" of the overall square footage for each "Ornamental Erosion Control Mix" planting area.

TURFGRASS (Seed) ONLY--Application of Amendments for *Turfgrass (Seed) only areas.* Incorporate the approved quantities of Nutritional based soil amendments into the top 6" of the overall square footage for each "turfgrass (seed) only" planting area.

ORNAMENTAL PRAIRIE MIX--Application of Amendments for *Ornamental Prairie Mix (Plug) areas.* Incorporate the approved quantities of Nutritional based soil amendments into the top 6" of the overall square footage for each shrub only planting area.

DRY POND (Seed) ONLY--Application of Amendments for *Emergent pond (Seed) only areas.* Incorporate the approved quantities of Nutritional based soil amendments into the top 6" of the overall square footage for each shrub only planting area.

PERENNIALS & GROUND COVER MIX--Application of Amendments for *perennials & ground cover mix areas.* Incorporate the approved quantities of Nutritional based soil amendments into the top 6" of the overall square footage for each "perennials only" planting area.

EROSION CONTROL ONLY (Seed)--Application of Amendments for *erosion control (seed) only*. Incorporate the approved quantities of Nutritional based soil amendments into the top 6" of the overall square footage for each "erosion control only (seed)" planting area.

WOODLAND MIX (Seed)--Application of Amendments for *turf w trees only areas.* Incorporate the approved quantities of Nutritional based soil amendments into the top 6" of the overall square footage for each "trees w turfgrass only" planting area.

C. Inspections

Sustainability Consultant shall approve materials prior to use and shall ensure proper quantities of materials are incorporated per the above specifications.

Sustainability Consultant shall inspect amendments during amending operations and after all amendments are incorporated.

Provide 72-hour notice prior to commencing amending operations to arrange inspection time and location.

PART 3 – EXECUTION

3.01 TURF AND PLANTING BED AREA SOIL PREPARATION

A. Receive site at finish grade (+/-.10”). Ensure proper grading and drainage of site prior to acceptance.

B. Before start of project, spray all existing areas that are a part of construction or landscaping with 2% solution of glyphosate (Roundup or equal) to kill existing vegetation. Protect from erosion per other sections (NIC)

C. Upon completion of construction and prior to grading and soil work, remove all deleterious material – boulders, branches, construction debris. Remove all roots and stone over 2.5” diameter or length.

D. Remove all base stone, concrete, asphalt, etc from raised beds or newly constructed islands.

E. Rip all landscaped areas (including turf areas) to 12” deep. Ripping teeth shall be no further apart than 18” o.c.

F. Rip all raised beds or newly constructed islands to 12” deep. Ripping teeth shall be no further apart than 18” o.c.

G. Place approved soil materials and lightly compact until final grade per engineering drawings. Place no more than 8 inches per lift before compacting. Compaction shall be NO MORE than 150psi. Grade by hand or equipment to finish grade, assuring proper drainage.

H. Till to 12” deep and grade to finish grade per engineer’s plans. Confirm in writing compaction is NO MORE than 150psi

I. BIOLOGICAL STIMULANTS & MINERAL BALANCERS—

Incorporate the Soil Sulfur, Bio Char Now-Chip Size, CarbonPro-G Granular Microbial, and 18-24-12 Poly Plus OPTI Polymer Coated Urea Fertilizer -- Biological Stimulants and Mineral balancers per rates on Soil Prep Quantities Chart.

Incorporation depth of all elements in the biological stimulants & mineral balancers is to be 12”.

These amendments are to be in place 14 days prior to any plant or seeding incorporation.

J. NUTRITIONAL DEVELOPMENT—

Apply CarbonizPN PRO SOIL Enhancer per rates on “Nutritional Development” Soil Prep Quantities Chart:

Incorporate these Nutritional Development Amendments, for the planting groups assigned before or while plantings are being completed, into top 6” of soil as directed above.

Apply 8-10-10 Fertilizer per rates on “Nutritional Development” Soil Prep Quantities Chart::

Incorporate these Nutritional Development Amendments, for the planting groups assigned before or while plantings are being completed, into top six inches of soil as directed above.

