City of South Haven

VOLUME III – SITE IMPROVEMENTS

CONTRACT DOCUMENTS AND SPECIFICATIONS

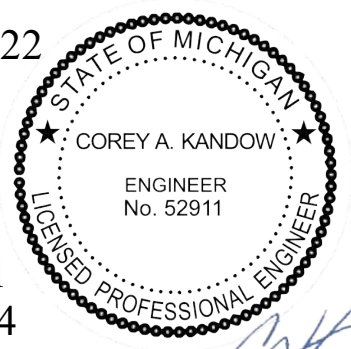
CENTER STREET RECONSTRUCTION
MICHIGAN AVENUE TO WILLIAMS STREET

OWNER:
CITY OF SOUTH HAVEN
539 PHOENIX STREET
SOUTH HAVEN, MI 49090

ENGINEER:
ABONMARCHE
95 WEST MAIN STREET
BENTON HARBOR, MI 49022

June 3, 2019

SRF PROJECT NO. 5602-03
DWRF PROJECT NO. 7463-01
ACI PROJECT NO. 19-0294



SECTION 00 01 10

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04 05 00
MASONRY MORTAR

PART 1 – GENERAL

1.01 SUMMARY:

A. Section includes:

1. This Section includes, but is not necessarily limited to, the furnishing and installation of mortar, accessories as indicated on the Drawings, as specified herein, and as necessary for the proper and complete performance of the work.

B. Mortar specified in this Section includes mortar for the following: Precast Concrete Caps, Masonry Column with Planter Pot.

C. Related Sections:

1. Section 04 72 00 – Architectural Precast Concrete
2. Section 32 32 23 – Concrete Segmental Freestanding Wall

1.02 UNIT PRICE – MEASUREMENT AND PAYMENT

1. Included in Concrete Segmental Freestanding Wall and Masonry Column with Planter Pot pay items.

1.03 REFERENCES:

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:

1. ACI 530 – Building Code Requirements for Masonry Structures.
2. ACI 530.1 – Specifications for Masonry Structures.
3. ASTM Standard Specifications:
   a. C 91 – Masonry Cement.
   b. C 144 – Aggregate for Masonry Mortar.
   c. C 270 – Mortar for Unit Masonry
4. BOCA – National Building Code.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Receiving and storage:

1. All materials shall be delivered in original, unbroken, brand marked containers.
2. Store materials in a manner which will prevent deterioration and contamination with foreign matter.

B. Replacements:

1. Reject damaged, deteriorated or contaminated material and immediately remove from the Site.
2. Replace rejected materials with new materials at no additional cost to OWNER.

1.05 SUBMITTALS
A. Mortar Color Samples:
1. Supply latex mortar color samples for selection by Landscape Architect.

PART 2 – PRODUCTS

2.01 MATERIALS:
A. Mortar:
1. Brands of materials and source of sand:
a. Same for entire Work.
b. Shall not be changed except with written approval for LANDSCAPE ARCHITECT.
c. Mortar used for reconstructed stone units shall be compatible with precast concrete.
2. Mortar for Reconstruction Stone Units: Latex modified thick mortar
1. Laticrete 370 or Mapei equivalent
3. Masonry cement for CMU:
a. ASTM C 91. Type N.
b. Minimum air content: 8%
c. Maximum air content: 21%
4. Mortar sand for CMU:
a. ASTM C 144.
b. Clean, natural-colored sand.
c. Damp and loose.
5. Water:
a. Clean and potable.
b. Free of harmful amounts of acids, alkalis and organic matter
6. Admixtures: Do not lower the freezing point of mortar by use of admixtures or anti-freeze agents.

PART 3 – EXECUTION

3.01 PREPARATION AND USE:
A. Measure materials by volume or equivalent weight, not by shovel.

B. Mix in power mixer for not less than 5 minutes after all materials are in the mixer, using only enough water to obtain proper workability.

3.02 RETEMPERING AND TIME LIMITS:
A. Masonry cement mortar:
1. After the initial mixing, keep the mix tempered: add water as required so that the mix will contain the maximum amount of water consistent with good workability.

2. Mix not used within the following time periods after initial mixing shall be discarded:
   a. Temperature 80 degrees F or higher: 1-1/2 hours.
   b. Temperature 80 degrees F or lower: 2-1/2 hours.

END OF SECTION

04 05 23

MASONRY ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY:

A. Section includes:

1. This Section includes, but is not necessarily limited to, the furnishing and placement of all masonry accessories as indicated on the Drawings, as specified herein, and as necessary for the proper and complete performance of the Work.

B. Masonry accessories specified in this Section include the following:
   1. Concrete inserts.
   2. Flashing built into stone work.
   3. Cleaning compound.
   4. Weep holes.

C. Related Sections:
   1. Section 04 05 00 – Masonry Mortar.
   2. Section 04 72 00 – Architectural Precast Concrete

1.02 UNIT PRICE – MEASUREMENT AND PAYMENT

1. Included in Concrete Segmental Freestanding Wall and Unit Masonry Work.

1.03 REFERENCES:

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standard Specifications:
      a. A 82 – Steel Wire, Plain, for Concrete Reinforcement.
      b. A 153 – Zinc Coating (Hot Dip) on Iron and Steel.
      c. A 641 – Zinc Coated (Galvanized) Carbon Steel Wire.
      d. B 209 – Aluminum and Aluminum-Alloy Sheet and Plate.
   2. ACI:
      a. 530 – Building Code Requirements for Masonry Structures.
      b. 530.1 – Specifications for Masonry Structures.

1.04 SUBMITTALS:

A. Submit in accordance with Sections 01300 – Submittals.

B. Shop Drawings:
   1. Submit for each masonry accessory.
   2. Required information:
      a. Manufacturer’s specifications and installation instructions.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. Concrete inserts in dovetail slots:
1. Triangle 3/16-inch galvanized wire ties appropriate for dovetail slots furnished and installed in accordance with:
a. Section 03250 – Concrete Accessories.
b. Section 03300 – Cast-in-Place Concrete.

B. Wall Flashing:
1. Exterior walls:
a. Aluminum flashing:
1) ASTM B 209, alloy 3003, temper H14, AA-C22A41.
2) Clear anodized finish.
3) 0.032-inch thick with hemmed edge.
4) Take care not to damage exposed edge.

C. Control joints:
1. Constructed in field: Rake and calk joint.

D. Weep holes:
1. Clear plastic tubing:
a. Hohmann and Barnard, Inc.: or equal.
b. 1/4-inch O.D.
c. 4-inch long.
d. That will not stain stonework.
e. 24 inches on center.

E. Cleaning compound:
1. Mild, noncaustic detergent solution:
a. 801 Super Real Clean by Superior Manufacturing Company.
b. 600 Sureclean by Process Solvent Company, Inc.
c. Murex.
d. Saf-T-Klenz.

PART 3 – EXECUTION

3.01 INSTALLATION

A. See Section 04 05 23 – For installation of masonry accessories specified under this Section and indicated on the Drawings.

B. Advise concrete installer of specified requirements regarding placement of inserts which are to be used by the masonry installer for anchoring of masonry work.

3.02 CLEANING: Clean all installed masonry materials and related areas in accordance with Section 01562 Cleaning.

END OF SECTION

04 72 00

ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.01 SUMMARY:

A. Section includes:
1. Precast Concrete Caps (for Concrete Segmental Freestanding Wall)
2. Masonry Column Caps

B. Related Sections:
1. Section 04 05 00 - Masonry Mortar
2. Section 04 05 23 – Masonry Accessories
3. Section 32 32 23 – Concrete Segmental Freestanding Wall

1.02 UNIT PRICE – MEASUREMENT AND PAYMENT
1. Included in Concrete Segmental Freestanding Wall and Masonry Column with Planter Pot pay items.

1.02 SUBMITTALS:

A. Submit in accordance with Section 01300 – Submittals.
1. Submit for precast concrete and accessories.
2. Required information.

B. Shop drawings:
1. Setting drawings, showing details and sizes of precast concrete and arrangements of joints.
2. Suitable wash on all pieces with exposed top surfaces.
3. The setting mark of each precast concrete and its location for the Project.

C. Samples:
1. Submit for Precast concrete.
2. Submit for selection and approval, samples of the Precast concrete specified which will be typical of the general range of color and finish to be furnished.

1.04 REFERENCES:
A. Precast concrete Institute specification for Precast concrete, wet and dry

1.03 DEFINITIONS:
A. Dry Cast – manufactured from zero slump concrete.
1. Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.

2. Machine casting method: Manufactured from earth moist, zero-slump concrete compacted by machinery using vibration and pressure against a mold until it becomes densely consolidated.

B. Wet Cast – manufactured from measurable slump concrete.

1. Wet casting method: manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.03 QUALITY ASSURANCE:

A. Qualifications:

1. Fabrication and installation personnel:

a. Trained and experienced in the fabrication and installation of the materials and equipment.

b. Knowledgeable of the design and the reviewed Shop Drawings.

2. Precast concrete manufacturer shall have plant certified by the Precast concrete Institute:

a. The manufacturer shall have a minimum of five years continuous operation, having experience, adequate facilities, and capacity to furnish the quality, sizes, and quantity of precast concrete required without delaying the progress of the work, and whose products have been previously used and exposed to the weather with satisfactory results.

3. Warranty Period: minimum of 10 years.

1.04 DELIVERY, STORAGE AND HANDLING:

A. Receiving and storage:

1. All materials shall be delivered in original, unbroken, brand marked containers.
2. Handle and store materials:
   a. In a manner which will prevent:
      1) Deterioration or damage.
      2) Contamination with foreign matter.
      3) Damage by weather or elements.

B. Rejected material and replacements:

1. Reject damaged, deteriorated or contaminated material and immediately remove from the Site.
2. Replace rejected materials with new materials at no additional cost to OWNER.

PART 2 – PRODUCTS

2.01 ARCHITECTURAL PRECAST CONCRETE:

A. Comply with ASTM C 1364. Physical properties: Provide the following:

1. Compressive Strength - ASTM C 1194: 6,500 psi minimum for products at 28 days.

2. Absorption - ASTM C 1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products at 28 days.

3. Air Content – ASTM C 173 or C 231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for VDT products.
4. Freeze-thaw – ASTM C 1364: The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
5. Linear Shrinkage – ASTM C 426: Shrinkage shall not exceed 0.065%.

B. Job site testing – One sample from production units may be selected at random from the field for each 500 cubic feet (14 m 3) delivered to the job site.

1. Three field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
2. Three field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

2.02 MATERIALS:

A. Materials:

1. Cement: Portland Type I or Type III white and/or grey meeting ASTM C 150.
2. Fine aggregate: Carefully graded and washed natural sands, or manufactured granite, quartz or limestone sands meeting ASTM C 33 except that gradation may vary to achieve desired finish and texture.
3. Coarse aggregate: Carefully graded and washed natural gravies, or crushed, graded stone such as granite, quartz, limestone, or other durable stone meeting ASTM C 33 except that gradation may vary to achieve desired finished and texture.
4. Admixtures:
    a. ASTM C 260 for air-entraining admixtures.
    b. ASTM C 494/C 495M Types A - G for water reducing, retarding, accelerating and high range admixtures.
5. Water: Potable tap-water free from impurities.
6. Reinforcing bars:
    a. ASTM A 615/A 615M: Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in.
    b. Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.
7. Miscellaneous:
    a. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

B. Mixes:

1. The manufacturer shall be responsible to design a mix which achieves both the strength and finish desired.
2. Compressive strength shall be not less than between 4800 and 6000 psi at 28 days when tested in accordance with the requirements of this specification, dependent upon shape and size of the piece.
3. The average water absorption of Precast concrete shall not exceed 6% by dry weight when tested in accordance with the requirements of this specification.

C. Reinforcement:

1. Precast concrete shall be reinforced with new billet steel reinforcing bars meeting ASTM A 615, grade 40 or grade 60, when necessary for safe handling, setting and structural stress, and the size of the reinforcing shall be specified.
2. If the surfaces are to be exposed to the weather, the reinforcement shall be galvanized or epoxy coated when covered with less than 2 inches of material for bars larger than 5/8 inch.
3. The material covering in all cases shall be at least twice the diameter of the bars.
4. Where applicable, cold-drawn steel wire reinforced meeting ASTM A 82. Welded Wire Fabric Reinforcement meeting ASTM A 185 or ASTM A 497 or steel bar or rod mat reinforced meeting ASTM A 184 may be used.

D. Color and finish:
1. Exposed surface, unless otherwise specified, shall exhibit a typically fine grained texture similar to natural stone with no bugholes permitted.
2. Color and texture of Precast concrete shall be generally equal to the approved sample when viewed in direct daylight at a 5 foot distance.
3. The range of total acceptable color (lightness, color saturation and hue) variation shall not exceed CIELAB 3.0 provided that the difference in hue alone does exceed CIELAB 1.0 as defined by the International Commission on Illumination, 1976 Standard.

E. Accessories: Type 304 or 316 stainless steel smooth dowels.

2.03 SOURCE QUALITY CONTROL

A. Tolerance:
1. Precast concrete dimensions: The numerically greater of plus or minus 1/8” or length / 360.
2. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 in., on unformed sides of unit, 3/8 in. maximum deviation.

2.04 CURING

A. Cure units in a warm curing chamber approximately 100ºF (37.8ºC) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70ºF (21.1ºC) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days @ 50°F (10°C) or 5 days @ 70°F (21°C)) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Installing contractor shall check Precast concrete materials for fit and finish prior to installation. Unacceptable units shall not be set.

3.2 SETTING TOLERANCES

A. Comply with Precast Concrete Institute® Technical Manual.
B. Set stones 1/8 in. or less, within the plane of adjacent units.
C. Joints, plus - 1/16 in., minus - 1/8 in.

3.3. JOINTING

A. Joint size:
1. At stone/brick joints 3/8 in.
2. At stone/stone joints in vertical position 1/4 in. (3/8 in. optional).
3. Stone/stone joints exposed on top 3/8 in.

B. Joint materials:
1. Mortar, Type N, ASTM C 270.
2. Use a full bed of mortar at all bed joints.
3. Flush vertical joints full with mortar.
4. Leave all joints with exposed tops or under relieving angles open for sealant.
5.Leave head joints in copings and projecting components open for sealant.

C. Location of joints:
1. As shown on shop drawings.
2. At control and expansion joints unless otherwise shown.

3.4. SETTING

A. Drench units with clean water prior to setting.
B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
C. Set units in full bed of mortar, unless otherwise detailed.
D. Rake mortar joints 3/4 in. in for pointing.
E. Remove excess mortar from unit faces immediately after setting.
F. Tuck point unit joints to a slight concave profile.

