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APPENDICES

SECTION 02 41 13
SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Remove 4” canyon drain and curb, gutter, and sidewalk, as noted on the Drawings.

1.02 REQUIREMENTS

A. Prior to starting demolition, comply with requirements listed in the City Standard Specifications. Comply with Environmental Protection Agency (EPA) regulations and disposal regulations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 UTILITIES

A. Locate, identify, disconnect, and cap off utility services to be demolished.

B. Maintain and protect existing utilities to remain in service before proceeding with demolition, providing bypass connections as necessary. Maintain streetlight operation during relocation of single streetlight and pull box adjacent to concrete curb, gutter, and sidewalk removal.

C. Where equipment or devices have been removed, and where the active side of the pipe remains, Contractor shall cap or plug all abandoned piping using either threaded or soldered fittings. Do not rely on the existing valves for a positive shutoff.

3.02 DEMOLITION

A. Conduct demolition without disrupting adjacent property owner uses.

B. Conduct demolition operations and remove debris to prevent injury to people and damage to adjacent buildings and site improvements.

C. Perform Work in such a manner as to prevent damage to existing facilities to remain or to be salvaged. Hazardous Work shall not be left standing or hanging, but shall be knocked or pulled down to avoid damage or injury to employees or the public.

D. Conduct demolition operations in such a manner as to prevent damage to existing trees and plants that are to remain.

3.03 CUTTING AND PATCHING

A. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

3.04 SALVAGE

A. Items indicated to be removed and salvaged remain City’s property. Remove, clean, and deliver to City’s designated storage area or as directed by the City’s Representative.

B. Coordinate storage and/or relocation of relocated single streetlight and with the City’s Representative until such time that they can be relocated to their new locations, per the Electrical Plans.

3.05 DISPOSAL

A. Unless otherwise indicated, demolished materials become Contractor's property.

B. Promptly remove demolished materials from City’s property and legally dispose of them. Do not burn demolished materials.

3.06 HAZARDOUS MATERIALS

A. Except as otherwise specified, in the event Contractor encounters on the Project site material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead,

or other hazardous substances that have not been rendered harmless, Contractor shall immediately stop work in the area affected and report the condition to the City's Representative in writing. The work in the affected area shall not thereafter be resumed except by written agreement of City and Contractor if in fact the material is asbestos, PCB, lead, or other hazardous substances and has not been rendered harmless. The work in the affected area shall be resumed in the absence of asbestos, PCB, lead, or other hazardous substances, or when such materials have been rendered harmless.

B. Disclose any hazardous substance or condition exposed during the work to the City's Representative for decision or remedy.

END OF SECTION
02 41 13

SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing reinforced and grouted concrete masonry units.

B. Related Sections:

1. Graffiti-resistant coatings are specified in Section 09 96 23.

1.02 SUBMITTALS

A. Product Data: Manufacturer's product data for each type of masonry unit and other manufactured products, including certifications that each type complies with specified requirements.

B. Shop Drawings: For fabrication, bending, and placement of reinforcing bars.

1. Comply with ACI 315.

2. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies required for fabrication and placement.

C. Samples:

1. Shapes, sizes and kinds in sufficient numbers to show full range of color, texture, and surface quality to be expected in the completed work.

2. For initial selection, samples showing full extent of colors available. For verification purposes, colored masonry mortar for each color required, showing the full range of color to be expected in the finished work. Label samples to indicate type and amount of colorant used.

D. Mock-up: Provide a 3 foot x 3 foot mock-up sample panel of grouted masonry unit for review by City’s Representative. Accepted mock-up may remain as part of the work and shall be the standard for performance of the masonry installation.

E. Mortar and grout mix designs for City’s Representative's review and the City's Testing Laboratory approval at least 7-days before block placement begins.

F. Certificates: Show mortar and grout cement conforms to specified requirements.

1.03 QUALITY ASSURANCE

A. Masonry work shall conform to CBC Chapter 21.

B. Tolerances:

1. Variation from Plumb: For vertical lines and surfaces of columns, walls and arises, do not exceed 1/4-inch in 10- feet, or 3/8-inch in a story height not to exceed 20-feet, nor 1/2-inch in 40-feet or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4-inch in any story or 20-feet maximum, nor 1/2-inch in 40-feet or more. For vertical alignment of head joints do not exceed plus or minus 1/4-inch in 10-feet, 1/2-inch maximum.

2. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4-inch in any bay or 20-feet maximum, nor 1/2-inch in 40-feet or more. For top surface of bearing walls, do not exceed 1/8-inch between adjacent floor elements in 10-feet or 1/16-inch within width of a single unit.

3. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2-inch in any bay or 20-feet maximum, nor 3/4-inch in

40-feet or more.

4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4-inch nor plus 1/2-inch.
5. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated or specified by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch. Do not exceed head joint thickness indicated or specified by more than plus or minus 1/8-inch.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Mortar and Grout:

1. Deliver and store packaged materials in manufacturer's original packaging off the ground, in a dry, enclosed space until ready for use. Do not use materials that have been exposed to moisture.
2. Stockpile and handle aggregates to prevent segregation and contamination.
3. Maintain sand for volume proportioning of mortar and grout in a damp loose condition.

1.05 JOB CONDITIONS

A. Cold Weather Requirements: Comply with CBC Section 2104.3

B. Protect surrounding work as required from damage from masonry work. Clean or otherwise correct damage to surrounding work resulting from masonry work.

C. For mortar and grout, follow requirements of ACI 530 for cold and hot weather conditions.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS

A. Portland Cement: ASTM C150, Type I or II.

B. Fly Ash: ASTM C618, Type F.

C. Hydrated Lime: ASTM C207, Type S.

D. Sand: ASTM C144. For joints less than 1/4-inch, use aggregate graded with 100-percent passing a No. 16 sieve.

E. Water: Suitable for drinking, clean, and free of harmful amounts of acid, alkalis, salts, or organic materials.

F. Admixtures: When required, use only non-chloride based accelerators. Do not use antifreeze substances.

G. Pigments: When required, use mineral oxide pigments not to exceed 5-percent of the weight of masonry cement or 10-percent of the weight of portland cement in the mortar.

2.02 GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I or II.

B. Fly Ash: ASTM C618, Type F.

C. Hydrated Lime: ASTM C207, Type S.

D. Aggregate: ASTM C404.

E. Water: Suitable for drinking, clean, and free of harmful amounts of acid, alkalis, salts, or organic materials.

F. Admixtures: When required, use only non-chloride based accelerators. Do not use antifreeze substances.

2.03 MORTAR MIXES

A. Mortar:

1. Comply with CBC Section 2103.8 and Table 2103.8(1) or 2103.8(2), Type S.
2. Mortar shall be mixed as follows, with a total mixing time not less than 10-minutes.
    a. Place approximately half of required water and sand into mixer while running.
    b. Add cement and remainder of sand and water into mixer in that order and mix for a period of at least 2-minutes.
    c. Add lime and continue mixing as long as needed to secure a uniform mass.
    d. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1-to-10, by weight.
3. Use and place mortar in final position within 2-hours after mixing. Mortars that have stiffened due to evaporation of water may be re-tempered with water as required to restore required consistency during this period.

2.04 GROUT MIXES

A. Grout: Comply with CBC Section 2103.12.

1. Minimum Compressive Strength: 2,000-psi.
2. Proportions: As specified in CBC Table 2103.12.
3. Materials for grout shall be measured in suitable calibrated devices. After the addition of water, all materials shall be mixed for at least 3-minutes in a drum type batch mixer. Mixing equipment and procedures shall produce grout with the uniformity required for concrete by ASTM C94.

2.05 MASONRY UNITS

A. Comply with referenced standards and other requirements specified for each form of concrete masonry unit required.

1. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
2. Provide square-edged units for outside corners unless other indicated.
3. Minimum net compressive strength of all concrete block units at 28-days shall be 1,900-psi.

B. Decorative Loadbearing Block:

1. Weight Classification: Medium weight made with lightweight expanded clay or shale aggregate in accordance with ASTM C331. Medium weight block shall range from a minimum of 105-pounds to less than 125-pcf.
2. Grade N.
3. Size: Nominal face dimensions of 16-inches long x 8-inches high x thicknesses indicated.
4. Type I, moisture-controlled units,
5. Exposed Faces: texture and color as shown on the drawings, or equal
6. Decorative block shall be "color controlled". The block shall be sorted at the factory if required to match approved color sample range and completed mock-up panel.

2.06 REINFORCEMENT

A. Reinforcing Bars: Comply with CBC Section 2103.13 and ASTM A615, Grade 60 deformed bars except as otherwise indicated.

B. Shop-fabricate reinforcing bars which are shown to be bent or hooked.

2.07 MISCELLANEOUS MATERIALS

A. Control Joints: Preformed rubber in profiles required.

B. Masonry Cleaner: Job-mixed detergent solution of trisodium phosphate (1/2-cup dry measure) and laundry detergent (1/2-cup dry measure) dissolved in one gallon of water.

2.08 SOURCE QUALITY CONTROL

A. Comply with CBC Section 2105.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Thickness: Build masonry construction to the full thickness indicated. Build single wythe walls to the thickness of the masonry units, using units of nominal thickness specified.

B. Cut masonry units with motor-driven saw producing clean sharp, unchipped edges.

1. Cut units as required to provide pattern indicated and to fit adjoining work neatly.

2. Use full units without cutting wherever possible.

3. Use dry cutting saws to cut concrete masonry units.

C. Do not wet concrete masonry units.

D. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths. Locate openings, movement-type joints, returns and offsets. Avoid use of less than half-size units at corners, jambs and other locations.

E. Lay walls plumb, with courses level, accurately spaced and coordinated with other work.

F. Pattern Bond: Lay exposed masonry in running bond unless otherwise indicated.

G. Stopping and Resuming Work: Rake back 1/2-masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry, and remove loose masonry units and mortar prior to laying fresh masonry.

H. Built-In Work: Build-in items specified under this and other Sections as the work progresses.

1. Fill space between structural steel frames and masonry with silicone joint filler. Use mortar for other frames.

I. Placing Reinforcement:

1. Clean reinforcing of loose rust, mill scale, earth, and other materials which will reduce bond to mortar or grout.

2. Do not use reinforcement with kinks or bends not indicated, or bars with reduced cross-section due to excessive rusting or other causes.

3. Position reinforcing accurately as indicated.

a. Support and secure vertical bars against displacement.

b. Horizontal reinforcing may be placed as the masonry work progresses.

c. Where vertical bars are in close proximity, provide a clear distance between bars of not less than the greater of the nominal bar diameter or 1-inch.

d. For columns, piers and pilasters, provide a clear distance between vertical bars of not less than 1-1/2-times the nominal bar diameter or 1-1/2-inches, whichever is greater. Provide lateral ties as indicated.

4. Splice reinforcing only where indicated.

a. Provide lapped splices, unless otherwise indicated.

b. In splicing vertical bars or attaching to dowels, lap ends and wire tie.

5. Weld splices where indicated. Comply with the requirements of AWS D1.4 for welding materials and procedures.

3.2 MORTAR BEDDING AND JOINTING

A. Joints: Lay walls with 3/8-inch joints, except for minor variations required to maintain bond alignment.

1. Tool exposed joints slightly concave using a jointer larger than joint thickness.

2. Rake out mortar in joints to receive caulking or sealants.

B. Remove masonry units disturbed after laying; clean and relay in fresh mortar.

1. Do not pound corners at jambs to fit stretcher units which have been set in position.

2. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.3 CONTROL AND EXPANSION JOINTS

A. Provide vertical expansion, control and isolation joints in masonry where indicated.

B. Neoprene rubber control joint material shall be placed in the joints as indicated. Do not fill joints with mortar.

3.4 LINTELS

A. Provide masonry lintels at openings of more than 12-inches without structural steel or other supporting lintels.

1. Use specially formed "U"-shaped lintel units with reinforcing bars placed as indicated and filled with grout of consistency required to fill space between reinforcing bars and masonry unit.

2. Provide 8-inch minimum bearing at each jamb, unless otherwise indicated.

3.5 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. General: Comply with CBC Section 2104.

1. All head and bed joints shall be filled solid with mortar for a distance in from the face of the unit not less than the thickness of the shell.

2. Head joints of open-end units with beveled ends that are to be fully grouted need not be mortared. The beveled ends shall form a grout key which permits grout within 5/8-inch of the face of the unit. The units shall be tightly butted to prevent leakage of grout.

B. Walls:

1. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted.

a. Keep cavities free of mortar.

b. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

2. Bond Beams: Use special units or modify regular units to allow for placement of continuous horizontal reinforcing.

C. Columns, Piers and Pilasters:

1. Use concrete masonry units of the size, shape and number of vertical core spaces to provide minimum clearances and grout coverage for number and size of vertical bars indicated.

2. Pattern Bond: Alternate head joints in vertical alignment, unless otherwise indicated.

3. Where bonded pilaster construction is indicated, lay wall and pilaster units together to

maximum pour height specified.

3.6 GROUTING

A. General Requirements: Comply with CBC Section 2104.1.2.7.

1. Place grout in final position within 1/2-hours after introduction of mixing water.

2. Consolidate grout by mechanical vibration during placement before loss of plasticity in a manner to fill the grout space. Grout pours greater than 12-inches in height shall be reconsolidated by mechanical vibration to minimize voids due to water loss. Grout not mechanically vibrated shall be puddled.

3. Do not insert vibrators in lower pours that are in a semi-solidified state.

B. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.

C. Between grout pours, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of 1-1/2-inches below a mortar joint. Where a bond beam occurs, stop grout pour a minimum of 1/2-inch below the top of the masonry.

D. Provide cleanouts for all grout pours over 5-feet in height.

E. Where required, provide cleanouts in the bottom course at every vertical bar, but not spaced more than 32-inches on center. Seal cleanouts after inspection and before grouting.

F. Where cleanouts are not provided, keep the bottom and sides of grout spaces.

G. Units may be laid to the full height of the grout pour and grout shall be placed in a continuous pour in lifts not exceeding 6-feet.

H. All cells and spaces containing reinforcing shall be grouted.

3.7 REPAIR, POINTING AND CLEANING, AND PROTECTION

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing:

1. During tooling of joints, enlarge voids or holes, except weep holes, and fill with mortar.

2. Point-up joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain City’s Representative's approval of sample cleaning before proceeding with masonry cleaning.

3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering with liquid strippable masking agent, polyethylene film or waterproof masking tape.

4 Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing with clear water.

5. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

D. Protection: Provide and maintain protection to ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.8 FIELD QUALITY CONTROL

A. Special Inspections: Comply with CBC Section 1704.5.

B. Compliance with requirements for specified compressive strength for masonry f'm shall be in accordance with one of the following methods:

1. Masonry Prism Testing: As specified in CBC Section 2105.3.1. Compressive strength determined in accordance with ASTM C1314 for each set of prisms shall equal or exceed f'm at 28-days.

END OF SECTION
04 22 00

SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and other Contract Documents, including General Conditions, Supplementary Conditions, and Division 1 Specification Sections, apply to work of this Section.

1.02 SUMMARY

A. This section includes the following metal fabrications:

1. Project signage, brackets, anchors, and fence rails.
2. Miscellaneous non-structural metal fabrications.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for products used in miscellaneous metal fabrications, including paint products and grout.

C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.

C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel", and D1.2 "Structural Welding Code - Aluminum."

1.05 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: conform to ASTM A36. Where weathering steel, corten, or Corten steel is specified, conform to ASTM A588

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

D. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.02 FASTENERS

A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A. Finish: to match adjacent work, hot dipped galvanized unless noted otherwise. Use Type 3 bolts for corrosion resistant weathering steel.

C. Lag Bolts: Square or hex head type, ASME B18.2.1.

D. Machine Screws: Cadmium plated steel, ASME B18.6.3.

E. Wood Screws: ASME B18.6.1 Flat head carbon steel, at wood-to-wood connections, round head or pan head for fastening metal to wood, unless otherwise indicated.

F. Plain Washers: Round, carbon steel, ASME B18.22.1.

G. Drilled-In Expansion Anchors: Wedge type expansion anchors with current ICBO approval as indicated or approved equal.

2.03 PAINT

A. Shop and Touch-up primer for Ferrous Metal: SSPC Paint 23.

2.04 ACCESSORIES

A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi at 28 days;

2.05 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.06 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning.

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine the conditions for the work and verify bearing surfaces are at correct elevation. Field verify all measurements.

B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete construction. Coordinate delivery of such items to project site.

3.02 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Shear and punch metals cleanly and accurately. Remove burrs.

D. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Remove sharp or rough areas on exposed traffic surfaces.

F. Weld corners and seams continuously to comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

H. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

I. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

J. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

3.03 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.04 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION
05 50 00

SECTION 09 90 00
PAINTING AND COATING

PART 1 - GENERAL

1.01 CONDITIONS

A. The general provisions of the Contract, including General Conditions and Special Provisions apply to the work specified in this Section.

1.02 DESCRIPTION

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

1. Provide all materials, tools, equipment, appliances, labor, and supervision required to paint and finish all surfaces and/or components as specified herein and as indicated on the Drawings, including all miscellaneous items and labor required to complete the Work of this Section.

2. Surface preparation, priming and painting of all surfaces as indicated on the Drawings as to be painted or to be coated, or as follows:

   a. Miscellaneous surfaces.

3. All surfaces that are left unfinished by the requirements of other sections shall be painted or finished as part of this contract.

B. Definition: The term “paint”, as used herein, shall mean all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime intermediate or finish coats.

1.03 WORK NOT INCLUDED

A. Pre-Finished Items: Unless otherwise specified or indicated on the Drawings, do not include the painting of items that are specified to receive manufacturer’s factory finish, i.e., such items as site furnishings, irrigation equipment, electrical equipment, etc. See applicable Sections.

B. Finished Metal Surfaces: Unless otherwise specified, all metal surfaces or anodized aluminum, stainless steel, chromium plate, copper, bronze, or similar finished materials do not require painting.

1.04 SUBMITTALS

A. Provide in accordance with the General Conditions prior to ordering material, a complete, detailed list of materials proposed for use on work. Include affidavit from manufacturer stating that proposed materials are the best of their respective kinds and suitable for intended purpose. Submit in ample time to avoid delays in work if the list, or portions thereof, are rejected.

B. Painter shall prepare and submit color samples to match color chips in 12-inch square size and must receive approval from City’s Representative before applying final paint coats to finish surfaces. Approved samples shall be retained at the City’s Representative office for record.

1.05 PAINT COORDINATION

A. Provide prime coats which are compatible with finish paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of total painting system for various surfaces. Upon request from other trades, furnish information and specifications for finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Project Inspector in writing of any anticipated problems using specified painting systems with surfaces primed by others.

1.06 JOB CONDITIONS

A. Applicator shall examine areas, surfaces, and conditions under which painting Work is to be applied and notify the City’s Representative in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to City’s Representative and Applicator, or Applicator shall assume responsibility for and rectify any unsatisfactory finish resulting.

B. Starting of painting Work shall be construed as Applicator's acceptance of surfaces and conditions.

1.07 WEATHER CONDITIONS

A. Apply water base paints only when temperature of surfaces to be painted and surrounding air temperature are between fifty (50) degrees F (10 degrees C) and ninety (90) degrees F (32 degrees C), unless otherwise permitted by paint manufacturer's printed specifications.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between forty-five (45) degrees F (7 degrees C) and ninety-five (95) degrees F (35 degrees C), unless otherwise permitted by paint manufacturer's printed specifications.

C. Do not apply paint in rain, fog, or mist; or when relative humidity exceeds eighty-five (85) percent; or to damp or wet surfaces.

1.08 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new, and unopened packages or containers bearing manufacturer's name and label, and the following information:

Manufacturer's Name.
Manufacturer's stock number and date of manufacture.
Special color mix: name and number.
Contents by volume for major pigment and vehicle constituents.
Thinning instructions.
Application instructions.

B. Store materials and equipment as approved by applicable codes and enforce good housekeeping practices. Any soiled or used rags waste, etc., shall be removed from the site every night and every precaution shall be taken to avoid the danger of fire. No paint materials shall be washed or emptied on the site or into any sewer drains, storm drains or street gutters.

1.09 PROTECTIONS

A. Protect Work of other trades, whether to be painted or not, against damage by painting and finishing Work. Provide suitable covering or other methods of protection during progress of this Work. Correct any damage by cleaning, repairing, or replacing, and repainting, as acceptable to the City's Representative.

B. Provide "Wet Paint" signs as required to protect newly painted surfaces. Remove all protective materials upon completion of the Work and touch-up and restore all damaged or defaced surfaces, including the removal of paint spots from other surfaces.

1.10 GUARANTEE

A. Adhesion: All materials applied shall be guaranteed for a period of two (2) years against failure due to surface conditions, materials, or application. There shall be no evidence of fingerprints blisters, running, peeling, scaling, chalking, streaks or stains.

PART 2 - PRODUCTS

2.01 COLOR SCHEDULE

A. City's Representative shall furnish to the Contractor a color schedule of paints to be used based on one of the approved manufacturer's color charts or requirements for specially mixed colors. Use of one of the other approved manufacturers requires the Contractor to match the color schedule provided by the Project Inspector.

B. Manufacturers names used to designate colors of color schedule is not intended to imply that products names are required to the exclusion of equivalent products of other manufacturers.

C. All colors and manufacturers shall be approved and authorized by the City's Representative before commencing Work.

2.02 MATERIALS QUALITY

A. Provide best quality grade of various types of paints as regularly manufactured by acceptable paint materials manufacturer. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

1. Acceptable paint manufacturers include, or approved equal:

a. Benjamin Moore Company

b. The Glidden Company

c. Pratt and Lambert, Inc.

d. Dunn and Edwards

e. Sherwin-Williams

f. W.P. Fuller Company

g. Tiger Drylac

h. Penofin, a trade name of Performance Coating, Inc. P.O. Box 1569, 360 Mendocino Drive, Ukiah CA 95482, tel. 707.462.3023.

B. Provide primer and undercoat paint produced by the same manufacturer as finish paint. Use only thinners approved by paint manufacturer and use only within recommended limits.

2.03 MATERIALS

A. Wood, painted (exterior and interior):

1st coat: Kelly-Moore, 255 Acry-Shield 100% Acrylic primer - or- Weather Shield Exterior primer

2nd & 3rd coats: Kelly-Moore 1250 Acry-Shield 100% Acrylic Exterior Semi-Gloss Enamel

B. Wood, sealed (exterior and interior):

All coats: Semi-transparent Marine Oil, 99% UV protection, VOC limited to 250 grams/liter. Penofin "250 VOC Marine Oil" or equal.

C. Interior masonry surfaces - smooth face:

1st coat: Tnemec, Series 130, Envirofill

(block filler, anti-bacterial properties)

2nd & 3rd coats: Tnemec, Series 280, Tneme-Glaze

(modified polyamine epoxy)

(Select color from manufacturer's 16 standard colors)

D. Concrete floor and base - interior of building only:

1st & 2nd coats: Tnemec, Series 201, Epoxoprime

E. Metals:

1st coat: Kelly-Moore,1725 Acry-Shield 100% Acrylic

Metal primer - or - see item 2.4 directly below

2nd & 3rd coats: Kelly-Moore 1250 Acry-Shield 100% Acrylic

Exterior Semi-Gloss Enamel

2.04 METAL PRIMER

A. Primer for metal surfaces shall be Red Oxide Primer, conforming to Federal Specification TT-P-31 for metal surfaces and Federal Specification TT-P-64b for galvanized surfaces.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with manufacturer's instructions, and as herein specified, for each particular surface condition. Ensure material and ambient temperatures are as recommended by manufacturer.

B. Paint no items fitted with finish hardware or other similar items until hardware has been removed or provided with surface-applied protection prior to surface preparation and painting operations. Install hardware or remove surface-applied protection after paint has dried.

C. Metal Surfaces: Clean all metal surfaces, which are not galvanized or shop-painted, of scale, dirt, rust and other deleterious materials before priming. Clean metal in accordance with Steel Structures Painting Council (SSPC) Specifications.

1. SP-2: Hand Tool Cleaning
2. SP-3: Power Tool Cleaning
3. SP-7: Brush-off Blasting Cleaning

Remove oil, grease, and similar contaminants in accordance with:

1. SP-1: Solvent Cleaning

D. Galvanized Surfaces: Clean all galvanized surfaces of oil and other surface contaminants with a crystalline zinc phosphate pretreatment (phosphoric acid etch). Remove pretreatment solution by thoroughly washing with clean water and wipe dry.

3.02 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's specifications.

B. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into materials. Remove film and if necessary, strain materials before using.

3.03 APPLICATION OF PRIMER COAT

A. Apply primer coast to all surfaces which are required to be painted or finished, and which have not been prime coated or shop-painted by others. For metal surfaces, roughen shop-painted coats as required.

B. Immediately after surface preparation brush or spray on primer in accordance with manufacturer's instructions at a rate to provide uniform dry film thickness of two (2.0) mils for each coat. Use painting methods which shall result in full coverage of joints, corners, edges, and exposed surfaces.

C. All primer coats shall be free from runs, sags, and other defects. All coats shall be thoroughly dry before applying succeeding coats.

D. Apply one (1) coat of metal primer for metal surfaces, as specified and/or as recommended by manufacturer's instructions.

3.04 APPLICATION OF PAINT

A. Apply paint in accordance with manufacturer's instructions. Use applicators and techniques best suited for each surface and type of materials being painted.

B. All painting Work shall be done by skilled workman in a professional manner. All coats shall be evenly spread and shall be free from run, sags, and other defects. All coats shall be thoroughly dry before applying succeeding coats.

C. All individual coats of paint shall be inspected and approved by the City's Representative before application of the succeeding specified coat; otherwise, no credit for the coat applied shall be given, and the Applicator shall automatically assume responsibility to recoat the Work. The applicator shall provide the City's Representative a report of each coat applied when completed for inspection and approval to comply with the above.

D. Where coverage is incomplete, not uniform, or not to the required dry film thickness, re-coat at no extra cost to the City.

E. Apply finish coats of paint to all exposed surfaces as follows:

1. For primed metal surfaces, apply two (2) coats of 100% acrylic latex base paint, per manufacturer's recommendations. Apply first coat of paint within 72 hours of primer application. If first coat of finish paint cannot be applied within the specified application time, the contractor shall re-clean and re-primer all exposed metal surfaces prior to start of metal paining operations.

F. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

G. Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practical after preparation and before subsequent surface deteriorations.

H. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until pain has dried to where it feels firm, does not deform, or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

I. Apply all coating without reduction, except as specifically required by label directions, or required by this Section.

J. Sand lightly between all coats on smooth surfaces as recommended by the manufacturer for adhesion of subsequent coats.

K. Paint all exposed surfaces and anything inaccessible after installation prior to installation, if required to be painted.

3.05 APPLICATION OF EPOXY PAINT

A. Use epoxy paint for floor and wall in restrooms up to ADA height.

3.06 APPLICATION OF WOOD SEALANT

A. Apply a liberal coat to the surface. Allow to penetrate into the wood 20-30 minutes, then wipe the surface to remove any excess sealer.

B. After 12 hours, repeat for a second coat.

C. After a minimum of 90 days but prior to project acceptance, repeat for a third coat.

3.07 EXCESS MATERIALS

A. Following project completion, deliver all excess paint sealer, and color samples as directed by the City's Representative.

END OF SECTION
09 90 00

SECTION 09 96 23
GRAFFITI-RESISTANT COATINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section Includes: Graffiti-resistant coatings on exterior vertical surfaces of concrete unit masonry walls, cast-in-place concrete, ball wall, and stonework.

B. Related Sections:

1. Concrete Unit Masonry is specified in Section 04 22 00.

1.02 SUBMITTALS

A. Product Data: Manufacturer's product literature for each coating system indicated. Include block fillers and primers.

B. Sample Panel: Apply specified graffiti-resistant coatings on approximately 10-square feet of wall area where directed by the City's Representative. Obtain City's Representative's approval before proceeding with coating application. Approved sample shall be used as a standard for the Project.

D. Maintenance Materials and Instructions:

1. Furnish one identified unopened 5-gallon container of each coating used, and one 5-gallon container of cleaning agent to be used for graffiti removal.
2. Coating and cleaning agent shall not be used for re-coating or touching-up damaged surfaces before final acceptance of the work.
3. Furnish City with manufacturer's instructions for graffiti removal and maintenance.

1.03 QUALITY ASSURANCE

A. Applicator shall be certified by the coating manufacturer for application of graffiti-resistant coatings of the type required for this Project, with a record of successful in-service performance.

B. Source Limitations: Obtain base coatings, top coatings, and removal agent from the same manufacturer.

1.04 PERFORMANCE REQUIREMENTS

A. Provide graffiti-resistant coating system complying with the following:

1. Permanent coating system. Coating shall not require re-application regardless of number of graffiti taggings during the life of the 10-year performance warranty period.
2. Show no signs of deterioration or change of appearance after graffiti removal during the warranty period. No ghosting, staining, or shadowing.
3. Capability of removing 100-percent of all types of paint and graffiti materials from treated surfaces without damaging the coating or the substrate.
4. Upon graffiti removal, no evidence of graffiti shall remain.
5. Capable of withstanding a minimum of 120 cleaning cycles over the same area without measurable coating deterioration.
6. Shall not increase dirt pick-up of substrate.

1.05 JOB CONDITIONS

A. Environmental Requirements: Comply with coating manufacturer's recommendations for environmental conditions regarding coating application. Do not apply coating in areas where dust is being generated.

B. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating application.

C. Provide drop cloths, shields, barricades, and other protection necessary to safeguard adjacent surfaces not to be painted. Post signs immediately after coating application.

D. Provide and maintain protection as required to protect finished work from damage until final acceptance.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:

1. Name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. Handling instructions and precautions.

B. Store materials in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45-deg. F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.07 WARRANTY

A. Warrant graffiti-resistant coatings to be free from defects in materials and workmanship for a period of 10-years from date of Substantial Completion. Graffiti-resistant coatings shall continue to repel graffiti after repeated cleaning during the 10-year warranty period. This warranty shall be in addition to and not a limitation of other rights the City may have against the Contractor under the Contract Documents.

1.08 EXTRA MATERIALS

A. Furnish extra graffiti removal materials in quantity equal to twelve 16-ounce bottles. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents.

B. Deliver materials and an inventory list just prior to Substantial Completion and store where directed by the City's Representative.

PART 2 - PRODUCTS

2.01 GRAFFITI-RESISTANT COATINGS

A. Provide materials that comply with local Air Quality Management District's VOC classification.

B. Coatings shall meet the following requirements:

1. ASTM B117 and ASTM D714 (salt spray minimum acceptable of 8000 hours).

2. ASTM D530 (hardness).
3. ASTM D412 (tensile strength and elongation).
4. ASTM D522 (pass 3/8-inch mandrel).
5. ASTM D968 (abrasion test).
6. ASTM E96 (vapor transmission).
7. Water clear, non-yellowing, free of waxes and urethanes.
8. Non-toxic, non-flammable, biodegradable, with a PH 7 to 8.5.
9. Shall allow moisture vapor transmission.

C. Siloxane Penetrating Water Sealer: Compatible with graffiti solution system. Provide over concrete masonry units surfaces prior to application of undercoating.

D. Undercoating: Water-based high-performance under coating used as a sealer.

E. Topcoating: Permanent anti-graffiti top coating, clear matte finish.

F. Graffiti Remover: Non-flammable, biodegradable, with a pH 7-8.5 and recyclable, allowing graffiti removal without the use of blasting equipment, hot water, or high-pressure wash equipment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which graffiti-resistant coatings will be applied.

1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
2. Start of application is construed as applicator's acceptance of surfaces within that particular area.

B. Review other Sections where primers or coatings are provided to ensure compatibility of total systems for various substrates.

1. If potentially incompatibility of primers applied by others exists, obtain the following from the primer applicator before proceeding:
    a. Confirmation of primer's suitability for expected service conditions.
    b. Confirmation of primer's ability to be top coated with specified materials.
2. Notify the City's Representative of anticipated problems before proceeding with application.

3.02 PREPARATION

A. Remove plates, machined surfaces, and similar items in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before coating.

1. After completing coating operations, reinstall items that were removed; use workers skilled in the work involved.

B. Cleaning: Before applying coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coating according to manufacturer's written instructions for each substrate condition.

1. Provide barrier coats over incompatible primers or remove primers and re-prime substrate.

2. Cementitious Substrates: Prepare concrete masonry, cement plaster and concrete surfaces. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces. Do not coat surfaces if moisture content exceeds manufacturer's maximum.

D. Material Preparation: Mix and prepare coating materials in accordance with manufacturer's instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.

2. Stir materials before applying to produce a mixture of uniform density. Sir as required during application.

3.03 APPLICATION

A. Apply coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.

a. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.

b. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform, or feel sticky under moderate thumb pressure, and application of another coat does not cause under-coat to lift or lose adhesion.

2. Apply to full height of vertical surface.

B. Application over Cementitious Surfaces:

1. All natural surfaces including concrete, masonry units, brick tile and block shall be treated with a siloxane penetrating water sealer compatible with the graffiti solution system.

2. Base: Minimum of 2 coats or as required to achieve a pinhole free surface, of specified barrier coating, 3- to 4-mils minimum dry film thickness.