Apply 14-14-14 Fertilizer per rates on “Nutritional Development” Soil Prep Quantities Chart:

Incorporate these Nutritional Development Amendments, for the planting groups assigned before or while plantings are being completed, into top four inches of soil as directed above.

Apply 0-0-50 Granular Fertilizer per rates on “Nutritional Development” Soil Prep Quantities Chart:

Incorporate these Nutritional Development Amendments, for the planting groups assigned before or while plantings are being completed, into top six inches of soil as directed above.

K. Once all planting is complete, restore all landscape beds to final grade and remove all excess soil from site.

Assure proper drainage and fill in all settled areas and riffs or gullies.

Remove all stone, roots, construction debris and deleterious material off site.

Repair ruts, gullies or disturbed areas in seed or sod, and rope or cordon off to prevent traffic during establishment period.

3.02 RESTORATION

A. Restore existing and new structures, fences, roads, sidewalks, paving, curbs, and landscaping damaged during execution of work of this Section, as approved by the Sustainability Consultant.

B. During work, keep surfaces clean and work area in an orderly condition.

3.03 TOLERANCES

A. Hold finished grade adjacent walks, curbs, and pavement in planting beds to be mulched to 3 inches below top edge of pavement.

EXHIBIT ‘A”

A- 1.1 SOIL PREPARATION REQUIREMENTS – ENTIRE SOIL Sq. Ft. HORT NEEDS

BIOLOGICAL STIMULATION & MINERAL BALANCING

"CLEAR CREEK" Soil Preparation Recommendations - General

Mineral Balancing & Biologial Stimulation

	A						Total Sq. Ft.:	Total Acreage:
General Est. Surface Square Footage:	356,785						356785	8.19

Mineral Balancing Overall

Product Catagory:	Manufacturer Specific Product:	Application Scale:	Application Method:	A						Total Product Application:	Manufacturer
Soil_Sulfur	DISPER-SUL 90% Sulfur Turf Grade 50 lb.	LBS Per 1,000 SqFt	Incorporate - 12"	40						14271.4	Martin Midstream Partners
Engineered_BioCarbon	CarbonPro-G Granular Microbial & Carbon Plant Health Nutrient Optimizer	LBS Per 1,000 SqFt	Incorporate - 12"	20						7135.7	LESCO
Fertilizer	Fertilizer 18-24-12 50% PolyPlus 50 lb.	LBS Per 1,000 SqFt	Incorporate - 12"	7						2497.495	LESCO

Biological Stimulation

Product Category:	Manufacturer Specific Product:	Application Scale:	Application Method:	A						Total Product Application:	Manufacturer
Engineered_BioCarb	Biochar Now - Chip	Cu.ft. Per 1,000	Incorporate - 12"	25						8919.625	Biochar Now, LLC

A-1.2 SOIL PREPARATION REQUIREMENTS – NUTRITIONAL DEVELOPMENT

"Clear Creek" Soil Preparation Recommendations

Nutritional Development

	A	B	C		E	F	G	H	I	Total Sq. Ft. Coverage Area:
Sq. Ft. Estimate Per Planting Type Area	3584	1664	2400	0	20232	31115	106408	41437	55335	262175

Nutritional Feeding Recommendations

Product Catagory:	Manufacturer Specific Product:	Application Scale:	Application Method:	A	B	C		E	F	G	H	I	Total Product Application:	Manufacturer
Granular_Humate	CarbonizPN™ PRO SOIL ENHANCER 40 lbs (CARBONIZPN-SOIL)	LBS Per 1,000 SqFt	Incorporate - 6"						15	15	15	10	3237.75	Mirimichi Green
Granular_Humate	CarbonizPN™ PRO SOIL ENHANCER 40 lbs (CARBONIZPN-SOIL)	LBS Per 1,000 SqFt	Incorporate - 12"	20	20	20		15					456.44	Mirimichi Green
Magnesium_Sulfate	Sulfate of Potash 0-0-50 Granular	LBS Per 1,000 SqFt	Incorporate - 6"						3	2	3	3	596.477	Seed Ranch
Magnesium_Sulfate	Sulfate of Potash 0-0-50 Granular	LBS Per 1,000 SqFt	Incorporate - 12"	4	4	6		4					116.32	Seed Ranch
Fertilizer	The Andersons 14-14-14 Landscape Ornamental Fe	LBS Per 1,000 SqFt	Incorporate - 4"							8				The Andersons
Fertilizer	8-10-10 Poly Plus Polymer Coated Urea w 2.25% Mg, 5.5% S, .05% Cu, 3% Fe, 2% Mn, .1%	LBS Per 1,000 SqFt	Incorporate - 6"						15		15	10		LESCO
Fertilizer	8-10-10 Poly Plus Polymer Coated Urea w 2.25% Mg, 5.5% S, .05% Cu, 3% Fe, 2% Mn, .1% Zn	LBS Per 1,000 SqFt	Incorporate - 12"	8	8	8		15					41.984	LESCO