3.5. JOINT PROTECTION

A. Comply with requirements of Section 07 90 00.
B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6. REPAIR AND CLEANING

A. Repair chips with touchup materials furnished by manufacturer.
B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
C. Consult with manufacturer for appropriate cleaners

3.7. INSPECTION AND ACCEPTANCE

A. Inspect finished installation according to Precast concrete Institute® Technical Bulletin #36.

B. Do not field apply water repellent until repair, cleaning, inspection and acceptance is completed

END OF SECTION

SECTION 12 93 00

SITE EQUIPMENT INSTALLATION

PART 1 – GENERAL

1.1 SUMMARY:

A. This Section includes:
1. Loop bike racks.
2. Benches.
3. Trash Receptacles
4. Planter pots on masonry column

B. Related Section:
1. Portland Cement Concrete Work" for concrete footings

1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Loop bike racks: Madrax #U-238-SF-P(standard) (2-3/8" od steel tubing) surface mount.
1. Basis of Measurement: each installed.
2. Basis of payment: Includes furnishing and installing loop bike rack in concrete foundations.

B. Benches: Thomas Steele Carnival CRB-6, 6 feet long, fabricated steel bench, black.
1. Basis of Measurement: each installed.
2. Basis of payment: Includes furnishing and installing bench on concrete paving (separate pay item) with s.s. fasteners per manufacturer's recommendations.

C. Trash Receptacles: Thomas Steele Carnival CRTR-42-Door, 30 inch diameter, 45 inch height fabricated steel, with flat lid, black, 253 lbs.
1. Basis of Measurement: each installed.
2. Basis of payment: Includes furnishing and installing trash receptacle on concrete paving (separate pay items) with s.s. fasteners per manufacturer's recommendations.

D. Planter Pot on Masonry Column: Tournesol Site Works, Arcade ACS 3610; finish: acid etch standard colors.
1. Basis of Measurement: included in Masonry Column with Planter Pot pay item.

E. Precast Seating Block: Wausau Tile Site Furnishings, Model # TF5119; custom finish: top – 11-121-JUL; sides – 111-122-JUL.
1. Basis of Measurement: each installed.
2. Basis of payment: Includes furnishing and installing precast seating block.

PART 2 – PRODUCTS

See Specifications. Submit Product drawings.

PART 3 – EXECUTION

3.1 INSTALLATION

A. The Contractor shall be wholly and completely responsible for loss, damage or any other occurrence that might affect the complete installation of the equipment as planned and shall make complete replacement or repair or lost or damaged items as deemed appropriate by the Landscape Architect. Contractor shall be responsible for ascertaining the completeness of the assembly packages.

B. Contractor shall install bike loop, benches, trash receptacles, and planters, as per details on construction drawings and as per manufacturer's instructions. All fasteners shall be provided with site equipment packages; however, Contractor shall provide all necessary equipment, labor and materials to completely install equipment in a rigid, permanent, secure and safe manner.

C. Contractor shall inform Landscape Architect were finished surfaces are not free of protruding fastener ends, pinch points, sharp edges or points, sharply protruding assembly members, slipper areas or similar potentially hazardous, visually unattractive or functionally-inappropriate conditions, and shall correct those problems as directed by Landscape Architect.

3.2 REPAIRS

A. The Contractor shall repair any damage to the surfaces or integrity of the site equipment to the satisfaction on the Owner. If repair is not satisfactory, Contractor shall replace, at his expense, the damaged section or piece of equipment affected.

END OF SECTION

32 13 16
COLORED CONCRETE
With
EXPOSED AGGREGATE FINISH

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Integrally colored concrete sidewalks with exposed aggregate finish.
2. Scoring of “concrete band” in paving
3. Integrally Colored Concrete Band, separate pour
4. Curing of integrally colored concrete.
5. Jointing and caulking

B. Related Sections:

1. "Cast-In-Place Concrete" for general applications of concrete and coordination of sample submittal [and color selection].

1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Sidewalk, Conc, Colored, Exposed Aggregate, 4 inch
   1. Basis of measurement: by square foot
   2. Basis of payment: Includes colored concrete with exposed aggregate finish and tooled joints for locations shown on plans. Includes all joints according to plan layout, caulking, finishing, and curing.

B. Sidewalk, Conc, Colored, Exposed Aggregate, 6 inch
   1. Basis of measurement: by square foot
   2. Basis of payment: Includes colored concrete with exposed aggregate finish and tooled joints for locations shown on plans. Includes all joints according to plan layout, caulking, finishing, and curing.

C. Sidewalk Ramp, Conc. Colored, Exposed Aggregate, 6 inch
   1. Basis of measurement: by square foot
   2. Basis of payment: Includes colored concrete with exposed aggregate finish and tooled joints for locations shown on plans. Includes all joints according to plan layout, caulking, finishing, and curing.

D. Sidewalk Test Pour
   1. Basis of measurement: by each
   2. Basis of payment: Includes 5’ x 15’ colored concrete with exposed aggregate finish and tooled joints sample panel to approve appearance. Includes all joints according

to plan layout, caulking, finishing, and curing. Also includes removal of test pour if not incorporated into the project.

1.3 REFERENCES

A. American Concrete Institute (ACI):
1. ACI 301 "Specification for Structural Concrete for Buildings."
2. ACI 302 IR "Recommended Practice for Concrete Floor and Slab Construction."
3. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete."
4. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete."
5. ACI 305R "Recommended Practice for Hot Weather Concreting."
6. ACI 306R "Recommended Practice for Cold Weather Concreting."

B. American Society for Testing and Materials (ASTM):
1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."

C. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO M194 "Chemical Admixtures."

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s complete technical data sheets for the following:
1. Colored admixture.
2. Curing compound.
3. Aggregates

B. Design Mixes: For each type of integrally colored concrete.

C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available.

D. Qualification Data: For firms indicated in "Quality Assurance" Article, including list of completed projects.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with 10-years experience in the production of specified products.

B. Installer Qualifications: An installer with five (5) years' experience with work of BOTH colored concrete and exposed aggregate, and demonstrable quality appearance.

C. Comply with the requirements of ACI 301.

D. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

E. Notification of manufacturer's authorized representative shall be given at least 1-week before start of Work.

F. Integrally Colored Concrete with Exposed Aggregate Mockups:
   1. Provide under provisions of Division 1 Section "Quality Control."
   2. At location on Project selected by Landscape Architect, place and finish 5 by 15 feet area.
   3. For accurate color, the quantity of concrete mixed to produce the sample should not be less than 3 cubic yards (or not less than 1/3 the capacity of the mixing drum on the ready-mix truck) and should always be in full cubic yard increments. Excess material shall be discarded according to local regulations.
   4. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels. Mockup shall be produced by the individual workers who will perform the work for the Project.
   5. Retain samples of cements, sands, aggregates and color additives used in mockup for comparison with materials used in remaining work.
   6. Accepted mockup provides visual standard for work of Section.
   7. Mockup shall remain through completion of work for use as a quality standard for finished work.
   8. Remove mockup when directed.

1.6 DELIVERY, STORAGE AND HANDLING

A. Colored Admixture: Comply with manufacturer's instructions. Deliver colored admixtures in original, unopened packaging. Store in dry conditions.

1.7 PROJECT CONDITIONS

A. Integrally Colored Concrete Environmental Requirements:
   1. Schedule placement to minimize exposure to wind and hot sun before curing materials is applied.
   2. Avoid placing concrete if rain, snow, or frost is forecast within 24-hours. Protect fresh concrete from moisture and freezing.
   3. Comply with professional practices described in ACI 305R and ACI 306R.

B. Schedule delivery of concrete to provide consistent mix times from batching until discharge. Mix times shall meet manufacturer's written recommendations.

1.8 PRE-JOB CONFERENCE

A. One week prior to placement of integrally colored concrete a meeting will be held to discuss the Project and application materials.

B. It is suggested that the Landscape Architect, General Contractor, Subcontractor, Ready-Mix Concrete Representative, and a Manufacturer's Representative be present.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. L. M. SCOFIELD COMPANY, Douglasville, Georgia and Los Angeles, California (800) 800-9900 or the appropriate local contact: Eastern Division – 201-672-9050; Western Division – 323-720-3055; Central Division Office – 630-377-5959.

2.2 MATERIALS

A. Colored Admixture for Integrally Colored Concrete: CHROMIX P® Admixture and CHROMIX ML®; L. M. SCOFIELD COMPANY.
   1. Admixture shall be a colored, water-reducing, admixture containing no calcium chloride with coloring agents that are limeproof and ultra-violet resistant.
   2. Colored admixture shall conform to the requirements of ACI 303.1, ASTM C979, ASTM C494 and ASSHTO M194.

B. Curing Compound for Integrally Colored Concrete: Curing compound shall comply with ASTM C309 and be of same manufacturer as colored admixture, for use with integrally colored concrete.
   1. Exterior Integrally Colored Concrete: clear Cure Seal-S. Use to cure exterior flatwork that will be allowed to cure naturally with only occasional maintenance.

C. Substitutions for colored admixture and curing compound: none allowed

D. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
   1. Aggregate Sizes: 5/8 to 3/8 inch, in tans and brown color range.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 3/16”.

2.3 COLORS

A. Concrete Color[s]:
   1. Cement: Color shall be as specified on drawings
   2. Sand: Color shall be locally available natural sand
   3. Aggregate: Concrete producer's shall use a natural stone with tan/brown tones complying with drawing details. Submit sample
   4. Colored Admixture: As selected by Landscape Architect from Scofield Color Chart A-312.10. COLOR: Westwood Brown C-27.

B. Curing Compound: Clear.
C. Caulk: to match colored concrete.

2.4 CONCRETE MIX DESIGN

A. Minimum Cement Content: [5] five sacks per cubic yard of concrete.

B. Slump of concrete shall be consistent throughout Project at 4-inches or less. At no time shall slump exceed 5-inches. Do not use super plasticizers or mid-range water reducers.

C. Do not add calcium chloride to mix as it causes mottling and surface discoloration.

D. Supplemental admixtures shall not be used unless approved by manufacturer.

E. Do not add water to the mix in the field.

F. Add colored admixture to concrete mix according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install concrete according to requirements of Division 3 Section "Cast-In-Place Concrete."

B. Do not add water to concrete mix in the field.

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

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
2. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to indicated radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.2 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.

3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

3.3 CURING

A. Integrally Colored Concrete: Apply curing compound for integrally colored concrete according to manufacturer's instructions using manufacturer's recommended application techniques. Apply curing compound at consistent time for each pour to maintain close color consistency.

B. Curing compound shall be clear and supplied by same manufacturer of the colored admixture.

C. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 *Plastic Shrinkage Cracking* published by the National Ready Mixed Concrete Association.

D. Do not cover concrete with plastic sheeting.

3.4 TEST POURS

A. Construct the first 100 square feet of colored concrete with exposed aggregate finish in a location selected by Owner. Perform all work of permanent sidewalk, including jointing, finishing, and curing. Owner will review the completed test pour and approve or disapprove the test pour for acceptable aesthetic quality. If Owner disapproves the test pour, repeat.

B. After Owner has approved a test pour, remove all prior test pours, and the approved test pour shall remain and be incorporated into the project.

C. Comparison to the approved test pour will be the basis for acceptance of all subsequent pours.

3.5 TOLERANCES

A. Minor variations in appearance of integrally colored concrete, which are similar to natural variations in color and appearance of uncolored concrete, are acceptable.

3.5 COLORED CONCRETE APPLICATORS

A. For a list of qualified contractors, contact your local Scofield representative or the appropriate Division Office: Eastern Division – 201-672-9050; Western Division – 323-720-3055; Central Division Office – 630-377-5959.

SECTION 32 14 13.19

PERMEABLE CONCRETE PAVER MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Permeable Concrete Pavers
   2. Permeable Joint Opening Aggregate
   3. Permeable Setting Bed Aggregate (Open-graded)
   4. Permeable Base Aggregate (Open-graded)
   5. Permeable Subbase Aggregate (Open-graded)
   6. Geotextile Separator Fabric
   7. Paver Sealer

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

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Permeable Concrete Pavers.
   1. Basis of Measurement: By square foot.
   2. Basis of Payment: Includes all labor, materials, and equipment for a completed installed permeable paver system. Including excavation, subbase, base, bedding stone, geotextile fabric, paver, joint aggregate and sealer.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) latest addition:
   1. C 29 Bulk Density and Voids in Aggregate Materials.
   2. C 33, Standard Specification for Concrete Aggregates.
   3. C 67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile, Section 8, Freezing and Thawing.
   4. C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   5. C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   6. C 144 Standard Specifications for Aggregate for Masonry Mortar.
   7. D 448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
   8. C 936, Standard Specification for Solid Concrete Interlocking Paving Units.
   9. C 979, Standard Specification for Pigments for Integrally Colored Concrete.
   10. D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.

11. D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (44.5 N) Rammer and 18 in. (457 mm) drop.
12. C1645-06 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units
13. D 1883, Test Method for California Bearing Ratio of Laboratory-Compacted Soils.
14. D 2940 Graded Aggregate Material for Bases or Subbases for Highways or Airports.
15. D 4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
16. D 5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles
17. D 4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
18. D 4533, Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles
19. D 4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
20. D 4491, Standard Test Method for Water Permeability of Geotextiles by Permittivity
21. D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
22. D 4354, Standard Practice for Sampling of Geosynthetics for Testing
23. D 4759, Standard Practice for Determining the Specifications Conformance of Geosynthetics

1.04 SUBMITTALS

A. Permeable Concrete Pavers:
   1. Samples for verification: Three representative full-size samples of each paver type, thickness, color and finish that indicate the range of color variation and texture expected upon project completion.
   2. Accepted samples become the standard of acceptance for the product produced.
   3. Test results from an independent testing laboratory for compliance of concrete pavers with ASTM C 936.
   4. Manufacturer’s catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.

B. Permeable Joint Opening Aggregate:
   1. Provide two representative one pound samples in containers of aggregate materials that indicate the range of color variation and texture expected upon project completion.
   2. Accepted samples become the standard of acceptance for the product produced.

3. Test results from an independent testing laboratory for sieve analysis, including washed gradations per ASTM C 136.
4. Test results for void space percentage per ASTM C 29.

C. Permeable Setting Bed, Base and Subbase Aggregate:
1. Test results from an independent testing laboratory for compliance with ASTM D 448 No. 8, No. 57 and No. 2.
2. Test results from an independent testing laboratory for sieve analysis, including washed gradations per ASTM C 136.
3. Test results for void space percentage per ASTM C 29.

D. Paving Installation Contractor:
1. Job references from a minimum of three projects similar in size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.

1.05 QUALITY ASSURANCE

A. Utilize a Manufacturer having at least ten years of experience manufacturing interlocking concrete pavers on projects of similar nature or project size.