3. Finish: Minimum 2 coats of top coating, 3- to 4-mils minimum dry film thickness or as required to comply with specified warranty requirements.

C. Completed Work: Match approved samples and mock-up for color, texture, and coverage. Refer to Section 01 43 39 Mock-ups for general mock-up requirements. Remove, refinish, or recoat work that does not comply with specified requirements.

3.04 FIELD QUALITY CONTROL

A. The City's Representative reserve the right to invoke the following procedure at any time and as often as City's Representative deems necessary during the period when coatings are being applied:

1. City will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of the Contractor.

2. City may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Remove non-complying coating materials from the Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

B. Demonstration: Apply alkyd-based graffiti to a 2-foot square treated area selected by the City's Representative. Allow graffiti to remain on surface for a minimum of 5-days and demonstrate complete removal in the presence of the City's Representative.

3.05 CLEANING

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

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

3.06 PROTECTION

A. Protect adjacent work against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating as approved by the City's Representative, and leave in an undamaged condition.

B. Provide "wet paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings.

END OF SECTION
09 92 23

SECTION 12 93 00
SITE FURNISHINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish all labor, materials, miscellaneous hardware, foundations, miscellaneous appurtenances, facilities, transportation, and services required for installation of all site furnishings and related work as shown on the Drawings and/or specified herein.

B. Although such Work is not specifically indicated, provide all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure and complete installation.

1.02 SUMMARY OF WORK

A. The general extent of work contained in this section is shown on the drawings and can include, but may not be limited to, furnishing and/or installation of the following:

1. Group Picnic Shade Shelter
2. Dog Park Shade Shelter
3. Benches
4. Picnic Tables
5. Trash and Recycling Receptacles
6. Drinking Fountains
7. Bicycle Racks
8. Dog Waste Pet Station
9. Children’s Play Area Equipment
10. Play Area Shade Sail Structure
11. Fold Down and Fixed Bollards
12. Decorative Concrete Post and Rail Fence
13. Ballfield Equipment Storage Container
14. Ballfield Scorer’s Table and Bench
15. Ballfield Player Benches
16. Ballfield Spectator Bleachers
17. Basketball Post, Backboard, Rim, and Net
18. Tennis Court Posts and Net
19. Tennis Court Outpost Message Board
20. Volleyball Court Posts and Net
21. BBQ Grills

1.03 RELATED SECTIONS

A. General and Project Conditions of the Bid Documents

B. Section 00 11 00 Summary of Work

C. Section 32 13 13 Concrete Paving

1.04 REFERENCES AND REGULATORY REQUIREMENTS

A. American Institute of Steel Construction:

1. AISC Steel Construction Manual (14th Edition).

B. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
6. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
7. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
8. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
9. ASTM A588 - Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4-in. (100-mm) Thick.
10. ASTM A618 - Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
11. ASTM A992 - Standard Specification for Structural Steel Shapes.
12. ASTM F436 - Standard Specification for Hardened Steel Washers.
13. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

C. California Building Code

1.05 QUALIFICATION OF INSTALLER

A. Installer shall be thoroughly trained and experienced in the skills required and shall be completely familiar with the products and their installation as specified on the Drawings and in this Section. Installer shall be present at all times during progress of Work of this Section and shall direct all Work performed.

1.06 SUBMITTALS

A. Submit manufacturer's catalog cuts of all products for approval by City’s Representative per the supplementary conditions. Catalog cuts shall clearly identify product, finishes, color, schedule, and installation.

B. Product Data: Submit catalog “cut sheets” of all materials and equipment proposed to be furnished and/or installed under this portion of the work. Include the manufacturers and distributors name, as applicable. Insure that the “cut sheets” clearly describe the specific product by catalog number and that additional non-specified products that may appear on the same “cut sheet” are crossed out where applicable.

C. Submit aforementioned information for all items, regardless of whether item is owner furnished or furnished by others. Selection, verification, and approval of all items and options are imperative to fully coordinating the work. Clearly designate any item not furnished by City’s Representative.

D. Samples: Submit samples of colors and finishes for all applicable products and furnishings for selection by City’s Representative.

E. Shop Drawings: Submit complete shop drawings for all materials or furnishings requiring field or shop fabrication.

1.07 QUALITY ASSURANCE

A. Review: All equipment shall be reviewed for conformance with the intent of the Contract Documents and accepted by the City's Representative prior to installation.

B. All site furnishings shall be new.

1.08 DELIVERY, STORAGE, HANDLING

A. The Contractor is responsible for coordination of the delivery, acceptance, handling and storage of all site furnishings.

B. Store and handle site furnishings as acceptable to the City's Representative and so that work or access of others is not impeded.

C. The Contractor shall protect all site furnishings from theft or damage at all times until such items have been accepted by the City's Representative.

PART 2 - PRODUCTS

2.01 GROUP PICNIC SHADE SHELTER

A. Per Sheet L1.0, Symbol 2-07

B. Or equal

2.02 DOG PARK SHADE SHELTER

A. Per Sheet L1.0, Symbol 2-08

B. Or equal

2.03 BENCHES

A. Per Sheet L1.0, Symbols 2-09 & 2-10

B. Or equal

2.04 PICNIC TABLES

A. Per Sheet L1.0, Symbols 2-11 & 2-12

B. Or equal

2.05 TRASH AND RECYCLING RECEPTACLES

A. Per Sheet L1.0, Symbols 2-13 & 2-14

B. Or equal

2.06 DRINKING FOUNTAINS

A. Per Sheet L1.0, Symbols 2-15 & 2-16

B. Or equal

2.07 BICYCLE RACKS

A. Per Sheet L1.0, Symbol 2-17

B. Or equal

2.08 DOG WASTE PET STATION

A. Per Sheet L1.0, Symbol 2-18

B. Or equal

2.09 CHILDREN'S PLAY AREA EQUIPMENT

A. Per Sheet L1.0, Symbol 2-19 and Sheets L1.8 - L1.9

B. Or equal

2.10 PLAY AREA SHADE SAIL STRUCTURE

A. Per Sheet L1.0, Symbol 2-20

B. Or equal

2.11 FOLD DOWN AND FIXED BOLLARDS

A. Per Sheet L1.0, Symbols 2-23 & 2-24

B. Or equal

2.12 DECORATIVE CONCRETE POST AND RAIL FENCE

A. Per Sheet L1.0, Symbol 2-29

B. Or equal

2.13 BALLFIELD EQIPMENT STORAGE CONTAINER

A. Per Sheet L1.0, Symbol 2-36

B. Or equal

2.14 BALLFIELD SCORER'S TABLE AND BENCH

A. Per Sheet L1.0, Symbol 2-37

B. Or equal

2.15 BALLFIELD PLAYER BENCHES

A. Per Sheet L1.0, Symbol 2-38

B. Or equal

2.16 BALLFIELD SPECTATOR BLEECHERS

A. Per Sheet L1.0, Symbol 2-39

B. Or equal

2.17 BASKETBALL POST, BACKBOARD, RIM, AND NET

A. Per Sheet L1.0, Symbol 2-41

B. Or equal

2.18 TENNIS COURT POSTS AND NET

A. Per Sheet L1.0, Symbol 2-42

B. Or equal

2.19 TENNIS COURT OUTPOST MESSAGE BOARD

A. Per Sheet L1.0, Symbol 2-43

B. Or equal

2.20 VOLLEYBALL COURT POSTS & NET

A. Per Sheet L1.0, Symbol 2-45

B. Or equal

2.21 BBQ GRILLS

A. Per Sheet L1.0, Symbol 2-47

B. Or equal

2.22 BRONZE DEDICATION PLAQUE (City-Furnished and Installed Item)

A. Bronze outdoor architectural signage with brown leatherette background and standard 3/8" border with brush finish.

B. City of Folsom shall order and install the plaque. Contractor required to coordinate and obtain shop drawings of plaque from City prior to ordering precast cap, and for grouting after installation of plaque.

PART 3- EXECUTION

3.01 SEQUENCING AND SCHEDULING

A. Coordinate timing of installation of site furnishings with all other pertinent work.

3.02 INSTALLATION

A. Layout: Conform to layout shown on Drawings, and in accordance with all applicable codes. Coordinate footings with all other work.

B. Concrete Footings:

1. Install per manufacturer's instructions unless noted otherwise as shown in Drawings.
2. Concrete shall conform to requirements of Section 32 13 13 Concrete Paving unless noted otherwise.
3. In the event of a conflict, the more stringent requirement or better quality shall apply.

C. Install site furnishings in strict conformance with, accepted Shop Drawings, manufacturer's instructions, as shown on the plans.

D. Install items level and plumb.

E. Field-paint, coat, or finish all mounting hardware to match manufacturer's finish.

3.03 PROTECTION AND CLEANING

A. Do not remove protective wrappings from furnishings until instructed by City's Representative. Keep all trash lids (if specified) closed and locked and do not allow trash receptacles to be used until after acceptance.

B. Clean all concrete slobber, dirt, or other debris from installed work. Protect all installed work from other work until accepted by City's Representative.

END OF SECTION
12 93 00

SECTION 13 26 00
PREMANUFACTURED REDRESTROOM

PART 1 - GENERAL

1.01 SUMMARY

A. Description: coordination and installation of a double precast concrete flush toilet building, complete with a floor slab, utility chase, storage room, drinking fountain, plumbing, light fixtures, finishes, and accessories. Restroom may consist of either factory-built units, or compiled materials delivered to the site and erected by manufacturer's forces (turnkey).

B. Work includes Contractor ordering, purchasing, and installing the restroom to include all necessary coordination, pad preparation, utilities, flatwork, and all other labor, materials, and service required for a complete and functional installation.

C. Work covered under related sections:

1. Painting: 09 90 00 – Painting and Coating.
2. Electrical connections to building: 26 00 10 – Basic Electrical Requirements
3. Preparation of subgrade: 31 20 00 – Earthwork
4. Concrete building sidewalk: 32 13 13 – Concrete Paving

D. Order of work: Contractor must coordinate order of work, connections, and ancillary work with manufacturer's recommendations and requirements.

1.02 SUBMITTALS

A. Provided by Contractor for coordination: Manufacturer's information and requirements for pad and site preparation.

B. Also to be provided by Contractor:

1. Three copies of manufacturer's technical data including detailed plans and specifications.
2. Manufacturer's warranty.
3. Structural Calculation Package stamped by a Licensed California Structural Engineer
4. Haul route and traffic plans
5. Fire Alarm package as required for Fire Department Approval.
6. Manufacturer's building worksheets and any other request(s) for building information required.
7. Letter of Acceptance from manufacturer stating that the restroom has been placed, or constructed by manufacturer's forces, and installed in accordance with these specifications, and that the full manufacturer's warranty will be in effect. This submittal must be made within twenty (20) calendar days following installation of the restroom.

1.03 QUALITY REQUIREMENTS

A. The following standards are adopted by reference:

1. American Society for Testing and Materials (ASTM)
   a. ASTM C33 Concrete Aggregate
   b. ASTM C39 Method of Test for Compressive Strength of Cylindrical Concrete Specimens
   c. ASTM C94 Standard Specifications for Ready Mix Concrete
   d. ASTM C143 Method of Test for Slump of Concrete

e. ASTM C150 Standard Specification for Portland Cement

f. ASTM C192 Method of Making and Curing Test Specimens in the Laboratory

2. American Concrete Institute (ACI)

a. ACI 318 Building Code Requirements for Reinforced Concrete

b. ACI 1211.1 Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete

3. Precast Concrete Institute (PCI)

a. PCI MNL 116 Quality Control for Plants and Production of Precast Prestressed Concrete Products

4. American Welding Society (AWS)

a. AWS D1.1 American Welding Society Standard Specification D1.1, Structural Steel

5. Structural Steel Painting Council Standard Procedures (SSPC)

a. SSPC Standard Procedures SP-1 through SP-6

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. The following manufacturer and product are pre-approved:

1. Public Restroom Company, 2587 Business Pkwy, Minden, NV 89423, tel. (775) 783-1200. Project / Proposal Reference: 11184-1/13/2022-2

2. Acceptable Manufacturers: In the event of a substitution, it is Contractor's responsibility to provide full and complete data adequate to demonstrate compliance with the criteria here specified. Incomplete data will be rejected.

B. Design Criteria.

1. Floor load: 250 pounds per square foot.

2. Roof live load: 60 pounds per square foot.

3. Wind load: 120 miles per hour.

4. Seismic load: Zone three.

5. Accessibility: Meet Americans with Disabilities Act Accessibility Guidelines (ADAAG) and California Building Code (Title 24).

2.02 MATERIALS

A. Concrete - General

1. The concrete mix design must be designed to ACI 211.1 to produce concrete of good workability.

2. Concrete must contain a minimum of 610 pounds of cement per cubic yard. Cement must be a low alkali type III conforming to ASTM C-150.

3. Coarse aggregates used in the concrete mix design must conform to ASTM C33 with the designated size of coarse aggregate #67.

4. Minimum water/cement ratio must not exceed .45. Slump may not exceed 5".

5. Air-entraining admixtures must conform to ASTM C260. Water reducing admixtures must conform to ASTM C494, Type A. Other admixtures may not be used without the City Representative's approval.

B. Colored Concrete

1. Color additives must conform to ASTM C979, color to be as selected by the City's Representative. A 12"x12"x1" color sample must be provided for review.
2. The following must contain colored concrete:
    a. Toilet building walls and roof panels – color to match Basalite #345.
    b. Screen panels – color to be selected.
    c. The same brand and type of color additive must be used throughout the manufacturing process.
    d. All ingredients must be weighed and the mixing operation must be adequate to ensure uniform dispersion of the color.

C. Cold Weather Concrete
1. Cold weather concrete placement must be in accordance with ACI 306.
2. Concrete may not be placed if ambient temperature is expected to be below 35° F during the curing period unless heat is readily available to maintain the surface temperature of the concrete at least 45° F.
3. Materials containing frost or lumps of frozen materials may not be used.

D. Hot Weather Concrete: The temperature of the concrete must not exceed 80° F. at the time of placement and when the ambient reaches 90° F, the concrete must be protected with moist covering.

E. Concrete Reinforcement
1. All reinforcing steel must conform to ASTM A615. All welded wire fabric must conform to ASTM A185.
2. All reinforcement must be new, free of dirt, oil, paint, grease, loose mill scale and loose or thick rust when placed.
3. Details not shown on drawings or specified must be to ACI 318.
4. Steel reinforcement must be centered in the cross-sectional area of the walls and must have at least 1" of cover on the under surface of the floor and roof.
5. The maximum allowable variation for center-center spacing of reinforcing steel is ½".
6. Full lengths of reinforcing steel must be used when possible. When splices are necessary on long runs, splices must be alternated from opposite sides of the components for adjacent steel bars. Lap bars #4 or smaller a minimum of 12". Lap bars larger than #4 a minimum of 24 bar diameters.
7. Reinforcing bars must be bent cold. No bars partially embedded in concrete may be field bent without prior written approval.

F. Sealers and Curing Compounds
1. Curing compounds, if used, must be colorless, complying with ASTM C309, type I or 1-D.
2. Weatherproofing sealer for exterior of building must be clear, pure acrylic water repellant penetrating sealer.

G. Caulking, Grout, Adhesive and Sealer
1. All caulking must remain flexible and non-sag at temperatures from -50° to +140° F.
2. Interior joints must be caulked with a paintable silicone-based caulk.
3. Exterior joints must be caulked with a tripolymer sealant caulk. which compliments the exterior color.
4. Grout must be a non-shrink type and must be painted to match the color of surrounding concrete as nearly as possible.

5. Epoxy concrete adhesive must be two component, rigid, non-sag gel adhesive for bonding to dry or damp surfaces, moisture insensitive.
6. Portland cement mortar must consist of one part Portland cement, three parts sand and enough water to make workable mixture.

H. Paint

1. All paints and materials must conform to all Federal specifications or be similar “top-of-the-line-components”. Paints may not contain more than 0.06% by weight of lead.
2. Type of paints for toilets
   a. Inside concrete surfaces:
      i. Inside floors: 1 coat of 1-part water-based epoxy (grey) with a silica sand suspension to provide uniform texture.
      ii. Interior walls and ceilings: 2 coats of a modified acrylic penetrating pigment (white), followed by 1 coat of clear sealer.
   b. Metal surfaces both inside and out, except stainless steel:
      i.. 1 coat primer and 1 coat of enamel
      ii. Tops and bottoms of doors must be coated per the finish schedule prior to installation.
   c. Exterior concrete surfaces:
      i. Exterior slab must be 1 coat of clear sealer
      ii. Exterior walls must be 2 coats of pure acrylic water repellent penetrating stain in the same color as the walls or roof followed by 1 coat of clear acrylic anti-graffiti sealer.

I. Grab bars: Grab bars must be 18-gauge, type 304 stainless steel, #4 finish, with 1-1/2” clearance. Grab bars must each be able to withstand 300-pound top loading.

J. Toilet Room Accessories

1. Toilet Paper Dispenser: Dispenser must be constructed of ¼” thick stainless steel. Dispenser must be capable of holding 12" rolls of toilet paper. Toilet paper holder fastening system must be able to withstand 300-pound top loading.
2. Soap Dispenser: Bobrick B-155 or ASI 0343, dispenser to be 40" maximum above finish floor.
3. Surface mounted sanitary napkin disposal: Bobrick B-254 or ASI 0473-A, opening 33" maximum above finish floor.
4. Toilet seat dispenser: Bobrick B-3013 or ASI 0477-SM, opening 40" maximum above finish floor.
5. Trash can: supply one per stall, RUBBERMAID, 24 gal. Square white Swing Top Trash Can Item # 8E201, Mfr. Model # FGT1424SSRB, Swing Top Trash Can, Shape Square, Capacity 24 gal., Color White, Height 35-1/2 In., Length 14 In., Width 14 In., Top Type Hinged, Stainless Steel Material, Standards: UL Listed/FM Approved Fire-Safe/Self Extinguishing and California State Fire Marshall Listed, Includes Retainer Band

K. Steel Doors

1. Door sizes:
   a. 36" wide x 80" high for restrooms
   b. 30" wide (minimum) x 80" high for utility chase
2. Doors must be flush panel type 1-3/4” thick, minimum 18-gauge prime coated steel panels with minimum 12 gauge internal bracing channels with polystyrene core.

3. Door frames must be knockdown or welded type, single rabbet, minimum 16-gauge prime coated steel, width to suit wall thickness. Three (3) rubber door silencers must be provided on latch side of frame.

L. Door Hinges: Door hinges must be 3 per door with dull chrome plating 4-1/2”x4-1/2”, adjustable tension, automatic-closing for each door.

M. Lockset

1. Lockset must meet ANSI A156.2 Series 4000, Grade 1 cylindrical lockset for exterior doors.
2. Lever handle both inside and out
3. Exterior lever operated by key; door remains locked when no key is used.
4. Inside lever always active.
5. US-26D finish.
6. City will provide pinning schedule.
7. Strike shall be electric, remote activated, satin stainless-steel finish, model ”ES5” as manufactured by BEST, a tradename of Stanley Security Solutions, tel. 317.849.2250. Note: contractor shall wire the electric strike to the RainMaster Irrigation controller, using a 24v relay located either in the chase or the controller. Contractor shall install all wiring, conduit, components, etc. as required to connect to controller.

N. Dead Bolt: Deadbolt must be an auxiliary indicator lock Pri-Va-Cee model K-250-RG, Falcon D871 or equivalent with a red/green message indicator, T Grade II deadbolt, 2¾” backset, chrome finish, and emergency key. The cylinder must be a standard 1-1/8” to 1-3/4” Schlage Mortise cylinder with compression ring and 626 finish.

O. Doorstop: Doorstop must have a cast metal base, US-26D finish with gray rubber 2-3/8” diameter bumper with a 1” projection.

P. Double Coat Hook: Coat hook must be 304 stainless steel 12 gauge (2.8mm), formed construction with a satin finish and have 3/16”x 7/8” nail in anchor. Upper hook must extend at least 2-1/2” from the wall. Lower hook must extend at least 1-1/4” from the wall.

Q. Shelf: A shelf must be provided in each restroom. The shelf must be 12” x 30” stainless steel, mounted 48“ maximum above the finished floor, and must be able to withstand 300-pound top loading.

R. Mirror: Mirror to be 18” x 24” stainless steel.

S. Door Sweep: Door sweep must be provided at the bottom of door and must be an adjustable brush type.

T. Wall Vent: Wall vent must be cast into the concrete wall. The units’ frame must be C3 x 4.1 channel steel. The louver frame must be 3/16” x #3 flat bar. The louver must be inverted Y, no-vision 2”x2”x1/8” angle. All steel must be primed and painted as defined in metal painting specification. There must be an insect screen between louvers.

U. Plumbing

1. Waste and vent material must be ABS or PVC plastic and must be plumbed to meet California Building Codes.
2. Water material must be copper tubing Type L, hard drawn. All water lines must be of a size to provide proper flushing action based on a nominal water pressure of 40 psi.
3. All plumbing must be concealed in the service area.
4. Toilet must be constructed of vitreous china, wall hung. Toilet must be mounted with the top of the seat 17 inches above the finished floor. Seat must be heavy duty solid plastic with an open front.
5. Flush valves shall be: SLOAN Royal 111 ESS Toilet 24VAC, 50/60 Hz 1.6 Technical Specs:

Item Automatic Flush Valve, Fixture Type Toilet, Exposed, Power Source 24VAC, 50/60 Hz, Gallons per Flush 1.6, Inlet Size 1", Spud Coupling 1-1/2", Rough-In 11-1/2".

6. Lavatory must be enamel coated cast iron with back splashguard, front overflow opening, equipped with brass trap and drainpipe without stopper. Sink must be 20” wide x 18” front to back x 6 inches deep.
7. Water valve must be self-closing water set with indexed push button.
8. A Hose bib must be available in the chase area.
9. A main shut-off valve and drain must be provided with plumbing.

V. Mechanical

1. Exhaust fan for each restroom, activated with lights.

W. Electrical

1. All electrical wiring must be in conduit, surface mounted in the service area and concealed in the user compartments. All wire must be copper.
2. A 100-amp breaker panel (120/208v, 3 phase) must be provided in the building.
3. Outdoor lights above compartment doors must be LED, cast aluminum case, rated for outdoor use.
4. The hand dryer shall be: American Dryer EXT7-SS Extreme Air Hand Dryer, Extreme Air, 540 Watts, No Heat, GreenSpec, LEED, 100-240 Smart Voltage, Adjustable Quiet Levels, Antimicrobial, Stainless Steel Cover, Commercial Hand Dryer
5. Lighting on the exterior of building must be photocell activated; chase/utility room must be switch activated; and restroom interior lights and fans must be activated by a motion sensor.
6. Interior lights must be vandal-resistant LED fixtures.

PART 3 - EXECUTION

3.01 MANUFACTURE

A. Mixing and Delivery of Concrete:

Mixing and delivery of concrete must be in accordance with ASTM C94, section 10.6 through 10.9 with the following additions.

1. Aggregate and water must be adjusted to compensate for differences in the saturated surface-dry condition.
2. Concrete must be discharged as soon as possible after mixing is complete. This time may not exceed 30 minutes.

B. Placing and Consolidating Concrete

Concrete must be consolidated by the use of mechanical vibrators. Vibration must be sufficient to accomplish compaction but not to the point that segregation occurs.

C. Finishing Concrete

1. Interior floor and exterior slabs must be floated and troweled. A light broom finish must be applied to the exterior and interior slabs.
2. Exterior wall textures must be smooth concrete
3. Roof texture must be ribbed metal.
4. The underside of the overhang must have a smooth finish.

D. Cracks and Patching

1. Cracks in concrete components which are judged to affect the structural integrity of the building will be rejected.

2. Small holes, depressions and air voids must be patched with a suitable material. The patch must match the color, finish and texture or the surrounding surface.

3. Patching will not be allowed on defective areas if the structural integrity of the building is affected.

E. Curing and Hardening Concrete

1. Concrete surfaces may not be allowed to dry out from exposure to hot, dry weather during initial curing period.

3.02 FINISHING AND FABRICATION

A. Structural Joints

1. Wall components must be joined together welded plates or other approved system. Weld plates must be anchored into the concrete panel and welded together with a continuous weld. The inside seams must be a paintable caulk. The outside seams must use a caulk in a coordinating building color or clear.

2. Walls and roof must be joined with weld plates, 3”x6”, at each building corner, or other approved system.

3. The joint between the floor slab and walls must be joined with a grout mixture on the inside, a matched colored caulk on the outside and two weld plates, 6” long per wall, or other approved system.

B. Painting/Staining

1. An appropriate curing time must be allowed before paint is applied to concrete.

2. Some applications may require acid etching. If this is the case, a 30% solution of hydrochloric acid must be used, flushed with water and allowed to thoroughly air dry.

3. Painting may not be done outside in cold, frosty or damp weather.

4. Painting may not be done outside in winter unless the temperature is 50° F or higher.

5. Painting may not be done in dusty areas.

3.02 INSPECTIONS AND TESTING

A. All inspection and testing of concrete must be in accordance with ASTM C94.

3. The following tests must be performed on concrete used in the manufacture of toilets. All testing must be performed in a laboratory. Testing may only be performed by qualified individuals who have been certified ACI Technician Grade

a. Sampling must be in accordance with ASTM C172.

b. The slump of the concrete must be performed on the first batch of concrete in accordance with ASTM C143. This slump must be 3”-5”.

c. The air content of the concrete must be checked per ASTM C231 on the first batch of concrete. The air content must be 4.5% +/- 1.75%.

d. The compressive strength of the cylinders must be tested to ASTM C39. One (1) cylinder must be made for release, one (1) for 7 days and one (1) for 28 days. The release must be a minimum strength of 2500 psi, the 7-day must be a minimum of 4000 psi and the 28-day must be a minimum of 5000 psi.

e. A copy of all test reports must be available to the customer as soon as 28-day test results are available. All test results must be retained as quality records.

B. All welding must be in accordance with AWS D1.1.

3. Submit written welding procedures and standards for review.

4. The welding inspector must have current CWI certification.

5. All welds must be visually inspected.
6. All full penetration welds must be ultrasonically tested.

3.03 INSTALLATION

A. Work specified under this Section relates to the placement of the unit by others on prepared foundation pads.

B. Location: It is the responsibility of Contractor to:

3. Provide exact location for installation by stakes or other approved method.
4. Take precautions in case of overhead or underground obstructions.
5. Coordinate access to the site for truck delivery and sufficient area for a crane to install and the equipment to perform the contract requirements.
6. Place water, sewer, and electrical connections per manufacturer's drawings. Connections must be placed to easily connect to the building.
7. Set the subgrade so that the finished floor elevation is level and between 0 and ¼ " above the adjoining sidewalk grade as shown on the plans.

C. Compacting

The bottom of the pad area must be compacted after it has been excavated. After the base has been placed, it must be compacted to 95%. The bearing of the soil and base should be a minimum of 1,500 pounds per square foot. The building must not bear directly on rock; if rock is encountered, it must be undercut to a minimum of 4" below the building and replaced with an approved fill material.

D. Base: Refer to project geotechnical report, and minimum requirements as shown on the plans. Contractor is responsible to fully coordinate all pad and base preparation requirements with the selected building manufacturer.

E. Access to Site: Delivery to site will be made on normal highway trucks and trailers.

F. Concrete flatwork around the restroom building may not be placed prior to installation of the building.

END OF SECTION
13 26 00

SECTION 26 00 10
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Table of Contents, Division 26 - Electrical:

SECTION NO.	SECTION TITLE
1. 260010	BASIC ELECTRICAL REQUIREMENTS
2. 260060	POWER SYSTEM STUDY
3. 260519	BUILDING WIRE AND CABLE
4. 260526	GROUNDING AND BONDING
5. 260533	BOXES
6. 260543	UNDERGROUND DUCTS AND STRUCTURES
7. 260553	ELECTRICAL IDENTIFICATION
8. 262416	PANELBOARDS
9. 262431	SWITCHBOARDS
10. 262726	WIRING DEVICES
11. 262816	OVERCURRENT PROTECTIVE DEVICES
12. 265668	SPORTS FIELD LIGHTING

B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.
   1. Quality assurance.
   2. Definition of terms.
   3. Submittals.
   4. Coordination.
   5. Record documents.
   6. Operation and maintenance manuals.
   7. Project management and coordination services.
   8. Excavation.
   9. Rough-in.
   10. Electrical installation.
   11. Cutting, patching, painting, and sealing.
   12. Field quality control.
   13. Cleaning.
   14. Project closeout.

C. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.
   1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.
   2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.

3. Concrete work: Include forming, steel bar reinforcing, cast-in- place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Also includes setting of floor boxes in existing concrete slabs, saw-cutting of existing slabs and grouting of conduits in saw-cut. Refer to Division 03, Concrete.
4. Miscellaneous metal work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of panelboards, distribution boards, etc. Refer to Division 05, Miscellaneous Metals.
5. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.

1.02 QUALITY ASSURANCE

A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements, or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.

C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
    1. California Electric Code (CEC).
    2. California Building Code (CBC).
    3. California Fire Code (CFC).
    4. California Mechanical Code (CMC).

D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:
    1. ACI American Concrete Institute
    2. ANSI American National Standards Institute
    3. ASTM American Society for Testing Materials
    4. CBM Certified Ballast Manufacturers
    5. ETL Electrical Testing Laboratories
    6. FS Federal Specification
    7. IEEE Institute of Electrical and Electronics Engineers, Inc.
    8. IPCEA Insulated Power Cable Engineer Association
    9. NEMA National Electrical Manufacturer's Association
    10. UL Underwriters' Laboratories

1.03 DEFINITION OF TERMS

A. The following list of terms as used in the Division 26 documents shall be defined as follows:
    1. "Provide": Shall mean furnish, install, and connect unless otherwise indicated.
    2. "Furnish": Shall mean purchase and deliver to Project site.

3. "Install": Shall mean to physically install the items in-place.
4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.
5. "As directed": Shall be as directed by the Owner or their authorized Representative.
6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

1.04 SUBMITTALS

A. Refer to Division 1.

B. Format: Furnish submittal data in electronic format for each Specification Section with a table of contents listing materials by Section and paragraph number.

C. Submittals shall consist of detailed Shop Drawings, Specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and those which are excluded. Furnish quantities of each submittal as noted in Division 01.

D. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents or provide a Specification Section line-by-line compliance response statement with detailed exception/ deviation response statements for all applicable provisions for the applicable Specification Section. Any Specification Section lines without a detailed exception/ deviation response statement shall be treated as the Contractor or Vendor is submitting in full compliance with the applicable Specification Section requirements. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.

E. The Contractor shall submit detailed Drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the construction documents. Physical size of electrical equipment indicated on the Drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'- 0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.

F. As part of the equipment and fixture submittals, the Contractor shall provide anchorage calculations for floor and wall mounted electrical equipment and fixtures, distribution conduits and raceways, in conformance with the 2019 California Building Code (CBC) and ASCE 7-16. Use the Occupancy Category, Ground Accelerations, Site Class, Seismic Design Category, and Seismic Importance Factor as noted in the structural drawings. For components required for Life Safety or containing hazardous materials use Ip=1.5. Structural Calculations shall be prepared, stamped, and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

G. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights, and approximate centers of gravity.

H. Review of submittals is for general conformance to design concept and general compliance with the Specification Sections. Submittal Review Comments do not imply waiver of Specifications Section requirements unless specifically noted.

I. All resubmittals shall include a cover letter that lists the action taken and revisions made to each Drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

J. Testing report:
    1. Test report shall include the following:
        a. Summary of Project.
        b. Description of equipment.
        c. Equipment used to conduct the test.
            1) Type.
            2) Manufacturer.
            3) Model number.
            4) Serial number.
            5) Date of last calibration.
            6) Documentation of calibration leading to NIST standards.
        d. Description of test.
        e. Test results, as compared to Manufacturers or industry accepted standards and tolerances.
        f. Conclusion and recommendation.
        g. Signature of responsible test organization authority.

K. Substitutions:
    1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.
    2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit to the Engineer all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.
    3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility, and appearance. Materials, processes, or equipment, which in the opinion of the Engineer is equal in quality, utility, and appearance, will be approved as substitutions to that specified.
    4. Whenever any material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.
    5. Substitutions shall be equal, in the opinion of the Architect/Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Architect/Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one

specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work or from any provisions of the Specifications.

6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes, and equipment, including the effect of the substitution on the Contractor, Subcontractor's, or other Contractor's Work. No substitution of material, processes or equipment shall be permitted without written authorization of the Architect/Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

1.05 COORDINATION

A. Discrepancies:
   1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.
   2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors, ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:
   1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities, and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.
   2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices, and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.
   3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

C. Preparation:
   1. Drawings:
      a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.

b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

1.06 RECORD DOCUMENTS

A. Provide Project Record Drawings as described in Division 1 and herein:
   1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit, and wire sizing as well as routing, revised luminaire schedule listing Manufacturers and products installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current, monthly payments may be withheld.
   2. Record Drawings shall be the transfer of information on these prints to the construction documents via computer aided drafting (CAD). A set of CAD files of the electrical construction documents will be provided to the Contractor by the Engineer.
   3. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:
      a. All underground installation.
      b. Final electrical installation.
   4. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:
      a. Electronic files of Drawings in PDF and CAD.