PLANTING AREA TYPE	DESCRIPTION
A	Flowering Trees ONLY
B	Medium Decidous Trees ONLY
C	Large Decidous Trees ONLY
E	Shrubs ONLY
F	Ornamental Erosion Control Mix
G	Turfgrass (Seed) ONLY
H	Oramental Prairie Mix
I	Dry Pond Mix (Seed)

NOTES:	
	All products outlined are to be applied/incorporated just prior to planting of plant materials outlined
	Plant Area Type A are to incorporate required amendment in a 8' x 8' x 1' at and beyond each tree ball
	Plant Area Type B are to incorporate required amendment in a 8' x 8' x 1' at and beyond each tree ball
	Plant Area Type C are to incorporate required amendment in a 10' x 10' x 1' at and beyond each tree ball
	Plant Area Type E are to incorporate required amendment at edge of plant ball & then beyond each ball by

"Clear Creek" Soil Preparation Recommendations

Nutritional Development

	J	K	L							Total Sq. Ft. Coverage Area:
Sq. Ft. Estimate Per Planting Type Area	15861	62906	15843							94610

Nutritional Feeding Recommendations

Product Catagory:	Manufacturer Specific Product:	Application Scale:	Application Method:	J	K	L							Total Product Application:	Manufacturer
Granular_Humate	CarbonizPN™ PRO SOIL ENHANCER 40 lbs (CARBONIZPN-SOIL)	LBS Per 1,000 SqFt	Incorporate - 6"	15	10	10							1025.405	Mirimichi Green
Magnesium_Sulfate	Sulfate of Potash 0-0-50 Granular	LBS Per 1,000 SqFt	Incorporate - 6"	4	3	4							315.534	Seed Ranch
Fertilizer	8-10-10 Poly Plus Polymer Coated Urea w 2.25% Mg, 5.5% S, .05% Cu, 3% Fe, 2% Mn, .1%	LBS Per 1,000 SqFt	Incorporate - 6"	15	10								866.975	LESCO
Fertilizer	The Andersons 14-14-14 Landscape Ornamental Fe	LBS Per 1,000 SqFt	Incorporate - 6"			8							126.744	The Andersons

PLANTING AREA TYPE	DESCRIPTION
J	Perennial & Groundcover Mix
K	Erosion Control (Seed) ONLY
L	Woodland Mix (Seed)

NOTES:	
	All products outlined are to be applied/incorporated just prior to planting of plant materials outlined