B: Source Limitations:
1. Obtain Permeable Concrete Pavers from one source location with the resources to provide products of consistent quality in appearance and physical properties.
2. Obtain Permeable Joint Opening Aggregate from one source with the resources to provide materials and products of consistent quality in appearance and physical properties.

C. Paving Contractor Qualifications:
1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
2. Utilize a Contractor conforming to all local, state/provincial licensing and bonding requirements.

D. Mockups:
1. Install a 5 ft x 5 ft paver area.
2. Use this area to determine surcharge of the bedding aggregate layer, joint sizes, lines, laying pattern(s) and levelness.
3. This area will be used as the standard by which the work will be judged.
4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
5. If mock-up is not retained, remove and properly dispose.

1.06 DELIVERY, STORAGE & HANDLING

A. Manufacturer required to complete production of materials within 30 days after order has been placed to avoid construction delays.

B. Deliver Permeable Concrete Pavers in manufacturer’s original, unopened and undamaged container packaging with identification labels intact.
1. Coordinate delivery and paving schedule to minimize interference with normal use of streets and sidewalks adjacent to paver installation.

2. Deliver concrete pavers to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.
3. Unload pavers at job site in such a manner that no damage occurs to the product or adjacent surfaces.

C. Store and protect materials free from mud, dirt and other foreign materials.

1.07 PROJECT/SITE CONDITIONS

A. Environmental Requirements:
1. Do not install permeable pavers on bedding sand.
2. Do not install permeable pavers on frozen permeable setting bed aggregate materials.
3. Do not install permeable pavers over frozen permeable base or subbase aggregates.
4. Do not install permeable base or subbase aggregates over frozen subgrade.

1.08 PERMEABLE CONCRETE PAVER OVERAGE AND ATTIC STOCK

A. Provide a minimum of 5% additional material for overage to be used during construction.

B. Contractor to furnish 100 square feet of each product and size used to owner for maintenance and repair. Furnish Permeable Concrete Pavers from the same production run as installed materials.

C. Manufacture to supply maintenance and reinstatement manuals for Permeable Concrete Paver units.

PART 2 - PRODUCTS

2.01 PERMEABLE CONCRETE PAVERS

A. Basis-of-Design Product: The permeable concrete paver shapes are based on:
1. Unilock:
a. Eco-Priora
2. As manufactured by:
Unilock Michigan
12591 Emerson Drive
Brighton, MI 48116
Contact: Jason Stafford – 616 889-4669 or your local Territory Manager
3. Substitutions: No substitutions permitted.

B. Product requirements:
1. Permeable Paver Type: Unilock Eco-Prioria
a. Color: Beechwood
b. Finish:
1. Standard
c. Edge: Chamfer - 3 mm bevel
d. Size: Manufacture the sizes indicated with a maximum tolerance of plus or minus 1/16 in all directions.
1. 5” x 10” x 3.125” (if 10” x 10” x 3.125” are available, supply a mix of sizes)

C. Provide pavers meeting the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units. Efflorescence is not a cause for rejection.
   1. Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).
   2. Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.
   3. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C1645, with no breakage greater than 1.0% loss in dry weight of any individual unit. Conduct this test method not more than 12 months prior to delivery of units.

D. Accept only pigments in concrete pavers conforming to ASTM C 979. ACI Report No. 212.3R provides guidance on the use of pigments.

E. Maximum allowable breakage of product is 5%.

2.02 PERMEABLE JOINT OPENING AGGREGATE

A. Provide Permeable Joint Opening Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 8 as shown in Table 1.

TABLE 1 - ECO-PRIORIA
PERMEABLE JOINT OPENING AGGREGATE
GRADATION REQUIREMENTS

ASTM No. C 33 No. 9 with no equivalent	
SUBBASE AGGREGATE	SUBBASE AGGREGATE
3/8 in (9.5 mm)	100
No. 4 (4.75 mm)	85 to 100
No. 8 (2.36 mm)	10 to 40
No. 16 (1.18 mm)	0 to 10
No. 50 (mm)	0 to 5

2.03 PERMEABLE SETTING BED AGGREGATE

A. Provide Permeable Setting Bed Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 8 as presented in Table 2.

TABLE 2
PERMEABLE SETTING BED AGGREGATE
GRADATION REQUIREMENTS

ASTM No. C 33 No. 8 (acceptable equivalent: MDOT 29A)	
Sieve Size	Percent Passing
½ in (12.5 mm)	100
3/8 in (9.5 mm)	85 to 100
No. 4 (4.75 mm)	10 to 30

No. 8 (2.36 mm)	0 to 10
No. 16 (1.18 mm)	0 to 5

2.04 PERMEABLE BASE AGGREGATE

A. Provide Permeable Base Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 57 as presented in Table 3.

TABLE 3
PERMEABLE BASE AGGREGATE
GRADATION REQUIREMENTS

ASTM C 33 No. 57 (acceptable equivalent: MDOT 6AA)	
Sieve Size	Percent Passing
1-1/2 in (37.5 mm)	100
1 in (25 mm)	95 to 100
1/2 in (12.5 mm)	25 to 60
No. 4 (4.75 mm)	0 to 10
No. 8 (2.36 mm)	0 to 5

2.05 PERMEABLE SUBBASE AGGREGATE

A. Provide Permeable Subbase Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 2 as presented in Table 4.

TABLE 4
PERMEABLE SUBBASE AGGREGATE
GRADATION REQUIREMENTS

ASTM C 33 No. 2 (1 x 3 not MDOT Classified-no fines)	
Sieve Size	Percent Passing
3 in (75 mm)	100
2-1/2 in (63 mm)	90 to 100
2 in (50 mm)	35 to 70
1-1/2 in (37.5 mm)	0 to 15
3/4 (19 mm)	0 to 5

Note: Provide washed, clean, have zero plasticity, free from deleterious or foreign matter, crushed, angular rock and contain no No. 200 sieve size aggregate materials used in the construction of permeable pavement. Aggregate materials serve as the structural load bearing platform of the pavement as well as a temporary receptor for the infiltrated water that is collected through the openings in the pavement's surface.

2.06 GEOTEXTILE

A. Provide Geotextile material conforming to the following performance characteristics, measured per the test methods referenced:
   1. 4 oz., nonwoven needle punched geotextile composed of 100% polypropylene staple fibers that are inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.
   2. Grab Tensile Strength: ASTM D 4632: 115 lbs.
   3. Grab Tensile Elongation: ASTM D 4632: 50%
   4. Trapezoidal Tear: ASTM D4533: 50 lbs.
   5. Puncture: ASTM D4833: 65 lbs.
   6. Apparent Opening Size: ASTM D 4751: 0.212 mm, 70 U.S. Sieve
   7. Permittivity: ASTM D 4491: 2.0 sec -1
   8. Flow Rate: ASTM D 4491: 140 gal/min/s.f.

B. As supplied by Unilock Chicago, 301 E. Sullivan Rd., Aurora, IL 60505.
   Contact: Brad Swanson – (630) 742-4168 or your local Territory Manager
   1. Carthage Mills – FX-40HS
   2. U.S. Fabrics – US 115NW
   3. Mirafi – 140N

2.07 EDGE RESTRAINTS

A. Concrete Edge Restraint as indicated on drawings

2.08 ACCESSORIES

A. Sealer
   1. Supplier: through Unilock Chicago, 301 E. Sullivan Rd., Aurora, IL 60505
      Contact: Your local Territory Manager
   2. Material Type and Description: B.P. Pro Permeable Stabilizing Sealer
   3. Material Standard: Permeable stabilizing sealer that bonds permeable paver joint aggregate together without restricting the water flow through the paver surface.

Permeable Stabilzizing Sealer

Summary
Permeable Stabilizing Sealer bonds permeable paver chips together without restricting the water flow through the surface to allow easier maintenance of these pavements.

Uses
Interlocking concrete and clay permeable pavers.

Features	Benefits
Enhanced look	Dual purpose sealer that protects both the surface and the joint fill.
Breathable	Non-whitening
Immediate application	Seals immediately, no waiting period
Stabilized Permeable Chips	Significantly reduces wash out
Satin sheen finish	Attractive beautifying finish
Stain protection	Easy clean barrier
Water resistant	Protects from the environment
Antifade	Maintains surface colors
Salt guard	Protects against freeze-thaw and salt damage
Ready to use	No mixing
Longevity	No mixing

Product Description
BP Pro Permeable Stabilizing Sealer is designed specifically for use on permeable block paving. It is designed to stabilize fill chips and seal the paver surface in one application. It is a water-based single component polymer that penetrates into the pores and seals the surface with a coating that gives you a enhanced satin sheen. It is VOC, EPA, OSHA and FDA compliant. It has the consistency of water and is milky white with a slight odor when in its liquid state and dries clear. It can be used on both new and existing projects because it is breathable and it will not trap efflorescence or moisture and whiten. Permeable Stabilizing Sealer is environmentally friendly and UV stable. The product is easy to install and offers increased stain protection and protection from the elements. Cured product is heat and freeze resistant.

Surface Preparation
All surfaces must be clean, free from efflorescence and loose debris including dust and plant material prior to application of a BP Pro sealer product. The surface and the chips must also be dry. If the surface or chips contains moisture, this could affect the look of the material on the surface when it dries or penetration and adhesion of the chips impacting the stabilization itself. On older pavements and walls cleaning must be carried out and the surface must be dry to allow proper penetration of the materials into the substrate and to provide the best aesthetic results. In some cases it is necessary to remove existing penetrating or film forming sealers prior to carrying out work. The paver joints should be filled with dry, correctly graded aggregate ASTM C-144 jointing sand with the top level not exceeding the bottom of the chamfer. We recommend that you use BP Pro cleaners created specifically for these surfaces. Follow their specific instructions to achieve your cleaning goals and properly prepare the surface.

Application Information
BP Pro Permeable Stabilizing Sealer should be mist coated onto the pavement to saturate the surface and joint sand to achieve the optimal surface seal and penetration to stabilize the joint fill. This mist coating can best be achieved by a low pressure electric fluid pump or on small projects by using a pump-up sprayer. Use coverage guidelines to ensure that you use the correct amount of material for your project and divide it into measured sections to ensure that it is applied as uniformly as possible. You must apply sufficient material to the surface to achieve joint penetration. A squeegee should be used to remove pooling and excess material from the surface and direct it into the joints to get better penetration. Care should be taken to avoid over applications (see Precautionary Information to understand risks). Applications should cease in inclement weather including precipitation, high wind and excessive heat and cold. Material should not freeze in its liquid state during its curing process as this may impact the effectiveness of the ship bond. Clean all application equipment with water and do not allow material to dry in containers as removal becomes more difficult. Call 866-61-BPPro or visit our website www.BPPro.biz for more information.

Drying Time
These suggestions will be effected by weather and surface conditions so please take these factors into consideration.

Dry time	30 minutes – 3 hours the surface should be dry to the touch
Cure time	24 hours for initial curing with complete curing will take additional time
Vehicle and precipitation	24 hours

Maintenance
Pavements should be correctly maintained to get the best performance from both Pavements should be correctly maintained to get the best performance from both the pavement and BP Pro Permeable Stabilizing Sealer. BP Pro sealers and protective treatments are compatible with BP Pro cleaners and maintenance products and can be used to remove organic and inorganic stains like oils, food and beverages and mineral deposits from the pavement surface. Test cleaners in inconspicuous areas prior to cleaning and always thoroughly rinse off surface after cleaning. Hot water pressure washer should be used in conjunction with BP Pro cleaners for best results; heat will significantly improve results when extracting the residue from oil based stains (call for correct cleaning practices). Care should be taken to ensure that excessive pressure is not utilized, as it may erode joint sand and could damage the surface of your Hardscape. BP Pro Joint Stabilizing Sealer will not show wear patterns and topical resealing can be carried out frequently without showing significant aesthetic differences on the surface although testing should be done to verify this on your pavement. Re-applications should be carried out every 2 - 4 years depending on type of pavement, usage and wear. We recommend using BP Pro cleaning equipment to maintain these pavements call 866-61-BPPro or visit our website www.BPPro.biz for more informaiton.

Storage and Handling
Containers should be properly sealed and protected from freezing. Temperature should range between 50°F - 100°F.

Shelf Life
Shelf life is up to 2 years

866-61-BPpro (27776) www.BPpro.biz

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas indicated to receive paving for compliance with requirements for installation tolerances and other conditions affecting performance before placing the Permeable Concrete Pavers.
   1. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
   2. Verify that Geotextiles, if applicable, have been placed according to drawings and specifications.
   3. Verify that Permeable Base and Subbase Aggregate materials, thickness, compacted density, surface tolerances and elevations conform to specified requirements.
   4. Provide written density test results for soil subgrade, Permeable Base and Subbase Aggregate materials to the Owner, General Contractor and paver installation subcontractor.
   5. Verify location, type, and elevations of edge restraints, concrete collars around utility structures, and drainage inlets.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Beginning of bedding sand and paver installation signifies acceptance of base and edge restraints.

3.02 PREPARATION

A. Verify that the subgrade soil is free from standing water.

B. Stockpile Permeable Setting Bed, Joint, Base and Subbase Aggregate materials such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.

C. Remove any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities before placing the Geotextile and Permeable Subbase Aggregate materials.

D. Keep area where pavement is to be constructed free from sediment during entire job. Remove and replace all Geotextile, Permeable Joint, Setting Bed, Base and Subbase Aggregate materials contaminated with sediment with clean materials.

E. Complete all subdrainage of underground services within the pavement area in conjunction with subgrade preparation and before the commencement of Permeable Subbase Aggregate construction.

F. Do not damage underdrain pipes, overflow pipes, observation wells, or inlets and other drainage appurtenances during installation. Report all damage immediately.

G. Compact soil subgrade uniformly to at least 90 percent of Standard Proctor Density per ASTM D 698 for pedestrian areas. Compact soil subgrade uniformly to at least 95 percent Modified Proctor per ASTM D 1557 for vehicular areas.

H. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earth Moving" to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting and replace with compacted backfill or fill as directed.

Note: Mechanical tampers (jumping jacks) are recommended for compaction of soil subgrade and aggregate base around lamp standards, utility structures, building edges, curbs, tree wells and other protrusions. Compact areas, not accessible to roller compaction equipment, to the specified density with mechanical tampers. CAUTION – Proceed with care around the perimeters of excavations, buildings, curbs, etc. These areas are especially prone to consolidation and settlement. Do not place wedges of backfill in these areas. If possible particularly in these areas, proceed with backfilling and compacting in shallow lifts, parallel to the finished surface.