B. Panel schedules:
   1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms provided by the Manufacturer and inserted in the pocket of the inner door of each panelboard. See Section 262416: Panelboards for requirements.

C. Field labels, markings, and warning signs: Provide in accordance and as required by:
   1. Arc-Flash Warning: CEC Article 110.16.
   2. Identification of Disconnecting Means: CEC Article 110.22 (A).
   3. Available Fault Current: CEC Article 110.24.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Prior to Project closeout furnish to the Owner O & M Manuals in PDF format containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each Section all equipment furnished under Division 26. Refer to Division 1 for additional information.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.

B. Verify final locations for rough ins with field measurements and with the requirements for the actual equipment to be connected.

3.02 ELECTRICAL INSTALLATION

A. Preparation, sequencing, handling, and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:
   1. Shop Drawings prepared by Manufacturer.
   2. Verify all dimensions by field measurements.
   3. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
   4. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
   5. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components, where installed exposed in finished spaces.
   6. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
   7. Conform to the National Electrical Contractors Association "Standard of Installation" for general installation practice.

3.03 CUTTING, PATCHING, PAINTING AND SEALING

A. Protection of Installed Work: Protect all adjacent installations when doing any work.

B. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

C. Patch existing surfaces using experienced installers and new materials matching existing materials and the original installation. For installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.04 FIELD QUALITY CONTROL

A. General testing requirements:

1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer's tolerances and is installed in accordance with design Specifications.
2. Tests and inspections shall determine suitability for energization.
3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.
4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.

B. Tests: In addition to specific system test described elsewhere, tests shall include:
1. Sports Lighting: Provide aiming services to assure the fixtures are installed and aimed as directed from the manufacturer. Lighting calculations shall be developed and field measurements taken on a 20' X 20' grid.
2. Lighting control circuits: Test lighting circuits for correct operation through their control devices. This shall include any scheduling features in the sports lighting controls.
3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm system shall be performed.
4. Circuit numbering verification: Select on a random basis, various circuit breakers within the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.

C. Testing safety and precautions:
1. Safety practices shall include the following requirements:
   a. Applicable State and Local safety operating procedures.
   b. OSHA.
   c. NSC.
   d. NFPA 70E.
2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.

D. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.

E. Notify Owner one week in advance of any testing.

F. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired, or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.

G. Include all test results in the maintenance manuals.

3.05 CLEANING

A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.06 PROJECT CLOSEOUT

A. Special tools: Provide one of each tool type required for proper operation and maintenance of the equipment provided under this Section. All tools shall be delivered to the Owner at the Project completion.

B. Keying: The District uses their own locks. Contractor shall request locks and keying information from the District prior to final walk through. Coordinate all keying with the District.

END OF SECTION
26 00 10

SECTION 26 00 60
POWER SYSTEM STUDY

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Services necessary to complete the system analysis studies required for the item specified under this Division, including but not limited to:
   1. Short circuit study.
   2. Protective device evaluation study.
   3. Arc flash and shock risk assessment.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with equipment specified elsewhere to perform a complete analysis study.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. American National Standards Institute, Inc. (ANSI):
      ANSI Z535.4; Product Safety Signs and Labels
   2. Institute of Electrical and Electronic Engineers (IEEE):
      IEEE 1584; Guide for Performing Arc-Flash Hazard Calculations
   3. National Fire Protection Association (NFPA):
      NFPA 70E; Standard for Electrical Safety in the Workplace

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. The results of the Power System Study shall be summarized in a final report. Three (3) bound copies of the final report shall be submitted.
   2. The report shall include the following Sections:
      a. Description, purpose, basis and scope of the study and a single line diagram of that portion of the power system, which is included within the scope of the study.
      b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties and commentary regarding it.
      c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection and commentary regarding it.
      d. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
      e. Recommended size for power fuses and recommended settings for ground fault relays and for all adjustable trip relays.
      f. f. Confirmation in writing of compliance with Arc Energy Reduction per CEC Articles 240.67 and 240.87.
      g. Tabulations of arc flash and shock risk assessment results and commentary regarding results.
      h. Sample arc flash and shock hazard warning label.

3. Contractor shall also provide an electronic copy of the report as part of the Record Document process. Electronic copy of the report shall be in PDF format and its native file format (e.g. XXX.PRJ).

B. The study shall be submitted prior to final review of the distribution equipment Shop Drawings, prior to release of equipment for manufacture. If formal completion of the study may cause delay in equipment manufacture, approval from the Architect may be obtained for a preliminary submittal of sufficient data to ensure that the selection of device ratings and characteristics will be satisfactory. Then the formal study will be provided to verify the preliminary findings.

1.04 QUALITY ASSURANCE

A. The system analysis studies shall be performed by the Switchboard/Switchgear Manufacturer or by an approved Independent Testing Company. The analysis shall be stamped by a professional engineer licensed in the State of California.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL

A. The studies shall include all portions of the electrical distribution system from the main normal power services down to and including the 208volt AC distribution system. Normal system connections and those that result in maximum fault conditions shall be adequately covered in the study.

3.02 SHORT CIRCUIT STUDY AND PROTECTIVE DEVICE EVALUATION STUDY

A. The short circuit study shall be performed with the aid of a computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.

B. The study input data shall include the maximum available short circuit contribution, resistance and reactance components of the branch impedance, the X/R ratios, base quantities selected and other source impedance.

C. Short circuit close and latch duty values and interrupting duty values shall be calculated on the basis of maximum available current at each substation bus, switchgear bus, medium voltage controller, switchboard, low voltage motor control center, distribution panelboard, pertinent branch circuit panel and other significant locations through the system. The short circuit tabulations shall include asymmetrical fault currents, symmetrical fault currents and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch, shall be listed with its respective X/R ratio.

D. A protective device evaluation study shall be performed to determine the adequacy of circuit breakers, switches, transfer switches and fuses by tabulating and comparing the short circuit ratings of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the Architect's attention.

3.03 ARC FLASH AND SHOCK RISK ASSESSMENT

A. An arc flash and shock risk assessment shall be performed in accordance with NFPA 70E (utilizing IEEE 1584 calculation method for incident energy analysis method) at each switchboard, distribution board, panelboard, etc. in accordance with the referenced standards. NFPA 70E hazard/ risk tables for arc flash PPE category method are not acceptable for compliance with this section.

B. The arc flash and shock risk assessment shall include all voltage classes of equipment from the service entrance down to and including the panelboards, etc. in addition to all possible scenario configurations from alternate power sources (e.g. generators, etc.).

C. The company performing the arc flash and shock risk assessment shall provide arc flash and shock hazard warning labels for all equipment evaluated in accordance with NFPA 70E and ANSI Z535.4. Labeling shall be as follows:
    1. Label type:
        a. White vinyl or polyester with the following warning symbol color and black text:
            1) Incident energy below 40 cal/cm² = Orange.
            2) Incident energy for 40 cal/cm² and above = Red with DANGER symbol in lieu of WARNING.
        b. Industrial grade self-adhesive backing.
        c. Suitable for indoor or outdoor environments for a minimum of 3-years without fading or degrading.
    2. Label information (minimum):
        a. Nominal system voltage.
        b. Arc flash boundary (inches).
        c. Available incident energy and the corresponding working distance (inches).
        d. Limited approach boundary (inches).
        e. Restricted approach boundary (inches).
        f. Equipment identification.
        g. Date.
    3. Labels shall be affixed to all equipment covered under the risk assessment by the company performing the arc flash and shock risk assessment.
    4. Prior to printing and affixing labels, coordinate with the Owner and Architect, which scenario will be used for the labels.

END OF SECTION
26 00 60

SECTION 26 05 19
BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Building wire.
   2. Wiring connections and terminations.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Federal Specifications (FS):
      FS J-C-30A; Cable and Wire, Electrical (Power, Fixed Installation).
      FS W-S-610C; Splice Conductor.
      FS HH-I-595C; Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic.
   2. Underwriters Laboratories, Inc. (UL):
      UL 44; Thermoset-Insulated Wires and Cables.
      UL 83; Thermoplastic-Insulated Wires and Cables.
      UL 486A & B; Wire Connectors.
      UL 486C; Splicing Wire Connectors.
      UL 486D; Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
      UL 493; Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
      UL 510; Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
   3. National Electrical Manufacturer Association (NEMA):
      NEMA WC-70; Power Cables Rated 2,000 V or Less for the Distribution of Electrical Energy.
   4. Institute of Electrical and Electronic Engineers (IEEE):
      IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.
      IEEE 576; Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit Manufacturer's installation instructions.

4. Final test results.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Building wire:
      a. Cerrowire
      b. General Cable
      c. Southwire Company
      d. Stabiloy (aluminum only)
      e. United Wire and Cable
   2. Wiring connectors and terminations:
      a. 3M Company.
      b. Ideal.
      c. Blackburn-Holub.
      d. Burndy.
      e. Thomas & Betts Corp.
      f. Beau Barrier.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 BUILDING WIRE

A. Conductor material:
   1. Provide annealed copper for all wire, conductor, and cable, unless otherwise indicated.
   2. Copper wire AWG #8 and larger shall be stranded, unless otherwise indicated.
   3. Copper wire AWG #10 and smaller may be solid or stranded as best suited for the installation.

B. Insulation material:
   1. All insulated wire, conductor and cable shall be 600volt rated, unless otherwise noted on the Drawings.
   2. Thermoplastic-insulated building wire.
   3. Rubber-insulated building wire.
   4. Copper feeders and branch circuits larger than #6 AWG: Type THW, XHHW or dual rated THHN/THWN.
   5. Copper feeders and branch circuits #6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.
   6. Control Circuits: Type THW or dual rated THHN/THWN.

7. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.03 WIRING CONNECTIONS AND TERMINATIONS

A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

B. Electrical spring wire connectors:
   1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.
   2. Self-striping pigtail and tap U-contact connectors shall not be used.

C. Compression type terminating lugs:
   1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug Manufacturer or as indicated on Drawings. Notch or single point type crimping is NOT acceptable.
   2. Two-hole, long barrel lugs shall be provided for size #4/0 and larger wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.

D. Splicing and insulating tape: Provide black, ultraviolet proof, self-extinguishing, 7-mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000volts suitable for temperatures from minus 18-degrees C to 105-degrees C. Federal Spec. HH-I-595, Scotch 33+ or equal minimum.

E. Insulating putty:
   1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.
   2. Use putty suitable for temperatures from minus 17.8-degrees C to 37.8-degrees C with a dielectric strength of 570volts/mil minimum.

F. Insulating resin:
   1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. Scotchcast 4 or equal for wet or underground vaults, boxes, etc. splices or terminations.
   2. Use resin with a set up time of approximately 30-minutes at 21.1-degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.

G. Terminal strips:
   1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.
   2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.
   3. Identify all terminals with numbering sequence being used for a system.

H. Crimp type connectors:
   1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support

2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.
3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.
4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.

I. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.

J. Wire lubricating compound:
1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.
2. Shall not be used on wire for isolated type electrical power systems.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.

B. Feeders and branch circuits in wet locations shall be rated 75-degree C.

C. Feeders and branch circuits in dry locations shall be rated 90-degree C.

D. Minimum conductor size:
1. Provide minimum AWG #12 for all power and lighting branch circuits.
2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.

E. Color coding:
1. For 120/208volt, 1-phase, 3-wire systems:
   a. Phase A - Black
   b. Phase B - Red
   c. Neutral - White
   d. Ground - Green

3.03 WIRING METHODS

A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Install all single conductors in raceway system, unless otherwise noted.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.

D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

E. Provide #10 AWG pig tails on all 20amp and 30amp wiring devices served by #8 AWG conductors and larger.

F. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with its associated phase conductor where more than one neutral is present in a conduit.

G. Neatly form, train, and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches, and equipment assemblies.

H. Seal cable or wire, entering equipment from underground between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.

I. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type, and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.

J. Stranded wire shall be terminated using fitting, lugs or devices listed for the application. However, in no case shall stranded wire be terminated solely by wrapping it around a screw or bolt.

3.04 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway in accordance with IEEE 576, Manufacturer's written instructions, as indicated on the Drawings and as specified herein after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

B. Completely mandrel all underground conduits prior to installing conductors.

C. Completely and thoroughly swab raceway system before installing conductors.

D. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than #1 AWG.

E. Wire pulling:
   1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
   2. Use rope made of nonmetallic material for pulling feeders.
   3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
   4. Pull in together multiple conductors or cables in a single conduit.
   5. Pulling tensions and sidewall pressures shall not exceed 60% of the manufacturer's recommended maximum values. Pulling tension shall be continuously monitored during the pull by a calibrated dynamometer. If pulling tension is exceeded during the

pull, immediately notify the engineer to determine if the cables will be considered damaged and require contractor replacement.

F. Install and test all cables in accordance with Manufacturer's instructions and warranty.

3.05 WIRE SPLICES, JOINTS AND TERMINATION

A. Join and terminate wire, conductors, and cables in accordance with UL 486A, C, CEC and Manufacturer's instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Splices and terminations shall be made mechanically and electrically secure.

E. Where it's determined that unsatisfactory splice or terminations have been installed, remove the devices and install approved devices at no addition cost.

F. Terminate wires in Terminal Cabinets, relay, and contactor panels, etc. using terminal strip connectors.

G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.

H. Install cable ties and maintain harnessing.

I. Encapsulate splices in exterior outlets, pull boxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment.

J. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least 6-inches of tail and neatly packed in box after splice is made up.

K. Branch circuits (#10 AWG and smaller):
   1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600volt, 105-degree C. with integral insulation, approved for copper conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped wires.
   3. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.

L. Feeder circuits: (#6 to 750 kCMIL)
   1. Join or tap conductors from #6 AWG to 750 kCMIL using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.
   2. Terminate conductors from size #6 AWG to 750 kCMIL copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.

3. Field installed compression connectors for cable sizes 250 kCMIL and larger shall have not less than two clamping elements or compression indents per wire.
4. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.

M. Termination hardware assemblies:
1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.
2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
3. The crown of Belleville washers shall be under the nut.
4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendations are not obtainable, the following values shall be used:
   a. 1/4" - 20 bolt at 80-inch pounds torque.
   b. 5/16" - 18 bolt at 180-inch pounds torque.
   c. 3/8" - 16 bolt at 20-foot pounds torque.
   d. 1/2" - 13 bolt at 40-foot pounds torque.
   e. 5/8" - 11 bolt at 55-foot pounds torque.
   f. 3/4" - 10 bolt at 158-foot pounds torque.

3.06 IDENTIFICATION

A. Refer to Section 260553: Electrical Identification for additional requirements.

B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.

C. Color code conductors' size #8 and larger using specified phase color markers and identification tags.

D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.

E. In pull boxes and handholes, provide tags of the embossed brass type and show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.07 FIELD QUALITY CONTROL

A. Prefunctional testing:
1. Visual and mechanical inspection:
   a. Compare cable data with Contract Documents.
   b. Inspect exposed sections of wires and cables for physical damage and proper connections.
   c. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer's published data.
   d. Inspect compression applied connectors for correct cable match and indention.
   e. Verify visible cable bend meet or exceed ICEA and Manufacturer's minimum allowable bending radius.

f. If cables are terminated through window type current transformers, inspect to verify neutral and ground conductors are correctly placed for operation of protective devices.
g. Ensure wire and cable identification has been installed as specified herein.

2. Electrical testing:
   a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors, or appliances. Testing shall be as follows:
      1) 100% of all feeders 100amp rated and above.
      2) 50% of all feeders smaller than 100amps.
      3) 10% of all branch circuits at each individual panelboard.
   b. Perform insulation-resistance test using megohm meter with applied potential of 1000volt DC for a continuous duration of 60-seconds. Test conductors' phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.

   c. Perform continuity test of all feeder and branch circuits to ensure correct cable connections. Test all neutrals for improper grounds.
   d. Contractor shall furnish instruments, materials, and labor for these tests.
3. Test values: Investigate resistance values less than 50-megohms.
4. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION
26 05 19

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Power system grounding.
   2. Site lighting grounding.
   3. Electrical equipment and raceway grounding and bonding.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Underwriters Laboratories, Inc. (UL):
      UL 467; Grounding and Bonding Equipment.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      IEEE No. 142; Recommended Practice for Grounding of industrial and Commercial Power Systems.
      IEEE No. 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.03 SYSTEM DESCRIPTION

A. Except as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically indicated or specified.

B. Resistance:
   1. Resistance from the main switchboard ground bus through the ground electrode to earth shall not exceed 5-OHMS unless otherwise noted.
   2. Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20-OHMS

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
    1. Ground Rods:
        a. Weaver.
        b. Erico "Cadweld" Products, Inc.
    2. Ground Wells:
        a. Christy Concrete Products, Inc.
        b. Forni Corp.
    3. Ground Bushings, Connectors, Jumpers and Bus:
        a. O-Z/Gedney.
        b. Thomas & Betts Corp.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GROUND CONDUCTORS

A. Refer to Specification Section 260519: Building Wire and Cable for conductor specifications.

B. General purpose insulated:
    1. UL approved and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.
    2. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with CEC.

C. Bare conductors in direct contact with earth or encased in concrete: #4/0 AWG copper minimum, U.O.N.

D. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.03 DRIVEN (GROUND) RODS

A. Copper clad steel, minimum 3/4-inch diameter by 8 feet long, unless otherwise noted.

2.04 GROUND WELL BOXES FOR GROUND RODS

A. Precast concrete box nominal 9" throat diameter x 14" deep with light duty concrete cover for non-traffic areas or steel plate for traffic areas. Cover shall be embossed or engraved with "GROUND ROD".

2.05 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron or steel body with 150-degree Centigrade molded plastic insulating throat and lay-in grounding lug.

2.06 CONNECTIONS TO GROUND RODS OR SPLICES

A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high-pressure compression type connectors.
    1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld or equal. Each particular type of weld shall use a kit unique to that type of weld.
    2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of grounding system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Equipment bonding/grounding:
    1. Provide a CEC sized insulated copper ground conductor in all 120volt AC through 600volt AC feeder and branch circuit distribution conduits and cables.
    2. Provide a separate grounding bus at panelboards, switchboards. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35volts above ground.
    3. Conduit terminating in concentric, eccentric, or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.
    4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold-water piping system.
    5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.
    6. Site lighting grounding: Bond all metallic light poles and bollards. Provide ground rods where indicated on the Drawings.

3.03 FIELD QUALITY CONTROL

A. Prefunctional testing:
   1. Provide Testing Agency with Contract Documents for their review prior to the commencement of ground testing.
   2. Visual and mechanical inspection:
      a. Inspect the grounding electrode and connections prior to concrete encasement, burial, or concealment.
      b. Check tightness and welds of all ground conductor terminations.
      c. Verify installation complies with the intent of the Contract Documents
   3. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required complying with resistance limits specified under this Section of the Specification.
   4. A typewritten record of measured resistance values shall be submitted for review and included with the operation and maintenance manual furnished to the Owner at the time of Project closeout and before certificate of final payment is issued.

END OF SECTION
26 05 26

SECTION 26 05 33
BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Wall and ceiling outlet boxes.
   2. Pull and junction boxes.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. American National Standards Institute/National Electrical Manufacturer Association:
      ANSI/NEMA OS-1; Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
      ANSI/NEMA OS-2; Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
      NEMA 250; Enclosures for Electrical Equipment (1000 volts maximum).
   2. Underwriters Laboratories (UL):
      UL 50; Enclosures for Electrical Equipment.
      UL 514A; Metallic Outlet Boxes.
      UL 1773; Termination Boxes.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
    1. Outlet and junction boxes:
        a. Spring City Electrical Manufacturing Co.
        b. Thomas & Betts Corp.
        c. Raco, Inc.
    2. Cast boxes:
        a. Appleton Electric Co.
        b. Crouse-Hinds.
    3. Pullboxes:
        a. Circle AW Products.
        b. Hoffman Engineering Co.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 OUTLET BOXES

A. Standard outlet box:
    1. Provide galvanized, one-piece die formed or drawn steel or welded, knockout type box of size and configuration best suited to the application indicated on the Drawings.
    2. 4-inch square by 1.5-inch deep shall be minimum box size.
    3. ANSI/NEMA OS 1.

B. Concrete box:
    1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
    2. Select height as necessary to position knockouts above concrete reinforcing steel.
    3. ANSI/NEMA OS 1.

C. Cast metal outlet body:
    1. Provide 4-inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required.
    2. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.

D. Conduit outlet body: Provide Cadmium plated cast iron alloy, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.03 PULL AND JUNCTION BOXES

A. Sheet metal pull and junction box:
    1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16-gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated mac¬hine screws located 6 inches on centers.
    2. ANSI/NEMA OS 1.

B. Cast metal pull and junction box: Provide standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets.

C. Precast concrete boxes: Provide high density reinforced concrete pull and junction box with end and side knockouts and non-settling shoulders. Use cast iron lid with hold down bolts or use traffic rated covers in areas subject to vehicular traffic.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Install all outlet boxes flush with building walls, ceilings, and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed Work is called for on the Drawings.

B. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.

C. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.03 INSTALLATION

A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.

D. Leave no unused openings in any box. Install close-up plugs as required to seal openings.

E. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.

F. Provide precast concrete boxes in exterior planting areas, walkways, roads etc.

G. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.

H. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.

I. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.

3.04 SUPPORTS

A. Support boxes independently of conduit system.

END OF SECTION
26 05 33

SECTION 26 05 43
UNDERGROUND DUCTS AND STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Underground conduits and ducts.
   2. Handhole and pullboxes.
   3. Excavation, trenching and backfill.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 31 - Earthwork: General requirements for Excavation and Backfill and related items for ducts, manholes, pullboxes and handholes.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Federal Specifications (FS):
      FS WW-C-581; Specification for Galvanized Rigid Conduit.
      FS W-C-1094A; Conduit and Conduit Fittings Plastic, Rigid.
   2. American Concrete Institute (ACI):
      ACI 318; Building Code Requirements for Structural Concrete
   3. American National Standards Institute, Inc. (ANSI):
      ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
   4. American Society for Testing And Materials (ASTM):
      ASTM C31; Standard Practice for Making and Curing Concrete Test Specimens in the Field
      ASTM C39; Test Method for Compressive Strength of Cylindrical Concrete Specimens
      ASTM C172; Standard Practice for Sampling Freshly Mixed Concrete
      ASTM C192; Practice for Making and Curing Concrete Test Specimens in the Laboratory
      ASTM C231; Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
      ASTM C478; Specification for Precast Reinforced Concrete Manhole Sections
      ASTM C805; Test Method for Rebound Number of Hardened Concrete
      ASTM C857; Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
      ASTM C858; Specification for Underground Precast Concrete Utility Structures
      ASTM C877; Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections
      ASTM C891; Practice for Installation of Underground Precast Concrete Utility Structures

ASTM C990; Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C1037; Practice for Inspection of Underground Precast Concrete Utility Structures
ASTM C1064; Standard Test Method for Temperature of Freshly Mixed Concrete
ASTM C1231; Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinder
ASTM C1611; Standard Test Method for Slump Flow of Self-Consolidating Concrete

5. Underwriters Laboratories, Inc. (UL):
   UL 6; Rigid Metal Conduit.
   UL 651; Schedule 40 and 80 Rigid PVC Conduit.
6. National Electrical Manufacturer Association (NEMA):
   NEMA RN1; PVC Externally-coated Galvanized Rigid Steel Conduit.
   NEMA TC 2; Electrical Plastic Tubing and Conduit.
   NEMA TC 3; PVC Fittings for use with Rigid PVC Conduit.
   NEMA TC6; PVC Plastic Utilities Duct (EB and BD Type).

1.03 DEFINITIONS

A. Duct: Electrical conduit and other raceway, either metallic or nonmetallic, used underground embedded in earth.

B. Duct bank: Two or more conduits or another raceway installed underground in same trench.

C. Handhole: An underground junction box in a duct or duct bank.

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Shop Drawings showing details and design calculations for precast handholes, including reinforced steel.
   4. Submit Manufacturer's installation instructions.
   5. Complete bill of material listing all components.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

C. Precast concrete vaults shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer. The manufacturer shall have been regularly and continuously engaged in the

manufacture of precast concrete units similar to that indicated in the project specifications or drawings for at least 10 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
    1. Underground precast concrete utility structures:
        a. Oldcastle Enclosure Solutions.
        b. Jensen Precast.
    2. Conduits, ducts and fittings:
        a. Prime Conduit.
        b. JM Eagle.
        c. Cantex.
        d. Occidental Coating Company (OCAL).

B. Substitution: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONDUIT AND DUCT

A. Galvanized rigid steel conduit (GRS) in underground installations:
    1. PVC insulated galvanized rigid steel conduit (PVC GRS):
        a. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
        b. Fittings: Conduit couplings and connectors shall be steel or malleable iron as required with factory PVC coating and insulated jacket equivalent to that of the coated material.
    2. Tape insulated galvanized rigid steel conduit (Tape GRS):
        a. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with half lapping of PVC 10 mil tape over the exterior of the conduit. Half lap all raceways a minimum of one time and extend to 12-inches above grade.
        b. Fittings: Conduit couplings and connectors shall be steel or malleable iron as required with half lapping of PVC 10 mil tape over the exterior of the fittings. Half lap shall extend to 12-inches above grade.

B. Rigid non-metallic conduit (PVC):
    1. Conduit:
        a. Rigid polyvinylchloride, schedule 40 or 80 conforming to NEMA TC2 and UL 651. UL listed for exposed and direct-burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.
        b. Rigid polyvinylchloride, type EB or DB conforming to NEMA TC 6 and UL 651. UL listed for concrete encased burial and direct burial applications and for 90 degree C conductor insulation. Conduit shall include an integral bell fitting at one end.

2. Fittings: Couplings, adaptors, transition fittings, bell ends, etc., shall be molded PVC, slip on and solvent weld type. Schedule 40 or 80 conforming to NEMA TC 3 and type EB or DB conforming to NEMA TC 9.

C. Elbows:
   1. Low voltage systems (1000 volts and less):
      a. Minimum radius bends shall be factory standard-inches or greater, if indicated on the drawings or required by the cable manufacturer.
   2. Medium voltage systems (greater than 1000 volts):
      a. Minimum radius bends shall be 36-inches or greater, if required per CEC Article 300.34, indicated on the drawings, or required by the cable manufacturer.

D. Duct supports: Rigid PVC spacers selected to provide minimum duct spacing and concrete cover depths, while supporting ducts during concrete pour.

E. Duct sealing compound: Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 degree F, withstands temperature of 300 degrees F without slump and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, cable sheaths and jackets, etc.

2.03 PULLBOXES AND HANDHOLES

A. Construction: High densities precast reinforced concrete box, extension, base, and cover. Furnish box with end and side knockouts and non-settling shoulders. Cover shall have hold-down bolts and two lifting eyes.

B. Size: As indicated on the Drawings.

C. Cover markings: Covers shall read "ELECTRICAL", “COMMUNICATIONS”, or "SIGNAL" as appropriate.

D. Rated covers: Use cast iron lid with H20 traffic rating when subject to vehicular traffic.

2.04 CONSTRUCTION MATERIALS

A. Mortar: Conform to ASTM C270, Type M, except for quantities less than 2.0 Cu. Ft., where packaged mix complying with ASTM C387, Type M may be used.

B. Concrete: Conform to Division 03: Cast-in-place concrete for concrete and reinforcing.
   1. Strength: 3,000-PSI minimum 28-day compressive strength.
   2. Aggregate for duct encasement: 3/8-inch maximum size.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of duct and manhole installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 EARTHWORK

A. Excavation and backfill: Conform to Division 31, Earthwork.

B. Excavation for underground electrical structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus, a sufficient distance to permit placing and removal of concrete formwork, installation or services, other construction and for inspection.
   1. Excavate, by hand, areas within dripline of large trees. Protect the root system for damage and dry-out. Maintain moist conditions for root system and over exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
   2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

C. Trenching: Excavate trenches for electrical installation as follows:
   1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearances on both sides of raceways and equipment.
   2. Excavate trenches to depth indicated or required.
   3. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
   4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.

D. Backfilling and filling: Place soil materials in layers to required sub-grade elevations for each area classification, using materials and methods specified in Division 31: Earthwork.
   1. Under building slabs, use drainage fill materials.

3.03 CONDUIT AND DUCT INSTALLATION

A. Install duct lines in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Application:
   1. Direct burial ducts: Schedule 40, minimum 24-inches below finished grade.
   2. Below roads and paved surfaces:
      a. Schedule 80, minimum 36-inches below finished grade.
   3. Penetrations of building and equipment slabs: Insulated galvanized rigid steel conduit.

C. Slope duct to drain towards handholes and away from building and equipment entrances. Pitch not less than 4-inches per 100-feet.

D. Curved sections in duct lines shall consist of long sweep bends with a minimum radius of 25-feet in the horizontal and vertical directions. The use of manufactured bends is limited to building entrances and equipment stub-ups.

E. For communications and signal conduits, do not exceed a combined bend radius of greater than 180 degrees between pull points.

F. Underground conduit stub-ups to inside of building and exterior equipment shall be insulated galvanized rigid steel conduit.

G. Make joints in ducts and fittings watertight according to Manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

H. Terminate duct lines at handholes with end bells spaced 10-inches on center for 5-inch ducts and varied proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10-feet from the end bell without reducing duct line slope and without forming trap in the line.

I. Separation between direct buried duct lines shall be 3-inches minimum for like systems and 12-inches minimum between power and signal ducts.

J. For direct burial installations install continuous warning strip of heavy gage plastic imprinted "electrical ducts below", approximately 12-inch wide at 12-inches above ducts.

K. Mandrel all ducts upon completion of installation and prior to pulling cables.

3.04 HANDHOLE AND PULL BOX INSTALLATION

A. Install handholes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Handholes shall be installed flush with finished grade or surface. Install on a level 6-inch bed of well-tamped gravel or crushed stone.

C. Orientation of handholes shall be coordinated in advance with Landscape Architect and arranged to minimize connecting duct bends and deflections.

3.05 FIELD QUALITY CONTROL

A. Testing: Demonstrate capability and compliance with requirements upon completion of installation of underground duct and structures.
    1. Duct integrity: Rod ducts with a mandrel 1/4-inch smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest.

3.06 CLEANING

A. Pull brush through full length of ducts. Use round bristle brush with a diameter 1/2-inch greater than internal diameter of duct.

B. Clean internal surfaces of handholes. Remove foreign material.

END OF SECTION
26 05 43

SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Electrical equipment nameplates.
   2. Panelboard directories.
   3. Wire and cable identification.
   4. Buried electrical line warnings.
   5. Junction box identification.
   6. Inscribed device coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 09: Painting.

1.02 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein.
   2. Schedules for nameplates to be furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Conduit and wire markers:
      a. Thomas & Betts Corp.
      b. Brady.
      c. Griffolyn.
   2. Inscription Tape:
      a. Kroy.
      b. Merlin.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 NAMEPLATES

A. Type NP: Engraved, plastic laminated labels, signs, and instruction plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20-square inches or 8-inches in length; 1/8-inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.

B. Color and letter height as specified in Part 3: Execution.

2.03 LEGEND PLATES

A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.

B. Stamped characters to be paint filled.

2.04 BRASS TAGS

A. Type BT: Metal tags with die-stamped legend, punched for fastener.

B. Dimensions: 2" diameter 19 gauge.

2.05 PANELBOARD DIRECTORIES (400 AMP OR LESS)

A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.

B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126) for all 42-pole panelboards. For 84-pole panelboards the numbering is Section 1 (circuit numbers 1-84), Section 2 (circuit numbers (85-168), etc.

2.06 WIRE AND TERMINAL MARKERS

A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips.

B. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.

2.07 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.

2.08 UNDERGROUND CONDUIT MARKER

A. 6-inch wide, yellow polyethylene tape, with continuous black imprinting reading "Caution - Buried Electric Line Below".

2.09 INSCRIBED DEVICE COVERPLATES

A. Coverplate material shall be as specified in Section 262726: Wiring Devices.

B. Methods of inscription: (Unless otherwise noted)
    1. Type-on-tape:

a. Imprinted or thermal transfer characters onto tape lettering system.
b. Tape trimmer.
c. Matte finish spray-on clear coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 NAMEPLATES

A. Installation:
1. Degrease and clean surfaces to receive nameplates.
2. Install nameplates parallel to equipment lines.
3. Secure nameplates to equipment fronts using machine screws.

B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:
1. Equipment or device designation:
2. Amperage, KVA or horsepower rating, where applicable.
3. Voltage or signal system name.
4. Source of power or control.

C. Nameplates for power system distribution equipment and devices are to be black.

D. Minimum letter height shall be as follows:
1. For panelboards, switchboards, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.
2. For individual circuit breakers and switches in panelboards, distribution boards, and switchboards use 3/8-inch letters to identify equipment designation. Use 1/8-inch letters to identify all other.
3. For individual mounted circuit breakers, disconnect switches, enclosed switches, etc. use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.
4. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

3.03 LEGEND PLATES

A. Provide panel-mounted operators devices such as pilot lights, reset buttons, “HAND-OFF-AUTO” switches, etc.

3.04 BRASS TAGS

A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection i.e. "UFER", "Cold water bond", etc.