A-1.3 EXISTING SITE SOIL CONDITIONS

Clear Creek Existing Site/Soil Conditions:							
Lab Results							
Site Information:	**Quantity:**	**A-1**	**A-2**	**A-3**	**A-4**	**A-5**	**A-6**
Soil Analysis Report							
Nitrate - N	LBS/A	7	25	11	7	14	11
Sub-Soil							
Sub-Soil							
P1 Phosphorus (Weak Bray)	PPM	1VL	1VL	8L	1VL	6VL	6VL
P2 Phosphorus (Strong Bra	PPM	7VL	6VL	33M	5VL	17L	19L
Olsen Bicarb - P	PPM	4VL	11M	10L	6L	10L	7L
Potassium - K	PPM	82L	79L	46VL	63VL	62L	79L
Magnesium - Mg	PPM	313VH	158M	177H	172M	294VH	251VH
Sulfur - S	PPM						
Zinc - Zn	PPM						
Manganese - Mn	PPM						
Iron - Fe	PPM						
Copper - Cu	PPM						
Boron - B	PPM						
Calcium - Ca	PPM	2481H	2967VH	1810VH	2596VH	2114H	2618VH
Sodium - Na	PPM						
Soluble Salts	MMHOS/CM						
Excess Lime Rate							
Nutrient Availability - Profile							
Orthophosphate - P		2.3L	2.6L	17.6VH	4.6M	9.8VH	14.4VH
Phosphorus		4L	4L	20VH	7L	11M	17VH
Potassium - K		28L	39M	32M	35M	28L	41M
Magnesium - Mg		123VH	158VH	153VH	202VH	344VH	192VH
Calcium - Ca		444VH	5359VH	710VH	3222VH	1360VH	1084VH
Sodium - Na		10	12	15	11	10	11
Iron - Fe		65VH	53VH	112VH	41VH	48VH	65VH
Aluminum		156	42	110	74	86	129
Microbial Health Indicator (CO2 Burst)		94.00VH	25.00L	27.00M	20.00L	11.00L	70.00 O
Microbial Energy/Food (Organic Carbon)		127	206.3	182.1	184.8	121.7	212.4
Organic Matter	%	2.4L	1.7L	1.5VL	1.9L	1.3VL	2.0L
C.E.C.	MEQ/100G	15.2	16.4	10.6	14.6	13.2	15.4
pH		7.4	8	7.8	8	8	7.7

Soil Textural Composition							
Type:	**Rate:**	**A-1**	**A-2**	**A-3**	**A-4**	**A-5**	**A-6**
Sand	%	18%	36%	48%	36%	24%	26%
Silt	%	54%	40%	34%	38%	60%	50%
Clay	%	28%	24%	18%	26%	16%	24%
Soil Texture:		Silty Clay Loam	Loam	Loam	Loam	Silty Loam	Silty Loam

Clear Creek Existing Site/Soil Conditions:

Lab Results

Site Information:	Quantity:	SS-1	SS-2	SS-3			
Soil Analysis Report							
Nitrate - N	LBS/A	7	7	7			
Sub-Soil							
Sub-Soil							
P1 Phosphorus (Weak Bray)	PPM	1VL	3VL	1VL			
P2 Phosphorus (Strong Bra	PPM	4VL	10L	4VL			
Olsen Bicarb - P	PPM	3VL	6L	6L			
Potassium - K	PPM	53VL	40VL	64VL			
Magnesium - Mg	PPM	248VH	185VH	214H			
Sulfur - S	PPM						
Zinc - Zn	PPM						
Manganese - Mn	PPM						
Iron - Fe	PPM						
Copper - Cu	PPM						
Boron - B	PPM						
Calcium - Ca	PPM	1910H	1829VH	2633VH			
Sodium - Na	PPM						
Soluble Salts	MMHOS/CM						
Excess Lime Rate							
Nutrient Availability - Profile							
Orthophosphate - P		2.6L	8.9VH	5.4M			
Phosphorus		4L	10M	7L			
Potassium - K		21L	23L	22L			
Magnesium - Mg		128VH	153VH	144VH			
Calcium - Ca		515VH	649VH	832VH			
Sodium - Na		12	16	10			
Iron - Fe		70VH	96VH	48VH			
Aluminum		156	139	131			
Microbial Health Indicator (CO2 Burst)		52.00 O	11.00L	7.00L			
Microbial Energy/Food (Organic Carbon)		96.2	113.7				
Organic Matter	%	2.0L	1.1VL	1.2VL			
C.E.C.	MEQ/100G	11.8	10.8	15.1			
pH		7.4	7.9	7.9			

Soil Textural Composition

Type:	Rate:	SS-1	SS-2	SS-3			
Sand	%	20%	48%	32%			
Silt	%	54%	34%	44%			
Clay	%	26%	18%	24%			
Soil Texture:		Silty Loam	Loam	Loam			

END OF SECTION

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Seeding (native meadow seed mixes).
2. Seeding (turfgrass).
3. Hydroseeding (turfgrass).
4. Sodding (turfgrass).
5. Turf renovation.
6. Erosion-control material(s).

B. Related Requirements:

1. Section 329113 “Soil Preparation.”

2. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 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 include 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 329113 "Soil Preparation” 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Schedule conference to coordinate with Planting Preinstallation Conference, and conduct conference at project site, unless otherwise arranged.