3.03 INSTALLATION

A. EDGE RESTRAINTS

1. Provide edge restraints as indicated.
   a. Install job-built concrete edge restraints to comply with requirements in Division 3 Section "Cast-in-Place Concrete."
   b. Provide concrete edge restraint along the perimeter of all paving as specified. Install the face of the concrete edge restraint, where it abuts pavers vertical down to the subbase.
   c. Construct concrete edge restraint to dimensions and level specified and support on a compacted subbase not less than 6 in (150 mm) thick.

B. GEOTEXTILES

1. Provide separation geotextile on bottom and sides of prepared soil subgrade. Secure in place to prevent wrinkling or folding from equipment tires and tracks.
2. Overlap ends and edges a minimum of 18 in. (450 mm) in the direction of drainage.

C. PERMEABLE BASE AND SUBBASE AGGREGATE

1. Provide the Permeable Subbase Aggregate in uniform lifts not exceeding 6 in., (150 mm) loose thickness and compact to at least 95 percent as per ASTM D 4254 to depths as indicated.
2. Compact the Permeable Subbase Aggregate material with at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 ton vibratory roller until there is no visible movement. Do not crush aggregate with the roller.
3. Tolerance: Do not exceed the specified surface grade of the compacted Permeable Subbase Aggregate material more than ±3/4 in. (20 mm) over a 10 ft. (3 m) long straightedge laid in any direction.
4. Provide the Permeable Base Aggregate material in uniform lifts not exceeding 6 in. (150 mm) over the compacted Permeable Subbase Aggregate material and compact to at least 95 percent as per ASTM D 4254 to depths as indicated.
5. Compact the Permeable Base Aggregate material with at least two passes in the vibratory mode then at least two in the static mode with a minimum 10

ton vibratory roller until there is no visible movement. Do not crush aggregate with the compaction device.

6. Tolerance: Do not exceed the specified surface grade of the compacted Permeable Base Aggregate material more than ±1/2 in. (13 mm) over a 10 ft. (3 m) long straightedge laid in any direction.
7. Grade and compact the upper surface of the Permeable Base Aggregate material sufficiently to prevent infiltration of the Permeable Setting Bed Aggregate material both during construction and throughout its service life.

Note: In-place density of the Permeable Base and Subbase Aggregate materials may be checked per ASTM D 4254. Establish a Compacted density of 95% of the laboratory index density for the subbase and base stone.

D. PERMEABLE SETTING BED AGGREGATE

1. Provide and spread Permeable Setting Bed aggregate evenly over the Permeable Base Aggregate course and screed to a nominal thickness of 1-1/2 in. (40 mm).
   a. Do not disturb screeded Permeable Setting Bed Aggregate.
   b. Do not substantially exceed screed area which cannot be covered by pavers in one day.
   c. Do not use Permeable Setting Bed Aggregate material to fill depressions in the base surface.
2. Keep moisture content constant and density loose and constant until Concrete Pavers are set and compacted.
3. Inspect the Permeable Setting Bed Aggregate course prior to commencing the placement of the permeable concrete pavers.
4. Inspect the Setting Bed Aggregate course prior to commencing the placement of the Permeable Concrete Pavers. Acceptance of the Setting Bed Aggregate occurs with the initiation of Permeable Concrete Paver placement.

E. PERMEABLE CONCRETE PAVERS

1. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
2. Mix Concrete Pavers from a minimum of three (3) bundles simultaneously drawing the paver vertically rather than horizontally, as they are placed, to produce uniform blend of colors and textures. (Color variation occurs with all concrete products. This phenomenon is influenced by a variety of factors, e.g. moisture content, curing conditions, different aggregates and, most commonly, from different production runs. By installing from a minimum of three (3) bundles simultaneously, variation in color is dispersed and blended throughout the project).
3. Exercise care in handling face mix pavers to prevent surfaces from contacting backs or edges of other units.
4. Provide Permeable Concrete Pavers using joint pattern as indicated. Adjust joint pattern at pavement edges such that cutting of edge pavers is minimized. Cut all pavers exposed to vehicular tires no smaller than one-third of a whole paver.

5. Use string lines or chalk lines on Permeable Setting Bed aggregate to hold all pattern lines true.
6. Place units hand tight against spacer bars. Adjust horizontal placement of laid pavers to align straight.
   a. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
7. Provide space between paver units of 1/32 in. (1 mm) wide to achieve straight bond lines.
8. Do not exceed joint (bond) lines more than ±1/2 in. (±15 mm) over 50 ft. (15 m) from string lines.
9. Fill gaps between units or at edges of the paved area that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
10. 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.
11. Do not allow traffic on installed pavers until Permeable Joint Aggregate has been vibrated into joints. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and Permeable Joint Aggregate material. .
12. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a to 5000-lbf (22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
    a. After edge pavers are installed and there is a completed surface.
    b. Compact installed concrete pavers to within 6 feet (1,800 mm) of the laying face before ending each day's work. Cover pavers that have not been compacted and leveling course on which pavers have not been placed, with nonstaining plastic sheets to prevent Permeable Setting Bed Aggregate from becoming disturbed.
13. Protect face mix Concrete Paver surface from scuffing during compaction by utilizing a urethane pad.
14. Remove any cracked or structurally damaged pavers and replace with new units prior to installing Permeable Joint Opening Aggregate material.
15. Provide, spread and sweep Permeable Joint Opening Aggregate into joints immediately after vibrating pavers into Permeable Setting Bed course until full. Vibrate pavers and add Permeable Joint Aggregate material until joints are completely filled, then remove excess material. This will require at least 4 passes with a plate compactor.
16. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage). Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.
17. Remove excess Permeable Joint Aggregate broom clean from surface when installation is complete.

3.04 FIELD QUALITY CONTROL

A. Verify final elevations for conformance to the drawings after sweeping the surface clean.
   1. Do not deviate final surface tolerance from grade elevations more than ±□3/8 in. (±10 mm) under a 10 ft (3 m) straightedge or indicated slope, for finished surface of paving.
B. Set surface elevation of pavers 1/8 in. (3 mm) above adjacent drainage inlets, concrete collars or channels.
C. Lippage: No greater than 1/8 in. (3 mm) difference in height between Permeable Concrete Pavers and adjacent paved surfaces.

3.05 REPAIRING, CLEANING AND SEALING
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. Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed paver surfaces; wash and scrub clean.
   1. Clean Permeable Concrete Pavers in accordance with the manufacturer's written recommendations.
C. Seal as indicated.
   1. Apply Sealer for Permeable Concrete Pavers in accordance with the manufacturer's written recommendations.

3.06 PROTECTION
A. Protect completed work from damage due to subsequent construction activity on the site.

3.07 PERMEABLE JOINT AGGREGATE MATERIAL REFILLING
A. Remove all debris from joint and provide additional Permeable Joint Aggregate material after 60 days after date of Substantial Completion/Provisional Acceptance.
   1. Fill Permeable Joint Aggregate material full to the lip of the paver.

3.08 LIFE CYCLE ACTIVITIES
A. Paver cleaning: Clean Permeable Concrete Pavers as needed to remove staining, dirt, debris, etc.
   1. Clean per manufacturers recommendations.
B. Maintenance: Permeable Joint Aggregate Material.
   1. Annually inspect Permeable Joint Aggregate material for areas clogged with debris.
   2. Vacuum or sweep as necessary to restore surface infiltration.
   3. Remove debris by vacuuming or sweeping Permeable Joint Aggregate
      a. Replenish removed Permeable Joint Aggregate material with clean aggregate material flush to paver lip.
      b. Sweep excess material from paver surface.

END OF SECTION

32 31 19

STEEL ORNAMENTAL FENCE SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. Steel ornamental fence, 42” (with post plates)

B. Related Work:
1. Section - Earthwork
2. Section – Concrete

1.02 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Steel Ornamental Fence, 42 inch
1. Basis of Measurement: By linear foot.
2. Basis of Payment: Includes furnishing and installing fence sections bolted on standup concrete curb, complete. (stand up concrete curb paid for separately)
3: Product Information: Montage Plus by Ameristar, 3 rail, 42” ht with post plates for surface mounting.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
- ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- ASTM D523 - Test Method for Specular Gloss
- ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.04 SUBMITTALS

The manufacturer’s literature shall be submitted prior to installation.

1.05 QUALITY ASSURANCE

A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.06 PRODUCT HANDLING AND STORAGE

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.07 PRODUCT WARRANTY

A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufactures warranty shall be guaranteed for five (5) years from date of original purchase.

PART 2 - MATERIALS

2.01 MANUFACTURER

A. The fence system shall conform to Montage Plus standard picket *Welded and Rackable* (Ornamental Steel Majestic design, extended picket bottom rail treatment, 3-rail style manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma.

2.02 MATERIAL

A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft^2 (184 g/m^2), Coating Designation G-60.

B. Material for pickets shall be 3/4” square x 18 Ga. tubing. The rails shall be steel channel, 1.5” x 1.4375” x 14 Ga. Picket holes in the rail shall be spaced 4.675” o.c. for standard picket space. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

2.03 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned

pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly.

C. The manufactured panels and posts shall be subjected to an inline electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 (Note: The requirements in Table 2 meet or exceed the coating performance criteria of ASTM F2408).

D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

E. OMIT: Gates shall be fabricated using fusion welded ornamental panel material and 1-3/4" sq. x 14ga. gate ends. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

PART 3 - EXECUTION

3.01 PREPARATION

A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 INSTALLATION

A. Fence post shall be spaced according to Table 3, plus or minus ¼". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 FENCE INSTALLATION MAINTENANCE

A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 CLEANING

A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

Table 1 – Minimum Sizes for Montage Plus Posts		
Fence Posts	Panel Height	
2-1/2" x 16 Ga.	Up to & Including 6' Height	
Gate Leaf	Gate Height	
	Up to & Including 4'	Over 4' Up to & Including 6'
Up to 4'	2-1/2" x 14 Ga.	3" x 12 Ga.
4'1" to 6'	3" x 12 Ga.	3" x 12 Ga.
6'1" to 8'	3" x 12 Ga.	4" x 12 Ga.

Table 2 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60˚ Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Montage Plus – Post Spacing By Bracket Type						
Span	For CLASSIC, GENESIS, MAJESTIC, & WARRIOR 8' Nominal (91.95" Rail)					
Post Size	2-1/2"	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Montage Plus Universal (BB112)	Montage Plus Line Blvd. (BB114)	Montage Plus Flat Mount (BB111)		Montage Plus Swivel (BB113)*	
Post Settings ± 1/4" O.C.	95"	95"	95"	95-1/2"	*95"	*95-1/2"
*Note: When using BB113 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.						

END OF SECTION

SECTION 32 32 23

CONCRETE SEGMENTAL FREESTANDING WALL

PART 1 GENERAL

1.01 Summary

A. The work covered by this section includes the furnishing of all labour, materials, equipment, and incidentals for the design, inspection, and construction of a modular concrete Segmental Freestanding Wall ("SFW"). The work included in this section consists of, but is not limited, to the following:

1) Review of the site conditions with respect to suitability of the SFW Design.

2) Inspection of all construction operations and materials related to the SFW.

3) Excavation and foundation soil preparation.

4) Furnishing and placement of the Levelling Base.

5) Furnishing and placement of SFW units.

1.02 Unit Price – Measurement and Payment

A. Concrete Segmental Freestanding Wall
1) Basis of Measurement: by Lineal Foot
2) Basis of Payment: Includes segmental freestanding wall Track Backer units, Facia panels, closed-end facia corner panels, universal base units, custom precast concrete caps, aggregate base courses, and all tools, labor, and equipment necessary for installation.

1.03 Related Work

A. Section 04 72 00 – Architectural Precast Concrete

B. Section 31 10 00 – Site Clearing and Removals

C. Section 31 22 13 – Rough Grading

1.04 Reference Standards

A. Segmental Retaining Wall Design

1) Design Manual for Segmental Retaining Walls, National Concrete Masonry Association, Second Edition which will be referred to as the "NCMA Design Manual"

B. Segmental Retaining Wall Units

1) ASTM C140, "Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units"

2) ASTM C1262, "Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units"

3) ASTM C1372, "Standard Specification for Dry-Cast Segmental Retaining Wall Units"

4) ASTM D6638, "Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks)"

5) ASTM D6916, "Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks)"

1.05 Delivery, Material Handling, and Storage

A. The Installer shall check all materials delivered to the site to ensure that the materials specified in the Construction Documents have been received and are in good condition.

B. The Installer shall store and handle all materials in accordance with manufacturer's recommendations and in a manner to prevent deterioration or damage due to moisture, temperature changes, contaminants, handling, or other causes.

1.06 Submittals

A. Product Data: Submit manufacturer's complete technical data sheets for specified product.

B. Physical samples of specified color and finish of facia panels.

1.07 Segmental Retaining Wall System

A. Unilock U-Cara Multi-face Wall System

B. Facia Color: Natural Blend

C. Facia Finish: Smooth Face

D. Contact: Jason Stafford, Territory Manager – Unilock Michigan, Inc.

1) Office: 248-437-7037

2) Mobile: 616-889-4669

Or approved equal

PART 2 MATERIALS

2.01 Material Requirements

A. All approved products will be identified in the Construction Documents. No substitutions will be allowed unless approved in writing by the Landscape Architect.

B. The SFW units will be specified in the Construction Documents which shall include the manufacturer's name, product name, dimensions, color, and finish. Additionally the SFW units must:

1) Meet the minimum standard as defined by ASTM C1372 for:

a) Strength

b) Absorption

c) Freeze-Thaw durability

d) Permissible variation in dimensions

e) Finish and Appearance

2) Meet the physical properties listed below as tested using ASTM C140:
   a) Dimensional tolerance shall be +/- 3 mm (1/8 in.) for height, width, and length.
   b) The minimum 28-day compressive strength of 35 MPa (5000 psi).
   c) The maximum moisture absorption shall be 1.0 kN/cubic m (6.5 lbs/cubic ft).

B. Levelling Base

1) The levelling base material shall be non-frost susceptible, well-graded, compacted angular gravel-sand mixture (GW as per ASTM D2487).
2) Additional information may be required which could include:
   a) Effective friction angle (direct shear or triaxial)
   b) Soil gradation curve (ASTM D422)
   c) Soil pH (ASTM D4972)
   d) Permeability coefficient “Q”
   e) Potential for consolidation

PART 3 EXECUTION

3.01 Construction

A. Site Preparation

1) Comply with all current Federal, Provincial/State, and local regulations for execution of the work, including local building codes and excavation regulations. Provide excavation support as required to maintain stability of the area during excavation and SFW construction and to protect existing structures, utilities, landscape features, property, or improvements.
2) Prior to grading or excavation of the site, confirm the location of the SFW and all underground features, including utility locations within the area of construction. Ensure surrounding structures are protected from effects of SFW excavation.
3) Coordinate installation of underground utilities with SFW installation.
4) Control surface water drainage and prevent inundation of the SFW construction area during the construction process.
5) The Foundation Soil shall be excavated or filled as required to the grades and dimensions shown in the Construction Documents.