B. Provide tags for all feeder cables in underground vaults and pull boxes.

C. Provide tags for empty conduits in underground vault, pull boxes and stubs.

3.05 PANELBOARD DIRECTORIES (400AMP OR LESS)

A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.

B. Verify room numbers or area designation with Project Manager.

C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

3.06 WIRE AND CABLE IDENTIFICATION

A. Provide wire markers on each conductor in panelboards, pull boxes, outlet, and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.

B. Provide colored phase markers for conductors as noted in Section 260519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3-inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.07 UNDERGROUND CONDUIT MARKERS

A. During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

3.08 JUNCTION BOX IDENTIFICATION

A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.09 INSCRIBED DEVICE COVERPLATE

A. General:
   1. Lettering type: Helvetica, 12 point or 1/8" high.
   2. Color of characters shall be black.
   3. Locate the top of the inscription ½” below the top edge of the coverplate.
   4. Inscription shall be centered and square with coverplate.

B. Application:
   1. Provide inscribed coverplates for devices as outlined below:
      a. Receptacles.
      b. Switches.

END OF SECTION
26 05 53

SECTION 26 24 13
SWITCHBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Main service switchboard.
   2. Outdoor enclosure and accessories.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 03: Cast-in-place concrete. Equipment housekeeping pad.
   2. Division 09: Painting. Touch-up of painted surfaces.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Federal Specifications (FS):
      FS W-C-375;Circuit Breakers, Molded Case, Branch Circuit and Service.
   2. American National Standards Institute, Inc. (ANSI):
      ANSI C12; Code for Electricity Metering.
   3. Underwriters Laboratories, Inc. (UL):
      UL 98; Dead-Front Switches.
      UL 486E; Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
      UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
      UL 869A; Service Equipment.
      UL 891; Dead-Front Switchboards.
      UL 1053; Ground-Fault Sensing and Relaying Equipment.
   4. National Electrical Manufacturer Association (NEMA):
      NEMA AB1; Molded Case Circuit Breakers.
      NEMA PB 2; Deadfront Distribution Switchboards.
      NEMA PB 2.1; General Instruction for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or less.
      NEMA SG5; Power Switchgear Assemblies.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Shop Drawings to include:
      a. Front, plan, and side view elevations with overall dimensions.

b. Conduit entrance locations and requirements.
c. Busway service entrance and requirement.
d. Nameplate legends; size and number of bus bars per phase, neutral and ground.
e. Switchboard instrument details and accessories.
f. Electrical characteristics including voltage, frame size and trip rating and withstand ratings.

3. Outdoor weatherproof equipment enclosure and accessories.
4. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
5. Submit Manufacturer's installation instructions.
6. Complete Bill of Material listing all components.
7. Final test results.
8. Warranty.

B. Dimensions and configurations of switchboards shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.

C. Service entrance switchboard utility metering sections shall be submitted to the local electrical utility company for approval prior to submission to the Engineer. A letter of acceptance from utility company shall be included in submittal package.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and part numbers.
4. Pictorial and schematic Electrical Drawings of wiring systems, including operating and safety devices, control panels, instrumentation, and annunciators.
5. Telephone numbers for the authorized parts and service distributors.
6. Include all service bulletins and torque Specifications for all terminations.
7. Final testing report.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

C. Independent Testing Agency qualifications: Refer to Section 260010: Basic Electrical Requirements.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Switchboard components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

Components shall be properly packaged in factory-fabricated containers and mounted on shipping skids.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with NEMA PB2.1 and Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.08 EXTRA MATERIAL

A. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. ABB/ General Electric.
   2. Eaton.
   3. Industrial Electric Mfg.
   4. Siemens.
   5. Square D.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 SWITCHBOARDS - GENERAL

A. Enclosure:
   1. Each switchboard shall consist of a dead front, completely metal enclosed self-supporting structure. Construction shall consist of vertical sections of the universal frame type bolted together and braced with self-tapping bolts. Sides, top and rear shall be covered with captive-bolt fastened steel plates having formed edges all around. Front plates shall be sectionalized and removable. All plates shall be fabricated from 12-gage steel and shall have die-formed edges all around. The switchboard frame shall be suitable for use as floor sills in indoor installations. Corners shall be reinforced with rigged gussets internal and external to the structural members.
   2. Switchboards shall have depth as required to house all equipment contained within it. Switchboard shall be constructed so that the back and front of all sections align. Construction of the board shall allow maintenance of incoming line terminations, device connections and all bus bolted connections.

3. All devices shall be accessible and removable from the front unless rear access is indicated on the Drawings.
4. Provide necessary hardware to permit locking every overcurrent protective device handle in the "OFF" position.
5. Provide hinged access doors to all termination, meter, and relay compartments with knurled and slotted large head captive-bolts. The design shall allow access to compartments without tools and without removing any panels.
6. Furnish cable pull sections or top cable pull boxes where indicated on the Drawings complete with cable tie down supports. Where cable pull section or pull boxes contain utility service cables, provide utility acceptable sealing means.
7. Switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.
8. Utility metering compartment section shall be fabricated to meet all utility company requirements. Where separate vertical section is required for utility metering, match and align with switchboard enclosure.

B. Bus assembly and terminations:
1. The switchboard bussing shall be highly conductive tin-plated aluminum with sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements.
2. Switchboard bus bars and connections shall consist of high conductivitytin-plated aluminum (750 amps per square inch maximum) mounted on heavy duty glass polyester supports. Bolted connections using Belleville washers are required for all internal connections, including those between protective devices and bus.
3. Bus arrangement shall be Phase A-B-C-N left-to-right, top-to-bottom and front-to-rear as viewed from the front. Horizontal and vertical bus ampere rating shall be uniform from end-to-end.
4. All bussing to and from an overcurrent protective device shall be rated to the frame sizing, not the trip rating.
5. Where "SPACE" is indicated in the switchboards, cross connectors and mounting hardware shall be installed to match the frame size ampere rating noted on the Electrical Drawings. All "SPACES" shall be ready for installation of overcurrent protective devices at a future time.
6. Shipping splits and provisions for future bus extension shall be provided with necessary bus splices.
7. Each switchboard shall contain a full length, bottom/front located copper ground bus that is securely connected to each vertical section. Ground bus shall be sized in accordance with UL 891, Table 25.1.
8. Termination lugs: High compression circumference crimped type rated for use with aluminum/copper conductors.
9. Switchboards shall be fully rated for a minimum of 14,000 AIC Rating as indicated on the Drawings.
10. Neutral bus shall be 100-percent rated unless otherwise indicated on the Drawings.
11. Main service switchboards:
    a. Removable neutral link: Provide removable bolted bus section for the purpose of disconnecting the ground circuit conductor from the premises wiring at the supply side of the service in accordance with CEC article 230-75.
    b. Main bonding jumper: Connection between the grounded circuit conductor and the equipment ground conductor at the supply side of the service. Size in accordance

with CEC table 250-94 or 12-1/2% of the area of the largest phase conductor in accordance with CEC article 250-79(c).

C. Switching and overcurrent protective devices:
   1. Refer to Section 262816: Overcurrent Protective Devices.
   2. Main overcurrent protective devices(s) shall be fixedmountedmolded case circuit breaker with interrupting rating and frame and trip ratings as indicated on Drawings.
   3. Feeder overcurrent protective device(s) shall be fixedmountedmolded case circuit breaker with frame and trip rating as indicated on Drawings.
   4. Devices interrupting rating shall match that of switchboard for which the device is installed.
   5. Series ratings of overcurrent protective devices is not acceptable unless specifically noted on the Drawings.
   6. Devices shall be manually operated unless shunt trip and/or electrically operated devices are indicated on Drawings.

D. Instrumentation and controls:
   1. All internal devices (relays, transformers, etc.) shall be tagged as to rating and function with permanently fastened engraved nameplates.
   2. Relays: All relays shall be industrial control grade with a "ON" indicating neon light, hold down springs, minimum of 10amp rated contacts and a minimum of four form C contacts. Relays used for control power transfer shall have 20amp rated contacts. Do NOT use paralleled relays for relays with greater than 4-poles, use relays with the required number of poles. This is to prevent the situation where one relay fails, and half of the intended function is lost, which could be dangerous.

E. Refer to Electrical Drawings for the following:
   1. Mounting style; voltage; terminal lug size, location, and quantity; bus ampacity; interrupting capacity of bus and overcurrent protective devices, quantity, poles, and rating of overcurrent protective devices. Note that the AIC value noted on the Drawings for distribution equipment is the minimum rating of all components; values are in RMS symmetrical amps.

F. Miscellaneous requirements:
   1. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side.
   2. Nameplates: Engraved nameplates shall be provided for each device and all "SPACES" located in the switchboard. An engraved nameplate shall also be provided indicating the switchboard designation. See Section 260553: Electrical Identification for re¬quirements.
   3. All control wires shall be labeled with wire markers and referenced to the control wiring diagrams. Provide colored wires with colored stripes to facilitate troubleshooting and locating both ends of wires. Do not use wires with all the same wire color. Use fork, crimp type terminations on all control wires.
   4. Provide a test block and plugs for voltage and current monitoring at each main switch. Provide engraved legend plates to indicate function of each test point.
   5. Vertically mounted mains shall have the operating handle in the up position when energized.

G. Weatherproof outdoor enclosure and accessories:
   1. Provide a NEMA 3R non-walk-in type weatherproof housing with hinged lockable access doors. Each section shall have a minimum of 13-inch deep vestibule. Provide a latch for each door to ensure adequate closing pressure to seal against harmful weather.

   2. Provide each section of the switchboard with the following items with power obtained from a control power transformer and circuit breaker within the switchboard.
      a. Thermostatically controlled space heater.
   3. The weatherproof housings shall be provided with lifting eyes.

H. Finish:
   1. Five step zinc phosphate pre-treatment, one coat of rust inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 61 (light gray).
   2. A seven-step spray wash electroplate primer with final baked-on enamel finish; ANSI 61 (light gray) is an acceptable finish alternative.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of switchboard installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Ensure all conduit stub-ups for bottom entry into switchboard are in place and located as required per Shop Drawings.

B. Whether noted on the Drawings or not, provide a 4-inch high concrete housekeeping pad beneath equipment. Coordinate actual sizes of equipment based on approved Shop Drawings and extend pad 4-inches in all directions beyond overall dimension of base Provide reinforcing bars as required structurally within pad to ensure proper support of equipment.

3.03 INSTALLATION

A. Install switchboards in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Handling, storage, installation and energize of switchboards shall be carried out in accordance with latest edition of NEMA Publications PB 2.1.

C. Freestanding switchboards shall be accurately aligned, leveled, and bolted in place on full-length channels securely fastened to concrete floor.

D. Switchboards shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.

E. Provide mounting hardware brackets, bus bar drilling and filler pieces for all unused spaces.

F. "Train" interior wiring; bundle and clamp, using specified plastic wire wraps specified under Section 260519: Building Wire and Cable.

G. Replace any panel pieces, doors or trims having dents, bends, warps, or poor fit that may impede ready access, security, or integrity.

H. Conduits terminating in concentric, eccentric, or oversized knockouts at switchboards shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the switchboards.

I. Check and tighten all bolts and connections with a torque wrench using Manufacturer's recommended values.

J. Visually inspect switchboards for rust and corrosion if signs of rust and corrosion are present, board shall be restored to new condition or replaced.

K. In damp and wet locations mount switchboard with a minimum 1 inch of air space between enclosure and the wall or other supporting material.

3.04 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall perform all quality control electrical testing, calibration and inspection required herein. Testing shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements. Testing objectives shall be to:
    1. Assure switchboard installation conforms to specified requirements and operates within specified tolerances.
    2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
    3. Prepare final test report including results, observations, failures, adjustments, and remedies.
    4. Apply label on switchboard upon satisfactory completion of tests and results.
    5. Verify ratings and settings and make final adjustments.

B. Testing of overcurrent protective devices shall be done only after all devices are installed and prior to system being energized.

C. Prefunctional testing:
    1. Visual and mechanical inspection:
        a. Compare nameplate information and connections to Contract Documents.
        b. Inspect for physical damage, defects alignment and fit.
        c. Verify appropriate anchorage, required clearances and correct alignment.
        d. Inspect doors, panels and sections for paint, dents, scratches, fit and missing hardware
        e. Check tightness of all control and power connections.
        f. f. Check that all covers, barriers, and doors are secure.
        g. Verify correct barrier installation.
        h. Verify that relays and overcurrent protective devices meet Drawing, power system study and specified requirements.
        i. Perform mechanical operational tests in accordance with Manufacturer's instructions.

j. Exercise active components.
k. Inspect control power and instrument transformers.
l. Inspect insulators for evidence of physical damage or contaminated surfaces.

2. Electrical tests:
   a. Perform resistance tests through bus joints with low-resistance ohmmeter. Joints that cannot be directly measured due to permanently installed insulation wrap shall be indirectly measured from closest accessible connection.
   b. Perform insulation-resistance tests on each bus section, phase-to-phase, and phase-to-ground, at 1000volt DC for 60-seconds. Investigate resistance values less than 50-megohms.
   c. Perform over-potential test on each bus section, each phase-to-ground with phases not under test grounded, in accordance with Manufacturer's published data. Test voltage shall be applied for 60-seconds.
   d. Perform insulation-resistance tests at 1000volt DC for 60-seconds on control wiring. Do not perform this test on wiring connected to solid-state components.
   e. Perform current injection tests on the entire current circuit in each section of switchgear.
      1) Perform current tests by primary injection, where possible, with magnitudes such that minimum of 1amp flows in secondary circuit.
      2) Where primary injection is impractical, utilize secondary injection with minimum current of 1amp.
      3) Test current at each device.
   f. Perform tests on all instrument transformers in accordance with Manufacturer's written instructions.
   g. Perform the following tests on control power transformers:
      1) Perform insulation-resistance test. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be determined in accordance with Manufacturer's instructions.
      2) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm potential at all devices.
      3) Verify correct secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with secondary wiring disconnected.
   h. Potential transformer circuits:
      1) Perform insulation-resistance tests. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be determined in accordance with Manufacturer's instructions.
      2) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage.
      3) Verify secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with secondary wiring disconnected.
   i. Ground resistance:
      1) Measure system neutral-to-ground insulation-resistance with neutral disconnect link temporarily removed. Replace neutral disconnect link after test.
      2) Measure insulation-resistance of control wiring at 1000volt DC for 60-seconds. Refer to Manufacturer's instruction for devices with solid-state components
   j. Check phasing of alternate supply sources.
   k. Verify operation of switchboard heaters.

l. Test overcurrent protection devices per Section 262816: Overcurrent Protective Devices.

3. Test values:
   a. Bolt torque levels shall be in accordance with Manufacturer's requirements.
   b. Compare bus connection resistances to values of similar connections.
   c. Insulation-resistance values for bus, control wiring and control power transformers shall be in accordance with Manufacturer's published data. Values of insulation resistance less than Manufacturer's minimum levels should be investigated. Over-potential tests should not proceed until insulation-resistance levels are raised above minimum values.
   d. Insulation shall withstand the over-potential test voltage applied.
   e. Determine contact resistance in microhms. Resistance values shall not exceed high limit of normal range as indicated in Manufacturer's published data.
   f. System neutral-to-ground insulation shall be a minimum of one megohm.

D. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.

E. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

F. Contractor shall submit the Testing final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.05 CLEANING

A. Prior to energizing of switchboard, the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of switchboard per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.06 TRAINING

A. Factory authorized service representative shall conduct a 4-hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.

B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION
26 24 13

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Branch circuit panelboards.
   2. Distribution panelboards (400amps to 800amps).

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. Federal Specifications (FS):
      FS W-C-375;Circuit Breakers, Molded Case, Branch Circuit and Service.
   2. National Electrical Manufacturers Association (NEMA):
      NEMA AB 1; Molded Case Circuit Breakers.
      NEMA PB 1; Panelboards.
      NEMA PB 1.1; General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
   3. Underwriters Laboratories, Inc. (UL):
      UL 67; Panelboards.
      UL 486E; Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
      UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
      UL 870; Wireways, Auxiliary Gutters and Associated Fittings.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Shop Drawings: Include elevations, cabinet dimensions, gutter sizes, layout of contactors, relays, time clocks, lug sizes, bussing diagrams; make, location and capacity of installed equipment; mounting style; finish and panelboard nameplate inscription.
   4. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
   5. Submit Manufacturer's installation instructions.

6. Complete bill of material listing all components.
7. Warranty.

B. Dimensions and configurations of panelboards shall conform to the spaces allocated on the Drawings for their installation. The Contractor shall include with the submittal a layout of the electrical room if it differs from construction documents for review and approval by the Engineer prior to release of order.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and parts number.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Panelboard components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with NEMA PB1.1 and Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.08 EXTRA MATERIAL

A. Turn over two (2) sets of panelboard keys to the Owner at completion of Project. All panelboards shall be keyed alike.

B. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. ABB/ General Electric.
   2. Eaton.
   3. Siemens.
   4. Square D.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 PANELBOARDS - GENERAL

A. Enclosure:
   1. Cabinets shall be NEMA Type 1 enclosure, door, and trim of code gauge galvanized steel. Provide NEMA Type 3R enclosures for exterior mounted panelboard.
   2. Panelboard covers shall be door-in-door construction such that inner door exposes the overcurrent protective devices and the outer door exposes the complete panelboard interior (i.e. branch circuit conductors, lugs, neutral and ground bus, overcurrent protective devices, etc.). Outer door shall have full-length piano hinge and inner door shall have two-point hinges.
   3. Provide combination spring catch and lock on inside edge of the inner door trims with flush fitting joint between door and trim. Locks on all panelboards shall be keyed alike. Doors 36 inches and over in height shall be provided with three-point catch and lock. Provide quarter-turn captive bolts on the outer door.

B. Bus assembly and terminations:
   1. Bus shall be bolted copper with taps arranged for distributed phase connections to branch circuit devices
   2. Cross connectors shall be copper, drilled and tapped for bolt-on device connections, arranged for double row placement of device and designed to permit removal or addition of overcurrent protection devices without disturbing adjacent devices or removing main bus connections.
   3. Neutral bus shall be 100 percent rated of phase bus bars and shall have lugs for each outgoing branch circuit or feeder requiring a neutral connection unless otherwise noted.
   4. Ground bus shall be full size with lugs for each outgoing branch circuit and feeder.
   5. Refer to panelboard schedules on Drawings for bus rating. Bus rating shall match or be greater than main device or main lug rating.
   6. As a minimum, bus bars shall be rated 22,000 AIC for 120/208volt panelboards. Unless otherwise noted.
   7. Provide full sized bussing in all sections of multi-section panelboards.
   8. Termination Lugs: Rated for use with aluminum/copper conductors.
   9. All "SPACES" shall be ready for installation of future overcurrent protective device.

C. Miscellaneous requirements:

1. Circuit numbering: Starting at the top, indicate odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Provide metal embossed circuit identification of panelboards.
2. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panelboard door to reflect conditions at completion of Work. Directory shall be typewritten denoting loads served by room number or area for each circuit.
3. Nameplates: Provide engraved nameplate for each panelboard. See Section 260533: Electrical Identification for requirements.

D. Refer to Panelboard Schedules for the following:
1. Mounting style; service voltage; terminal lug size, location, and quantity; bus ampacity; interrupting capacity of bus and breakers; quanti¬ty, poles and rating of overcurrent protective devices.
2. If indicated on the Panelboard Schedules and/or Electrical Drawings provide contactors, relays, time clocks, etc. mounted within panelboard enclosure. Enclosure shall be fabricated such that circuit breaker portion of panel and contactor section shall have separate, lockable, hinged doors.

E. Overcurrent protective devices:
1. Refer to Section 262816: Overcurrent Protection Devices.
2. Overcurrent protective devices shall be molded case circuit breakers.
3. Main devices shall be hard bus connected to the panelboard bus bars.
4. In all cases, panelboards fed directly from a transformer shall have a main overcurrent protective device. If not indicated on the Drawings or Panelboard Schedules, provide this device sized to provide the full capacity of the transformer rating.
5. Main devices shall be vertically mounted and shall have their operating handle in the up position when energized. Main devices that are mounted in the same manner as the branch devices are NOT acceptable, i.e. main devices shall be individually mounted at the top or bottom of the phase bus bars.
6. Panelboards overcurrent protective devices layout shall conform to the layout indicated on the panelboard schedules.
7. Provide identified handle ties for single pole circuit breakers that share a neutral conductor.

F. Finish: Five step zinc phosphate pre-treatment, one coat of rust inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 61 (light gray).

2.03 DISTRIBUTION PANELBOARDS

A. Enclosures shall be sized as required and shall meet the space restriction allocated on Drawings. Panelboard shall comply with NEMA PB 1.

B. Provide necessary hardware to permit locking every overcurrent protective device handle in the "OFF" position.

C. Where "SPACE" is indicated on panelboard schedules or Drawings, install cross connectors and mounting hardware to match the frame size ampere rated noted.

2.04 BRANCH CIRCUIT PANELBOARDS

A. Enclosure shall be 20" wide x 5-3/4" deep, surface or flush mounted and shall comply with NEMA PB 1.

B. Flush panelboards mounted adjacent to each other shall be same physical size.

C. Where "SPACE" is indicated on panelboard schedules or Drawings, install minimum 100amp branch circuit cross connectors and mounting hardware. For future device spaces larger than 100amps, cross connectors shall match the frame size ampere rated noted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of panelboard installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Install panelboards in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Panelboard shall be pad mounted and anchored to the concrete. It shall be housed in an enclosure with the lighting controls cabinet.

C. Panelboards shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.

D. Provide mounting hardware brackets, busbar drillings and filler pieces for all unused spaces.

E. "Train" interior wiring; bundle and clamp, using specified plastic wire wraps specified under Section 260519: Building Wire and Cable.

F. Replace panel pieces, doors or trim exhibiting dents, bends, warps, or poor fit that may impede ready access, security, or integrity.

G. Conduits terminating in concentric, eccentric, or oversized knockouts at panelboards shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the panelboard.

H. Check and tighten all bolts and connections with a torque wrench using Manufacturer's recommended values.

I. Visually inspect panelboard for rust and corrosion. If signs of rust and corrosion are present, restore or replace panelboard to new condition.

J. Provide close up plugs in all unused openings in the cabinet.

K. Field install handle ties on single pole circuit breakers that share a neutral conductor.

3.03 FIELD QUALITY CONTROLS

A. Testing objectives shall be to:
   1. Assure panelboard installation conforms to specified requirements and operates within specified tolerances.
   2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
   3. Prepare final test report including results, observations, failures, adjustments, and remedies.
   4. Apply label on panelboards upon satisfactory completion of tests and results.
   5. Verify ratings and settings and make final adjustments.

B. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

C. Prefunctional testing:
   1. Visual and mechanical inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
      c. Compare nameplate information and connections to Contract Documents.
      d. Check tightness of all power connections.
      e. Check that all covers, barriers, and doors are secure.
   2. Electrical tests:
      a. Insulation resistance: 1000volt DC tests for one minute on all 600volt and lower rated equipment, components, buses, feeder and branch circuits and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 10-megohms resistance to ground shall be repaired or replaced.
      b. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
      c. Ground resistance: Test resistance to ground of system and equipment ground connection.
      d. Test overcurrent protection devices per Section 262816: Overcurrent Protective Devices.

D. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence, and the Engineer's hourly rate.

E. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

F. Contractor shall submit the Testing final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 CLEANING

A. Prior to energizing of panelboards, the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of panelboards per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION
26 24 16

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Receptacles.
   2. Coverplates.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. National Electrical Manufacturer's Association (NEMA):
      NEMA WD-1; General-Purpose Wiring Devices.
   2. Underwriter's Laboratories (UL):
      UL 231; Power Outlets.
      UL 514A; Metallic Outlet Boxes.
      UL 943; Ground-Fault Circuit-Interrupters.
      UL 1681; Wiring Device Configurations.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Provide color finishes for Architect to select from.
   4. Submit Manufacturer's installation instructions.

B. Where inscribed device coverplates are noted on the Drawings or in the Specifications, conform to the requirements of Section 260553: Electrical Identification.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.05 WARRANTY

A. Occupancy sensors offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
    1. Receptacles and coverplates:
        a. Hubbell.
        b. Pass & Seymour.
        c. Leviton.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 RECEPTACLES

A. Standards:
    1. Provide general purpose 20amp, 125/250volt AC receptacles that conform to NEMA WD-1 Specifications. Specialty receptacles shall conform to NEMA WD-5 Specifications as applicable.
    2. Provide NEMA 5-20R, industrial (heavy-duty) specification grade as noted herein, 20amp, 125volt AC, 2-pole, 3-wire grounding type receptacles.
    3. Receptacles shall be the standard conventional style device.

B. Color:
    1. Device color shall be white, unless otherwise noted.
    2. Devices connected to an emergency circuit shall be red.

C. Ground fault circuit interrupting (GFCI) receptacles:
    1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5-milli-amp line-to-ground fault current in approximately 1/40th of a second.
    2. Provide visual device with trip indication, manual reset, and test mechanisms and with point of use and multi-outlet protection.
    3. Provide self-test and monitor feature with visual indicators on device face representing power status, trip condition, ground fault condition and end of life status.
    4. Provide weather resistant devices at all damp and wet locations.
    5. Use Pass & Seymour #2097TR series, Hubbell GFTRST20 series, Leviton #S7899 series, for Specification grade GFCI receptacles.
    6. Use Pass & Seymour #2097TRWR series, Hubbell GFTWRST20 series, Leviton #WT899 series for weather resistant GFCI receptacles.

2.03 COVERPLATES

A. Weatherproof coverplates:
   1. Provide horizontal mounted weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, lockable, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.
   2. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.
   3. All coverplates shall be vandal-resistant.
   4. Provide two (2) keys for each locking type coverplate.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wiring device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Install wiring devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Mount receptacle in light pole as shown on drawings.

C. Provide coverplates.

3.03 FIELD QUALITY CONTROL

A. Electrical testing:
   1. Test proper polarity of all receptacles.
   2. Test ground continuity of all wiring devices.
   3. Test ground fault interrupting device operation.

3.04 CLEANING

A. Clean interior of all boxes from dirt and paint prior to installation of devices.

END OF SECTION
26 27 26

SECTION 26 28 16
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Molded case circuit breakers.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Federal Specification (FS):
      FS W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service.
   2. Underwriters Laboratories, Inc. (UL):
      UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
   3. National Electrical Manufacturer Association (NEMA):
      NEMA AB 1; Molded Case Circuit Breakers.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe product operation, equipment and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
   5. Provide current let-through and melting time information for each type and rating of fuses.
   6. Confirmation in writing of compliance with Arc Energy Reduction per CEC Articles 240.67 and 240.87.
   7. Submit Manufacturer's installation instructions.
   8. Complete bill of material listing all components.
   9. Warranty.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
    1. A detailed explanation of the operation of the system.
    2. Instructions for routine maintenance.
    3. Parts list and part numbers.
    4. Telephone numbers for authorized parts and service distributors.
    5. Final testing reports.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
    1. Circuit breakers:
        a. ABB/ General Electric.
        b. Eaton.
        c. Siemens.
        d. Square D.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 MOLDED CASE CIRCUIT BREAKERS

A. Branch and feeder circuit breakers shall be molded case, bolt on and trip indicating.

B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.

C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 22,000 RMS symmetrical amps for 208volt systems.

D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.

E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.

F. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.

G. All terminals shall be dual rated for aluminum or copper wire.

H. Circuit breakers with frame ratings 100amps and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100amps shall be installed in distribution type panels.

I. Circuit breakers with frame ratings above 100amps through 400 amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as indicated on Drawings at the voltage indicated.

J. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.

K. Spaces in the boards shall be able to accept any combination of 1, 2 or 3-pole circuit breakers as indicated. Provide all necessary bus, device supports, and mounting hardware sized for frame, not trip rating.

L. Series rated breakers are not acceptable unless specifically noted on the Drawings.

M. Breaker shall be rated to operate in an ambient temperature of 40-degrees C.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.

C. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable CEC and NEMA standards for installation.

3.03 FIELD QUALITY CONTROL

A. Testing of overcurrent protective devices shall be done only after all devices are installed and prior to system being energized.

B. Prefunctional testing:
   1. Visual and mechanical inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
      c. Compare nameplate information and connections to Contract Documents.
      d. Check tightness of all control and power connections.
      e. Check that all covers, barriers, and doors are secure.
   2. Electrical tests:
      a. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
      b. Test all circuit breakers with frame size 200amps and larger in each panelboard, distribution board, switchboard, etc. unless otherwise noted via primary current injection testing. Testing shall verify the following:
         1) Determine that circuit breaker will trip under overcurrent conditions, with tripping time in conformance with NEMA AB 1 requirements.
         2) Circuit breaker pickup and delay measurements are within the manufacturers published tolerances for long time, short time, instantaneous, and ground fault.

C. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

D. Contractor shall submit the Testing final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION
26 28 16

SECTION 26 56 68
SPORTS FIELD LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Sport field lighting fixtures.
   2. Lamps.
   3. Ballasts.
   4. Galvanized steel poles and luminaire mounting crossarms.
   5. Pole foundations.
   6. Lighting control system including cabinet, contactors, software, programming, etc.

B. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 3:
      a. Cast-in-place concrete. Ligh pole foundations.
      b. Sports field lighting is shown supported by precast, prestressed piers

C. Reference drawings: The drawings included in the bid package are the basis for the electrical design, pole spacing and the system configuration. They do not reflect all the athletic lighting system requirements. The contractor shall provide any additional components, contactors, fixture heads, wiring, etc. as required to comply with the performance criteria included in these specifications. Including, but not limited to additional fixture heads at pole locations, and provisions for a cellular antenna array.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
   1. American National Standards Institute (ANSI):
   2. Underwriters Laboratories, Inc. (UL):
      a. UL 57; Electric Lighting Fixtures.
   3. National Electrical Manufacturer Association (NEMA):
      a. NEMA

1.03 SUBMITTALS

A. The drawings and submittals are based on performance criteria as manufactured by Musco Sports Lighting, LLC.
   1. It has been predetermined that these project specifications are the minimum acceptable criteria for this project. Musco Sports Lighting LLC, Total Light Control – TLC for LED™ technology is the only pre-approved equipment supplier.

B. Manufacturers requesting approval shall provide submittal information as per Section 1.03 D. Submittal information must be received 10 days prior to bid opening, approved manufacturers will be notified by addendum.

C. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
    1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
    2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
    3. Independent Testing Laboratories, Inc., or equal, photometric test report for each luminaire type and lamp combination listed on the fixture schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for fixtures with asymmetric distributions and fixture luminance data for vertical angles above 45 degrees from nadir.
    4. Shop drawings:
        a. Light scans per D below.
        b. Spill scans per E below.
        c. Energy analysis confirming a maximum of 41.67 kW for the lighting system over the entire site.
        d. Pole structural calculations and foundation design stamped by a California licensed Structural Engineer.
        e. Provide written information for the automated control system to include monitoring. Also provide examples of system reporting and access for numbers for personal contact to operate the system.
        f. Lighting Manufacturer will supply certified photometric reports from Independent Testing Lab (ITL) or a Certified Lab along with an aiming angle summary for verification.
    5. Complete bill of material listing all lighting fixtures and components.
    6. Warranty.

D. Sports Lighting Performance
    1. Illumination Levels and Design Factors: The illumination levels specified shall be based on light levels for 25 years. Light levels shall not drop below specified targeted lighting levels during the specified warranty period. Appropriate light loss factors shall be applied and submitted for the basis of design.

Area of Lighting	Light Levels	Uniformity	# of Points	Grid Spacing
1st Base BP	30fc	-	6	10' x 10'
3rd Base BP	30fc	-	6	10' x 10'
Sand Volleyball 1&2	30fc	3:1	50	10' x 10'
Softball (Infield)	50fc	2:1	25	20' x 20'
Softball (Outfield)	30fc	2.5:1	61	20' x 20'
Tennis 1&2	50fc	2:1	30	20' x 20'

E. Spill And Glare Analysis
   1. Submitted spill/glare computer models shall depict the field test stations at the Eastern Residential property line. The test stations shall be shown every 30' along the line with the field lights on. Bidder shall submit, as described below:
      a. Horizontal footcandles: No single point shall exceed 0.5 footcandles. Models shall represent readings taken with the meter positioned horizontal 36 inches above grade.
      b. Vertical footcandles: No single point shall exceed 0.5 footcandles. Models shall represent readings taken with the meter positioned horizontal 36 inches above grade.
      c. Candela Readings: At the residential property line at 3' above grade, the max candela reading (by fixture) shall not exceed 5,000 (candela). Readings taken with all fields illuminated.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
   1. A detailed explanation of the operation of the system.
   2. Instructions for routine maintenance.
   3. Pictorial parts list and part numbers.
   4. Telephone numbers for the authorized parts and service distributors.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Only products and applications listed in this Section may be used on the project unless otherwise submitted.