1.5 SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
   1. Certification of each seed mixture for turfgrass. Include identification of source and name and telephone number of supplier.
   2. Certification of each specified native meadow seed mixture. Include identification of source and name and telephone number of supplier.

C. Indication of seeding method(s) and equipment to be used and intended depth of seed cover.

D. Product Data: For each type of product indicated.
   1. Mycorrhizal Fungi Inoculant: Product literature and manufacturer's recommended application rates and practices for turfgrass seed mix installations and native meadow seed mix installations.

E. Product Certificates: For fertilizers, from manufacturer (turfgrass only; do not use fertilizer on native meadow seed mix installations).

F. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

G. Schedules: Planting Schedule indicating anticipated seeding and sodding dates; Maintenance Schedule indicating anticipated maintenance activities, hours associated with the activities, and their frequencies.

H. Maintenance Log: Written record of actual maintenance activities performed during the maintenance period including description of activities, dates, list of personnel and products applied.

1.6 CLOSEOUT SUBMITTALS

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

1.7 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 National Association of Landscape Professionals or AmericanHort.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "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 one of the following categories from the National Association of Landscape Professionals:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Lawn Care Manager.
    c. Landscape Industry Certified Lawn Care Technician.

5. Pesticide Applicator: State licensed, commercial.

1.8 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" 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.

1.9 FIELD CONDITIONS

A. Planting Restrictions - Seed (Native Meadow Seed Mixes): Native meadow grasses and wildflowers are warm season grasses and require 70-degree soil temperature to germinate.
   1. Fall Planting: Dormant seeding from November 1 to December 31 is preferred (ground can be frozen).
   2. Spring Planting: Sowing seed from April 1 to July 1 is also acceptable.
   3. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

B. Planting Restrictions - Seed (Turfgrass): Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.
   1. Fall Planting: August 15 to October 15 (fall planting is preferred).
   2. Spring Planting: April 1 to May 1

C. Planting Restrictions - Sod: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.
   1. Fall Planting: September 15 to October 15
   2. Spring Planting: April 15 to May 15

D. 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.

1.10 COORDINATION

A. Coordinate Work of the Section with installation of underground utilities, topsoil/planting soils and plants.

PART 2 - PRODUCTS

2.1 SEED (NATIVE MEADOW SEED MIXES)

A. Native Meadow Seed: Fresh, clean, dry, new-crop seed.

B. Seed Mix: Proprietary seed mixes as follows:

   1. Products: Subject to compliance with requirements, provide the following mixes distributed by Spence Restoration Nursery, 2220 East Fuson Road, Muncie, IN 47302, ph. (765) 286-7154:

      a. Bioretention Mix 1: ‘Wet Mesic Prairie Mix’
      b. Bioretention Mix 2: ‘Basic Prairie Mix’

C. Cover Crop: Avena sativa (seed oats) and Lolium multiflorum (annual ryegrass) based on rate recommended by Spence Restoration Nursery.

2.2 SITE STABILIZATION SEED MIX

A. If the site is prepared at a time that does not allow the sowing of the specified native meadow seed mix within the specified time window, the following seed mix is to be sown:
   1. Avena sativa (seed oats) @ 64 pounds per acre
   2. Lolium multiflorum (annual ryegrass) @ 25 pounds per acre

B. Under no circumstances are the following species to be used:
   1. Winter rye
   2. Winter wheat

2.3 TURFGRASS SEED

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

B. Seed Species: State-certified seed of grass species as follows with not less than 85 percent germination, not less than 98 percent pure seed, and not more than 0.5 percent weed seed:
   1. Seed Species: Turf type tall fescue and Kentucky bluegrass blend as follows:
      a. Three of the following varieties, balancing advantageous characteristics and distributed @ 30% each of total seed mix: Avenger III, Dynamite G-LS, Firecracker G-LS, Raceway, Raptor LS, Spyder 2LS, Stealth, Titanium G-LS, Xanadu, Zion.
      b. United or Yellowstone Kentucky Bluegrass @ 10% of total seed mix.