B. Leveling Base or Spread Footing Placement

1) The Leveling Base shall be the specified material placed in the location to the dimensions shown in the Construction Documents.

C. Installation of Segmental Freestanding Wall Units

1) The bottom row of SFW Units shall be placed on the Leveling Base as shown in the Construction Documents. The units shall be placed in the middle of the Leveling Base. Care shall be taken to

ensure that the SFW Units are aligned properly, leveled from side to side and front to back, and are in complete contact with the Leveling Base.

2) The SFW Units above the bottom course shall be placed to interconnect as specified in the manufacturer's written installation instructions.

3) The SFW Units shall be swept clean before placing additional courses to ensure that no dirt, concrete, or other foreign materials become lodged between successive lifts of the SFW Units.

4) Successive courses shall be placed to create a running bond pattern with the edge of all units being approximately aligned with the middle of the unit in the course below it. Cut SFW Units may need to be placed to ensure the vertical line between adjacent SFW Units remains within the middle third of the SFW Unit below.

5) Repeat until the grades indicated in the Construction Documents are achieved.

D. Secure Coping

1) The Coping Adhesive may not be required as indicated in the Construction Documents.

END OF SECTION

SECTION 32 84 00

DESIGN/BUILD PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Design of 100% head-to-head coverage irrigation system, including comprehensive engineering analysis by a Certified Irrigation Designer, using performance requirements and design criteria indicated.
2. Trenching.
3. Pipe and fittings.
4. Valves.
5. Sprinklers, outlet heads, bubblers and accessories.
6. Control system, vacuum breaker, accessories.
7. Power connections.

B. Related Sections:
1. Section 31 23 17 - Trenching: Excavating and backfilling for irrigation piping.
2. Section 32 90 00 – Landscaping.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Conduit, Irrigation, 3 inch.
1. Basis of Measurement: By Linear Foot
2. Basis of Payment: Included trenching and backfill, pipe and fittings for irrigation system conduit where required.

B. Design / Build Planting Irrigation (Including Live Walls):
1. Basis of Measurement: By Lump Sum
2. Basis of Payment: Includes all design work and installation labor to provide a complete functioning irrigation system as shown on plans, including trenching and backfill, pipe and fittings, valves, control box, vacuum breakers, electrical conduit and wiring, and accessories, hookup to power (sleeves for irrigation pipe paid for separately).

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Irrigation products (i.e.: sprinklers, valves, controllers) shall be by a single manufacturer. All irrigation system components shall be supplied by the regionally authorized distributors to provide single source responsibility for warranty service and operations to conform to specifications in all respects.

B. Contractor's Qualifications: Irrigation contractor must meet the following criteria:
   1. Irrigation contractor to have established business for a minimum of 3 years.
   2. Irrigation contractor to be insured and capable of bonding.
   3. Irrigation contractor must have previous experience installing similar size jobs.

1.4 RELATED WORK

A. Section- General
   a. Sleeving for the irrigation system (see general notes on drawing for size and type specified.)
   c. Point of connection: All plumbing up to the irrigation contractor's point of connection, to be coordinated with Owner from existing streetscape irrigation system.

1.5 JOB CONDITIONS

A. Site Conditions:
   1. The Contractor shall coordinate his work with that of other trades wherever possible.
      a. Existing Utilities and Conditions
         1. Before excavation, the Contractor shall obtain location of all cables, conduits, sewers, septic tanks, and other underground utilities, and shall be cautious as not to damage them. If such obstacles conflict with the proposed work, the Contractor shall immediately notify the owner's representative for arrangements for relocation.
         2. In the event of damage, the contractor shall repair or replace these lines to the satisfaction of the Owner's Representative.
   2. It is the Irrigation Contractor's responsibility to verify that all sleeving is installed under paving in locations as shown on Drawings.

1.6 SUBMITTALS

A. Submit shop drawings for a fully functional irrigation system providing 100% head-to-head coverage, indicating types and locations of all sprinkler heads, valves, controllers, pipe, and all other necessary equipment.

B. Submit manufacturer's data sheets for all materials (sprinkler heads, valves, controllers and pipe) and all other related items to owner's representative.

C. Submit contractor's qualification form with bid form.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All sprinkler heads, valves and controllers for this project shall be manufactured by The Toro Company, Riverside, CA. There will be no product substitutions.

2.2 MATERIALS

A. PIPE

1. PVC Pipe: All PVC pipe shall be pressure pipe as manufactured by J-M Manufacturing or Cresline Plastic Pipe Company. High-impact virgin polyvinyl-chloride (PVC-1120) conforming to NSF Standard 14 and ASTM D-2241 for thermoplastic pipe with minimum 160 PSI test strength. Pipe shall have standard thermoplastic pipe dimension ratio of SDR-26 and shall be marked or stamped every 5 feet to indicate brand, strength rating, size and standards.

2. Polyethylene Pipe: All polyethylene pipe specified on plan shall be high-density (HD) flexible, non-toxic polyethylene made from 100% virgin polyethylene material, and all sizes shall have a minimum 100 PSI working pressure rating (ASTM D2239) conforming to NSF standard for thermoplastic pipe dimension ratio of SDR-15. All polyethylene pipe shall be continuously and permanently marked with the manufacturer's name, materials, size and schedule. Pipe shall conform to the U.S. Department of Commerce Commercial Standard CS255-63-PE-3408 or latest revision thereof. Pipe shall be suitable for potable water and shall bear the "NSF" trademark.

B. PIPE SLEEVES:

1.

Pipe Size	Sleeve size	Sleeve Type
3/4 " to 1"	2-inch	PVC 160 or Sch.40 DWV pipe
1-1/4" to 1-1/2"	3-inch	PVC 160 or Sch 40 DWV pipe
2"	4-inch	PVC 160 or Sch 40 DWV pipe
2-1/2" to3 "	6-inch	PVC 160 or Sch 40 DWV pipe
4-inch	8-inch	PVC 160 or Sch 40 DWV pipe
6-inch	10-inch	PVC 160 or Sch 40 DWV pipe

(Sleeve sizes and locations are based on a single pipe being installed in a sleeve. Contractor shall verify sleeve sizes with drawing.)

C. FITTINGS

1. PVC Pipe Fittings: All fittings 1-1/2" through 3 " shall be Schedule 40 PVC solvent weld, type 1, meeting the requirements of ASTM D-2466. No saddles allowed. All 4" fittings shall be gasketed joint Harco PVC Class 200 meeting ASTM D1784 DR21 requirements. Bell shall be gasket joint conforming to

ASTM3139 with gaskets conforming to ASTM F477. Fittings 6" and larger shall be Harco Ductile Iron Fittings manufactured with a grade of 65-45-12 in accordance with ASTM A-536. Fittings shall have deep push-on joints with gaskets meeting ASTM F-477 requirements.

2. Polyethylene Fittings: All fittings 1-1/4" and smaller downstream of control valve shall be plastic or insert type fittings where applicable. All 1-1/4" fittings shall be double clamped with all stainless steel worm gear clamps. All 1" and smaller fittings shall be clamped with all stainless steel worm gear clamps or all stainless steel crimp clamps.

D. VALVES AND VALVE BOXES

1. Valves: Type and size shall be determined through the design process by the Certified Irrigation Designer

2. Valve Boxes: All valves shall be protected by a two-piece valve box assembly consisting of a removable cover and box. Enclosure shall be rigid plastic material composed of fibrous components chemically inert and unaffected by moisture, corrosion and temperature changes. Boxes shall be sized as follows:

Minimum of 10" valve box and cover shall be used for all automatic valves 1-1/2" and smaller and for all manual gate valves and quick coupling valves.

Side walls to extend at least 2 inches below the bottom of the valve body; for deep mainline appropriate extensions shall be used to reach depth of valves. Valve box shall not bear directly on pipe. Manufacturer shall be Ametek or Carson.

E. BACKFLOW PREVENTION DEVICES: Type and size as determined by Certified Irrigation Designer.

F. QUICK COUPLING VALVES: Type and size as determined by Certified Irrigation Designer.

H. SPRINKLER HEADS: Type and size as determined by Certified Irrigation Designer.

I. CONTROLLERS: Type and size as determined by Certified Irrigation Designer.

J. SOLVENT AND PRIMER:

1. Solvent and primer used on PVC pipe shall meet the requirements of ASTM D-2564 and shall be approved by the National Sanitation Foundation. All solvent and primer to be used in accordance with manufacturer's specification. Primer to be purple in color. Solvent shall be used as is from original container. No thinner shall be added to the solvent to change its viscosity. If viscosity or consistency is unsuitable, the solvent shall not be used.

K. SWING JOINTS:

1. All sprinkler heads 6 GPM or less shall be attached to the piping with two-elbow joints consisting of 3/8" flexible pipe and coordinating elbows.
2. All quick coupling valves shall be attached to the piping with a PVC three elbow swing joint assembly with a brass thread to match the inlet size of the quick coupler, Spears or Lasco.

L. WIRE AND WIRE SPLICES
1. Wire: All wire shall be 600 volt soft annealed copper, PVC insulated, UL approved, type UF. Wire sizes shall be as called for on drawing.
2. Wire splices: All 24volt wire connections shall be made using water-tight 3M DBY connectors. All field splices shall be contained in a 6" valve box.

M. SPARE PARTS
1. Provide quick coupler keys.

PART 3 - EXECUTION

3.1 LAYOUT AND STAKING

A. Piping Layout: Piping layout is diagrammatic. Irrigation contractor shall verify site conditions. Any deviations from the plan shall be approved by the owner's representative prior to installation.

B. Staking: All sprinkler heads, valves and mainline line routing shall be staked prior to installation for approval upon request of Owner's Representative.

3.2 SYSTEM DESIGN

A. Design is based on information and criteria provided by the Owner, Owner's Representative and field conditions to be verified by Certified Irrigation Designer. Any deviation from the drawing requires a written authorization by the owner's representative prior to installation. Water and pressure requirements shall be as noted on drawings and verified by the Irrigation Contractor.

3.3 TRENCHING

A. Trenches shall be excavated so that irrigation lines are installed with the following minimum depths for pipe cover:
1. All polyethylene lateral pipe: Minimum depth - 10".
2. All PVC lateral pipe 3/4" and 1": Minimum depth - 12".
3. All PVC pipe: Depth as specified below:
1-1/2" - 2" pipe size 16" cover

2-1/2" - 4" pipe size 20" cover
6" - 8" pipe size 24" cover
10" pipe size 30" cover

4. All wire:
   115V power wire - 24" or as required by code.
   24V control wire - 14" or as required by code.

B. All PVC piping shall be trenched. PVC pipe 2-1/2" and smaller may be pulled with approval of owner's representative if proper soil conditions exist and minimum depth requirements are maintained

C. Polyethylene distribution pipe may be pulled, with approval of owner's representative, if proper soil conditions and minimum depth requirements are maintained.

D. Trench excavation in excess of required depth shall have bottom graded and tamped prior to any pipe placement.

E. Where trenching of PVC or polyethylene pipe lines is not possible because of adverse soil conditions or obstructions, and backhoe operation is required, provide labor, materials and equipment for this operation, including full trench backfilling with soil if required in opinion of owner's representative. Site restoration of these areas as directed by owner's representative. It shall be a part of this contract and shall be performed in the following manner:

a. Return to grade with native soil. Backfill material shall be free from debris, including rocks, large stones, clay clumps or other unsuitable substances and care shall be taken to prevent settling and damage to pipe during and after backfilling operations. When backfilling, soil shall be tamped in 6-inchlayers with a minimum of 6 inches of acceptable soil in turf areas and 12 inches in plant bed areas.

F. Depth of sleeves shall be as noted on installation details on drawing.

G. Pavement: Where existing pavement must be cut to install irrigation system, cut smoothly in straight lines 6 inches wider than trench.
1. Excavate to required depth and width.
2. Remove cut-out pavement and excavated material from the site.
3. Backfill with dry sand fill material, placing in 6-inch lifts.
4. Repair or replace pavement cuts with equivalent materials and finishes.
5. At walkways, jack piping under paving material, if possible.

3.4 INSTALLATION

A. GENERAL: Unless otherwise indicated, comply with requirements of Uniform Plumbing Code.

B. PIPING:
1. All mainlines and headers shall be kept to a minimum to 2 feet from all existing or proposed trees.
2. Polyethylene pipe connections shall be made with insert fittings held tightly in place and larger in diameter shall be double clamped.
3. PVC pipe shall be laid on solid undisturbed soil or on thoroughly compacted full bed of sand so as to assure full bedding, proper alignment and minimum slope for drainage.
4. PVC pipe ends and PVC fittings shall be thoroughly cleaned for full depth of fitting with liquid cleaner cement. Method of application shall be in accordance with manufacturer's recommendations for solvent weld connections.
5. Lay pipe on solid sub-base, uniformly sloped without humps or depressions.
6. At wall penetrations, pack the opening around pipe with non-shrink grout. At exterior face, leave perimeter slot approximately 1/2 inch wide by 4/5 inch deep. Fill this slot with backer rod and an acceptable elastomeric sealant.
7. Install PVC pipe in dry weather when temperature is above 40 degrees F (4 degrees C) in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperature above 40 degrees F (4 degrees C) before testing, unless otherwise recommended by manufacturer.

C. Connection to Water Source: Point of connection shall be as indicated on drawings. Contractor shall verify point of connection with landscape architect or owner's representative.

D. Cross Connection Protection: Install according to state and local plumbing codes. All piping shall be galvanized steel pipe or copper pipe.

E. Sprinkler Heads: Flush circuit lines with full head of water and install heads after flushing is complete.
1. Install lawn heads at manufacturer's recommended heights.
2. Install shrubbery heads flush with grade as indicated on drawing.
3. Locate part-circle heads to maintain minimum distance of 4 inches from walls and 2 inches from other boundaries, unless otherwise indicated.
4. All irrigation heads shall be installed on swing joints or as specified on drawing.
5. All nozzles shall match sprinkler head manufacturer.

F. Dielectric Protection: Use dielectric fittings at connections where pipes of dissimilar metals are joined.

3.5 THRUST BLOCKS

A. Provide concrete thrust blocks on thrust side of mainline pipe wherever pipe changes direction at tees, bends, or dead ends, and at any other location where thrust is to be expected.

B. Refer to pipe manufacturer's recommendations for type and method of thrust blocks.

3.6 TESTING AND INSPECTION

A. The Owner's authorized representative shall be responsible for inspection of the Contractor's work while such work is in progress. The Contractor will be notified of any work which does not meet the installation instructions and will be required to correct such work.