C. All components shall be designed and manufactured as a system. All luminaires, wire harnesses, ballast and other enclosures shall be factory assembled, aimed, wired and tested.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Equipment damaged during shipment shall be replaced and returned to manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

1.07 WARRANTY

A. 25-Year Warranty: Manufacturer shall supply a signed warranty covering materials and labor for the entire system for 25 years from the date of shipment. Warranty shall specify light levels, system energy consumption, monitoring, maintenance and control services, spill light control, and structural integrity. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The drawings and submittals are based on performance criteria as manufactured by Musco Sports Lighting, LLC. It has been predetermined that the project specifications are the minimum acceptable criteria for this project and only submittals that meet the requirements in their entirety will be accepted.

2.02 POLE STRUCTURAL STEEL

1. The pole shafts shall be high strength low alloy tapered tubular steel that is equal to current ASTM A595 standards, with galvanized coating inside and out. All connections of pole sections shall be by slip fitting the top section over the lower section by a length of at least 1.5 times the diameters.
2. Steel components of the poles shall be hot dip galvanized t current ASTM A-123. Steel portions of the pole shall be constructed such that all segments of the pole can be readily heated to like temperatures in commercially available galvanizing methods.
3. To avoid problems of galvanize adherence to differing steel alloys, all steel components used for the pole must be of the same type steel.
4. All exposed steel components of the pole shall be at least 18” above the surface of the ground to avoid exposure of the steel to the heavily moisture and oxygen laden air, both above and below the surface. There shall be a cap to cover the top of the pole so that rain will not enter the interior of the pole.
5. To avoid stress corrosion of the pole, there shall be no weld points of the steel portion of the pole within 18” of the ground. The pole shall be galvanized steel.

6. The poles for this project have been designed to withstand 110 mph winds based upon CBC-C standards. The premise of the wind speed criteria will be the 50 year mean recurrent isotach wind map. Applicable gust factors to be applied per code.

2.03 FOUNDATION DESIGN

1. The Manufacturer shall provide a stamped foundation design, prepared by a Structural Engineer, licensed in the State of California.
2. The foundation design shall be based upon recommendations contained in the Geotechnical Report furnished by the Owner.
3. It is the contractor's responsibility to notify the owner of soil conditions other than the design criteria. The owner shall then be responsible and absorb the additional costs associated with: Providing engineered foundation embedment design by a registered engineer in the State of California for soils other than specified soil conditions. Additional materials required to achieve alternate foundation. No direct burial steel poles allowed.
4. Lightning Protection: Manufacturer shall provide integrated lightning grounding via concrete encased electrode grounding system as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A. If grounding is not integrated into the structure, the Manufacturer shall supply grounding electrodes, copper down conductors and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be not less than 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

2.04 LED SPORTS LIGHTING FIXTURES

A. The lens is permanently sealed to keep optics away from harmful environmental elements. Fixture is vented and filtered to adapt to environmental elements. Heat sink with a unique convective air cooling design with high thermal conductivity and corrosion resistant construction. Machine mounted surface for maximum heat transfer of diode assembly and maintains low LED junction temperature during high wattage operation. Custom high power diode package with a metal core printed circuit board. The light control visors are factory aimed. Controls and directs more light onto the field which reduced glare and spill and enhances the on-field playability. Fixture is powder coated gray.

2.05 REMOTE ELECTRICAL ENCLOSURE

A. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. Drivers are remote for ease of installation and servicing. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure.

2.06 WIRE HARNESS

A. Spiral wound, abrasion protection sleeve, strain relief, plug-in connections.

2.07 CONTROLS AND MONITORING SYSTEM

A. Factory assembled lighting control cabinet (LCC) – The LCC shall be assembled and wired by a UL listed panel builder. The LCC shall contain Contactors, Monitoring and Control System and door mounted Manual off-on-auto selector switches. The LCC shall arrive at the job site ready to attach to an existing wall, switchgear, or a free standing enclosure.
    1. Control Wire Terminations - The Control Wire Terminations shall include UL listed terminal blocks mounted on a DIN rail and 250 volt, 16 amp, touch safe type fuse holders.
    2. The ECE shall be constructed of aluminum and shall be powder coated gray. The cabinet door shall utilize a lockable, 3 point latching assembly that provides a NEMA 4 rated seal.
    3. Contactor Modules – Contactors shall be UL listed for lighting applications. They shall be rated at full capacity, be electrically held, utilize a 120 volt coil and be rated for operation in a ambient temperature range from -40 degrees C to +70 degrees C.
    4. Manual off-on-auto Selector Switches – For on site manual control, three position selector switches shall be factory mounted to the ECE door. The switches shall be keyed and maintain position, with make before break contacts. The switches shall be factory wired to control terminal blocks.
    5. Warranty – The LCC shall be covered under the standard warranty for the accompanying lighting equipment.

B. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The manufacturer shall notify the owner of outages within 24 hours, or the next business day. The controller shall determine switch position (manual or auto) and contactor status (open or closed). The Monitoring System shall be factory wired to control terminal blocks.

C. Remote Lighting Control System: The Lighting Control System shall allow owners and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs. The Light Control System shall be factory wired to control terminal blocks.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of site lighting fixture installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Locate exact locations for all poles and verify locations with architect prior to installation.

3.03 INSTALLATION

A. Install lighting fixtures in accordance with manufacturer's written instructions, as shown on the drawings and as specified herein.

B. Contractor shall be responsible for all supports, hardware, etc necessary for a complete installation.

C. Fixtures shall be plumb, level, square, in straight lines, and without distortion.

D. Turn over project with all lamps in new and operating condition. Lamps that are burned less than 100 hours at project closeout are considered new.

E. Backfill - The pole base shall be installed per the manufacturers installation instructions.

F. Assembly - The pole base shall be separate from the pole such that the base may be installed, properly plumbed, and enlarged as to the bearing surface by concrete backfill allowing for inspection prior to the attachment of the steel pole.

G. Electrical Wiring - The pole and the luminaires shall be designed such that all wiring remains underground before entering the base of the pole and that no wiring shall be exposed to sun or weather as it transitions through the pole and to the ballast and on to each lamp.

H. Field Connections - All field electrical connections on the pole shall be achieved by UL listed plug-in or lug method of attachment from the load side of the disconnect to the lamp socket. The feeder and grounding conductors from the service entrance to the pole shall be connected at the pole by landing lugs.

3.04 INSTALLATION OF POLES

A. General: Store poles on decay-resistant treated skids at least 1 ft. above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.

B. Pole installation: Use fabric web slings (not chain or cable) to raise and set poles.

3.05 FIELD QUALITY CONTROL

A. Visual and mechanical inspection:
   1. Inspect for physical damage, defects, alignment and fit.
   2. Perform operational test of each lighting fixture after installed, circuited and energized.

B. Test and Measurement Procedures:
   1. All testing will be done with entire facility illuminated.
   2. Horizontal footcandle readings shall be measured with the test cell positioned horizontal 36 inches above grade.
   3. Maximum footcandles shall be measured with the test cell positioned 36 inches above grade and aimed at the brightest light source from the tested field.
   4. For final approval of the project the manufacturer shall provide a final report from the test results that shall provide the following items:

a. Identification of number and location of the test stations, that shall agree in number and location with description in specification.
b. Actual horizontal footcandle readings taken at each test station.
c. Actual maximum footcandle readings taken at each spill/glare test station.
d. Number of hours of operation and number of system starts.

C. Contractor shall replace at no cost to the Owner all equipment which is found defective or do not operate within factory specified tolerances.

3.06 ADJUSTING

A. Field aiming: The Contractor shall allow time in the bid, and be responsible upon the installation of the light fixtures, for aiming and lamping fixtures. This aiming will be performed at night under the direction of the Owner's representative and the Architect. The contractor shall be responsible for providing the labor and materials for field aiming. This will include, but not limited to, special rigging or scaffolding, adjusting fixtures in field, testing of various lamps with each fixture, and/or testing of various lenses or louvers with fixtures, as directed by the Architect or Engineer.

3.07 FIELD TECHNICIAN ON SITE VISIT

A. Manufacturer shall provide an on-site visit by a factory technician after completion of the installation. The factory technician shall make any necessary adjustments to the aiming in order to ensure that specified maximum footcandle levels are not exceeded. This service shall be included at no additional cost to the owner or installing contractor.

3.08 CLEANING

A. Clean lighting fixtures prior to project closeout in accordance with manufacturer's recommended materials and methods.

END OF SECTION
26 56 68

SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. Furnish all labor, materials, equipment, facilities, transportation, and services to complete all earthwork and related work shown on the Drawings and/or specified herein.

B. The general extent of the earthwork is shown on the Drawings and can include, but is not necessarily limited to the following:

1. Topsoil stripping
2. Rough grading
3. Filling and backfilling to attain required grades
4. Excavating for paving, footings, and foundations
5. Adherence to requirements, recommendations and/or Best Management Practices (BMPs) for storm water management per plans and as required by governing agencies

1.02 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 1997.

B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2000a.

C. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.

D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2000.

E. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994.

F. ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregates; 1995.

G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 1996.

H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 1996.

1.03 SUBMITTALS

A. Project Record Drawings:

1. Conform to Section 01 78 39 Project Record Documents, and/or applicable specification sections, General Conditions and Supplementary Conditions.
2. Accurately record locations of utilities remaining, re-routed utilities, new utilities, and newly discovered utilities by horizontal dimensions, elevations, inverts, and slope gradients.
3. As applicable, contractor shall submit five (5) samples (one quart-sized “zip-lock” plastic bag) of each proposed import material with current accompanying fertility and structure analyses, for review and acceptance by the City’s Representative a minimum of three weeks prior to proposed use. Refer to Section 32 90 00 for analysis and laboratory requirements.

1.04 QUALITY ASSURANCE

A. Geotechnical Investigation:

1. The City has paid for the services of a Geotechnical Engineer to make recommendations based on the soil conditions encountered the results of field and laboratory tests, and observations of the activities performed under this Section.

2. Relative compaction densities specified for structural fills under footings, slabs, or pavements shall be determined in accordance with ASTM D-1556 and D-1557, unless otherwise noted.

3. A geotechnical report was prepared for this project by Youngdahl Consulting (Project No. E17053.156, dated September 2022). The geotechnical report is Appendix "A"

B. Certification:

1. The contractor shall certify source and type of backfill and topsoil proposed to be incorporated into the work, at the request of the City's Representative and or geotechnical engineer.

2. At the request of the City's Representative, contractor shall certify elevations of excavations, footings, subgrades and finish grades at the contractor's expense.

C. Warranty

1. The Contractor shall warrant the Work against settlement for a period of one year after the date of final acceptance and shall repair damage caused by settlement within that time. Settlement will be deemed to have occurred if on paved surfaces, depressions greater than 3/8 inch occur relative to paved surfaces outside the excavation area.

D. Repair:

1. Repair settlement at excavated areas for a period of one year following final acceptance at no additional cost to City. Remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment; restore appearance, quality, and condition of surface and finish to match adjacent work, and eliminate evidence of restoration.

1.05 PROTECTION

A. Protect all existing structures, fences, roads, sidewalks, paving, curbs, and other items as necessary from earthwork activity.

B. Protect above or below grade utilities which are to remain.

C. Repair damage to any existing site features which are to remain. Repair and restoration shall be equal to quality and appearance of prior condition and to the satisfaction of the City's Representative

1.06 PROJECT CONDITIONS

A. Underground Utilities: Unknown buried utility lines may exist. If encountered, notify City's Representative immediately for direction and re-direct work to avoid delay.

1. Cooperate and coordinate with City's Representative and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility City.

2. Do not interrupt existing utilities serving occupied facilities without proper notification to, and written direction from, City's Representative.

B. Wet Conditions: No grading operations shall be conducted when excessively wet conditions exist as determined by the City's Representative.

C. Contractor shall provide de-watering equipment as required to continue scheduled operations and provide optimum working conditions at no additional cost to City.

D. Dry Conditions: Contractor shall apply sufficient water to materials during construction to properly compact materials and control dust.

1.07 GRADE STAKES AND LINES

A. All grading and sub grading shall be controlled by Contractor-installed intermediate grade stakes and lines necessary to obtain the finished grade elevations shown or implied in the Drawings. Subgrade and finish grade surfaces shall conform to the control planes established by these grade stakes and lines.

B. Protect and maintain all existing benchmarks, monuments, and other reference points. If disturbed or destroyed, they shall be replaced at the Contractor's expense.

C. Contractor shall set temporary benchmarks as necessary to properly complete construction operations.

D. Refer to Specification Section 01 71 23 for additional information.

PART 2 - PRODUCTS

2.01 DELIVERY, STORAGE AND HANDLING

A. Stockpile satisfactory excavated materials in approved location, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

2.02 MATERIALS

A. Topsoil: Excavated material from the top 4 inches (maximum) of existing grade is not acceptable material for planting. Topsoil suitable for planting areas shall be imported. Contractor shall submit proposed topsoil to City's Representative for review and acceptance prior to ordering and placing topsoil.

B. Subsoil: Excavated material below top 4 inches of existing grade, graded free of clay clods or siltstone material larger than 6 inches, rocks larger than 2 inches, and debris. Refer to Geotechnical Report.

C. Engineered fill shall have the following characteristics:

1. Have 100 percent pass through a 3-inch sieve, 95 to 100 percent pass through a 1-inch sieve.
2. Be thoroughly compacted without excessive voids.
3. Have a maximum Plasticity Index of 15.
4. Have an Expansion Index less than 20.
5. Have a minimum of 10% fines
6. Be free of organic materials and debris

D. Fill Materials: Use only suitable fill except where sand is required. Do not use water saturated soil material or contaminated material.

1. On-site soils are considered suitable for use in engineered fill material provided that they are at a workable moisture content and free of significant concentrations of organic materials, rubble or debris.
2. If imported material is required for fill and backfill, the imported material must be granular soil, free of organic matter, and conform to the requirements of engineered fill as listed above.

PART 3 - EXECUTION

3.01 OBSERVATION

A. The Contractor shall assess and evaluate all site conditions and layout the work before any earthwork shall begin. It is the contractor's responsibility to determine the exact nature and extent of subgrade conditions.

B. Subgrade and geotechnical information provided by the City shall not relieve the Contractor of responsibility for being familiar with the character and extent of subsurface conditions that may be encountered during performance of the Work.

3.02 PREPARATION

A. Identify all required lines, levels, contours, datum, control points and property lines required to properly establish limits of work.

B. Verify elevations of critical existing grades as noted on drawings and as directed by City's Representative. Notify City's Representative of discrepancies prior to start of work and re-direct work to avoid delay.

C. Identify all known below grade utilities. Contractor shall stake and flag locations.

D. Identify and flag surface grades and utilities.

E. Contact Underground Service Alert (USA North) (811) or (800-642-2444) and local utility companies to verify locations of existing utilities a minimum of two (2) working days prior to excavation.

3.03 PROTECTION

A. Maintain and protect existing utilities remaining which pass-through work area.

B. Perform excavation work near utilities and protected plant material by hand. Provide necessary protection as the work progresses.

C. Provide and maintain protection for walks, curbs, drains, trees, corners of structures, etc., as necessary to prevent damage

D. Barricade and/or cover open excavations occurring as part of this work and post with warning lights to the satisfaction of the City's Representative. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

E. Keep adjacent properties, streets and drives clean of any dirt, dust, or stains caused by earthwork operations.

F. Upon discovery of unknown utility or concealed conditions, notify the City's Representative immediately and re-direct work to avoid delay.

G. Control dust on and near the work, and on and near off-site borrow areas.

1. Thoroughly moisten surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of any other activities that may occur on the site.

2. Non-compliance with proper dust control measures shall be grounds for issuance of "stop work" orders by the City's Representative until such time as satisfactory measures can be implemented.

3.04 SITE CLEARING

A. Complete clearing and stripping as indicated on Drawings.

B. Remove and/or stockpile topsoil as indicated on the drawings. Do not excavate topsoil that has become wetted to, or beyond, the saturation point that would be required for optimum compaction.

3.05 EXCAVATION

A. Remove and dispose of all miscellaneous materials encountered when establishing required grade elevations.

1. Miscellaneous materials can include but are not limited to: pavements and other obstructions, underground structures, utilities, abandoned irrigation materials, and other materials encountered per the discretion of the City's Representative.

B. Stability of Excavations:

1. Comply with any applicable recommendations contained within the Project Geotechnical Report and requirements of agencies having jurisdiction.

2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

C. De-watering:

1. Provide and maintain, at all times during construction, ample means and devices with which to promptly remove and properly dispose of water from any source entering structural excavation, pipe trenches, or other excavations. All costs incurred from de-watering activities shall be paid for by the contractor.

D. Excavation for Structures:

1. Conform to elevations and dimensions shown in the drawings within a tolerance of plus-or-minus one tenth (0.10') of a foot and extending a sufficient distance from footings and foundations to permit placing and removal of concrete form-work, installation of services, and quality review.

E. Excavation for Pavements:

1. Cut surface under pavements to comply with cross-sections, elevations, and grades as shown in the Drawings and as outlined in the Geotechnical Report.

F. Material Storage: Stockpile satisfactory excavated materials where appropriate, until required for use. Stockpile topsoil and subgrade soil in separate piles. Contractor shall place, grade and shape stockpiles to ensure proper drainage.

1. Locate and retain stockpiles away from edge of excavations.

2. Dispose of excess soil material in a legal fashion after it has become evident that the material is no longer needed on the project and is of no value to the City.

G. Additional Excavation: When excavation has reached required subgrade elevation shown on Drawings, notify City's Representative who will inspect conditions. When unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and place excavated material as directed by the City's Representative.

H. Stability of Excavations: Comply with OSHA regulations for slope requirements. Provide shoring and bracing where required slope cannot be maintained.

I. Excavation for Pavements: Cut surface under pavements to comply with pavement section shown on Contract Documents.

J. Coordinate excavation, preparation and backfill with Work of related Sections for Project Site utilities, drainage, and irrigation systems.

K. Replace the excavated material or any approved supplementary import material in lifts not to exceed 6 inches in compacted thickness and compact each lift to a minimum 90 percent relative compaction.

L. The upper 12-inches of fill within building pads and concrete flatwork areas shall be per the project geotechnical report.

M. Perform footing excavations after fill placement is complete.

3.06 EXCAVATION IN ROCK

A. Excavation includes removing rock, boulder outcroppings, and rock masses by anticipated means if encountered during excavation/trenching operations.

B. “Anticipated” is hereby defined as within the advertised production rate of a Caterpillar D-9 or D-10 series crawler tractor, Caterpillar 245 excavator, 50,000 lb. Drill Rigger, and rock trenching equipment such as large excavators (Komatsu PC400, CAT 345), or equivalent, utilizing appropriate attachments for the conditions encountered and the work being performed.

C. The cost for removing rock, boulder outcroppings, and rock masses that can be removed by “Anticipated” means shall be included with the work and no additional payment shall be made.

D. The contractor shall remove rock in trenches by excavating twelve (12) inches below invert elevation or pipe and 24 inches wider than pipe diameter. Disposal of excavated material shall be either as fill under areas to be planted, but not less than 30” below finish grade, used as cobble or rock in areas designated on the plans, or directed by the City’s Representative.

E. When rock is uncovered that cannot be removed by anticipated means, the Contractor shall notify the Project Manager immediately. No work may proceed until verification and documentation has been made by the Project Manager. If verified and documented, the work may proceed as directed by the City’s Representative and payment under the “Rock Excavation” bid item will be made.

F. Blasting of rock is not anticipated to be necessary. Blasting is not to be considered as an alternative method under this item of the proposal.

3.07 BACKFILL AND FILL

A. Scarify all areas to receive fill to a minimum depth of eight inches, moisture condition as necessary, and compact to at least 90 percent of the maximum dry density based on the ASTM D1557 method.

B. Place approved material in layers to required subgrade elevations, for each area classification listed below. Do not use water saturated soil material or contaminated material.

1. In excavations, use approved excavated or imported material.
2. In planted areas, use imported soil or topsoil from site stockpile.
3. Under walks and pavements, use subbase material, approved excavated or imported material, or combination of both.
4. Under steps, use approved subbase material.
5. Under building slabs, use approved drainage fill material.

C. Backfill excavation as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities.
3. Removal of concrete formwork, shoring and bracing: Prevent settling due to removal of materials from below structures.

4. Backfilling of voids with satisfactory materials.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

D. Place backfill and fill materials in uniform lifts not more than twelve inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches loose depth for material compacted by hand-operated tampers. Prevent wedging action of backfill against structures and displacement of piping and conduit.

3.08 ROUGH GRADING

A. Grade site subsoil to establish proper subgrade elevations and site contouring as described or implied in the Drawings and Geotechnical Report.

B. Contouring: Construct landforms depicted in the Drawings to the satisfaction of the City's Representative.

1. "Round-off" all tops of slopes.
2. "Feather" all toes of slopes.

C. Provide smooth finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated on Drawings, or between such points and existing grades.

D. Grade areas outside of building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, within the following tolerances above or below required finish grade.

1. Lawn and Unpaved Areas to Receive Topsoil: 0.10 foot
2. Pavements and Walks: Line, grade, and cross-section, 0.10 foot
3. Structures: 0.10 foot.

E. Grade fill under building slabs smooth and even, free of voids, to required elevation.

3.9 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification as indicated below.

B. Percentage of Maximum Density Requirements: Compact soil to no less than the following percentages of maximum density in accordance with ASTM D 1557.

C. Building Slabs: Compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent relative compaction.

D. Areas to be planted: Maximum twelve inch (12") inch lifts to 85% relative compaction at a minimum of 2% above optimum moisture content.

E. Vehicular pavements: Maximum twelve inch (12") lifts to 90% relative compaction @ a minimum of 3% above optimum moisture content. The upper 8 inches of pavement subgrade soils shall be compacted to at least 95 percent relative compaction.

F. Other Areas:

Table 4, Project Compaction Requirements

Description	Percent Relative Compaction	Optimum Moisture Content
Field Baserock, Crushed Class 2 Permeable	92	± 2
Underground Utility Backfill, 5-Feet and Deeper	90	± 2

Underground Utility Backfill, Upper 5-Feet	95	± 2

G. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

1. Remove and replace or scarify and air dry soil material that is too wet to permit compaction to specified density.
2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Stockpile materials to be reused on site and materials to be removed in separate piles. Grade and protect stockpiles to avoid mixing or erosion.

B. Except for stripped topsoil or other material to remain or be reused, cleared and or stockpiled materials shall become the Contractor's property and shall be removed from the project site and disposed of legally.

3.11 PROTECTION

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

C. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

D. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

END OF SECTION
31 20 00

SECTION 31 22 19
FINISH GRADING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, services, and equipment indicated on Drawings and/or herein specified to complete all Finish Grading Work.

B. Finish grading shall consist of scarifying and establishing finish grade to conform to the contours, grades, line and shapes as indicated on the Drawings, and ensuring that all landscape areas are uniformly graded to an outlet.

C. Related Sections: Related sections may include but are not limited to:

1. Section 31 20 00 Earthwork
2. Section 32 90 00 Planting

1.02 DEFINITIONS

A. Subgrade: Surfaces upon which additional specified materials are to be placed, prepared, or constructed.

B. Rough grade: The establishment of grades to one-tenth (1/10) foot plus or minus tolerance of grades required to accomplish the Work described in other documents and drawings.

C. Finish grade: The establishment of grades to a plus or minus tolerance of final grades as indicated on Drawings. Tolerances are specified in applicable documents of the specifications (i.e., Planting, Concrete, Decomposed Granite, etc.) Finish Grade elevations in planted areas reference top of soil. Allowance shall be made for installation of mulch, sod, etc. as shown in the drawings.

D. Grading intent: Spot elevations (grades) and contours are indicated based on the best available data. Drawings are referenced to provide additional site grading data. The intent is to maintain constant slopes between spot elevations. If a spot elevation is determined to be in error, or the difference in elevation between points change, contact the City's Representative immediately for field adjustments of spot elevations.

1.03 EXISTING UTILITIES

A. Contractor is responsible to contact Underground Service Alert (USA North) (811) or (800-642-2444) and mark the location of all existing utilities before commencing Work.

B. Refer to the Drawings for information on proposed site utilities and their locations.

C. Retain and protect in operating condition all active utilities traversing the site designated to remain.

D. Where existing utilities not indicated on the Drawings are encountered, support, shore up, protect same and immediately contact the City's Representative for continuance and/or relocation of such services.

1.04 PROTECTION OF EXISTING CONDITIONS AND ADJACENT PROPERTIES

A. Use all means necessary to protect existing conditions designated to remain, newly constructed conditions and adjacent properties. Avoid any encroachment on adjacent properties.

B. Prevent damage to existing benchmarks, pavement, and utility lines. In the event of damage or loss, immediately make all repairs and replacements required to the satisfaction of the City's Representative and at no additional cost to the City.

1.05 QUALITY ASSURANCE

A. Finish grades shall conform to contours, grades, lines, and shapes, as indicated on Drawings, with uniform slopes between finish grades or between finish grades and existing grades.

B. Establish finish landscape grades in a continuous, uniform line, resulting in a uniform surface with positive drainage and without ridges or water pockets.

C. Finish landscape grade tolerance shall be .04 feet plus or minus of final grades indicated on Drawings.

1.06 SUBMITTALS

A. Per Section 31 20 00

PART 2 - PRODUCTS

A. Per Section 31 20 00 and Section 32 90 00

PART 3 - EXECUTION

3.01 PROTECTION

A. Rough grades shall be within plus or minus .10 foot of final finish grades as indicated on plans. If any discrepancies exist, notify the City's Representative immediately for direction.

B. Contractor shall be responsible for bringing rough grades into conformity with finish grades as indicated on the plans. Comply with tolerances specified in this document and as specified in applicable documents of the specifications (i.e., concrete, asphalt, planting, etc.).

C. Conduct work in an orderly manner. Dirt shall not be permitted to accumulate on hardscape or be washed into storm drains.

D. Use all means required to prevent the erosion of freshly graded areas during construction and until such time as proposed hard surfaces and landscaping have been constructed.

3.02 LAYOUT

A. Layout of all work under this Section shall be made by a licensed surveyor.

B. Maintain all benchmarks, control monuments and stakes. Protect from damage and dislocation.

C. If any discrepancies are found by the surveyor between the Drawings and actual site conditions, the City's Representative reserves the right to make minor adjustment in Work Specified as necessary to accomplish the intent of the Contract Documents without increased cost to the City.

3.03 FINISH LANDSCAPE GRADING

A. Scarify or rototill to a 6” depth all planting areas prior to finish grade operations and work until uniform and free from large clods larger than one (1) inch in greatest dimension.

B. Finish grade shall conform, after compaction, to shapes, spot elevations and contours as indicated on Drawings, with uniform levels or slopes between finish elevations or between finish elevations and existing elevations. Landforms shall be naturally formed, with increasing or decreasing slopes as follows:

1. “Round-off” all high points or tops of slopes to finish grade as noted on the drawings in a parabolic fashion, without exceeding maximum or minimum slopes as shown or as required.

2. “Feather” all low points or bottoms of slopes to finish grade as noted on the drawings in a parabolic fashion, without exceeding maximum or minimum slopes as shown or as required.

A. Soil amendment and preparation shall comply with Section 32 90 00 Planting.

B. Spread excess soil material excavated from plant pits to establish subgrades in surrounding planting areas.

C. Top six (6) inches of all areas to be planted shall be free of stones, stumps, or other deleterious matter one (1) inch in greatest dimension.

D. Compact soil in planting areas to 85% relative compaction in accordance with ASTM D1557-78.

E. Fine grade all planting areas to a smooth, loose, and uniform surface. Eliminate uneven areas, ridges, and depressions.

F. Shrub/ground cover planting areas shall be graded three and one-half (3-1/2) inches below adjacent paved areas, sidewalks, valve boxes, mow bands, drains, etc. in order to receive a three-inch-deep layer of wood chip mulch, establishing final grade one-half (1/2) inches below these surfaces.

G. Turf areas shall be graded 1/2 inch in hydroseed, and 1 inch in sod, below adjacent paved area, sidewalks, valve boxes, mow bands, drains, top of seat walls etc. in order to receive turf, establishing final grade flush with these surfaces.

3.04 OBSERVATION SCHEDULE

A. Normal progress observations shall be requested by the Contractor from the City's Representative as per observations listed in Sections: 32 84 00 Planting Irrigation, and 32 90 00 Planting.

3.05 CLEAN UP

A. Remove all trash, excess soil, or rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site.

B. The Contractor shall leave the site area broom-clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition acceptable to the City's Representative.

END OF SECTION
31 22 19

SECTION 31 23 33
UTILITY TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, equipment, facilities, transportation, and services to complete all excavation, trenching, backfilling, compaction, and related work as shown on the Drawings and/or specified herein. Standard specifications follow CSI 2004 3-part format.

B. Scope of work: The general extent of all trenching, backfilling, and compaction is shown on the Drawings and may include, but is not necessarily limited to, the following:

1. Storm Drainage System Installation
2. Irrigation System Installation
3. Paving Installation

1.02 RELATED SECTIONS

A. General and Project Conditions of the Bid Documents

1.03 REFERENCE AND REGULATORY REQUIREMENTS

A. Geotechnical Report:
1. Refer to Section 31 20 00
2. C 33, Specification for Concrete Aggregates.
3. C 150, Specification for Portland Cement.
4. C 260, Specification for Air-Entraining Admixtures for Concrete.
5. C 618, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
6. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
7. D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
8. D 2487, Classification of Soils for Engineering Purposes.
9. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
10. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
11. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.

B. California Building Code, California Code of Regulations, Title 24, Part 2 - Chapter 18, Foundations, and Retaining Walls, and Chapter 33, Site Work, Demolition and Construction.

C. Standard Specifications for Public Works Construction, 2015 Edition (The Greenbook).

D. Manual of Warning Signs, Lights and Devices for Use in Performance of Work Upon Highways, issued by the California State Department of Transportation.

E. Office of Safety and Health Act (OSHA) Construction Safety Orders

F. California Code of Regulations Title 8: Construction Safety Orders.

1.04 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 and/or applicable Division One and Two Specifications, General Conditions and Special Provisions.

B. Submit material certificates of compliance and/or sieve analysis for all products and materials proposed to be used in work covered by this section.

C. Project Record Drawings:

1. Conform to requirements of Section 01 78 39 and/or applicable general conditions and special provisions.

2. Accurately record locations of utilities remaining, re-routed utilities, new utilities, and newly discovered utilities by horizontal dimensions, elevations, inverts and slope gradients as practical.

1.05 DEFINITIONS

A. Finish Grade Elevations: Indicated on Drawings.

B. Bedding: Select Backfill used for initial placement in utility trenches and other excavations.

C. Standard Specifications: Standard Specifications for Public Works Construction, 2015 Edition (The Greenbook).

D. State Standard Specifications: State of California, Business and Transportation Agency, Department of Transportation (Caltrans), Standard Specifications, latest edition, excluding Sections pertaining to measurement and payment items.

E. Relative Compaction: Ratio, expressed as a percentage of field dry density as compacted to a maximum dry density of representative sample of the same material determined by American Society for Testing and Materials (ASTM) Test Method D1557 (c).

1.06 SEQUENCING AND SCHEDULING

A. Refer to all other Contract Documents, determine the extent and character of related work, and properly coordinate work specified herein with that described elsewhere to produce a complete, operational installation.

1.07 QUALITY ASSURANCE

A. Control of Work: Comply with Section 5 of the Standard Specifications.

B. Control of Materials:

1. Comply with of the Standard Specifications.

2. Provide materials of the same type and from the same source throughout the work.

C. Trench Safety: Comply with applicable portions of Sections 5 and 7 of the Standard Specifications and requirements of other agencies having jurisdiction (OSHA etc.).

1.08 WARRANTY

A. The Contractor shall warrant against settlement for a period of one year after the date of final acceptance, and shall repair damage caused by settlement within that time. For the purpose of this Specification, settlement will be deemed to have occurred if, on paved surfaces, the depression falls 3/8-inches below the average of the sides of the uncut portion.

PART 2 - MATERIALS

A. Provide materials as described below free of debris, roots, wood, scrap material, vegetative matter, refuse, soft unsound particles, or other deleterious and objectionable materials.

B. Select Backfill: Select backfill material shall be sand conforming to Section 19-3.025B of the Standard Specifications.

C. Native Backfill: Native backfill shall be acceptable soil material excavated from the project site. This material will be considered unclassified and additional testing may be required prior to backfill. Approval to use native backfill material shall be reviewed by geotechnical engineer prior to use as backfill material.

D. Class 2 Permeable Material: Class 2 permeable material shall conform to Section 68-2.02F(3) of the State Specifications.

E. Imported Materials: Deliver samples (minimum 2 gallon pail), sieve analysis and other reports as required to City's Representative a minimum of 3 weeks prior to proposed use.

PART 3 - EXECUTION

3.01 PREPARATION

A. General:

1. Prior to trenching, the contractor shall pothole existing utilities at locations indicated or implied on the plans, where new piping or utilities will cross existing utilities of uncertain depth to determine the elevation of the utility in question and ensure that the new line will clear the potential obstruction.
2. The Contractor shall mark out all construction areas in white, non-permanent paint and contact Underground Service Alert (U.S.A.) (800-642-2444) to locate all known utilities a minimum 48 working hours prior to any excavation.
3. Should an existing crossing utility present an obstruction, the proposed line shall be adjusted as acceptable to the City's Representative to clear the existing utility.