2.4 TURFGRASS SOD

A. Turfgrass Sod: Certified 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: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
   1. Minimum Age: 24 months
   2. Select sod grown in soils similar to those present on the project site.
   3. Turfgrass Species: a minimum of three cultivars of turf type tall fescue with up to one cultivar of Kentucky Bluegrass comprising a maximum of 10% of the mix.

C. Harvesting Sod: Machine-cut sod not exceeding one (1) sq. yd. in area with a minimum of 3/4 inch and a maximum of 1-1/4 inch topsoil base. Minimum width shall be eighteen (18) inches. Broken pads or pads with uneven ends shall not be acceptable.

2.5 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. 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.

2.6 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley. Hay or chopped corn stalks are not acceptable.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.7 PLANTING SUPPLEMENTS

A. Pesticide(s): 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.

D. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
   1. Product: North American Green DS75 Single Net Straw Blanket

PART 3 - EXECUTION

3.1 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; verify that prepared topsoil is otherwise ready to receive Work of this Section.
   2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   3. Confirm that required utilities are available and ready for use.

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.

3.2 TURF AREA / NATIVE MEADOW SEED MIX AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 “Soil Preparation.”

B. 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.

C. Placing Planting Soil: Place specified planting soil over exposed subgrade.

   1. Reduce elevation of planting soil at sodded areas to allow for soil thickness of sod.

2. Verify that planting soil is lightly compacted and firm. If walking compacts the planting soil more than ½", planting site shall be Culti-packed.

D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.3 PREPARATION OF NATIVE MEADOW SEEDBED

A. Mark edges of areas to be seeded, taking care to ensure areas to be seeded with differing seed mixes are defined in a craftsman-like manner with true geometric boundaries as delineated on the Drawings.

B. Water area to encourage germination of weed seeds near the surface. Most weed seeds will germinate within two weeks of application of moisture. Do not till the soil again as this will bring even more seeds up to the surface.

C. Spray any new weed growth with specified herbicide in accordance with manufacturer's instructions. Provide waiting period for soil to recover, as recommended by manufacturer, prior to seeding.

D. Do not till soil unless otherwise directed. Do not apply fertilizer. Culti-pack soil if it is in a tilled or otherwise un-firm condition.

E. Apply mycorrhizal fungi inoculant prior to sowing of seed. Apply at a rate of one pound per 1000 square feet.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area / Native Meadow Seed Mix Area Preparation" Article.

B. For erosion-control blanket, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING (NATIVE MEADOW SEED MIXES)

A. DO NOT APPLY FERTILIZER TO AREAS RECEIVING NATIVE MEADOW SEED MIXES.

B. Apply seed mix with appropriate rangeland seed drill with packing wheels designed for installation of native grass and wildflower seed. Rolling is not necessary if appropriate drill is used with packing wheels. Seeding depth: confirm and follow recommendation of native seed supplier.

C. Protect seeded slopes exceeding 1:6 against erosion with Erosion-Control Blankets installed and stapled according to manufacturer's recommendations.

D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a rate of 1 ton/acre to form a thin continuous blanket 3/4 inch in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Use air-dry, clean, mildew- and seed-free threshed straw of wheat or oats. Hay or chopped corn stalks are not acceptable.

2. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.6 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 8-10 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:6 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.7 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.8 SODDING

A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.9 TURF RENOVATION

A. Renovate existing turf where indicated.

B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades. Apply Mushroom Compost to surface to surface of turf renovation area.

1. Soil Amendment(s): Mushroom Compost, according to requirements of Section 329113 "Soil Preparation." Apply Mushroom Compost to ¼ inch depth.
2. Initial Fertilizer: Slow-release fertilizer applied according to manufacturer's recommendations.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.10 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow turf type tall fescue to a height of 3 to 4 inches.

D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.11 NATIVE MEADOW SEED MIX AREA MAINTENANCE

A. Maintain a satisfactory meadow area by weeding, mowing and replanting.

B. Provide a monthly program of weed control. Large weed patches shall be eliminated by either spot-spraying with a general herbicide, or selective cutting with a string trimmer. Apply herbicides in accordance with manufacturers' written instructions. Correct damage resulting from improper use of herbicides.

C. Provide first year mowing as follows:
1. First mowing to be 4-6 inches height before oats set seed heads.
2. Mow to 4-6 inches height on a monthly interval or whenever weeds reach a height of 10" for remainder of first season.