B. Upon completion of construction, the contractor will test the entire system under the normal working conditions. Upon visual inspection of the ground, should any leak be found, it shall be promptly repaired. All components will be checked for proper operation. Any malfunctioning equipment or leak shall be repaired and retested until it is in satisfactory working condition.

3.7 BALANCE AND ADJUSTMENT

A. Contractor shall balance and adjust various components of sprinkler system to maximize performance and efficiency. This includes synchronization of controllers, adjustments to pressure regulators, pressure relief valves, part circle sprinkler heads, individual station adjustments, and any other adjustments necessary to obtain optimum performance of system.

B. The contractor shall flush all lines and evacuate all air and debris from the system.

3.8 DRAWINGS OF RECORD/ OWNER'S MANUAL

A. Drawings of record: After completion of system and before final payment, contractor shall furnish to owner a reproducible copy of a drawing of record of the entire system showing accessory components (if applicable), sprinkler heads, valves, drains, controllers and pipelines to scale with dimensions where required.

B. Owner's Manual: After completion of the system and before final payment, contractor shall provide to the owner, instruction sheets including maintenance and operations manual and parts lists covering all operating equipment that shall be bound into a folder and furnished to the owner. Contractor shall also provide all necessary special tools for maintaining the system.

3.9 MAINTENANCE, GUARANTEE AND WARRANTY.

A. After completion, testing and acceptance of the system, instruct owner in the operation and maintenance of the system. Following acceptance, thoroughly flush and drain the system for winter, and in the following spring, put the system into operation at no additional expense to the owner.

B. For a period of 1 year from the date of final acceptance of work on the contract, contractor shall provide a labor warranty to promptly furnish and install, without cost to the owner, any and all parts which prove defective in material or workmanship.

C. A full 2-year manufacturer's warranty on all sprinkler heads, electric valves and controllers shall be provided by the Irrigation Contractor. Any part proven to be defective within the 2 year warranty period shall be replaced with no cost to the owner for parts. After the 1 year labor warranty has expired, the owner shall be responsible for the labor to replace defective sprinkler heads, electric valves or controllers.

D. Pipe warranty installation data form shall be filled out and forwarded to the company and warranty presented to the owner after completion and prior to payment.

END OF SECTION

32 90 00

LANDSCAPING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Plantings
2. Planting soils
3. Mulch
4. Pea Stone / Bonding Agent

1.02 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Plantings

1. Basis of Measurement: By Each, of the specified type.

2. Basis of Payment: Includes procurement, review, transport and installation of plants and accessories.

B. Planting Soil Mix

1. Basis of Measurement: By Cubic yard, measured in place

2. Basis of Payment: Includes procurement and installation and settling of planting soil in curbed planters, planter pots and tree grate pits for new trees. Includes fertilizer, inoculant, pre-emergent herbicide, and soil separator fabric where required.

C. Shredded Hardwood Mulch, 3” depth

1. Basis of Measurement: By Square yard

2. Basis of Payment: Includes procurement and installation of mulch in all shrub beds and tree grate pits for new trees (6 total), excluding raingardens. (mulch rings around trees is included in payment for the tree)

D. Pea Stone / Gravel-Lok Bonding Agent

1. Basis of Measurement: By Cubic yard, measured in place

2. Basis of Payment: Includes procurement and installation of pea stone and bonding agent specified on drawings in all sidewalk tree openings for new trees and existing trees to remain.

E. Landscaping Maintenance

1. Basis of Measurement: By Lump Sum

2. Basis of Payment: Includes watering, weeding, fertilizing, inspection and plant health monitoring, and cleanup of planting beds and plants throughout the maintenance period, and special warranty.

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1.03 SUBMITTALS

A. Product data in the form of manufacturer's technical data, product tags or proof of purchase/verification, soil tests are required to be provided by Contractor.

1.04 QUALITY ASSURANCE

A. Landscape Installer Qualifications: Engage an experienced Installer who has successfully completed Landscape installation work of similar scope and quality.

1.05 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required. Contractor to stake or paint on ground plant grouping locations for Landscape Architects approval prior to planting. Give at least 2 days notice to Landscape Architect.

1.06 SUBSOIL PREPARATION

A. Contractor shall review the site for subsoil compaction problems prior to beginning his work and notify owner if subsoil compaction exceeds 90%.

PART 2 – PRODUCTS

2.01 PLANTING SOIL MIX

A. Gradation: Friable loam, consisting of natural loam, sandy loam, silty loam, or clay loam humus-bearing soils adapted to support plant life.
B. Purity: Material shall be screened and free of roots, rocks larger than ½ inch, subsoil, debris, weeds, soil clumps larger than 1 inch, and foreign matter.
C. Acidity range: pH of 5.5 to 7.5.
D. Organic Matter: Minimum of 4 percent and maximum of 25 percent organic matter.
E. Decaying matter: No greater than 5 percent of total content by volume.

2.02 PLANTINGS

A. Plant material shall conform to the guideline standards for name, shape and quality established by the "Standardized Plant Names", 1942 Editor, American Joint Committee on horticultural Nomenclature and the "American Standard for Nursery Stock", 1990 Edition, American Association of Nurserymen. Tree caliper measurements shall be taken at a point on the trunk 6 inches above natural ground

line for trees up to and including 4 inches caliper size and at a point 12 inches above the natural ground line for trees greater than 4 inch caliper. If a range of sizes is given, no plant shall be less than minimum size and no less than 50% of the plants shall be as large as the average size specified. No change in quality, species, variety or sex of plants from those specified will be permitted without the written approval of the Landscape Architect.

B. Plant materials specified "BB" shall be adequately balled and burlapped with firm and natural earth balls not less than dimensions specified in AAN Standards and of sufficient depth to incorporate all fibrous and feeding roots. Container grown plants of specified quality and proper size of balls may be used, as approved by the Landscape Architect.

C. All plant materials shall be labeled with durable, waterproof, legible labels starting with the correct name.

D. Plant materials shall be freshly dug vigorous plants of specimen quality, exceptionally heavy, symmetrical, thickly branched, tightly knit plants, true to species and variety and conforming to the measurements specified in Plant Lists. All plants shall be free of disease, insect pests, eggs and larvae, and shall have healthy, well-balanced and thickly developed root system, and shall be matched specimens from a single block source and shall not be pruned before delivery.

2.03 FERTILIZER FOR PLANTINGS

A. Fertilizer for planting trees, shrubs and ground cover shall be a 5% nitrogen, 10% phosphorous and 5% potash commercial fertilizer, applied and mixed at a rate of not less than 0.25 pounds per cubic foot of soil and humus.

2.04 PRE-EMERGANT HERBICIDE

A. Eptam 5 or Approved Equal as recommended for site conditions

2.05 MULCH

A. Mulch shall be finely shredded hardwood bark, free of sticks and foreign material. Before purchasing, a representative sample of material shall be submitted to the Landscape Architect for approval.

B. Finely ground mulch shall be double ground finely shredded hardwood bark for use around annuals and small plants.

2.06 STAKES (limited use)

A. Stakes for tree installation shall be of new, sound wood of uniform size, free of knots, at least 2" X 2" X 6' long or as detailed and guyed with #11 gauge galvanized steel wire or 3/16" diameter, 7 strand cadmium plated cable which shall be run through 2 ply, ¾" diameter reinforced rubber hose.

2.07 TREE WRAP

A. Tree wrap shall be a standard wrapping material, manufactured as an arboricultural tree wrapping paper with crepe surface, brown in color and with two layers

cemented together by asphaltum. Wrap shall be secured to plants with twine, or a weather tolerant tape or equal, as approved by the Landscape Architect.

2.08 SOIL SEPARATOR FABRIC:

A. Soil separator fabric shall be a non-woven spun-bonded polypropylene spun from continuous filaments and thermally bonded. Fabric shall be TYPAR Landscape Fabric #3201 (Standard Duty).

2.09 INOCULANT

A. Blend of natural nutrients plus mycorrhiza spores, organic composts, humus, extracts, etc. Inoculant shall be M-ROOTS as manufactured by Roots Inc.; Independence, MO; and as distributed by J. Mollema & Sons, Inc., Grand Rapids, MI; Ph: 616-541-3000.

2.10 PEA STONE AND BONDING AGENT

A. See drawings.

PART 3 – EXECUTION

3.01 STORAGE AND DELIVERY OF PLANT MATERIAL

A. All plants not planted immediately after delivery shall be stored in a shaded protected area. Root balls shall be covered with an acceptable material to prevent, drying, freezing or submersion of the roots.

B. Plants shall be delivered in closed or covered vehicle to prevent plant injury.

C. All evergreens and deciduous plant material shall have anti-desiccant spray applied to above-ground parts prior to digging.

3.02 EXISTING VEGETATION PROTECTION

A. Existing plants to remain, as shown on the plans and/or indicated by field inspection shall be protected from soil compaction and other damage during the planting and construction operations. Care will be taken by the Contractor to work in and from open areas to avoid contact with the existing trees and the root feeding areas. The Contractor is responsible for repair of all damage and in the case of extreme damage shall replace the plant with a specimen nursery grown plant as similar in size as possible to the destroyed plant as directed by the Landscape Architect. Compaction of soils caused by these planting operations within root feeding areas will be loosened or repaired as directed by the Landscape Architect.

3.03 PLANTING PROCEDURES

A. TIMING OF OPERATIONS: Transplanting installations shall occur with in the following calendar scheduled:

1. Deciduous trees and shrubs: transplant September 10 through June 1.
2. Evergreen trees and shrubs: transplant September 20 to June 1.
3. Ground cover and perennial plants: transplant March 31 through June 1.
4. No transplanting or planting operations shall occur while soil is excessively wet or is frozen.

B. INSPECTION: Contractor shall inform Landscape Architect 48 hours minimum prior to placement of plantings for inspection of plant materials.

C. LOCATION: The location of all plants and outline of the planting areas shall be staked or visibly marked on the ground for approval by the Landscape Architect.

D. INSTALLATION:

1. Scarify subgrade soils to a depth of 6 inches before placing planting soil mix.

2. Place planting soil mix in designated areas to the specified grade. Fine grade surface of planting soil.

3. Tree pits shall be excavated 16” greater in diameter (minimum) than the root ball or the spread of tree roots. Shrub pits shall be excavated 8” larger (minimum) than the root mass. In all cases the pit depth shall be only as deep as necessary to set the root ball on firm soil to meet finished grade. Root ball shall be planted at same depth as nursery conditions, unless otherwise approved. Contractor shall not leave any plant hole open or unattended where it will present a hazard to pedestrians or vehicles. If planting pit must be left open it shall be covered and have barriers or signals.

4. All plants shall be planted in the soil mixture as specified, backfilled in 6” layers, and then thoroughly settled by deep watering. No material in frozen or muddy conditions shall be used for backfilling plants pits. Plant foot tablets shall be placed as specified herein.

5. All ground cover plants and perennial plants shall be placed in rows, each being space in a checkerboard, i.e. alternating centers pattern, spaced as specified on the drawings.

6. The finished level of the soil in newly planted areas shall be such that when the backfill is settled and the mulch applied, the top of the mulch shall be not more than (1") one inch above the surrounding finished grades.

E. FERTILIZATION

1. Planting tablets shall be placed in quantity and location according to manufacturer's instructions and recommendations. Granular plant food shall be applied to the surface of the plant beds including the ground cover beds, which does not contain the planting tablet. The plant food shall be spread over the root area starting six inches from the trunk and extending to the drip line of each plant or to the outer edge of the plant bed, which ever is larger, at the rate of two pounds (2 lbs.) per 100 square feet.

F. STAKING and WRAPPING

1. All trees shall be protected by tree stakes or by guying, as detailed on the drawings, using specified materials. Stakes shall be driven vertically, not closer to the trunk of the tree than sixteen (16) inches and at sufficient distance from the tree to avoid piercing the roots or plant ball, yet remain in the mulched areas.

2. Each tree shall be staked immediately following its planting, watering and determination that it will settle to the proper grade. Plants shall stand plumb after staking.

3. Contractor shall obtain Landscape Architect's approval of tree trunk condition PRIOR TO wrapping tree trunks. Wrap trunks of deciduous trees with a spiral wrapping with thirty percent (30%) overlap to a minimum height above the first branch. Wrap from base up and tie wrapping securely every 12 inches. DO NOT WRAP BIRCH TREES.

4. The Contractor shall prune plants only at time of planting to remove damaged branches, dead wood, suckers, broken, or badly bruised branches after consultation with Landscape Architect. Excessively damaged or improperly pruned plants will not be acceptable.

G. SAUCER FORMATION: A topsoil saucer, compacted to hold water, shall be constructed for all individual trees and shrubs. No soils in frozen or muddy condition shall be used for constructing saucers.

1. Trees: An earth saucer 4" high and 8' wide above finished grade shall be formed inside the outer edge of each tree pit after the backfill has been brought to finished grade and settled, unless otherwise detailed.

2. Shrubs: After the backfill around the shrubs has been brought to finish grade level and settled, a topsoil earth saucer 3" high and 6" wide shall be formed inside

the outer edge of each shrub pit or around the perimeter of the entire shrub bed if approved by the Landscape Architect.

H. MULCHING

1. After the plants have been watered, backfilled and allowed to settle for twenty-four hours and saucers constructed, the mulch shall be applied.

2. Trees and shrubs shall be mulched with 3" deep layer of bark mulch, all within the saucer. Mulch shall not be placed in direct contact with tree trunk.

3. Ground and cover plantings shall be mulched with 2" deep layer of bark mulch.

4. Shrubs and ground covers shall be bedded by creating a bed outline 6" outside the drop line of the shrub. The outline shall be cut perpendicular to the lawn level. Any existing grass within this bed outline shall be removed at least 3" deep to prevent grass growth. Then the bed shall be mulched with 3" deep layer of bark mulch.

I. SPADE-DUG PLANT MATERIAL

1. Contractor may use spade-dug plant material for planting trees provided the tree spade is 44" minimum for trees not greater than 5" caliper or 66" minimum for trees not greater than an 8" caliper.

J. PRE-EMERGENT HERBICIDE

1. Plant beds shall be treated with pre-emergent herbicide on March 1, June 1 and September 1 (for the duration of the landscape construction and prior to substantial completion) as required and as recommended by the manufacturer.

K. INOCULANT APPLICATION

1. Apply per manufacturer's recommendations for application rate and placement to ALL newly-planted trees, shrubs and perennials/ground covers.

L. CLEANUP

1. Contractor shall maintain safe and net conditions on the site. The ground shall be leveled of all debris, of all unnecessary materials and all equipment which shall be entirely removed from the public traffic ways when not being used to the satisfaction of the Landscape Architect. All paved areas shall be maintained to be free of any dirt at the end of each workday.