3.02 TRENCH EXCAVATION

A. General

1. The Contractor shall excavate whatever substance is encountered to the lines and grades shown on the Drawings. Materials suitable for use as backfill shall be piled in an orderly manner a sufficient distance from the edge of the trench to avoid overloading and to prevent sliding into the trench.
2. The Contractor shall do such grading or Work as is necessary to prevent surface water from entering the excavation.
3. Excavation shall include removal of all water and materials that interfere with construction. Remove any water which may be encountered in the trench by pumping or other methods prior to pipe laying, bedding and backfill operations. Trenches shall be sufficiently dry to permit proper jointing and compaction.
4. It shall be the contractor's responsibility to direct vehicular and pedestrian traffic safely through or around the work area at all times.
5. The contractor shall relocate, replace, reconstruct or repair, to an "as-was" or better condition, all surface or subsurface improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the construction activities. Except as specified in other Sections or shown in the Drawings, this provision applies to all surface improvements of whatever nature such as walls, fences, above-grade utilities, landscaping, paving, structures, or other physical features whether shown in the Drawings or not and to all subsurface improvements such as utilities which may be indicated in the Drawings or marked in the field. The contractor shall connect such utilities to existing systems and leave all in a workable and operating condition. The cost of this work shall be considered as included in other items of work and no additional compensation will be allowed.
6. The maximum allowable trench width at the top of pipe shall be 18 inches greater than the pipe diameter.
7. Do not interfere with the area of influence of adjacent footings. This area is generally described as extending from the bottom of any footing outward at a 45 degree angle.

B. Existing Paving Areas

1. Existing asphalt concrete paving over new trenches shall be sawcut, removed, and legally disposed. Existing asphalt concrete paving shall be neatly sawcut one foot (1') greater on each side than the trench width. If a longitudinal pavement joint or edge of pavement, curb or

gutter is located within three feet of the limit of excavation, all intervening pavement shall be removed and replaced after completion of backfilling. If concrete curb and/or gutter are to be replaced, the adjacent existing asphalt concrete paving shall be sawcut one foot (1') from the edge of concrete curb and/or gutter.

2. Existing portland cement concrete paving over new trenches shall be sawcut to a minimum depth of 1-1/2 inches or one half the depth of paved section, whichever is greater, in straight lines at construction joint or expansion joint.

C. Compacted Fill Areas: Where trenches must be excavated in compacted fill, these trenches shall be backfilled with the fill materials excavated and re-compacted in the layers and to the density specified for the particular area.

D. Open Trench:

1. No trench shall be left in an open un-protected condition at the end of the day. At the end of the day any open trench shall be protected in a manner acceptable to the City's Representative.

2. Provisions for trench crossings and access shall be made at all paved areas, water gate valves, and fire hydrants unless otherwise acceptable to the City's Representative.

E. Excavated Material

1. All excavated material not required for backfill or of value to the City shall be removed and legally disposed of by the contractor at no additional cost.

2. Material excavated in paved areas shall be laid alongside the trench no closer than two feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.

3. Provisions shall be made whereby all storm and waste water can flow uninterrupted in gutters or drainage channels to drainage structures.

4. Excavated material shall not be stored on existing landscaping or paving without provisions being made to protect the surface below from being stained or otherwise adversely affected.

F. Shoring

1. Should excavations extend more than 4 feet below existing ground surface, shoring will be required.

2. Excavations can be sloped back to an inclination of 1.5 horizontal to 1 vertical as an option for shoring in these conditions.

3. Utility trenches shall be excavated according to accepted engineering practices following OSHA.

G. Excavation in Rock

1. Per Section 31 20 00.

3.03 PIPE BEDDING

A. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be de-watered as necessary. The City's Representative shall determine the suitability of the trench bottom and the amount of sand, gravel, or crushed rock needed to stabilize the soft foundation.

B. Placement of Bedding Material: Place sufficient bedding material in trench bottom up to grade of bottom of pipe. Relative compaction of tamped material shall be not less than 90 percent relative compaction. Place and compact additional bedding material to provide uniform bearing under the full length of the pipe to a minimum width of 60 percent of its external diameter.

3.04 TRENCH BACKFILL AND COMPACTION

A. General:

1. Construct backfill in two operations (initial and final).
2. Do not backfill where the foundation material in trench is already saturated, except as acceptable to the City's Representative. Provide a minimum cover as may be specified.
3. Where settling greater than the tolerance allowed for grading occurs in trenches and pits due to un-stable subgrade material, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation.
4. For utilities under roads, streets, concrete slabs or other areas to be paved, place final backfill in 6-inch maximum loose lifts. Compact all backfill surrounding ducts, conduits, pipes and other structures, including the top 12-inches of subgrade to 95 percent of ASTM D1557 maximum density. Backfill to permit the rolling and compacting of the completed excavation with the adjoining material providing the specified density necessary to enable paving of the area immediately after backfilling has been completed.

B. Initial Backfill:

1. Prior to trench backfill, the condition of the trench and laying of pipe shall be acceptable to the City's Representative.
2. Select backfill material shall be used as initial backfill for all utilities except irrigation piping and synthetic turf subdrain, unless otherwise noted. After the pipe has been properly laid and accepted by the City's Representative, select backfill material shall be placed on both sides of the pipe and compacted to the depth shown in the Drawings.
3. Compaction: The initial backfill material shall be hand tamped in layers not exceeding four inches (4") in uncompacted depth and shall be brought up uniformly on both sides of the pipe to avoid bending or distortional stress. After handtamping, the compaction of the initial backfill material shall be at least 95% compaction.

C. Final Backfill:

1. Only approved native backfill material shall be used for final backfill, unless otherwise noted.
2. Compaction: Final backfill compaction shall be by mechanical means with backfill material placed in layers not exceeding six inches (6") in loose depth. Each layer shall be thoroughly compacted before succeeding layers are placed. The use of machine tampers, except manually held types, shall not be permitted. Final backfill shall be compacted to a relative compaction of 95% for paving areas. In planting areas, provide acceptable topsoil to required depth compacted to 85%.

D. Jetting: No jetting shall be allowed.

3.05 TRENCH SURFACING

A. General

1. In unimproved areas, the trench surface shall be restored to its original condition. No mounds of earth shall be left along the trench.
2. All backfill shall be flush with adjoining grade in a firm, unyielding position with no visible settling for a period of one year after Final Acceptance.
3. Class II A.B. shall be used for final backfill in paved areas and under foundations.

B. Tolerances

1. Top Surfaces for general backfilling: Plus or minus 0.10 foot from required elevations.
2. Top Surface of backfilling under paved areas: plus or minus 0.10 foot from required elevations.

3.06 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. Per Section 31 20 00.

3.07 CLEANING

A. Leave unused materials in a neat, compact stockpile during progress of work.

B. Remove unused stockpiled materials. Leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION
31 23 33

SECTION 31 25 13
TEMPORARY EROSION CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work included: The work included in this Section includes all labor, materials, and equipment necessary to place temporary and permanent erosion and sediment control measures as detailed on the Drawings, SWPPP and specified herein. A Qualified SWPPP Practitioner (QSP), hired by the Contractor, under contract is responsible for executing the SWPPP document as well as any monitoring, testing, and implementing storm water control and/or protection before and during construction. The QSP is responsible for creating a log in account via the State Water Resources Control Board SMARTS online system and carrying out the du- ties of the QSP for this project including but not limited to weekly, pre rain event, and post rain event reports, annual report, Notice of Termination (NOT), coordinating with the Water Board and any testing required by the SWPPP. The Erosion Control Plan included in the project drawings can and shall be modified accordingly by the contractor throughout construction to comply with the State Water Resources Control Board Standards for construction. The Contractor shall remain responsible for all erosion control measures as may be required to protect the site for the duration of the contract.

1.02 RELATED SECTIONS

A. Section 31 20 00 Earthwork

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards

1. All work to be done in accordance with the City of Folsom Standard Specifications and Drawings, where conflicts occur between the City of Folsom Standard Specifications and Drawings and the specifications noted herein, the more stringent interpretation shall apply.

2. All work to be done in accordance with the State Water Resources Control Board Standards for Erosion and Sediment Control.

3. Caltrans Standard Specifications.

1.04 QUALITY ASSURANCE AND CONTROL

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

1.05 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties and water resources from erosion and sediment damage throughout life of contract.

1.06 SUBMITTALS

A. Project Data:

1. Materials list of items proposed to be provided under this Section.

2. Specifications and other data needed to prove compliance with the specified requirements.
3. Weekly Inspection Reports, Before, During and Post Rain Event Inspection Reports and any other testing or inspection report required by the State Water Resources Control Board in compliance of their Standards. Please note that inspections must be done at a minimum of once a week and those reports kept on file at the job trailer. Do not mail to state or city offices. A copy of the reports and inspections should be attached to the SWPP Plan.

PART 2 - PRODUCTS

2.01 FOR EROSION AND SEDIMENT CONTROL

A. The primary erosion and sediment control measures implemented during the Mass Grading/Site Preparation phase of the project shall be inspected, maintained, and repaired in accordance with the Storm Water Pollution Prevention Plan for this project. Secondary measures such as Inlet Protection, dust control, erosion control blanket, temporary and permanent seeding shall be installed/applied as necessary. See Plans for placement of BMP's and the Erosion Control Details for further information.

B. Inlet protection as shown on the above-mentioned Plans and Inlet Protection Details.

PART 3 – EXECUTION

3.01 PREPARATION

A. Review Site Improvement Plans and the Storm Water Pollution Prevention Plan along with the approved "Notice of Intent" issued by the California Regional Water Quality Control Board (RWQCB).

B. Deficiencies or changes on Site Improvement Plans or Storm Water Pollution Prevention Plan as it is applied to current conditions shall be brought to the attention of the City's Representative for remedial action.

3.02 EROSION CONTROL & STORM WATER POLLUTION PREVENTION PLAN IMPLEMENTATION

A. Place erosion control and storm water pollution prevention measures in accordance with the ap-proved Contract Documents as construction proceeds and the appropriate phase is in progress for each measure.

B. Permanent erosion control measures shall be incorporated into the Project at the earliest practical time to minimize the need for temporary controls.

3.03 PERMANENT AND TEMPORARY SEEDING MEASURES

A. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.

B. Slopes that erode easily or that will not be graded for a period of fourteen (14) days or more shall be temporarily seeded as work progresses with temporary seeding.

3.04 REMOVAL OF EROSION AND SEDIMENT CONTROL MEASURES

A. When site is ninety-five percent (95%) re-vegetated and stabilized with grasses, remove temporary sediment risers. Remove accumulated sediment and regrade area to original contours. Seed and protect with permanent grass seed mixture.

B. Remove drainage structure inlet protection.

C. Remove silt fence and temporary check dams. Seed and protect any disturbed areas with permanent grass seed mixture.

END OF SECTION
31 25 13

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section describes the requirements for furnishing and installing asphalt paving for the parking lot, basketball, and tennis courts, to include:

1. Asphaltic concrete paving, wearing, binder and base course.
2. Surface sealer.
3. Aggregate subbase course.

1.02 RELATED SECTIONS

A. General and Project Conditions of the Bid Documents

1.03 REFERENCES

A. Asphalt Institute:

1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types
2. AI MS-19 - Basic Asphalt Emulsion Manual.

B. ASTM International:

1. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
2. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

C. Caltrans Standard Specifications:

1. Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS, latest edition.

1.04 PERFORMANCE REQUIREMENTS

A. Paving: Designed in accordance with Caltrans Standard Specifications, Section 39.

1.05 SUBMITTALS

A. Product Data: Submit product information and mix design.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with Caltrans Standard Specifications, Section 39.

B. Mixing Plant: Conform to Caltrans Standard Specifications, Section 39.

C. Obtain materials from same source throughout.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Asphalt Cement: In accordance with Caltrans Standard Specifications, Section 39.

B. Aggregate for Base Course Mix: Shall be ½” aggregate in accordance with Caltrans Standard Specifications, Section 39.

C. Aggregate for Wearing Course Mix: Shall be 3/8” aggregate in accordance with Caltrans Standard Specifications, Section 39.

D. Tack Coat: In accordance with Caltrans Standard Specifications.

E. Slurry Seal: In accordance with Caltrans Standard Specifications, Section 37-3.

F. Aggregate for Slurry Seal: In accordance with Caltrans Standard Specifications, Section 37-3.

2.02 ASPHALT PAVING MIX

A. Use dry material to avoid foaming. Mix uniformly.

B. Base Course: In accordance with Caltrans Standard Specifications, Section 39.

C. Wearing Course: In accordance with Caltrans Standard Specifications, Section 39.

2.03 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design of each class of mix for review prior to beginning of Work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify compacted subgrade subbase is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify gutter drainage grilles and frames, manhole frames, and are installed in correct position and elevation.

3.02 SUBBASE

A. Prepare subbase in accordance with Caltrans Standard Specifications, Section 39.

3.03 PREPARATION – SURFACE

A. Clean surface free of dirt, water, and debris.

B. Fill cracks greater than 1/8 inch.

C. Correct areas of subgrade failure.

3.04 PREPARATION - PRIMER

A. Apply primer in accordance with Caltrans Standard Specifications, Section 39.

1. Immediately before applying the prime coat, all loose dirt and other objectionable material shall be removed from the full width of the surface to be primed. The bituminous material including solved shall be uniformly applied with a bituminous distributor at the rate of 0.25 to 0.50 gallon per square yard depending on the base course surface texture. The type of bituminous material and application rate shall be approved by the City's Representative prior to application.

2. Following the application, the primed surface shall be allowed to dry not less than 24 hours without being disturbed or for such additional time as may be necessary to permit the drying out of the prime coat until it will not be picked up by traffic or equipment. This period shall be determined by the City's Representative. The surface shall then be maintained by the Contractor until the surfacing has been placed. Suitable precautions shall be taken by the Contractor to protect the primed surface against any damage during this interval, including supplying and spreading any sand necessary to blot up excess bituminous material.

3. The Contractor shall furnish vendor's certified test reports for each carload, or equivalent of bituminous material shipped to the project. The report shall be delivered to the City's Representative before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

3.05 PREPARATION - TACK COAT

A. Apply tack coat in accordance with Caltrans Standard Specifications.

3.06 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place wearing course within twenty-four hours of placing and compacting binder course. When binder course is placed more than twenty-four hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

B. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

C. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.07 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge, and 1/8” with an 18” straight edge.

1. Contractor shall conduct a flood test of asphalt surface. Bird bath areas 1/16” deep or more remaining after a period of one (1) hour in 70 degrees or hotter weather shall be remediated. String line test shall help determine if a low area is simply adjacent to a high area or is indeed a low area.

2. Low areas shall be ground down and high areas shall be pathed per manufacturer.

3. Finish surface planarity shall be inspected and adjusted by the Contractor using the string line method. A mason’s line held taught between two workmen shall check for separations between the mason’s line and the finished surface that are equal to or greater than the tolerances specified. The entire finished surface shall be checked with the mason’s line in increments no greater than 5 linear feet. Areas of separation shall be identified with depth of separation indicated.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from Indicated Elevation: Within 1/2 inch.

3.08 PROTECTION OF FINISED WORK

A. Immediately after placement, protect pavement from mechanical injury for 48 hours or until surface temperature is less than 140 degrees F.

B. Comply with requirements of Section 01 77 00 Contract Closeout.

END OF SECTION
32 12 16

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes site concrete, including but not limited to pavements, walls, footings, and sub slabs.

B. Provide all labor, materials, equipment, and services to complete the work as indicated on the drawings, and in accordance with these specifications. Work includes but is not limited to the following:

1. Concrete formwork
2. Concrete reinforcement
3. Cast-in-place concrete items:
    a. Concrete paving, sidewalks, ramps, pads, curbs, mow bands, etc.
    b. Miscellaneous concrete.
    c. All imbeds including anchor bolts, tiedowns, hold downs with bolts, straps, and sleeves.

C. Related Sections

1. General and Project Conditions of the Bid Documents

1.02 REFERENCES

A. Caltrans Standard Specifications - Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation (Caltrans), latest edition.

B. ASTM - American Society for Testing and Materials

C. ACI - American Concrete Institute, Manual of Concrete Practice.

D. CBC – California Building Code

1.03 DEFINITIONS

A. Percent Compaction: ASTM D1557, percentage as shown on the Drawings of the maximum in-place dry density of the same material.

1.04 SUBMITTALS

A. Conform to the requirements of Division 1, Section 01 33 23 Shop Drawings, Product Data, and Samples.

B. Shop Drawings Reinforcement: Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

C. Concrete Design Mixes:

1. The preparation of design mixes will be the responsibility of the Contractor. Mix designs may be prepared by the supplier and shall be certified by a Civil Engineer registered in California. Mix designs will be designed by the supplier and approved by the City’s Representative.
2. Written reports will be submitted to the City’s Representative of each proposed mix for review. Do not begin concrete production until mixes have been reviewed by the City’s Representative.
3. Adjustment of Concrete Mixes:

4. Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results and other circumstances warrant; at no additional cost to the City and as accepted by the City's Representative. Provide submittals as in A above. Submit adjustment designs a minimum of 48 hours ahead of schedule for concrete production.

D. Product Data: Manufacturer's current catalog cuts and specifications for the following:

1. Expansion joint filler, sealant, backer rod and bond breaker, including manufacturer's standard color chart for sealant
2. Air-entrainment.
3. Curing Compound.
4. Fly Ash or Slag
5. MDO plywood made for forming.

E. Samples:

1. MDO plywood made for forming, one 6"x 6" piece.
2. Exposed aggregate.

F. Certificates:

1. Reinforcing Steel: Certificate of compliance
2. Concrete Mix Design: Ticket for each batch delivered showing the following:
   a. Mix identification.
   b. Weight of cement, aggregate, water, and admixtures, aggregate sizes/proportion, and air entrainment.

1.05 QUALITY ASSURANCE

A. Comply with American Society for Testing Materials (ASTM) A-615 "Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement," and "Manual of Standard Practice for Detailing Reinforced Concrete Structures," publication American Concrete Institute (ACI) 315-65 of the American Concrete Institute.

B. Comply with all pertinent recommendations contained in ACI, "Recommended Practice of Concrete Formwork, ACI-347", and Section 2606, 1997 California Building Code (CBC).

C. Construct forms to sizes, shapes, lines, and dimensions indicated on Drawings, and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in Work. Use selected materials to obtain required finish. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Provide complete forms of such strength and construction as to prevent any spread, shifting, or settling when concrete is deposited, and tight enough to avoid any leakage or washing out of cement mortar.

E. Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all Work performed under this Section. For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeymen concrete finishers.

F. Conform to Section 90 of the Caltrans Standard Specifications.

G. The Contractor shall contact City's Representative of any discrepancies between field conditions and plans prior to proceeding with Work. The written dimension on Drawings shall supersede the graphic presentation. Dimensions are from back of curb, center line, base lines or as noted on the plans. All field adjustments must be approved by City's Representative prior to installation.

H. All walks and curbs shall be established in the field for review and approval prior to concrete pours. The Contractor shall layout the area or form work for review by City's Representative. If approval is not obtained, the Contractor is responsible for removal of any unauthorized field adjustments.

I. Transitions of curves to other curves, and curves to straight line tangents, shall be smooth and continuous.

J. Place expansion joint and score joints as shown on plan. Adjustments in the field shall be made only with the approval of City's Representative.

K. Where new concrete paving is placed adjacent to curbs or existing concrete paving, a construction joint (cold joint) shall be provided between the new concrete paving and curbs and existing concrete paving and curbs.

L. Sleeving shall be coordinated with concrete work. Refer to irrigation plan for sleeving location.

M. The Contractor shall be responsible for repairing, at no additional cost to City, any disturbed existing landscape designated to remain which resulted from construction of this project.

N. Some materials may require a several week order lead time. Contractor is responsible for determining any and all ordering lead times and providing required materials at the project site in a timely manner. No unapproved substitutions will be allowed. Contact City's Representative immediately if a specified material is not available.

O. Mock-up:

1. One 4-foot square mockup for all poured in place finishes, including concrete paving and vertical walls, as shown on the drawings. Mock-ups shall also include finish, jointing, thickness, and edging.

2. Mock-ups shall be reviewed and approved by the City's Representative prior to commencing full work. Approved mock-up shall serve as a standard of quality for judging the acceptance of paving on the Project and may remain as part of the work.

P. Lines and Levels: To be established by a licensed Surveyor or registered Civil Engineer.

Q. Mix Standards: Conform to the ACI Manual and the Portland Cement Association's "Design and Control of Concrete Mixes".

R. Design of Concrete Mix: Employ approved commercial testing laboratory to design concrete mixes as follows:

Item	Minimum Cement Content	28-Day Minimum Strength	Maximum Slump	Aggregate Size	Maximum Water / Cement Ratio
Curbs and Footings	517 lb./cy.	3,000 PSI	4 in.	¾ in	0.55
Exterior Walkways	517 lb./cy.	3,000 PSI	4 in.	¾ in	0.45
Walls and Paving	564 lb./cy.	4,000 PSI	4 in.	¾ in	0.45

S. Fly Ash:

1. Source Control: The following sources of ash are not to be used:

a. Ash from a peaking plant instead of a base loaded plant.

b. Ash from plants burning different coals or blends of coal.

c. Ash from plants burning other fuels (wood chips, tires, trash) blended with coal.

d. Ash from plants using oil as a supplementary fuel.

e. Ash from plants using precipitator additives, such as ammonia.

f. Ash from start-up or shut-down phases of operation.

g. Ash from plants not operating at a "steady state."

h. Ash that is handled and stored using a wet system.

2. Fly ash used in concrete should be as consistent and uniform as possible. Fly ash to be used in concrete should be monitored by a quality assurance/quality control (QA/QC) program that complies with the recommended procedures in ASTM C31.(6) These procedures establish standards for methods of sampling and frequency of performing tests for fineness, loss on ignition (LOI), specific gravity, and pozzolanic activity such that the consistency of a fly ash source can be certified.

1.06 QUALIFICATION OF INSTALLER

A. Installer shall be thoroughly trained and experienced in the skills required and shall be completely familiar with the products and their installation as specified on the Drawings and in this Section. Installer shall be present at all times during progress of Work of this Section and shall direct all Work performed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivered Mixes: Coordinate delivery so that mixes may be immediately poured upon arrival at site.

B. Components and Accessories:

1. Fittings and Reinforcements: Protect from rust, soil, and oil contamination at all times. Store on pallets above ground.

2. Templates: Protect from damage. Test accuracy prior to each use.

1.08 SEQUENCING AND SCHEDULING

A. Coordination: Coordinate all items of other trades to be furnished and set in place. Coordinate proper installation of all accessories embedded in the concrete and for the provision of holes, openings, etc., necessary to the execution of the work of the trades in ample time that progress of the work is not delayed.

1.09 JOB CONDITIONS

A. Cold-Weather Placement: comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

B. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

C. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray form, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

1.10 COORDINATION

A. Secure all pipe sleeves, anchors, and bolts, including those for angle frames, inserts, ties and other materials in connection with concrete construction, in position before concrete is placed.

B. Obtain information and instructions from other Trades and suppliers in ample time to schedule and coordinate the installation of items furnished by them to be embedded in concrete so provisions for their work can be made without delaying the project.

1.11 FORM CONSTRUCTION TOLERANCES

A. Set form to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of Work so that forms can remain in place for twenty-four hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than one-eighth inch in ten feet vertical elevation.
2. Vertical face on longitudinal axis not more than one-fourth inch in ten feet horizontal width.
3. Circular or curved formwork shall be continuous, complete radii as indicated on Drawings. No straight segments in circular/curved formwork shall be accepted.

1.12 TESTS AND OBSERVATIONS

A. The following tests shall be made by City's testing laboratory or by a certified Special Inspector as determined by the City. Special inspections for Concrete Construction shall be in accordance with Section 1704.4 and Table 1704.4 of the 2013 CBC and as noted below:

1. Periodic Inspection of reinforcing steel and placement.
2. Cement: Mill analysis and test reports by supplier certifying cement conforms to Specifications is acceptable in lieu of tests at the discretion of City's Representative.
3. Provide free access to Work and cooperate with testing laboratory.
4. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
5. Concrete Inspections:
    a. Continuous Placement Inspection: Inspect for proper installation procedures.
    b. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
6. Strength Test Samples:
    a. Sampling Procedures: ASTM C172.
    b. Cylinder Molding and Curing Procedures: ASTM C31, cylinder specimens.
7. Concrete cylinders: Make and cure in accordance with ASTM C31.
    a. Record shall be made of the time cylinders were made and of locations of concrete from which the cylinders were taken.
    b. Three identical cylinders shall be taken from each pour of 25 cubic yards or part thereof, being placed each day.
    c. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
    d. Make one additional cylinder during cold weather concreting, and field cure.

8. Field Testing:
    a. Slump Test Method: ASTM C143.
    b. Air Content Test Method: ASTM C173.
    c. Temperature Test Method: ASTM C1064.
    d. Measure slump and temperature for each compressive strength concrete sample.
    e. Measure air content in air entrained concrete for each compressive strength concrete sample.
9. Cylinder Compressive Strength Testing:
    a. Test Method: ASTM C39.
    b. Test Acceptance: In accordance with ACI 318.
    c. Test one cylinder at 7 days.
    d. Test two cylinders at 28 days.
10. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
11. Should tests show that concrete is below specified strength; the Contractor shall remove all such concrete. Full cost of removal of inferior concrete, its replacement with concrete of proper specified strength and testing shall be borne by the Contractor.

1.13 CODES AND STANDARDS

A. ACI 301 "Structural Concrete for Building"
B. ACE 305 “Recommended Practice for Hot Weather Concreting”
C. ACI 306 “Recommended Practice for Cold Weather Concreting”.
D. ACI 308 “Curing Concrete”
E. ACI 309 “Recommended Practice for Consolidation of Concrete”
F. ACI 318 "Building Code Requirements for Reinforced Concrete".
G. ACI 347 “Recommended Practice for Concrete Formwork”.
H. ACI 605 “Recommended Practice for Hot Weather Concreting”.
I. ACI 614 "Recommended Practice for Measuring, Mixing, and Placing Concrete".
J. ASTM C31 “Practices for Making and Curing Concrete Test Specimens in the Field”.
K. ASTM C33-86 "Specifications for Concrete Aggregate".
L. ASTM C94-89 "Specifications for Ready Mixed Concrete".
M. ASTM C143 “Test Method for Slump Portland Cement Concrete”.
N. ASTM C150 “Portland Cement”.
O. ASTM C309 “Specifications for Liquid Membrane-forming Compounds for Curing Concrete”.
P. Western Concrete Reinforce Steel Institute (WCRSI) "Manual of Standard Practice".
Q. Where provisions of pertinent codes and standards conflict with this Specification, the more stringent provisions shall govern.
R. California Building Code (CBC), latest edition.
S. Section 90 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.01 CONCRETE REINFORCEMENT

A. Reinforcing Bars: Deformed Billet Steel Bars, ASTM A-615, Grade 40 or 60, containing a minimum of 70% total recycled content, clean and free from rust, scale, or coating that will reduce bond.

B. Smooth Dowels for Joints: ASTM A615, Grade 40 smooth, billet-steel bars, shop painted with iron-oxide zinc-chromate primer.

C. Welded Wire Mesh: ASTM A-185 plain type and uncoated finish.

2.02 CONCRETE

A. Concrete Mix:

1. Ready-mixed concrete in accordance with ASTM C-94 and with aggregates comply with ASTM C-33 and Portland Cement ASTM C-150, Type II.

2. All mixes shall conform to applicable building code requirements listed herein or on the Drawings. All mix designs shall be submitted to the City's Representative for approval before being used. Mix design shall show proportions of cement, fine and coarse aggregate, and water and graduation of combined aggregates. Calcium chloride shall not be added at any mix.

3. Concrete shall be Class B per Caltrans Standards.

4. Cement: All cement shall be Portland cement Type II and shall be the product of one manufacturer. The temperature of cement delivered to the plant shall not exceed 150 degrees Fahrenheit.

5. Aggregates

   a. Coarse aggregate shall have a minimum cleanliness value of 75.

   b. Fine aggregate shall have a minimum of sand equivalent of 75.

   c. Any suitable individual grading of coarse aggregates may be used.

6. Exposed Aggregate: Exposed hard, sound, durable, and free of all deleterious materials and staining qualities.

7. Water: All water shall be clean and free from deleterious matter.

8. Admixture: No admixture of any type shall be used without prior approval of the City's Representative.

9. Concrete shall be as specified: Class B

   a. 28-Day Minimum Strength: Refer to Table in Paragraph 1.5(R) above

   b. Concrete slump: Refer to Table in Paragraph 1.5(R) above

   c. Air Content: No air entrainment

B. Fly Ash: Pozzolanic admixtures, conforming to ASTM C618, Class C, with weight loss of ignition limited to not exceed 3 percent shall be used in mix designs to replace Portland Cement up to 15% by weight, unless noted otherwise on drawings.

1. Reference: ACI 211.4R-93.

C. Aggregate base for on-grade slabs:

1. Per the Standard Specifications

D. Water: Clean, potable (domestic) free from injurious amounts of salts, oils, acids, alkalis, organic materials, or other deleterious matter. Available from source determined by City's Representative.

E. Air Entrainment: ASTM C260.

F. Admixtures: Admixtures containing chlorides are not permitted. All admixtures shall be mixed in

accordance with manufacture's written recommendations.

2.03 ACCESSORIES

A. Tie Wires: Black annealed, ASTM A-82, minimum 16 gauge.

B. Chains, Bolsters, Bar supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

C. Stirrup Steel: ASTM A-82.

D. Snap Ties: Snap-off metal of fixed length capable of leaving no metal within one and one-half (1 1/2) inches of surface nor causing fractures, spall or other defects larger than one (1) inch in diameter.

E. Expansion Joint Materials:

1. Premolded Joint Filler: ASTM D1751, non-extruding and bituminous type resilient filler, compatible with sealant, and having a "guide strip" removable depth gauge.

2. Joint Sealant: ASTM C290, non-snag sealant "Dynatred" by Pecora Corporation, (214) 278-8158 or "Sonolastic Sealant Two-Part" by Sonneborn, (415) 889-9899, or equal.

   a. Color shall be selected by the City's Representative from the manufacturer's full color selection.

3. Bond Breaker: Pressure-sensitive tape as recommended by sealant manufacturer to suit application.

F. Forms:

1. Steel or wood of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.

2. Use forms that are straight and free of distortions and defects.

3. Use flexible spring forms or laminated boards to form radius bends as required.

G. Form Release Agent: Colorless non-staining, free from oils. Chemical agent shall not impair bonding of paint or other proposed coatings.

H. Form-Facing Materials:

1. All Surfaces: of sufficient strength to hold concrete properly in place and prevent leakage of water from forms.

2. Exposed Surfaces: Matte finish, coated, medium density overlay plywood made for forming. No wood-textured finish will be permitted on exposed concrete unless specified as such.

3. For "Board Formed" concrete finishes rough-sawn nominal 2x6 boards shall be used, with surfaces sand-blasted to reveal natural grain. 1 x 6 may be used for gently curved faces, with sufficient bracing to prevent "pop-outs." Texture shall be approved prior to pouring concrete.

I. Wood Headers:

1. Wood: Construction Heart grade rough Redwood header and stake or pressure-treated rough Douglas Fir stake.

2. Nails: Hot-dipped galvanized.

J. Curing Compound: ASTM C309, Type I-D, Class A.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that subgrade preparation for concrete paving has been completed prior to commencement of work.

B. Surface Drainage:

1. Report in writing conflicts discovered on the site or prior work, which would prevent positive drainage. Correct prior to performing concrete work.
2. Do not permit finished paving surfaces to vary more than 1/4 in. measured with a 10 ft. metal straightedge, except at grade changes. No "birdbaths" or other surface irregularities will be permitted. Properly correct irregularities.

3.02 PREPARATION

A. Templates: Use templates for all anchor plates, bolts, inserts and other items embedded in concrete. Accurately secure so that they will not be displaced during placing of concrete.

B. Piping and Conduit: Do not embed piping, other than electrical conduit, in structural concrete. Locate conduit to maintain strength of structures at maximum. Verify size, length, and location of electrical conduit.

C. Aggregate Base Course: Compact base course to thicknesses and relative compaction shown on Drawings.

3.03 CONCRETE REINFORCEMENT PLACEMENT

A. Fabricate reinforcement in accordance with ACI-315, providing a minimum concrete cover of three inches or as specified in UBC, latest edition.

B. Place all reinforcement in the exact position shown on the Drawings and secure in position during the placing and compacting of concrete. Wire bars together with No.16-gauge wire with ties at all intersections except where spacing is less than twelve inches in each direction, in which case tie alternate intersections.

C. Place all sleeves, inserts, anchors and embedded items required for adjoining work or for its support prior to concreting. Fill voids in embedded items temporarily with readily removable material to prevent entry of concrete.

D. Give all contractors and subcontractors whose work is related to concrete or supported by it, ample notice, and opportunity to introduce and/or furnish embedded items before concrete placement.

E. Verify that concrete reinforcement may be installed in strict accordance with all pertinent codes and regulations, the Shop Drawings, and the original design.