D. Roll, re-grade, and immediately replant bare or eroded areas and re-mulch to produce a uniformly smooth grade. Provide material and installation the same as those used in the original installation.
1. Repair eroded areas by filling with topsoil, re-grading, and replanting.

E. Provide a log of maintenance activities including dates, hours, equipment used, and personnel involved.

3.12 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.13 SATISFACTORY STAND OF NATIVE MEADOW

A. Installation shall meet the following criteria as determined by Architect during final inspection and at acceptance:
   1. Satisfactory Stand of Native Meadow (at the beginning of the second growing season):
      a. A healthy, uniform stand of grasses and wildflowers with 75% of the plant community being covered with the intended plant material.
      b. 50% of the specified species shall be present.
      c. 25% of the plant material shall be the permanent species.
   2. Use specified materials to reestablish native meadow stands that do not comply with requirements and continue maintenance until conditions are satisfactory. In areas where native meadow stands require over-seeding to meet specification, over-seeding will be performed using a slit seeder. No other over-seeding method will be acceptable.
   3. If satisfactory stand of native meadow has not been established at final inspection, another inspection shall be made upon written Contractor request.

3.14 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.15 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf and native meadow work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.16 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following period:

1. Seeded Turf: 60 days from date of site planting completion.

2. Sodded Turf: 30 days from date of site planting completion.

B. Native Meadow Maintenance Service: Provide full maintenance by skilled employees of landscape installer. Maintain as required in "Native Meadow Seed Mix Area Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable native meadow stand is established, but for not less than the following period:

1. Seeded Native Meadows: 12 months from date of site planting completion, including one full growing season.

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Tree stabilization.
3. Tree-watering devices.
4. Landscape edgings.

B. Related Requirements:

1. Section 329113 "Soil Preparation" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 329200 "Turf and Grasses" for turf (lawn) and native meadow planting, hydroseeding, and erosion-control materials.

1.3 DEFINITIONS

A. General Note: this article defines terms that may appear in the Contract Documents.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation.

C. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

D. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

E. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less

than the minimum root spread according to ANSI Z60.1 for type and size of plant required.

F. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

H. Finish Grade: Elevation of finished surface of planting soil.

I. 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 include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

J. 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.

K. Planting Area: Areas to be planted.

L. 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 329113 "Soil Preparation" for drawing designations for planting soils.

M. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

N. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

O. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

P. 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.

1.4 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Schedule conference for a date not less than 60 days prior to commencement of planting installation, and conduct conference at project site, unless otherwise arranged.

1.6 SUBMITTALS

A. Qualification Data: For landscape Installer

B. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in digital format, min. 150 dpi of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

C. Samples for Verification: For each of the following:
1. Organic Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
2. Slow-Release, Tree-Watering Device: One unit of each size required.

D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

E. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

F. Schedules: Planting Schedule indicating anticipated planting dates; Maintenance Schedule indicating anticipated maintenance activities, hours associated with activities, and their frequencies.

G. Maintenance Log: Written record of actual maintenance activities performed during the maintenance period including description of activities, dates, list of personnel and products applied.

H. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

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 landscape installation in addition to requirements in Section 014000 "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 one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Interior.
    c. Landscape Industry Certified Horticultural Technician.

5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper

measurements 6 inches above the root flare for trees up to and including 4-inch caliper size, and 12 inches above the root flare for larger sizes.

2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. 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 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. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

H. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

I. Fertilizer: Deliver fertilizer in original sealed, waterproof containers labeled with weight, chemical analysis and manufacturer. Retain all labels and/or containers in an on-site location through planting completion date.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Install all plant material during a calendar time frame that is consistent with good horticultural practice. Install woody plant material between March 15 and December 1; install herbaceous plants of #1 container (one (1) gallon) or smaller size between March 15 and August 15. Coordinate planting periods with maintenance periods to provide required maintenance from date of planting completion.

C. Weather Limitations:
1. Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Do not install plants:
   a. When ambient temperatures are forecast to drop below 30 degrees F or rise above 90 degrees F;
   b. When wind velocity exceeds, or is forecast to exceed, 30 mph;
   c. When ground is frozen, snow-covered, muddy or in an otherwise unsuitable condition;
   d. During periods of extreme drought.
2. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

D. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Architect.