M. MAINTENANCE

1. Maintenance period shall begin immediately after each plant is planted and continue until two months after Substantial Completion of the entire project. When full maintenance period has not elapsed before end of the growing season,

or if plants are not fully established at that time, the balance of the maintenance period shall extend into the next growing season.

2. Contractor shall maintain all beds and plantings in a healthy growing condition by spraying, pest control, weeding, cultivating pits and beds where needed, replacing displaced mulch basins, plant beds, resetting stakes, tightening guy wires, replacing flags, etc.

3. Watering of plant material shall be the Contractor's responsibility throughout the maintenance period and includes the coordination of access to mains, irrigation systems or other related supply facilities. This work shall maintain a finished quality appearance and healthy plantings.

PART 4 – WARRANTY

4.01 GENERAL

A. The special warranty specified herein shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under the requirements of the Contract Documents.

4.02 INITIAL ACCEPTANCE

A. The Landscape Architect shall inspect all work for acceptance upon written request of the Contractor at the completion of the initial planting installation. The request shall be received at least five (5) calendar days before the anticipated date of inspection.

B. Acceptance of plant material by the Landscape Architect will be based on general conformance to the project design only and shall not relieve the Contractor of responsibility for full conformance to the specifications including maintenance.

C. Upon finding the work to be in general conformance with the project design, including apparent healthy condition of all plants, the Landscape Architect or Architect will provide a certificate of substantial completion.

4.03 WARRANTY PERIOD

A. The warranty period for all plantings shall begin upon issuance of a certificate of substantial completion. The guarantee periods shall be as follows:

1. Trees less than 4" caliper as called for on plant list shall be guaranteed one year.
2. Trees 4" caliper and greater shall be guaranteed for two years.
3. Shrubs (all sizes), ground covers and perennial shall be guaranteed for one year.
4. Ground covers and perennials shall be guaranteed for one year.

4.03 INSPECTIONS

A. During the last month of the warrantee period, the Contractor shall inspect all plantings with the Landscape Architect present to identify any dead plants.
B. Owner and Landscape Architect may inspect plants at any time during the warranty period.
C. Plants are determined to be dead when one third of the branching structure is dead.

4.02 REPLACEMENT OF PLANTINGS

A. If at any time during the warranty period plants are found to be dead, Contractor shall replace dead plants within 7 days of receiving notice or at earliest arrival of appropriate planting season.

B. Replacement plantings shall be made in accordance with original specifications.

C. When replacements have been made and are in compliance with specifications, the requirements for planting under this contract are considered fulfilled. A limit of one replacement of each plant will be required, except for losses or replacements due to failure to comply with requirements.

END OF SECTION

SECTION 32 91 19

LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Provision of new topsoil
   2. Final grade topsoil for finish turf areas.
   3. Soil testing.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading.
   2. Section 31 23 17 - Trenching.
   3. Section 32 92 19 - Seeding.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Topsoil Surface, 6 inch.
   1. Basis of Measurement: By square yard.
   2. Basis of Payment: Includes supplying topsoil materials, stockpiling, preparing and scarifying substrate surface, placing where required to the specified depth, and rolling.
   3. Basis of Application: This pay item shall apply where topsoil is used to prepare for turf establishment (lawn areas). Soil used in planting beds shall be paid for according to section 32 90 00.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures

B. Samples: Submit, in air-tight containers, 5 lb sample of topsoil to testing laboratory.

C. Testing Report: Submit to Owner the laboratory testing report with nutrient and pH levels with recommended soil supplements and application rates.

1.4 QUALITY ASSURANCE

A. Furnish topsoil and planting soil material from single source throughout the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:

1. Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth and free from subsoil, stumps, roots, brush, stones (2 inches or more in any dimension), clay lumps, brush and noxious weeds. Topsoil shall be classified as a loam, silt loan, silty clay loam, or clay loam, as determined from the Bureau of Plan Industrial, Soils and Agriculture Engineering, USDA triangular soil texture chart and shall have a PH range of approximately 5.5 to 7.5, unless otherwise specified when tested in accordance with the current methods of testing of the Association of Official Agriculture Chemists. The organic content shall not be less than 3% nor more than 20% as determined by the wet combustion method (chromic acid reduction) test.

2.2 SOURCE QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements: Testing, inspection and analysis requirements.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

D. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify all utility construction is complete.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

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

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

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, and stones, in excess of 1/2 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil to nominal depth of 6 inches. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material and buildings to prevent damage.

E. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage. Make all grade changes gradual.

F. Lightly compact placed topsoil with smooth roller not exceeding 100 lbs per linear foot.

G. Remove surplus subsoil and topsoil from site.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus 1/2 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Prohibit construction traffic over topsoil.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fertilizing.
2. Seeding.
3. Mulching.
4. Watering.
5. Mowing.
6. Weed Control.
7. Maintenance.

B. Related Sections:
1. Section 32 91 19 - Landscape Grading

1.2 PRICE AND PAYMENT PROCEDURES - UNIT PRICES

A. Seed:
1. Basis of Measurement: Square Yard
2. Basis of Payment: Includes supplying seed and fertilizer, spreading, applying, rolling, and raking; supplying and installing mulch blanket, staking, and light topsoil dressing; watering of seeded areas to aid in seed germination and growth; mowing, trimming, removing clippings, and repairing damage; supplying herbicide to control the growth of weeds and applying at the appropriate rate.

1.3 REFERENCES

A. Definitions:
1. Weeds: Any plant species other than the specified species, including but not limited to Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

B. Reference Standards:
1. ASTM International:
a. ASTM C602 - Standard Specification for Agricultural Liming Materials

1.4 ADMINISTRATIVE REQUIREMENTS

A. Scheduling: Schedule fertilizing, seeding, and mulching to occur concurrent with landscape grading. Cover topsoil with mulch blanket on the same day that topsoil is placed.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit pertinent data for seed mix, fertilizer, mulch blanket, and other accessories.

C. Manufacturer’s Installation Instructions:
   1. Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify materials and products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height, types, application frequency, and recommended coverage of fertilizer.

C. Submit recommended type, application frequency, and recommended coverage of fertilizer.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Seed Supplier: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   2. Installer: Company specializing in performing work of this section with minimum three years documented experience, approved by Owner.
   3. Herbicide Applicator: Individual licensed in the State of Michigan and certified by the Michigan Department of Agriculture in the required category.

B. Certifications: Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

C. Single Source Responsibility: Furnish each product from single source throughout the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product Delivery Requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 AMBIENT CONDITIONS

A. Place permanent seed from April 15 through October 10.

B. Place dormant seed after November 15, but not on frozen ground.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Seed Mixture:

Species	Minimum Purity (%)	Germination (%)	Mixture Proportions (% by weight)
Kentucky Blue Grass	98	85	10
Perennial Ryegrass	96	85	20
Hard Fescue	97	85	20
Creeping Red Fescue	97	85	40
Fults Salt Grass	98	85	10

2.2 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil according to soil analysis. When soil analysis is not available, use a water soluble fertilizer containing a 1:1:1 ratio of nitrogen,

phosphorous, and potassium nutrient. Ensure fertilizer components include urea, diammonium phosphate, and potassium chloride.

C. Lime: ASTM C602, Class T or Class O agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

E. Mulch Blanket: 100 percent straw fiber matrix stitched with biodegradable thread to a biodegradable natural fiber top net.
   1. Products:
      a. North American Green: S75BN.
      b. Substitutions: Section 01 60 00 - Product Requirements: Product Substitution Procedures.

F. Herbicide: Suitable for elimination of weeds and harmless to grass species specified.

G. Stakes:
   1. As recommended by mulch blanket manufacturer for site conditions.
   2. Biodegradable materials only, metal stakes prohibited.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify utility work and improvements are complete.

C. Verify mailbox relocation is complete.

D. Verify prepared topsoil is ready to receive the Work of this section.

3.2 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 4 inches of soil.

B. Apply fertilizer at application rate recommended by soil analysis. When soil analysis is not available, apply fertilizer at the required rate to provide 48 pounds of nitrogen, 48 pounds of phosphorus, and 48 pounds of potassium nutrient per acre.

1. Apply after smooth raking of topsoil and prior to roller compaction.
2. Do not apply fertilizer at same time or with same machine used to apply seed.

C. Mix fertilizer thoroughly into upper 2 inches of topsoil.

D. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Apply seed at rate of 5 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.
1. Do not seed areas in excess of that which can be mulched on same day.
2. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

B. Roll seeded area with roller not exceeding 112 lbs. per linear foot.

C. Immediately following seeding and compacting, install mulch blanket. Maintain clear of shrubs and trees.

D. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.4 SEED PROTECTION

A. Cover seeded areas with mulch blanket. Use mulch blanket for slopes 1 vertical to 4 horizontal or flatter. Use mulch blanket, high velocity for slopes steeper than 1 vertical to 4 horizontal and for open channels.
1. Roll fabric onto surface without stretching or pulling.
2. Cut to fit irregular shapes.
3. Secure with stakes in pattern recommended by manufacturer.
4. Do not place mulch blanket over adjacent, existing lawn areas.

B. Install mulch blanket or mulch blanket, high velocity on slopes as follows:
1. Roll fabric horizontally across slope, beginning at top of slope.
2. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep by 6 inch wide excavated topsoil trench.
3. Backfill trench and rake smooth, level with adjacent soil. Apply additional seed as needed. Fold back 12 inch width of fabric over top of excavated trench.
4. Overlap edges and ends of adjacent rolls minimum 12 inches. Overlap edge of higher roll over edge of lower roll.
5. Secure with stakes in pattern recommended by manufacturer.

6. Follow manufacturer's written instructions during placement and staking of mulch blanket.

C. Install mulch blanket, high velocity in channels as follows:
1. Roll fabric longitudinally along channel, beginning at top of slope.
2. Lay fabric smoothly on surface, bury top of each section on each side of channel in 6 inch deep by 6 inch wide excavated topsoil trench.
3. Backfill trench and rake smooth, level with adjacent soil. Apply additional seed as needed. Fold back 12 inch width of fabric over top of excavated trench.
4. Overlap edges and ends of adjacent rolls minimum 12 inches. Overlap edge of higher roll over edge of lower roll. Overlap rolls in direction of flow with upstream end over downstream end.
5. Secure with stakes in pattern recommended by manufacturer.
6. Follow manufacturer's written instructions during placement and staking of mulch blanket.

D. Lightly dress with topsoil to ensure close contact between mulch blanket and soil.

3.5 WATERING

A. Apply water in the amount directed by Engineer, within 24 hours after receiving Engineer's direction. Water to prevent grass from drying out.

B. Apply water slowly, at a rate that does not displace seed, fertilizer, soil or mulching materials.

C. Repair all damage caused by excessive application rate or by watering equipment.

3.6 MOWING

A. Mow grass within 3 days when directed by Engineer.

B. Do not perform first mowing until seedlings are 40 percent higher than desired height.

C. Do not mow when mowing equipment will damage soil, turf, or mulching materials.

D. Mow grass to a maximum height of 2½ inches or as directed by Engineer. Do not cut more than ⅓ of grass blade height.

E. Neatly trim edges and hand clip where necessary

F. Remove clippings.

G. Repair damage caused by mowing.

3.7 WEED CONTROL

A. Obtain Engineer's approval of the name and application rate of the herbicide before applying.

B. Comply with all local, state, and federal requirements.

C. Apply herbicide over newly established turf areas to control the growth of weeds where directed by Engineer. Do not apply herbicide before grass seedlings have grown to a sufficient maturity to withstand the herbicide.

D. Remedy damage resulting from improper use of herbicides.

3.8 CORRECTIVE MAINTENANCE

A. Examine newly establishing turf areas at regular intervals until final acceptance. Inspect for erosion, loose mulch blankets, weeds, uneven soil and depressions, dry soil conditions, and areas of below average growth.

B. Immediately correct erosion and uneven soil by installing additional topsoil and regrading. Apply fertilizer, seed, and mulch blankets to regraded areas.

C. Immediately correct loose mulch blankets by adding stakes or lightly dressing with topsoil as directed by Engineer. Ensure close contact between mulch blankets and soil as turf develops.

D. Immediately correct areas of below average growth by reseeding as directed by Engineer.

E. Pay cost of all corrective maintenance. Corrective maintenance will not be paid for by Owner.

END OF SECTION

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LIVE WALL

PART 1: GENERAL

1.1. SCOPE

Provide labor, materials, and equipment to install a modular planted living wall system which includes: modules, module inserts, furring tracks, mounting rail/irrigation conduit, fasteners, and irrigation infrastructure.

1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Chemical Bank North Live Wall:
    1. Basis of Measurement: By Lump Sum
    2. Basis of Payment: Including all materials and components (posts, base plates, brackets, planter boxes, furring strips, concealment boxes, irrigation components, hardware) and plant material as shown on drawings and required by manufacturer based on approved shop drawings; and all materials, labor, and equipment required for installation.

B. Chemical Bank South Live Wall:
    1. Basis of Measurement: By Lump Sum
    2. Basis of Payment: Including all materials and components (posts, base plates, brackets, planter boxes, furring strips, concealment boxes, irrigation components, hardware) and plant material as shown on drawings and required by manufacturer based on approved shop drawings; and all materials, labor, and equipment required for installation.

1.3 SUBMITTALS

A. To fully disclose merits of system and specifications, provide three (3) product catalogs and supporting literature showing specifications and project photographs of completed jobs.
B. To demonstrate soil quality, provide two (2) plastic bags, each containing a 1 cup (8 oz.) sample of growing medium.
C. To ensure proper care, provide written maintenance protocol.
D. To ensure proper installation, provide written documentation of installation procedures.
E. To facilitate planning and create installation efficiency, indicate length of time required to install the planted living wall.
F. To ensure proper plant selection and efficient delivery, provide address and contact information of professional horticulturist who will oversee planting and cultivation of modules.

G. Shop Drawings: Manufacturer to provide layout of planters, rails, and irrigation. Contractor to provide layout of plumbing, mainline water feed and drain.
H. Method and materials list of fastening hardware for installation of furring tracks and chase concealment brackets.
I. Method and materials list of irrigation components and fittings.
J. 15 Year limited warranty provided by living wall system manufacturer.

1.4 QUALITY ASSURANCE

A. No deviation should be made from this specification. Installer assumes liability for any deviations from specification.
B. Prior to installing modules, the following procedures are to be conducted:
    1. The Engineer shall verify that the wall is properly designed and constructed to adequately support the load of the planted living wall system. All means of fastening furring tracks and chase brackets to the building's wall system are ultimately the responsibility of the local architect/engineer.
    2. Wall is to be approved, ready to accept vegetated wall, by general contractor. Approval to be in writing.
C. Living wall system to be maintained with bi-weekly inspections and to make adjustments to protocol as needed by general contractor until the time of final acceptance.
D. During the installation and afterward, an inspection is to be conducted by a technical representative of the installer to verify that the living wall system has been installed in accord with then current written specifications.