F. Bending:

1. Fabricate all reinforcement in strict accordance with the reviewed Shop Drawings.
2. Do not use bars with kinks or bends not indicated on the Drawings or on the reviewed Shop Drawings.
3. Do not bend or straighten steel in a manner that will injure the material.
4. Bend all bars cold.
5. Make all bends for other bars, including hooks, around a pin having diameter not less than six times the minimum thickness of the bar for number 8 and smaller and eight times the thickness for number 9 and larger.

G. Before the start of concrete placement, accurately place all concrete reinforcement, positively securing and supporting by concrete blocks, metal chairs or spacer, or by metal hangers.

H. Clearance:

1. Preserve clear space between bars of not less than one time the normal diameter of round bars.
2. In no case let the clear distance be less than 1 inch or less than 1-1/3 times the maximum size of aggregate.
3. Provide the following minimum concrete covering of reinforcement:

4. Concrete below ground deposited against forms: 3 inches.
5. Concrete deposited against earth: 3 inches.
6. Concrete elsewhere: as indicated on Drawings.

I. Splicing:

1. Horizontal bars:
2. Place bars in horizontal members with minimum laps at splices sufficient to develop the strength of the bars. Splice 40 bar diameters minimum.
3. Bars may be wired together at laps.
4. Wherever possible, stagger the splices of adjacent bars.
5. Wire fabric: Make all splices in wire fabric at least 1-1/2 meshes wide.
6. Other splices: Make only those other splices that are indicated on the approved Shop Drawings or specifically approved by City's Representative.

J. Dowels/Anchor Bolts: Place all required steel dowels/anchor bolts and securely anchor them into position before the concrete is placed. Bending the dowels after placement of concrete will not be permitted.

K. Obstruction: In the event conduits, piping, inserts, sleeves, or any other items interfere with placing reinforcement as indicated on the Drawings, or as otherwise required, immediately consult City's Representative and obtain review of new procedure before placing concrete.

3.04 CONCRETE FORMWORK CONSTRUCTION

A. Construct support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete.

B. Contractor assumes full responsibility in the removal of forms. The length of time forms must remain in place depends on the rate of time required for concrete to obtain a proper strength. Remove forms after the concrete is sufficiently hard to prevent damage to concrete.

C. Circular or curved formwork shall be continuous, complete radii as indicated on Drawings. No straight segments in circular/curved formwork shall be accepted.

D. Reuse of Forms:

1. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of surface.
2. Thoroughly clean and properly coat forms before reuse.

3.05 INSTALLATION

A. Notification: Notify the City's Representative at least 48 hours before placing concrete.

B. Placing Concrete:

1. Unless otherwise indicated or required by the Drawings, concrete paving shall be placed on compacted subgrade to thicknesses indicated on the Drawings to 95 percent compaction.
2. Place concrete in accordance with ACI-304 and Section 2605 of the California Building Code. Immediately after depositing, compact concrete thoroughly by mechanical vibration. No vibrating of forms is allowed. Mixing shall be continuous, with no interruptions from the time the truck is filled until the time it is emptied. Concrete shall be placed within one and a half hours from the time water is first added.
3. Ensure anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause hardship in placing concrete.
4. Ensure reinforcement, inserts, embedded parts, etc. are not disturbed during concrete placement.

5. Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur, unless otherwise indicated on the Drawings.
6. Lines and Grades: Elevations requiring accurate placement shall be set by a competent instrument man, using a professional type instrument.
7. For all concrete placed on soil, the subgrade shall be wet and compacted prior to placing.
8. Before placing concrete mixing, conveying, and finishing equipment, forms and reinforcing shall be well-cleaned. Wet form before placing concrete unless oiled forms are used.

3.06 CURING AND PROTECTION

A. Beginning immediately after placement, protect concrete from premature drying, from excessively hot or cold temperatures, and from mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for a period necessary for hydration of cement and hardening of concrete. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation – control material. Apply according to manufacturer's instruction.

B. As soon as building flat work has hardened sufficiently to prevent injury to finish, apply an approved concrete curing agent in accordance with the manufacturer's recommendation.

C. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than seven (7) days.

D. Excessive cracking as determined by the City's Representative which is aesthetically unacceptable or which will result in premature disintegration of paving shall result in replacement of concrete.

E. Removal of Forms: Remove no sooner than seven (7) days after each pour.

F. Conform to all applicable requirements for curing and protection of concrete, Sections 90-7 and 90-8 of the Caltrans Standard Specifications.

G. Spraying: Spray concrete during the curing period as frequently as drying conditions may require.

H. Curing: Cure concrete in accordance with the ACI Manual of Concrete Practice. During curing period, maintain concrete above 70 degrees F. for at least 3 days or above 50 degrees F. for at least 5 days.

I. Damage and Defacement: Protect all concrete work against damage and defacement during subsequent construction operations until final acceptance.

3.07 CLEANING AND PATCHING

A. Removal: Remove all projecting fins, bolts, wire, nails, etc., not necessary for the work, or cut them back 1 in. from the surface and patch in an inconspicuous manner.

B. Snap Ties: Immediately after removal of forms, cut off snap ties extending from the face of concrete to at least 1 in. deep in the concrete. Fill or plug as detailed in Drawings.

C. Voids: Fill holes with a 1:3 cement/sand mortar with the same color as the adjoining concrete. Mix and place the mortar as dry as possible and finish flush with the adjacent surface.

D. Corrective Patching: Correct all defects in concrete work. Chip all voids to a depth of at least 1 in. with the edges perpendicular to the surface and parallel to form markings. Fill all voids, surface irregularities, or honeycombing by patching or rubbing. Ensure that all concrete surfaces so repaired duplicate the appearance of the unpatched work.

E. Finishing: Work finish surface texture as specified below.

3.08 FINISHES

A. Medium Broom Finish:

1. Floating: Float surface once it has sufficiently stiffened. Check planeness of surface with a 10 ft. straightedge in all directions. Cut down high spots and fill lows. Immediately refloat to a uniform non-directional sandy texture.
2. Obtain by drawing a stiff bristled broom across a floated finish.
3. Direction of brooming to be perpendicular to direction of paving.

B. Exposed Aggregate Finish

1. Seeded Exposed Aggregate Finish. Immediately after floating, broadcast a single layer of aggregate uniformly onto the pavement surface. Tamp seeded aggregate into plastic concrete and float to entirely embed aggregate with mortar cover of 1/16 inch.
    a. Prior to the concrete placing operation, all select seeding aggregate shall be thoroughly washed so that it is free of all dust, dirt, and clay particles. The aggregate should be in a damp condition but without free surface water at the time of seeding application. There shall be sufficient select aggregate on hand to complete the seeding once it has commenced.
    b. The seeding operation shall start immediately after the placement of concrete as described above. The select aggregate shall be carefully and uniformly seeded by suitable means so that the entire surface is completely covered with one layer of stone. Stacked stones and flat and slivery particles shall be removed at this time. The aggregate shall be embedded by suitable means. Care shall be taken to not over-embed and deform the surface. Under no circumstances shall areas lacking sufficient mortar be filled with small quantities of the base concrete mix.
    c. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon bristle broom.
    d. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required/
    e. Work shall be planned so that the concrete placing and aggregate seeding procedures are coordinated with the capabilities of the washing and brushing crew.

3.09 JOINTS

A. Construction Joints:

1. Locate and install joints as indicated on the Drawings so they do not impair strength or appearance of slab.
2. All joints and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression.

B. Score Joints:

1. Locate and install joints as indicated on the Drawings so they do not impair strength or appearance of slab.
2. Score joints shall be formed in the fresh concrete using a jointer to cut the groove so that a smooth uniform impression is obtained. All joints shall be struck before and after finishing.
3. Locate and form joints with 1/4-inch radius edges and 1 inch to 1-1/4 inch deep score at the location as shown on the Drawings.
4. All joints and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression.

C. Expansion Joints:

1. Locate and install joints as indicated on the Drawings so they do not impair strength or appearance of slab.
2. Expansion joints shall be provided at the location and 40-foot maximum intervals as shown on the plans, and at all locations where concrete paving abuts buildings, curbs or other pro-

posed or existing structures. Install as per detail on the Drawings.

3. All joints and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression.
4. Install backer-rod and joint sealant as indicated on the Drawings.
5. Sealing of Expansion Joints: After the curing period, strip out all depth gauge strips and carefully clean expansion joints. Fill with joint compound as shown on Drawings. Avoid spilling compound on paved surfaces or overflowing from joint.
6. Protect expansion joints from damage until placement of filler or caulk.

3.10 FIELD QUALITY CONTROL

A. Samples: Contractor shall coordinate with the City's Representative provide samples for testing during the course of the work as described in Article 1.13 Tests and Observations.

B. Field inspection and testing will be performed by a qualified testing laboratory in accordance with ACI 318 and as described in Article 1.13 Tests and Observations.

C. Cost of Testing: Contractor shall be responsible for costs associated with testing.

D. Rejected Materials: Remove off the site all concrete below specified strength.

E. Cost of Removal and Retesting: Contractor shall be responsible for costs associated with removal and costs associated with retesting.

F. Integral color: Color shall be evenly saturated in concrete mix to provide consistent, even, and distinct color in finished installation, including after medium sandblast finish is applied.

G. Defective Work: Remove in its entirety and replace all defective concrete work which after corrective patching, rubbing, etc., fails to duplicate the appearance of unpatched work and/or conform to the standards set forth in these Specifications.

H. Observe formwork continuously while concrete is being placed to see that there are no deviations from desired elevation, alignment, plumbness or camber.

I. If during construction any weakness develops and falsework shows undue settlement or discoloration, stop work, remove affected construction if permanently damaged, and strengthen false- work.

END OF SECTION
32 13 13

SECTION 32 18 16
PLAYGROUND RESILIENT SURFACING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This work includes furnishing and installing safety surfacing. The surfacing manufacturer/installer shall be responsible for all labor, materials, tools, and equipment to perform all work and services for a complete installation of the surface, in conformance with all applicable laws, codes, and standards.

1.02 SUBMITTALS

A. Per Supplementary Conditions.

B. Manufacturer's descriptive data and installation instructions.

C. Manufacturer's details showing depths of wear surface and sub-base materials, anchoring systems, and edge details.

D. A list of all materials and components to be installed, including Manufacturer's name, storage requirements, and precautions, and shall state chemical composition and test results to which material has been subjected in compliance with these specifications.

E. Test results to substantiate that the product meets or exceeds all ASTM & ADA requirements for each standard listed in Section 1.4 Quality Assurance. Test must be performed and certified by an independent laboratory.

F. Copy of IPEMA Certification.

G. Documentation of Contractor Pre-Qualification as stated in Section 1.4 Quality Assurance.

H. Documentation of Insurance Requirements as stated in Section 1.4 Quality Assurance.

I. Statement signed by the Manufacturer of the synthetic safety surfacing attesting that all materials under this section shall be installed by the Manufacturer or its Certified Installers.

J. A listing of at least ten (10) installations where products similar to those proposed for use have been installed and have been in successful service for a minimum period of three (3) years. This list shall include Owner or purchaser, address of installation, date of installation, contact person, and phone number.

K. A sample specimen of safety surfacing(s) proposed for this project.

L. Upon request, a list of all organizations and affiliations of the company offering the product(s).

1.03 REFERENCES

A. Public Playground Safety Handbook, U.S. Consumer Product Safety Commission (CPSC), latest edition.

1.04 QUALITY ASSURANCE, POURED-IN-PLACE SYSTEMS

A. Test Results

1. Impact Attenuation: Surfacing within playground equipment use zones shall meet or exceed the performance requirements of CPSC, ASTM F 1292, and/or CSA Z614-98 that a surface yield both a peak deceleration of no more than 200 g's and a Head Injury Criteria (HIC) value of no more than 1,000 for a head-first fall from the highest accessible portion of play equipment being installed as shown on drawings. Impact attenuation performance shall be documented by a certificate of compliance provided by third party at Contractor's expense.

2. Coefficient of Friction: ASTM D2047: All products must meet minimum standard on coefficient of friction of 0.7-wet, 0.9-dry.

3. Surface Frictional Properties & Skid Resistance – ASTM E303: All products shall meet or exceed 90 BPN when tested Dry and 64 BPN when tested Wet.
4. Permeability: Product shall meet or exceed a coefficient of permeability (velocity) of seven (7) feet per minute. NOTE: From a geotechnical standpoint, the permeability of a material is a measure of the velocity at which water will flow through the void spaces or pores under a given hydraulic gradient. The product shall handle a minimum of 8" of rainfall per hour.
5. Flammability of Finished Floor Cover - ASTM D2859: Product shall conform to flammability requirements.
6. Accessibility of Surface Systems – ASTM F1951: All playground surfacing products must pass testing to ensure wheelchair access under and around playground equipment as required by the Americans with Disabilities Act.
7. Tear Strength – ASTM D624-00e1 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic: Tear Resistance must be equal to or greater than 12 pounds per inch.
8. Tensile Strength – ASTM D412-02 Standard Test Methods for Vulcanized Rubber Elastomers and Thermoplastic Elastomers: Tensile Strength must be equal to or greater than 25 Psi.
9. IPEMA certification specific to poured-in-place safety surfacing and for products listed, i.e., for .5mm TPV, 1-4mm TPV, and/or .5mm EDPM.

B. Installer Qualifications

1. All materials under this section shall be installed by the Manufacturer or its Certified Installers. The playground surfacing installation shall not be performed by anyone other than the product Manufacturer or its Certified Installers.
2. The installation crew will include at least one member that has completed the OSHA 10 Hour Training course and received certification.

C. Contractor Pre-Qualifications

1. All bidders must have a current California Contractor’s License at or before the time of bid opening date.
2. A list of fifteen (15) surfacing projects completed with a similar product. List shall include names of project representatives and respective telephone numbers. At least five (5) of these projects must be at least five (5) years old. This list shall also contain projects which require the same level of difficulty, size of project, type of project, e.g., color transitions and special graphics.
3. All bidders must also submit Material Safety Data sheets (MSDS) and Product Data Sheets on all materials.

D. Warranty: material performance must be warrantied for five (5) years for TPV or EDPM based products with a 1-4mm size, and for seven (7) years for TPV based products with a 0.5-1.5mm size.

1.05 QUALITY ASSURANCE, LOOSE FILL SYSTEMS:

A. Engineered Wood Fiber:

1. Material performance must be warranted by the manufacturer for 25 years.
2. Material must be tested under ASTM F1292 (Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment), on new material and on 12-year-old Engineered Wood Fiber, and shall have the follow with the following results:

a. Test results for Engineered Wood Fiber must show G-max values of less than 155G for an 8” thick system or 120G for a 12” system with a 12’ drop height, and HIC values less than 1,000 for both new and 12-year-old materials.

b. Test results for Engineered Wood Fiber must show G-max values of less than 200G for a 12” system with a 14’ drop height, and HIC values less than 1,000 for both new and 12-year-old materials.

c. Test results for mats must show G-max values of less than 200G and HIC values of less than 1,000 for a 3’ drop height.

3. Material must be tested under ASTM F2075 (Standard Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment) and have the following results:

a. Material must undergo the test method described in Section 9.0 to determine the presence of tramp metal particles. Metal particles embedded or mixed in Engineered Wood Fiber may cause injury if a child were to fall on/or come in contact with them. The limit for tramp metal was set to reduce the potential of injury.

b. Standard wood chips, bark mulch, or materials from recycled pallets are not acceptable.

PART 2 – PRODUCTS

2.01 MATERIALS, POURED-IN-PLACE SYSTEMS

A. Polyurethane Binder

1. Binder for safety surfacing shall be specifically designed for use with rubber granule material for outdoor installations.

2. Binder for safety surfacing shall be specifically designed for use with rubber granule material for outdoor installations.

3. Binder is a single component polyurethane pre-polymer formulated using a polymeric foam of Diphenylmethane 4, 4’ Diisocyanate (MDI), Amber Viscosity – 4500cps, NCO content – 9.0, Density – 20dc-68, PCF Flash Point - >390dF, Elongation – 550%, Tensile – 3900 lb./sq. in.

4. No toluene diphenol isocyanate (TDI) shall be used.

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

6. Weight of polyurethane shall be no less than 8.5 lbs./gal (1.02 Kg/1) and no more than 9.5 lbs./gal (1.14 Kg/1)

7. Color tinted binder will not be allowed.

B. SBR (Impact Layer)

1. Only 100% shredded styrene butadiene rubber may be used.

2. Strands of SBR may vary from 0.5 mm – 2.0 mm in thickness by 3.0 mm – 20 mm in length.

C. EPDM (wear surface, where specified)

1. EPDM particles shall meet requirements of ASTM D 412 and CSA Z614-98 for tensile strength and elongation; and ASTM D 2240 (Shore A) hardness of 55-65, not less than 26 percent rubber hydrocarbons.

2. EPDM shall be peroxide cured with an EPDM content of 26% and shall include a processing aid to prevent hardness with 26% poly content to maintain dynamic testing characteristics, weatherization, and UV stability.

3. Size of rubber particles shall be not less than 1.00 mm, or greater than 3.0 mm across. With a minimum EPDM content of 25% by weight and certified letter from Manufacturer stating this content. All rubber shall remain consistent in gradation and size.
4. Strand, shaved, chipped, or shredded rubber is not acceptable in the poured cap.

D. TPV (wear surface, where specified)

1. TPV material shall be angular granules with a Shore A Hardness of 65° A ±, a Tensile Strength equal to or greater than 3.0 Mpa, and an Elongation at Break greater than 400%.
2. Size of TPV particles shall be not less than 0.5 mm, or greater than 1.5 mm across.
3. Strand, shaved, chipped, or shredded material of any type is not acceptable.

2.02 MATERIALS, LOOSE FILL SYSTEMS:

A. Engineered Wood Fiber:

1. Composed of shredded wood fiber consisting of varying size, from a minimum of1/8” wide to a maximum of 1/2” thick, and a minimum 1” wide to a maximum of 3” long.
2. As manufactured by Fibar playground surfaces, (800) 342-2721, to match existing installations.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prepare subgrade in accordance with the project geotechnical report and the contract documents.

B. Install base materials, as detailed. Base shall be approved by the Installer and the City’s Representative, and tested by the City’s Testing Laboratory, prior to installation of the safety surface.

C. Scheduling – Resilient Surfacing shall be installed after other sub-contractors are complete and the area is free from pedestrian traffic.

D. Poured-in-Place Systems:

1. The base shall have the specific minimum slope (2%) and shall have no ridges impeding drainage more than 1/4" when measured in any direction with a 10’-foot straight edge. Verify that sub-surfacing drainage, if required, has been installed to provide positive drainage.
2. Tolerance of concrete or asphalt base shall be within 1/4 inch (3.0 mm) in 10 feet (3050 mm). Tolerance of aggregate subsurface shall be within 3/8 inch (10mm) in 10 ft (3050 mm). Verify that aggregate subsurface has been fully compacted in 2” lifts to 95 percent or greater.
3. Asphalt base shall be allowed to cure a minimum of fourteen (14) days and new concrete shall be allowed to cure a minimum of seven (7) days prior to commencement of surfacing.
4. For Concrete surfaces, shot blast, acid etch, or power wash as required to obtain optimum bond of the cushion to the concrete.
5. Cleaning – if concrete or asphalt base materials is used, entire base shall be clean, dry, and free from any foreign and loose material.

E. Loose Fill Systems:

1. Settled material as detailed on the drawings

3.02 INSTALLATION, POURED-IN-PLACE SYSTEMS

A. Primer

1. Apply a urethane primer to all structures, poles, solid base, edging, perimeter, or other surfaces in contact with the poured in place systems.

B. Cushion Layer

1. Polyurethane binder and SBR will be mixed on site in a rotating tumbler to ensure components are thoroughly mixed and are in accordance with manufacturers recommendations.
2. Binder shall be not less than 12 percent (12%), nor more than 16 percent (16%), of the total weight of rubber, and shall provide 100 percent coating of the particles.
3. The SBR and binder mixture will then be poured-in-place by means of screeding, and hand-troweled to maintain a seamless application.
4. Installation method shall use a screed, measured at least 1/16” thicker than the required depth.
5. Whenever practical, cushion layer shall be installed in one continuous pour on the same day. When a second pour is required, fully coat the edge of the previous work with polyurethane binder to ensure 100 percent bond with new work. Apply adhesive in small quantities so that new c mixture can be placed before the adhesive dries.
6. Total depth of the safety surface system throughout the playground equipment use zone shall be as required to meet the applicable critical fall height requirements, or as specified by the City’s Representative.
7. Thickness of the SBR cushion layer will be total depth required thickness of the wear course layer.
8. Surface edges shall be flush with edge of adjacent area or tapered to provide safe transition. When connecting to a concrete curb or border the hardened edge shall be primed with adhesive.
9. The SBR cushion layer surface shall be porous.

C. Wear Course Layer

1. Wear Course Layer shall be TPV and aliphatic binder.
2. Aliphatic polyurethane binder TPV particles will be mixed on site in a rotating tumbler to ensure components are thoroughly mixed and are in accordance with manufacturer’s recommendations.
3. The binder shall be not less than 20 percent of total weight of rubber used in the wear surface and shall provide 100 percent coating of the particles.
4. The wear course mixture will then be poured-in-place by means of screeding, and hand-troweled to maintain a seamless application.
5. Installation method shall use a measured screed rod 1/16” thicker than the required depth.
6. The cap will have a minimum weight of 2.2 pounds per square foot.
7. Thickness of wear surface shall be a minimum 1/2 inch.
8. The wear layer shall be porous.
9. Color transitions shall be full wear course depth.
10. Edges - Surface edges shall be flush with edge of adjacent area or tapered to provide safe transition.

11. Color: The wear course shall include four premium colors (total) chosen by the Landscape Architect during the submittal process, unless otherwise stated on plans.

END OF SECTION
32 18 16

SECTION 32 31 13
CHAIN LINK
FENCING

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. Furnish all labor, materials, equipment, facilities, transportation, and services to complete all chain link fencing installations and related work as shown on the Drawings and/or specified herein.

B. The general extent of the chain link fencing improvements is shown on the Drawings, and can include but is not necessarily limited to the following:

1. Thermally fused and bonded PVC coated (“vinyl coated”) galvanized chain link fabric, posts, gates, hardware, and related appurtenances

1.02 RELATED SECTIONS

A. Related sections can include, but may not be limited to:

1. General and Project Conditions of the Bid Documents
2. Section 32 13 13 Concrete Paving
3. Section 09 90 00 Painting and Coating

1.03 REFERENCES AND REGULATORY REQUIREMENTS

A. ASTM:

1. A-120 - Standard Specification for Pipe, Steel, Black and Hot-Dipper Zinc coated (Galvanized) Welded and Seamless, for Ordinary Uses
2. A 123-84 - Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. A 153-84 - Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
4. A 392-84 - Standard Specifications for Zinc-Coated Steel Chain Link Fence Fabric

B. Chain Link Fence Manufacturers Institute (CLFMI)

C. Industrial Steel Guide for Fence, Rails, Posts, Gates, and Accessories

D. State of California Department of Transportation Standard Specifications, latest edition.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and/or standard catalog "cut sheets" of all materials, coatings, fittings, and equipment proposed to be furnished and installed under this portion of the work. Include the manufacturer's name and catalog number for each item where applicable. Clearly annotate (star or asterisk-in black ink) which portions of "cut-sheets" are applicable if more than one product is shown.

B. Shop Drawings: Submit complete Shop Drawings for all different types and sizes of gates and fencing systems.

C. Shop Drawings shall include, but may not be limited to:

1. All information regarding clearances, connections, components, and any miscellaneous related appurtenances (such as wood baseboards, locking mechanisms etc.)
2. Concrete footing and reinforcement information
3. Installation Instructions and/or Drawings: Submit as applicable.
4. Samples: Color selections for finishes of “vinyl” and/or “powder coated” fencing systems.

D. SEQUENCE AND SCHEDULING

1. Contractor shall coordinate construction timing of all chain link fencing and related work with installation of concrete work and all other work.

PART 2 - PRODUCTS

2.01 PRODUCT SPECIFICATIONS

A. MATERIALS: General Note- all fencing, by area, shall receive the same finish coating wherever possible. Nuts, bolts, applicable moving portions of hinges etc. shall be “painted to match” with PVC touch-up paint in vinyl or powder coated systems.

1. Fabric

a. Selvage: Knuckled finish top and bottom.

b. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 16 feet high. Wire sizes include zinc coating.

c. Size: Two (2) inch mesh, 9-gauge (0.148-inch diameter) unless noted otherwise

d. Galvanized Wire: Zinc coated wire-ASTM A 392, Class 1, with not less than 1.2 oz. zinc. per sq. ft.

e. Thermally Fused and Bonded PVC (vinyl coated) Finish: ASTM F 668 Class 2b, 7mil (0.18 mm) thickness thermally fused over zinc-coated wire. Color: Black.

2. Framing

a. Strength requirements for posts and rails shall conform to ASTM F 669.

b. Pipe shall be straight, true to section, material, and sizes specified, and shall conform to the following weights per foot:

NPS in inches	Outside Diameter (OD) in inches	Type 1 Steel	Type II Steel
1	1.315	1.68	1.35
1.25	1.660 (1-5/8")	2.27	1.84
1.5	1.900 (2")	2.72	2.28
2	2.375 (2-1/2")	3.65	3.12
2.5	2.875 (3")	5.79	4.64
3	3.500	7.58	5.71
3.5	4.000	9.11	6.56
4	4.500	10.79	---
6	6.625	18.97	---
8	8.625	28.55	---

c. Steel Framework

i. Posts, Rails, Braces, and Gate Frames:

ii. Type I Steel Pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (Schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.

iii. Type II pipe: not applicable

d. End, corner, and pull posts for following fabric heights

i. Up to 6 feet: 2.375" OD (2-1/2" OD)

ii. 6 feet up to 8 feet: 2.875" OD (3" OD)

iii. 8 feet up to 16 feet: 3.5" OD

e. Line or intermediate posts for following fabric heights

i. Up to 4 feet: 1.90" OD (2" OD)

ii. 4 feet to 6 feet: 2.375" OD (2-1/2" OD)

iii. 6 feet to 8 feet: 2.875" OD (3" OD)

iv. 8 feet to 16 feet: 3.5" OD

f. Top, Bottom and Horizontal Intermediate Rails

i. Top, bottom, and horizontal intermediate rails (as applicable) shall be 1.66" OD (1- 5/8" OD)

g. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

i. 6 feet to 10 feet: 3.5" OD

ii. Under 6 feet: 2.875" OD (3" OD)

h. Gate Frames: Furnish frames (single or double gate), for nominal gate widths as follows:

i. 6 feet to 10 feet: 1.90" OD (2" OD)

ii. Under 6 feet:1.66" OD (1-5/8"OD)

i. For fencing with vinyl coated fabric, posts, and railings to be painted to match vinyl color.

3. Fittings and Accessories

a. Material: Comply with ASTM F 626. Mill-finished aluminum or galvanized iron or steel, to suit manufacturer's standards.

b. Zinc Coating: Unless specified otherwise, steel fence fittings and accessories shall be galvanized in accordance with ASTM A 153, with zinc weights per Table 1 of ASTM A153.

c. Tension Wire: 7-gauge (0.177-inch diameter) coil spring steel with finish to match fabric (where applicable).

d. Tie Wires: 9-gauge (0.148 inch diameter) steel with finish to match fabric.

e. Post and Line Caps: Provide weather tight closure cap for each post. Provide line post caps with loop to receive wire or top rail with finish to match fabric.

f. Tension Bars: Hot-dip galvanized steel with minimum length 2 inches less than full height of fabric, minimum cross-section of 3/16 inch by 3/4 inch and minimum of 1.2 oz. zinc coating per sq. ft. of surface area.

g. Tension Clips: Minimum 3/4 inch wide 12-gauge (.105 inch) thick with finish to match fabric.

h. Diagonal Truss Rods: Shall be 3/8-inch diameter steel rods with fittings and Truss Tightener.

i. Hinges: “Master Halco” heavy duty, or acceptable equal.

j. Concrete: Concrete for footings shall be Class B minimum. Refer to Section 32 13 13 Concrete Paving for additional information.

k. Locking device: shall be a Rolo Latch or approved equivalent

l. All Fittings and Accessories shall be powder coated black to match all vinyl coating.

m. ADA compliant gate lock Hoover fence, HA504-Plus

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to excavation, layout all fencing locations for review and acceptance by City's Representative.

3.02 INSTALLATION

A. Conform to layout shown on Drawings, except as modified by the City's Representative.

B. Erect in strict conformance with reviewed and accepted Drawings, Shop Drawings, and manufacturer's recommendations.

C. Install new footings as shown on Drawings.

D. Posts shall be installed vertical and plumb.

E. General: Install fence in compliance with ASTM F 567. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

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

1. Unless noted otherwise, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross section of post.

2. Unless noted otherwise, excavate hole depths approximately 3 inches lower than post bottom, with bottom of posts set not less than 36 inches below finish grade surface.

3. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation. Space chain link posts maximum 10 feet on center, and tube steel fence posts 7'-8-3/4" maximum face to face, unless noted otherwise. Surface mount posts with mounting plates where indicated. Fasten with lag bolts and shields. Align tube steel fence panels between posts and firmly attach rail brackets to posts with 1/4" bolt and lock nut ensuring panels and posts remain plumb.

G. Top Rails: Run rail continuously through line posts caps, bending to radius for curved runs and at other posts termination into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

H. Bottom Rails: Install bottom rails between posts with fittings and accessories as shown in Drawings (as applicable).

I. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

J. Tension Wire: As applicable, install at bottom of fabric (and at top if top rail is not specified) as shown in Drawings. Install tension wire before stretching fabric and attach to each post with ties. Secure wire to fabric with 12.5-gauge hog rings at 24" on center maximum.

K. Fabric: Leave approximately 2 inches between finish grade and bottom selvages unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on baseball field side or “primary use” side of fence (unless noted otherwise), and anchor to framework so that fabric remains in tension after pulling force is released.

L. Tension Bars: Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric integrally woven into post. Thread through fabric, and secure to end, corner, pull, and gate posts with tension clips spaced not over fifteen (15) inches on center.

M. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing. Tie fabric to line posts 12 inches max. on center and to rails and braces 24 inches max. on center.

N. Fasteners: Install nuts for tension clips and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

O. Welding: All welds shall be shop fabricated prior to galvanizing unless otherwise acceptable to City's Representative. Any and all field welds shall be completed by a Certified Structural Welder and shall be "spray-galvanized" or otherwise treated subject to the discretion of the City's Representative.

END OF SECTION
32 31 13

SECTION 32 84 00
PLANTING IRRIGATION

PART 1 - GENERAL

1.01 SUMMARY

A. Scope of Work: Provide complete irrigation system to provide water necessary to sustain planting in healthy condition.

B. Related Sections:

1. General and Project Conditions of the Bid Documents

1.02 SUBMITTALS

A. Material List

1. Manufacturer's product technical data for every product installed shall be submitted prior to performing the work. Product information shall include the manufacturer, model number, and options (if any) for all equipment proposed.

B. As-built Drawings

1. As-built Drawings showing location of constructed work (if different from locations shown on plan) shall be submitted to the City's Representative for review prior to project turnover. Drawings shall include dimensions from two permanent points of reference (i.e., built objects and not including plant material). Items to be located include:

a. Mainline (maximum dimension interval of 100' along straight runs, dimension all changes in direction)

b. Valves (all types)

c. Point of connection

d. Control wiring (if different from mainline)

e. Other equipment as directed by City's Representative

C. Controller Charts

1. Charts indicating the area(s) irrigated by each zone shall be prepared. Multiple sheets may be required to clearly identify all areas.

a. Charts shall be separated by controller.

b. The chart shall be prepared on a black line reduction of the plans.

c. Zones shall be identified by number and by varying colors. Colors shall not be duplicated on any one sheet.

d. Charts shall be laminated, 10 mils both sides.

e. Charts shall be prepared and available in the controller enclosure or otherwise turned over during the final inspection of the irrigation system, but in any case, prior to project acceptance or turnover.

D. Operation and Maintenance Manual

1. Prepare an Operation and Maintenance manual including the following:

a. Table of Contents

b. Contact information including

i. Contractor's and sub contractors' name, address, email, and telephone number.

ii. Guarantee statement.

iii. Manufacturer's product representative and contact information, if consulted or otherwise contacted in conjunction with construction.

c. Copy of the irrigation controller schedule provided in the construction drawings.

d. The irrigation controller schedule as programmed (if different from above).

e. Product information, parts sheets, installation instructions, and operation manual for all material and equipment installed (as applicable).

E. Additional items & equipment to be furnished:

1. Provide the following to the City's Representative prior to acceptance:

a. Digital file in AutoCAD format containing geo-locations of constructed irrigation equipment.

b. Three sets of any special tools or keys required to access or operate any equipment installed.

c. One quick coupler key and hose swivel for every 10 (or fraction thereof) quick couplers installed.

1.03 QUALITY ASSURANCE

A. Manufacturer's directions and instructions and drawings shall be followed in all cases where information is not provided on the drawings or these specifications.

B. Explanation of Drawings:

1. For design clarity, drawings are generally diagrammatic and not indicative of exact placement or quantities as may be required to complete the work. Any question as to the placement of equipment and line shall be resolved prior to installation.