E. Coordinate work of this Section with installation of underground utilities, irrigation system, and seeding.

1.11 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of planting completion, including on continuous growing season:

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 10 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 10-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:

1. Finely ground native hardwood bark.

a. AAA Hardwood Fines, Tiffany Lawn and Garden Supply, Inc., (317) 228-4900
b. Forrest Fines® Hardwood Bark Mulch, Greendell Landscape Solutions, Mooresville, IN (317) 996-2826
c. Hardwood Fines, Indiana Mulch, Indianapolis, IN (317) 638-8334
d. Approved equal

B. Mushroom Compost: Spent Mushroom Substrate as defined by the American Mushroom Institute and consisting of well-composted, stable, and weed- and pesticide-free mixture of wheat straw, hay, corn cobs, cottonseed hulls, gypsum, sphagnum peat, ground limestone, chicken litter, and /or horse stable bedding and free of substances toxic to plantings. Reference 329113 “Soil Preparation” for analysis.

2.4 PLANTING SUPPLEMENTS

A. Pesticide(s): 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.

2.5 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal, by length indicated, pointed at one end.
2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or compression springs.
3. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
4. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
5. Guy Cables: (for trees of 3” caliper and/or 14’ in height and larger) Five-strand, 3/16-inch-diameter, galvanized-steel cable, with zinc-coated compression springs, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
6. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.
7. Padding: Burlap.
8. Manufactured tree-stabilization systems (subject to compliance with requirements):
    a. Border Concepts, Inc.: Tomahawk Tree Stabilizers
    b. Foresight Products, LLC: Duckbill Rootball Fixing System
    c. Tree Staple, Inc.: Tree Staples

2.6 TREE-WATERING DEVICES

A. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over an extended time period manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.
   1. Color: green

2.7 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

C. Mycorrhizal Fungi Inoculant: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

D. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes. Subject to compliance with requirements, provide products by one of the following: Colmet; Sure-Loc Edging Corporation; Border Concepts, Inc.; Collier Metal Specialties, Inc.; Russell, J.D. Company (The). Edging size min. 3/16 inch wide by min. 4 inches deep. Stakes min. 12 inches long of tapered steel. Standard tapered ends, corners and splicers. Unpainted raw steel or standard black paint - color/finish by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and 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. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
   3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. 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.

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

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

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.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: Place manufactured planting soil over exposed subgrade and lightly compact to minimize settling.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi Inoculant: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will

sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

2. Excavate approximately three times as wide as ball diameter for balled and burlapped or container-grown stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
    a. For planting pits that will receive Structural Soil, excavate to the depth specified in the Drawings.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
8. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Soil removed from excavations is to be used as backfill soil unless otherwise indicated. Cross-reference 329113 Soil Preparation.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 to 2 inches above adjacent finish grades.

1. Backfill: For trees, use excavated soil mixed with one shovel-full of Mushroom Compost per 3’ of tree height. For shrubs and vines, use planting soil.

2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Three for each caliper inch of plant

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above finish grades.

1. Backfill: Planting soil
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Two per plant

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 MECHANIZED TREE-SPADE PLANTING

A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. Use the same tree spade to excavate the planting hole as will be used to extract and transport the tree.

C. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

D. Cut exposed roots cleanly during transplanting operations.

E. Plant trees following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

3.7 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.8 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing, unless otherwise noted.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of 2-inch average thickness, with 24-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.

3.10 EDGING INSTALLATION

A. Shovel-Cut Edging (“Spade Edge”): Separate mulched areas from turf areas, curbs, and paving with a 45-degree, 4- to 6-inch-deep, shovel-cut edge as indicated on Drawings.

B. Steel Edging: Install per manufacturer’s written instructions to match graphic representation(s) on Drawings, creating true arcs and straight lines as depicted.

3.11 INSTALLING SLOW-RELEASE WATERING DEVICE

A. Provide one device for each tree.

B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.12 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.13 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations.

Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.14 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than 10 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

3.15 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before planting completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of planting completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.16 MAINTENANCE SERVICE

A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months from date of planting completion

B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months from date of planting completion

END OF SECTION 329300

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