1.5 PRE-INSTALLATION MEETING

A. Installer representative to convene or consult with manufacturer technical representative one week before starting work. Then, installer representative to conduct on-site installation review with job-site foreman from installing company to review proper installation procedures.

1.6 DELIVERY, STORAGE, HANDLING, PROTECTION

A. Plumbing fixtures, mainline, UV resistant PVC pipe (SCH 80) and fittings (SCH 40), and drain to be sourced by installer.
B. Wall planter modules and all mounting and irrigation components to be delivered by manufacturer in good condition free from shipping damage to the installer.
C. All components to be handled with care to prevent damage.
D. Only after mounting hardware and plumbing have been installed and tested shall delivery of planted inserts, containing soil and plants, occur. Planted inserts to be installed on the wall within 4 hours of delivery. Product to be irrigated immediately following installation to settle soil and restore moisture to soil.

PART 2: PRODUCTS

2.1 VEGETATED WALL MANUFACTURER

A. Provide vegetated wall system with planter modules.
   1. LiveWall, LLC
      Subsidiary of Hortech, Inc.
      P.O. Box 533
      Spring Lake, MI 49456
      (877) 554-4065
      Fax: (616) 842-1392

   Or approved equal

B. Standard Module 0.15" thick (sidewall), color: Cool Gray. 16" long x 10" Tall x 6" Deep.
   1. Module is to be secured with a #10 .2" Self-Drilling Fastener: 18-8 SS # 10 x ¾" #3 Pan 6 lobe.
C. Soil height from container bottom is to be approximately 5.25" , although normal settling is to be expected and will reduce this height somewhat.
D. Saturated weight of module with mature vegetation: Standard: approximately 10-12 lbs per square ft.
E. Module clearance from wall: Approximately 1.5" including furring bracket.
F. Planted inserts containing soil and pre-grown plants, selected with approval of system manufacturer. Supplying nursery is to execute the following:

   1. Fill inserts with the appropriate soil.
   2. Plant with specified plants.
   3. Grow specified plants in such manner that they are mature (approx. 75%+ soil coverage and rooted to bottom) at the required time for installation.
G. Modules are not to be designed for climbing or use as a ladder. Create design in such manner as to discourage climbing. Post signage if vegetated wall system is to be located in an area where this may be an issue.

2.2 MOUNTING ASSEMBLY

A. Planted Wall Mounting Assembly

   1. Vertical furring tracks: 2" W x 1.5" D (for side-feed irrigation) OR 5" D (for rear-feed irrigation) x up to 8' H 6063-T6 Aluminum Furring Tracks: Appropriate wall fastener supplied by installer.
   2. Mounting slot rail with irrigation conduit: 3.325" Tall x 1.5" Deep x up to 8' Long 6063-T6 Extruded Aluminum Rail in champagne anodized finish, 0.1". min. thick (sidewall), with integrated irrigation conduit. Used with automatic irrigated systems only.

3. H-Rail : 3.325" Tall x up to 8' Long, min. 0.1" thick (sidewall) 6063-T6 Extruded Aluminum Rail in champagne anodized finish
4. 1" dia. x 0.125" thick vinyl washers (optional) – Use as required to insulate against galvanic action between metal walls and aluminum furring strips.
5. 1" dia. x 0.25" thick vinyl washers (optional) – Use as required for bracket spacers to provide plumb vertical surface.
6. Furring track anchors: Chosen by installer to be non-corrosive and compatible with building wall. Contact manufacturer for basic fastener recommendations.
7. Rail Fasteners: 302 SS Screw 1/4"-14 x 1.5" Button Torx #3 – Not to exceed 5 pound-feet of torque during installation.
8. Rail Spacing Tool: Two supplied by manufacturer per project to vertically space mounting rails.

2.3 IRRIGATION

A. Automatic Irrigation Assembly
1. Consult a qualified irrigation specialist to determine overall design configuration of irrigation, including pipe diameter, layout, head style and spacing. Live Wall irrigation shall be incorporated into the overall design/build irrigation design for the project's other landscape improvements.
2. Main feed line water pressure to be a minimum of 25 PSI and not to exceed 80 PSI.
3. Install automatic freeze protection drain valves on all main and lateral piping.
4. Irrigation Controller–manufacturer to specify and supply appropriately sized system for project.
5. Backflow preventer: Reduced Pressure Backflow Preventer, may be supplied by manufacturer.
6. Filter system of 150 micron.
7. Valves:
    1. 1" Flow Control Valves
    2. Each irrigation valve to be pressure regulated to 15 psi and to supply no more than 48 flood jet spray nozzles.
    3. A master valve shall be installed on the mainline after the backflow device.
    4. All wire connections to be waterproof, UL approved.
8. When cutting irrigation conduit rails, do not use hack saw as it leaves rough burrs which will plug the irrigation nozzles. Instead use diamond blade on circular saw. Slugger Metal Cutter by Jancy is recommended. In any event, remove all burrs prior to installation.
9. Hand De-burring Tool –to be used as required for irrigation conduit rails that have been cut.
10. Irrigation conduit rails to be joined with manufacturer-supplied connector. Connection to be tight and leak free.
11. Irrigation rail end connectors and adaptors require a set screw as security against displacement from water pressure, into predrilled pilot holes with compatible

stainless steel set screws with hex head to be supplied by manufacturer. If installing an end connector on a cut section of irrigation conduit rail, drill 3/16" pilot hole through conduit, 1/2" from end of rail to accommodate screw.

12. System manufacturer to supply 1" glue-free irrigation pipe and fittings, colored black to block light for connection from irrigation rails to valves. Contractor to source UV resistant SCH 80 gray PVC pipe and SCH 40 gray fittings for connecting the mainline to the valves.
13. Irrigation Nozzles (spaced 16" horizontally on irrigation conduit rails:): 1/8" dia., 0.5 oz brass flood jet 1" length. Flow volume is to be sized to installation and irrigation design: 0.2 gpm, 0.15 gpm, and 0.1 gpm. capacity.
14. Automatic Liquid Fertilization System (recommended). Manufacturer to specify and supply the recommended fertilizer injector for size of project.
15. Water–Installer to ensure source water to be of suitable quality for irrigation and free of excess minerals, or to be treated so as to be suitable for intended use.

B. Automatic Irrigation Settings
    1. System is to be run as frequently and as long as required to keep plants in healthy unwilted condition. Consult the manufacturer-supplied irrigation chart for recommended settings based upon average daily temperature, wall orientation and plant maturity.
    2. Over or under watering should be avoided, and the system adjusted to supply only as much water as is needed to prevent wilting.
    3. Walls that reflect light onto the living wall system will likely cause a need for more frequent or longer irrigation run times. And such exposure may require special plant selections, such as succulents, that are adapted to high light intensity. Consult manufacturer for appropriate plant selections for use on each wall surface.
    4. System to be blown out with compressed air no greater than 20psi annually in fall prior to reaching freezing temperatures.

2.4 PLANTS

A. Classify sun exposure as North, South, East or West, and take into account light blocked by trees, buildings and other structures.
B. Once light exposure is determined, use manufacturer-supplied design guide, in conjunction with local knowledge of climate and plant performance, to select and specify plant material.
C. Upon delivery, plants should be rooted to the bottom of the wall planter inserts, well established so as to cover 75% of the planter box surface at the time of installation, and to be free of pest and disease organisms. Plants should be adapted to light conditions consistent with the wall exposure and surroundings.

2.5 GROWING MEDIUM

A. Wall system growing medium to be engineered and consistent in terms of properties (organic vs. inorganic components) to match the life expectancy and nutritional

requirements of the particular plant types grown in the planted wall system. Living wall manufacturer to provide appropriate soil recommendations.

2.6 ACCESSORIES

A. Specify optional facing material to conceal irrigation feed. Powder coated aluminum shall may be used for this purpose. Facing material mounting brackets to custom fabricated by general contractor.

PART 3: EXECUTION

3.1 Installer to become familiar with system installation procedure prior to bidding on and performing work.

3.2 INSTALLATION SEASON
Module Installation to be conducted when plants are:

A. Properly adapted and acclimatized to local weather conditions.
B. Well rooted, cover 75% or greater of the soil surface area, and are substantially mature.

3.3 SAFEGUARDING SYSTEM INTEGRITY
Before working on wall, all Installers and Laborers to be:

A. Properly instructed in safety procedures and provided copies of manufacturer's installation instructions.
B. Instructed to keep all work surfaces clean and debris free.
C. To report immediately any damage to building wall surface or structure to supervisor, and to make appropriate repairs before proceeding.

3.4 RAIL INSTALLATION

A. Fasten vertically-oriented furring tracks to framing (Maximum of 24" o.c. spacing between rails) using anchors specified by manufacturer and sourced by installer.
B. Furring Tracks are to be spaced evenly and aligned with laser or plumb line. Use 1" dia. X 0.25" thick nylon washers as required for bracket spacers to provide plumb vertical surface.
C. Use 1" dia. X 0.125" thick nylon washers as required to insulate against galvanic action between metal walls and aluminum furring strips.
D. Inspection and approval of furring track installation is required prior to installation of mounting/irrigation rails.
E. Align laser or snap chalkline at specified location along bottom of furring tracks to mark for installation of bottom H-rail.
F. Install bottom H-Rail to furring tracks with provided fasteners. Pre-drill 0.257" Dia. (Type F close fit drill bit) pilot hole through rail and fasten to furring tracks at required

spacing with provided screw. Do not exceed 5 pound-feet of torque during installation of rail fastener.

G. After first row of H-Rail is installed, use the pair of spacing tools to line up and support the next row of rails for fastening at a vertical spacing of 12" o.c., and continue to use for all tiers thereafter.

3.5 IRRIGATION INSTALLATION

A. Only after technical representative of installer has inspected and approved rail installation, shall the irrigation system be installed.
B. Verify that there is sufficient water pressure at the main line. Water pressure to be a minimum of 25PSI and not to exceed 80 PSI.
C. Inspect predrilled orifices in mounting channel/irrigation conduits.
D. Never overtighten threaded irrigation fittings. Finger tighten all threaded fittings, plus an additional 1-2 turns past, using a thread sealant product that does not include PTFE or any other lubricant. Sealant compounds are to be non-hardening and compatible with plastic fittings if applicable.
E. Install appropriate end plugs, connectors and/or adapters to each open end of rail. Secure in place with set screws.
F. Connect required glue-free pipe fittings to the rail adapters. Working from the top irrigation conduit rail down to the water source, install the valves, 15 psi pressure regulators, irrigation lines, master value, backflow preventer, controller, and other components. Note: Each valve (zone) to supply maximum of 64 lineal feet of irrigation conduit rails (48 nozzles).
G. Before installing nozzles, run irrigation system to flush any debris or burrs from inside the irrigation conduits.
H. Install flood jet nozzles and orient so that the spray fans point downward.
I. Test system for proper function and coverage. Test electronic controller and all valves. Make sure all irrigation nozzles are working properly without obstruction.

3.6 PLANTER MODULE AND PLANT INSTALLATION

A. Only after irrigation system has been tested shall planter modules be installed.
B. Install planter modules by inserting them into the top rail, then dropping them into the bottom rail.
C. Install provided limiting screw along indicator line into planter module (below the rail).
D. Install preplanted inserts containing mature plants. Then immediately irrigate plants to settle and remoisten soil.
E. If wind challenged setting, installer shall install securing clips after placing planter inserts, in modules at all elevations. Securing clips to be used above 2 story elevation regardless of wind challenge.
F. Set irrigation system to run daily, at 1:00 PM for a duration of 2 minutes. Then, observe plantings two hours later. If there are signs of wilting, then run system again until soil is fully moistened. And, extend run time for the following day to 3 minutes and repeat process of observation and adjustment.

G. Fine tune duration and frequency of watering as needed, but avoid overwatering. The objective is to supply the bare minimum water needed, to keep the plants in a non-wilted condition. Excess water is of no benefit, and is in fact detrimental as it causes leaching of nutrients and fosters the growth of soil borne fungal disease organisms.

3.7 MAINTENANCE

A. Owner and maintenance contractor to register to receive regular maintenance reminders and instructional updates from manufacturer.
B. Documentation: Record all maintenance events and irrigation controller settings including duration and frequency. Include name of person, date and activity. Basic maintenance includes the following:
    1. Watering duration and frequency.
    2. If feeding continuously with a fertilizer injector, record injector setting and fertilizer product. If hand-fertilized system, record feedings with granular, slow-release fertilizer, include type and quantity applied.
    3. When soil is tested, the lab report should be maintained on file.
    4. Insect and disease concerns, and control measures used.
C. Spring Maintenance
    1. Structural Inspection - Remove some of the wall planters to inspect for signs of moisture behind the living wall system. If there is moisture, check sides, top and bottom of wall system for impediments to air flow and remove them.
    2. Pruning - Prune back previous year's growth, before the current spring's growth flush.
    3. Irrigation - Reactivate irrigation system after danger of hard frost is remote. Inspect system for obstructions, change controller batteries, repair leaks, and check water flow and pressure.
    4. Fertilizer - If not using liquid feed, apply slow release granular fertilizer.
    5. Replanting - If annuals or edibles were grown in previous year, plants will need to be replaced. They may be pregrown at a nursery or plugged on site. Clean reused liners and and use fresh soil. Perennials that have become rootbound may also need to be divided or replaced.
D. Summer Maintenance
    1. Conduct structural inspection.
    2. Inspect biweekly for weeds and remove upon sight.
    3. Pruning - During summer, depending on plant type, pruning to neaten the plantings or remove spent flowers may be desired.
    4. Inspect for pests and diseases.
E. Fall Maintenance
    1. Conduct structural inspection.
    2. In cold climates, do not prune perennials until the spring.
    3. Annual plantings may be removed from the wall for the winter, or left in place and replaced in the spring.
    4. In climates where temperatures fall below freezing, the system will need to be blown out with compressed air, not to exceed 20 psi.

F. Winter Maintenance
    1. During winter, avoid throwing snow onto system, as salt and deicing compounds can damage or kill plants.
    2. In warm climates, conduct structural inspection. Prune, water, and fertilize as described above.

3.9 ACCEPTANCE

A. Conduct post installation inspection to verify proper installation, design integrity, and plant health. Inspection to be made by General Contractor's Representative or by Owner's Representative upon General Contractor's request; five working days' notice required.
B. Upon acceptance, Owner assumes responsibility for system and plant material.

3.10 CLEAN UP

A. Throughout installation, keep all work surfaces clean and free of grit, dirt, or debris. Following installation, remove all excess materials and tools from job site. Ensure that any damage that occurs as a result of installation is appropriately and immediately repaired.

END OF SECTION