2. For design clarity, drawings do not indicate all outlets, fittings, sleeves, or other material as may be required to complete the work. Contractor shall review the plans and investigate existing conditions and shall provide all material required to meet existing conditions and install a complete and functional system.

C. Prior to commencing work, Contractor shall:

1. Review the site and resolve all obstructions, conflicts, or discrepancies that may be present.

2. Verify the point of connection and available pressure and flow as indicated on the drawings.

3. Verify the electrical point of connection and coordinate work.

4. Verify sleeves (if indicated as existing).

D. If water for the project is to be provided from any source other than a state-regulated supplier, contractor shall obtain and provide a water chemistry analysis to the City's Representative.

E. Contractor shall furnish a Guarantee on company letterhead bearing the signature of an authorized representative of the company, including the following information:

LANDSCAPE IRRIGATION SYSTEM GUARANTEE

Project Name: _____

Project Location: _____

We hereby guarantee the above-referenced landscape irrigation system we furnished and installed is free from defects in materials and workmanship, and that the work has been completed in substantial conformance with the contract documents. We agree to replace or repair any defects which may develop during the period of one year from the date of acceptance and also to repair or replace any damage resulting from the repair or replacement of the irrigation system at no additional cost to the owner, excepting ordinary wear and tear, unusual abuse, or neglect. We shall make such repairs or replacements within 10 days of written notification by the owner. In the event of our failure to make such repairs or replacements within the time specified, we authorize the owner to proceed to have repairs or replacements made at our expense and will reimburse reasonable costs and charges therefore upon demand.

Signed:_____ Date:_____

Title:_____

Company name: _____

Company address: _____

Contact phone: _____

Contact email: _____

1.04 COORDINATION AND SCHEDULING

A. The Contractor shall be responsible for promptly scheduling and progressing the work so as not to delay the project, including:

1. Coordination with other trades as required.
2. Timing of work and coordinating power, water, and other services or requirements.
3. Notifying the City's Representative of the following observations, with the advance time indicated:
    a. Mainline, control wire, and valve installation and testing – 14 days
    b. Lateral line and sprinkler installation – 7 days
    c. Coverage test – 7 days
    d. Final Inspection – 7 days

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Polyvinyl Chloride (PVC) Pipe shall be made from National Sanitation Foundation (NSF) approved Type I, Grade I virgin PVC compound conforming to ASTM resin specification D1785. All PVC pipe shall bear the following marked continuously: Manufacturer's name, nominal pipe size, schedule or class, pressure rating in pounds per square inch (PSI), NSF approval, and date of extrusion.

1. Mainline (constantly pressurized) Pipe and Fittings

    a. Mainline and sub-mains 3" and larger shall be Non-Potable (NP) bell and gasket PVC SR21 Class 200, conforming to ASTM D2241. Fittings, joint restraints, and saddle taps for outlets shall be schedule 80 solvent weld, conforming to ASTM D2437. Offsets shall be 8" minimum.

    b. Mainline and sub-mains 2 1/2" in diameter and smaller shall be Non-Potable (NP) PVC schedule 40. Fittings and outlets shall be PVC schedule 80 solvent weld, conforming to ASTM D2437. Offsets shall be 6" minimum.

    c. No gasketed joints shall be installed in sleeves. If sleeve length requires jointing, use PVC class 315 with PVC schedule 80 solvent welded couplings.

2. Lateral Line Pipe and Fittings

    a. Lateral lines shall be Non-Potable (NP) PVC Schedule 40 for sizes 3/4" to 2-1/2", and Class 200 conforming to ASTM D2241 for sizes 3" and above. For lateral lines through 3", fittings shall be PVC schedule 40 solvent weld, NSF approved. For lateral lines sized 3" and above, fittings shall be Class 350 ductile iron with joint restraints, conforming to AWWA C153. No lateral lines shall use 1-1/4" pipe or fittings.

B. Thrust Restraints:

1. Ductile iron joint restraints and/or restraining fittings shall be used for all piping 3" and larger in diameter, including lateral lines.

C. Brass Pipe and Fittings shall be 85 percent red brass, seamless, conforming to ASTM B43. Fittings shall be schedule 40 threaded pipe.

D. Copper pipe shall be type 'K', hard tempered seamless conforming to ASTM B88. Soldered joints shall comply with ASME B16.22. Flux shall conform to ASTM B 813, and solder shall conform to B 32. Cast fittings joints shall comply with ASME B16.18.

E. Galvanized Pipe and Fittings shall be schedule 40, threaded and hot dipped galvanized, complying with ASTM A53. Male end of threaded fittings shall be wrapped with three layers of PTFE tape. All Galvanized pipe and fittings installed below grade shall be wrapped with two layers of minimum 10 mil. pipe wrap.

F. Sleeves shall be as specified on the drawings.

G. Conduit shall be rigid non-metallic PVC schedule 40 bell-end, conforming to ANSI/UL 651 and NEMA TC-2.

1. Elbows shall be long-sweep schedule 40 bell-end, conforming to ANSI/UL 651 and NEMA TC-3
2. Couplings, adapters, and fittings shall conform to UL 514B and NEMA TC-3.

2.02 BACKFLOW ASSEMBLIES

A. Shall be as specified on the drawings, conforming to all codes and local jurisdictional requirements.

B. As shown on the drawings.

2.03 VALVES

A. Isolation (mainline) Valves

1. Valves shall be as specified on the drawings and same size as the pipe they are installed on. An isolation valve shall be installed downstream of the backflow device, or if none, at the point of connection, whether shown on the plans or not.

B. Shutoff (SO) valves installed immediately upstream of Remote Control Valves (RCV) shall be Schedule 80 PVC with integrated union for sizes 2” and smaller. Shutoff valves immediately upstream of 3” RCV’s shall be gate-type bronze as listed above.

C. Quick Coupling Valves (QC) shall be as specified on the drawings. Valves shall have a brass two-piece body with a minimum working pressure of 125 psi and be operable with a standard quick coupler key.

D. Remote Control Valves (RCV) shall be as specified on the drawings. Valves have a manual flow adjustment, fully potted solenoid, and include adjustable or pre-set pressure regulation option(s).

1. All remote control valves shall have a schedule 80 compression coupling installed between the valve outlet and downstream lateral. Compression coupling and valve shall be removable without disturbing the valve box.

a. Spears S110 series; or

b. A.Y. McDonald Mfg. Co 2072 series; or

c. American Granby CCC series; or

d. equal.

E. In-line Check Valves (CV) shall be rated to a minimum operating pressure of 150 psi, PVC or bronze construction, and installed on laterals as required to prevent low-head drainage in severe slope conditions (where lateral lines elevation change exceeds in-head check valve rating or 14’, whichever is less).

F. Mainline Automatic Air Release Valve(s) shall be cast iron conforming to ASTM A-126, Class B, with a stainless steel float. Air release valve shall have a maximum operating pressure of 150 psi for mainline sizes up to 4” and a maximum operating pressure of 300 psi for larger mainline sizes.

2.04 VALVE BOXES

A. Boxes for isolation valves, quick couplers, air release valve, and flow sensor shall be a 10” x 10-1/4” round box with bolt-down lid. Extension sleeve shall be PVC with a minimum diameter of 6”.

B. Boxes for master valve, RCV’s, and drip filters shall be 9-1/2” x 16” x 11” rectangular box with bolt-down lid, and extensions as required. Use a separate valve box or jumbo valve box for drip control assemblies if required to allow disassembly and servicing of filter in box.

C. Boxes for drip flush valves and air relief valves shall be 7” or 6” round boxes with push-on lids.

D. Color: Valve boxes and lids shall be green for potable water applications and purple where required for reclaimed water designation.

E. Identification: Remote Control Valve box lids shall be heat-branded with the controller and valve number (e.g.: A13). Quick Coupling Valves shall be branded “QC.” Master Valves shall be branded “MV.” Isolation Valves shall be branded “IV.”

2.05 MASTER VALVE AND FLOW SENSOR

1. Master Valve: shall be as specified on the drawings
2. Flow Sensor: shall be as specified on the drawings Equipment matches existing installations in the City of Folsom.
3. Flow sensor communication cable and Master Valve control wiring shall be as specified by the manufacturer.
4. Flow sensor and master valve supplied as a part of the FS/MV assembly option listed under “CONTROLLER,” below.

2.06 BOOSTER PUMP

A. Pre-assembled packaged unit shall be as specified on the drawings.

2.07 CONTROL WIRING

A. General: all wire shall be new, with wire and insulation intact and free of nicks and cuts.

B. Two-wire path: Polyethylene double-jacketed or UF-B UL PVC double-jacketed two-conductor solid core designed for direct burial with insulation 3/16 inch (.060”) thick, high density, sunlight resistant incased in an outer jacket of Polyethylene or PVC conforming to ICEA S-GL-402 or NEMA WC5, having a minimum wall thickness of .045 inches. (#TW-CAB-14) Wire size shall be #14 gauge. Each two-wire path (one per controller) shall have a different wire insulation or jacket color.

C. Communication wiring between sensor(s) and controller shall conform to the manufacturer’s requirements and shall be installed in electrical conduit, 3/4” diameter for runs of 50 feet or less, and 1” minimum diameter for longer runs.

D. Traditional low voltage control wiring (at master valve): direct burial solid copper wire, sized according to the length of the run, but minimum 14 gauge for control wires and 12 gauge for common wires. Wire jacket color shall be white for common wire, red for control wires, and yellow for spare wires.

E. Connectors for two-wire path shall be direct bury splice kits pre-filled with epoxy resin, supplied in a two-part composite bag with a barrier separating the expoy from the polyol. Splice kit shall be designed to encapsulate a one wire connector, stable in applications at elevated temperatures up to 121 degrees C, and with a cure time of 24 hours at 70 degrees F. 3M Scotchcast Connector 3570G-N or equal.

F. Connectors for traditional low voltage control wiring (ie, master valves) shall be as specified in paragraph D, or as follows: direct bury splice kits pre-filled with insulating gel designed to

encapsulate a Yellow or Red twist on wire connector, with a temperature range of 32 to 120 degrees F. Wire splice kits shall be UL-listed for wires carrying greater than 24 volts.

2.08 AUTOMATIC CONTROLLERS

A. Controller assembly shall be shall be as specified on the drawings, two-wire type, matching ex of communication with the City's existing central control system. Controller, enclosure, and options shall be a shop-assembled and hot- tested unit, as available through Toro. Contact Mike Smith at (707) 448-1700.

1. Controllers shall be as specified on the drawings.

2.09 LIGHTNING PROTECTION

A. Materials, devices, and other equipment shall be as shown on the drawings, and per equipment manufacturer's requirements.

1. At irrigation controller(s)
    a. (1) copper grounding plate per controller per drawings.
    b. #6 AWG bare copper wire
    c. Earth Contact/Ground Enhancement Material
        i. Grounding material shall:
            (a.) maintain constant resistance for life of system in set form
            (b.) maintain performance in all soil conditions including drought conditions
            (c.) not require recharging
            (d.) set in a cementitious form
            (e.) be non-corrosive
            (f.) not dissolve, decompose, or leach out with time – exceeding IEC® 62561-7 performance standards
            (g.) be manufactured by Loresco (Powerset), Pentair (Ground Enhancement Material), or approved equal.
2. At irrigation wiring
    a. Lightning Arrestors for the two-wire path shall be model # TW-LA-1 as manufactured by Rainmaster. Spacing and location per manufacturer's requirements, 600' o.c. maximum and at the furthest point of each loop and end of each run.

2.10 OVERHEAD EMITTER ASSEMBLIES

A. All emitters shall be as specified on the drawings, meet ASABE/ICC 802-2014 "Landscape Irrigation Sprinkler and Emitter Standard", and shall have been documented by the manufacturer to achieve a distribution uniformity (low quarter) of 0.65 or higher using the protocol defined in the standard above.

B. All nozzles shall include radius adjustment features, excepting bubblers.

C. Rising-stem bodies shall include a molded wiper seal with UV resistant material and include internal pressure regulation.

D. Bodies with optional factory-installed check valves shall be installed as required to prevent low-head drainage.

E. All bodies shall be installed on swing arms with 360-degree adjustment in three planes, sized to the inlet of the body.

1. Swing shall be constructed of schedule 40 PVC street elbows, and schedule 80 threaded risers, minimum 6" in length. All threaded fittings shall be wrapped with a minimum of 4 wraps of Teflon tape.

F. When specified on pop-up bodies, bubbler nozzles shall fully retract into the body, and shall not require an adapter to thread onto the riser stem.

G. Multi-Stream, Multi-Trajectory Rotating (MSMTR) Nozzles shall include arc adjustment and radius adjustment to a minimum of -25% of catalog throw. As radius and arc are decreased, the volume of water shall proportionally decrease to achieve matched precipitation rates throughout the range of adjustment.

2.11 ROTOR ASSEMBLIES

A. As indicated on the drawings.

B. All bodies shall be installed on swing arms with 360-degree adjustment in three planes, sized to the inlet of the body.

1. Swing shall be constructed of schedule 40 PVC street elbows, and schedule 80 threaded risers, minimum 6” in length. All threaded fittings shall be wrapped with a minimum of 4 wraps of Teflon tape.

PART 3 – EXECUTION

3.01 PREPARATION

A. Contractor shall review the site and confirm that all preceding work has been completed to allow installation of the irrigation system.

B. Verify water and electrical points of connection (services) and ensure they are adequate to serve the work.

C. Beginning work shall constitute acceptance of the site and suitability of services.

3.02 INSTALLATION

A. Trenching: Provide the following depths for all lines:

1. Mainline and control wiring: 18 inches EXCEPT at living turf sports field area with flat drain system. Throughout area with flat drain system, mainline shall be installed 24 inches deep to avoid flat drain system.

2. Lateral lines: 12 inches EXCEPT at living turf sports field area with flat drain system. Throughout area with flat drain system, lateral lines shall be installed 24 inches deep to avoid flat drain system.

3. All lines under vehicular pavement: 24 inches

4. All lines under pedestrian pavement: 18 inches

B. Bedding:

1. Mainlines shall have sand bedding, 3” deep.

C. Backfilling:

1. Backfilling shall not occur prior to all required observations and tests. Any lines covered prior to these shall be exposed at the contractor’s expense.

2. Initial backfill for mainline shall be 6” of sand.

3. Initial backfill for laterals shall be a fine granular material in a layer 6” deep, or covering the pipe to at least 2” in depth, whichever is greater. Native soil may be used for initial backfill, excepting that rocks, clods, and deleterious material 1/2” in diameter or greater shall be screened out.

4. Backfill shall be compacted to a density at least equal to undisturbed soil in planting areas. Settlement of trenches shall be deemed evidence of insufficient compaction and shall be corrected at the contractor’s expense, including adjustment of lines, heads, grades, and replacement of plant material.

D. Backfilling Under Paving:

1. Backfill shall consist of 6” of sand, then screened native material in 6” maximum lifts, compacted to 95% relative compaction. All trenches shall be left flush with the adjoining grade. As a part of irrigation work, contractor shall set in place and cap all sleeving under paving prior to paving work. If piping requires joints under paving, all piping shall be laid, capped, and pressure tested prior to paving work.
2. Piping under existing walks shall be done by jacking or boring. Hydraulic driving shall be permitted only under pedestrian paving not exceeding four feet in length. Where cutting and patching is required, concrete shall be removed to the nearest control joint. New concrete shall match existing finish and color.

3.03 PIPING

A. Piping:

1. Initially fill mainline slowly (maximum velocity 1 foot per second). Vent air from the mainline while filling. Thoroughly flush mainline prior to installing valves.
2. Pipe Clearance: all pipes 4” or greater shall have a minimum clearance of 6” from each other. All pipes 3” or less shall have a minimum clearance of 3” from each other.
3. Flushing: all lines shall be flushed prior to installation of emitter assemblies.
4. Deflection for PVC pipe: Do not exceed a longitudinal bending radius of 300 times the pipe outside diameter or the manufacturer’s rated deflection, whichever is less, for either solvent welded or gasketed pipe.
5. Mainline shall in all cases be looped or terminated in a thrust-restrained cap with a minimum of 12” offset to upstream fitting(s).

B. Thrust Restraints:

1. Install thrust restraints on all changes in direction, outlets, joints, and ends, and as otherwise required or recommended by the piping manufacturer. Install per manufacturer’s information and direction.
2. Thrust Blocking: Concrete thrust blocking shall be used at the booster pump drop pipes and other constant-pressure piping 2” in diameter or greater and not already receiving thrust restraints, as directed by the City’s Representative. Wrap all thrust-blocked pipes with 1 mil. or heavier plastic sheet prior to placing concrete.

C. Pipe Assemblies:

1. PVC solvent welded joints: follow ASTM D2855, “Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings”
2. Threaded joints: Do not use male inlet pipe thread (MIPT) adapters. All threaded PVC fittings shall be female end with schedule 80 nipples. Wrap nipple with 2 layers of Teflon thread tape prior to assembly. On PVC to metal connections, work metal connections first.
3. Use fittings to change pipe direction without exceeding deflection limits. For elevation changes, multiple 45 or 22.5 degree elbows shall be used. Do not use 90 degree elbows to change elevation.
4. Use minimum number of fittings required. Do not use multiple shorter lengths of pipe in lieu of one continuous piece.

3.04 BACKFLOW ASSEMBLY

A. Install as shown on the drawings and in conformance with all local codes and local jurisdiction requirements.

B. Locate assembly away from casual view, outside of turf areas. Screen with plant materials, as shown on the drawings or as directed by City’s Representative. Field verify and confirm final

location with City's Representative prior to installation.

C. Use copper or brass as required by code or local jurisdiction for assembly risers. Do not use PVC on backflow assemblies.

D. Install on a concrete pad a minimum of 4 inches thick and extending 6" beyond pump enclosure on all sides, or as detailed by backflow enclosure manufacturer, whichever is greater.

3.05 CONTROL WIRING

A. Install separate two-wire path for each controller.

B. Wiring shall be installed in the same trench as and adjacent to but not on top of the mainline. Wire shall be bundled together and secured with electrical tape at 10 feet intervals.

C. Wiring shall be laid loosely in the trench and snaked from side to side to allow sufficient length for thermal expansion and contraction. Do not pull, stress, or stretch wires.

D. Provide an expansion curl (pigtail) within 3 feet of each wire connection, the greater of 18" or sufficient length to allow the valve to be raised 12" above the finished surface.

E. Field splices between the controller and the remote control valve shall not be permitted without prior approval of the City's Representative.

F. All splices shall be made with dry electrical connectors within valve boxes.

G. Label all wires in the controller enclosure within 18" of the terminal strip with permanent tags wrapped around the wire, indicating the controller, and valve (for master valve/flow sensor wires).

3.06 AUTOMATIC CONTROLLER

A. Equipment shall be located outside casual view, but accessible for maintenance operations. Field verify controller locations and confirm with City's Representative prior to installation.

B. Grounding shall be accomplished with grounding plate, as shown in the drawings. Each piece of equipment shall be individually grounded.

C. Assure communication with City's Central Communication Station. Contractor to coordinate all required tests.

3.07 LIGHTNING PROTECTION

A. Materials, devices, and other equipment shall be installed as shown on the drawings, and per equipment manufacturer's requirements.

1. Irrigation Controllers

    a. Install grounding plates per drawings

    b. Refer to manufacturer's specifications for thickness and quantity of earth contact/ ground enhancement material.

2. Irrigation Control Wiring

    a. Lightning Arrestors shall be installed along the two wire path at intervals not to exceed 600'. Install grounding rod at each arrestor.

    b. A measured resistance reading of no more than 25 ohms is required at each Lightning Arrestor per ASIC Specifications Section 7.0 – Measuring resistance, item A.

3.08 BOOSTER PUMP

A. Install on a concrete pad a minimum of 4 inches thick, with all required penetrations, and extending 4" beyond pump enclosure on all sides, or as detailed by the manufacturer, whichever is greater. Wrap all penetrations in two layers of pipe wrap where in contact with slap.

B. Install per manufacturer's instructions.

C. Ground per all applicable codes and ordinances.

3.09 FLOW SENSOR

A. Install per manufacturer's instructions. Provide a minimum unobstructed pipe length of 10 times the diameter of the mainline pipe length upstream of the flow sensor, and 5 times the diameter of the mainline downstream of the flow sensor.

3.10 VALVES

A. Remote Control Valve Assemblies, Quick Couplers, and Isolation Valves

1. Install in approximate locations shown on drawings, but in planter areas instead of turf areas wherever possible, and as shown in the details. Valve boxes shall be perpendicular to adjacent walls, walks, or headers, and shall be parallel to each other.

2. Each valve shall be identified with a minimum 2" x 2-3/4" yellow (or purple, for non-potable applications) polyurethane I.D. tag attached to the control wire of the valve.

B. Mainline Air Release Valves

1. Install an automatic air relief valve on all mainlines with vertical elevation difference of 15 feet or more, and on all mainlines exceeding 2,000 linear feet, whether shown on the drawings or not. Air relief valve shall be 1" for mainlines up to 8" in diameter. Install at localized high point on mainline and verify location with City's Representative in field prior to installation.

C. Master Valves

1. Install per manufacturer's instructions and as shown on the drawings.

3.11 OVERHEAD EMITTERS/SPRINKLER ASSEMBLIES

A. Install as detailed in the drawings. Where adjacent to headers or hard surfaces, locate such that edging equipment can pass between the adjacent edge and emitter without damage to either.

B. In no case shall spacing exceed the manufacturer's listed thrown. Single-stream rotors shall be installed at a spacing of 80% or less of the manufacturer's listed throw.

3.12 FIELD QUALITY CONTROL

A. The mainline and all piping under paving shall be simultaneously pressure and leak tested. Contractor shall furnish force pump and all necessary equipment. Sufficiently brace piping to prevent movement while testing. If concrete thrust blocking is used, allow blocking to sufficiently cure. Restrain ends of mainlines. Ensure all air is removed from mainline prior to testing.

1. Test with a hydrostatic pressure of 120 psi, or 150% of the operating pressure (sustained mainline pressure), whichever is greater.

2. Observe pressure using a minimum of two gauges, at opposite ends of the mainline. Pressure shall not vary by more than 5 psi during the test.

3. Pressure shall be sustained for a minimum of two hours. If leaks are visible or pressure drops by more than 5 pounds, replace joints and retest.

B. Irrigation system shall be operated in its entirety and shall be adjusted for complete coverage, proper operation, and to reduce or eliminate overspray and water hammer. Adjustments may include:

1. Pressure regulating devices, whether stand-alone or integrated with remote control valves

2. Manual flow adjustment of each remote control valve

3. Arc and radius adjustment of each nozzle.

4. Substitution of variable arc nozzles or reduced radius nozzles if required.

C. The irrigation system, including controller, shall be operable prior to planting.

3.13 CLEAN UP

A. All materials and debris accumulated in conjunction with completing this Work, including trash, excess soil, and empty plant containers, shall be legally recycled or disposed of by Contractor off site.

B. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site.

C. The Contractor shall leave the site area broom-clean and shall wash down all walkways and other paved areas, leaving the premises in an excessively neat, clean, and safe condition.

D. Promptly remove soil, debris, or marks created by work from paved areas, buildings, site furnishings, and other appurtenances.

E. Clean vehicle tires before leaving site to avoid tracking soils onto paved areas.

END OF SECTION
32 84 00

SECTION 32 90 00
PLANTING

PART 1 - GENERAL

1.01 SUMMARY

A. Scope of Work: Provide landscape planting, complete in place, as shown and specified including: removal of rock, gravel and other construction related material, sub-grade treatment, soil replacement, rough grading, soil amendment and preparation, finish grading, planting, seeding, staking, header installation, decomposed granite installation, clean-up, and maintenance.

B. Related Sections:

1. General and Project Conditions of the Bid Documents

1.02 SUBMITTALS

A. Submittals shall include but not be limited to the following:

1. Topsoil, Amendments, including fertilizers: Product data including chemical and physical composition, sieve, plasticity, and analytical reports from an approved laboratory source illustrating compliance with industry standards and manufacturer's stated data.
2. Mulch: size, type, and source of material, including data demonstrating compliance with physical and chemical characteristics required herein.
3. Soils fertility testing report(s) (after rough grading). Report(s) to include the following:
    a. percentage of organic matter,
    b. salinity,
    c. pH.
    d. micro and macro mineral nutrients, including concentrations of nitrogen, phosphorus, potassium, calcium, and magnesium,
    e. potential hazards of impediments to plant growth from salinity; sodium, boron, impaired soil structure or drainage,
    f. written recommendations for soil amendment application rates, and
    g. infiltration rates.
    h. Soil Texture
4. Seed: Botanical and common name, percentage by weight, percentages of purity, germination and weed seed for each grass seed species.
5. Schedule indicating anticipated dates for plant delivery, inspections, reviews, and planting.
    a. Provide documentation at least 60 days before planting certifying that all plant material is available, listing sources of materials.
    b. Contractor is responsible for securing all material in a timely manner so as not to disrupt overall project schedule and allowing for customs and agricultural inspection (if necessary) for materials that may not be locally available.

B. Quality Assurance Submittals:

1. Plants shall be subject to inspection and approval by City's Representative at place of growth or upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. The health and vigor of the plant material is the sole responsibility of Contractor.
2. City's Representative may request delivery tags for bulk materials and receipts for other materials.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery

1. Deliver all packaged and/or manufactured products to the site in unopened containers bearing manufacturer's guaranteed chemical analysis.
2. Deliver all plants with legible identification labels.
    a. Label trees, shrubs, bundles of plants, or groundcover plants.
    b. Include correct botanical genus, species, and cultivar indicated on plant list.
    c. Use durable labels with water- and UV- resistant ink which will remain legible for at least sixty days.
3. Transport plants in enclosed or covered conveyances. Protect plant material during delivery and while temporarily stored to prevent damage to root ball and leaves, including, if necessary, application of anti-desiccants.
4. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

B. Storage

1. Store plant material in shade and protect from weather.
2. Maintain and protect plant material not to be planted within 4 hours of delivery in a healthy, vigorous condition.
3. Store seed, mulch, fertilizer, and other products with protection from weather or other conditions that would damage or impair the effectiveness of the product.

C. Handling

1. Contractor is cautioned to exercise care in handling, loading, unloading, and storing of plant materials. Plant materials that have been damaged in any way shall be discarded and shall be replaced with undamaged materials at the Contractor's expense.

1.04 COORDINATION AND SCHEDULING

A. Perform planting only when weather and soil conditions are suitable in accordance with standards of industry.

B. Scheduling: Install trees, shrubs, and liner stock plant material after irrigation system is installed and inspected, after soil amendments have been incorporated and finish grades have been achieved, and before wood mulch is spread.

C. Observation Schedule. Contractor shall notify City’s Representative in advance for the following site visits, according to the time indicated:

1. Plant material review or tagging at growing site - notify City’s Representative at least 30 days before planting.
2. Pre-job conference - 7 days.
3. Final grade and soil preparation review - 48 hours.
4. Plant material, plant layout, and planting operation review – 3 days.
5. Pre-maintenance - 7 days.
6. Final acceptance - 7 days.

1.05 SAMPLES AND TESTS

A. City’s Representative reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials

shall be immediately removed from the site at Contractor's expense. Cost of testing of materials not meeting specifications shall be paid by Contractor.

B. Contractor shall arrange for a soil fertility analysis by a certified soil testing laboratory after rough grading operations are complete. At minimum, provide one test of each source of imported soil, four tests of soil at a depth of 4-6 inches for turf areas, and six tests of soil at a depth of 8-12" for shrub and groundcover areas.

1.06 GUARANTEE AND REPLACEMENT

A. All plants and other materials installed shall be guaranteed against any and material failures, decline, and/or workmanship for the duration of the maintenance period. Any plant found to be dead or not in a satisfactory or healthy condition due to faulty materials, workmanship, natural occurrences, or improper maintenance shall be replaced immediately by the Contractor at no additional expense to the City.

B. The City's Representative shall be the sole judge as to the condition of plants and other materials. Material to be replaced within the guarantee period shall be replaced by the Contractor within twenty days of written notification by the Owner. All replacement materials and installation shall comply with the Drawings and Specifications.

PART 2 - PRODUCTS

2.01 GENERAL

A. Specific amendments and fertilizer amounts will be determined after rough grading operations are complete and soil fertility test results are provided by the Contractor and approved by the City's Representative. The amounts listed in the Preparation section are considered minimum amounts for the project unless directed otherwise.

2.02 PLANTING SOIL CONDITIONER

A. Gro-Power Plus (no known equal): Humus (bacteria included based fertilizer and soil conditioner with soil penetrant shall consist of the following percentages by weight: 5% nitrogen, 3% phosphoric acid, 1% potash, 50% humus, and 15% humic acids.

2.03 PLANTING ORGANIC AMENDMENT

A. Organic amendment shall be nitrogen stabilized composted wood residual or compost containing 0.56 to 0.84 percent N based on dry weight.

B. Particle Size: 95 - 100 percent passing 6.35 mm standard sieve, 80 - 100 percent passing 2.33 mm standard sieve

C. Iron Content: Minimum 0.08 percent dilute acid soluble Fe on dry weight basis.

D. Ash: 0-6.0 percent (dry weight).

2.04 SOIL AMENDMENTS

A. Soil Sulfur: Agricultural grade sulfur containing a minimum of 99 percent sulfur (expressed as elemental).

B. Iron Sulfate: 20 percent Iron (expressed as metallic iron), derived from ferric and ferrous sulphate, 10 percent sulfur (expressed as elemental).

C. Calcium Carbonate: 95 percent lime as derived from oyster shells.

D. Gypsum: Agricultural grade product containing 98 percent minimum calcium sulphate.

2.05 FERTILIZER

1. General Fertilizer: Pelleted or granular form shall consist of the following percentages by weight and shall be mixed by commercial fertilizer supplier: 16 percent nitrogen, 6 percent phosphoric acid, and 8 percent potash.

2. Turf Starter Fertilizer shall consist of the following percentages by weight: 16 percent nitrogen, 20 percent phosphoric acid, and 0 percent potash.

2.06 LANDSCAPE TOPSOIL

A. On-site stripped and stockpiled topsoil (if any) shall be considered suitable for planting upon receipt of a soil fertility analysis. Imported soil shall be of a sandy-loam texture, free of refuse, roots or other un-decomposed whole organic material, parasitic nematodes, rocks, clods, clay, or other deleterious material. A minimum of one soil fertility test shall be supplied for each source prior to import.

B. Particle Size:

CLASS	PARTICLE SIZE	MAX. % WT.	MIN. % WT.
Coarse Sand	0.5-2.0 mm	15	0
Silt Plus Clay	< 0.05 mm	50	25
Silt	0.002 - 0.05 mm	30	10
Clay	0 - 0.002 mm	25	10
Gravel	2 - 13 mm	15	
Rock	> 1/2 inch	10% by volume, none > 1 inch	0
Organic Matter		15	0

C. The pH of saturated paste shall be between 5.5 and 7.5 without high qualitative lime content. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 milliohms per centimeter at 25 degrees centigrade. The boron content shall be no greater than one part per million as measured on the saturation extract.

2.07 TOPSOIL FOR TURF AREAS

A. On-site stripped and stockpiled topsoil shall not be considered suitable for planting.

B. Top 8” of natural turf area imported soil shall be a mix imported material of a sandy loam to a loamy sand texture, free of refuse, roots or other un-decomposed whole organic material, parasitic nematodes, rocks, clods, clay, or other deleterious material. A minimum of one soil fertility test shall be supplied for each source prior to import.

C. Approved Suppliers of Topsoil or equal

1. Cascade Rock, Topsoil
    a. 65% Sand, 22% Silt and 13% Clay
    b. Verification submittal through recent testing of % sand is required.
2. TMT Enterprise, Topsoil
    a. Verification submittal through recent testing of % sand is required.

2.08 PLANT MATERIAL

A. Plants shall be in accordance with the California State Department of Agriculture's regulation for nursery inspections, rules, and rating. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous, and free of insect infestations, weeds, plant diseases, sun scalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and have well "hardened" systems and vigorous and fibrous root systems that are not root or pot bound.

B. Root conditions of the plants provided by Contractor in containers will be determined by removal of earth from the roots of not less than two plants or more than 2 percent of the total number of plants of each species or variety. Where container-grown plants are from several sources, the roots of not less than 2 plants of each species or variety from each source, will be inspected. In case the sample plants inspected are found to be defective, the City’s Representative reserves the right to reject the entire lot or lots of plants represented by the defective samples.

C. The size of the plants shall correspond with that normally expected for species and variety of commercially available nursery stock, conforming to ANSI Z60.1, “American Standard for Nursery Stock,” or as shown on the Drawings, whichever is greater. The minimum acceptable size of all plants measured before pruning with the branches in normal position. Plants larger in size than

specified may be used without prior approval.

D. All plants not conforming to the requirements herein specified, shall be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the Work and replaced with new plants at the Contractor's expense.

E. Pruning: At no time shall trees or plant materials be pruned, trimmed or topped prior to delivery and any alteration of their shape shall be conducted only with the approval and when in the presence of the City's Representative.

F. Trees specified as multi-trunked shall have at least three primary leaders from the base of the tree. Trees not otherwise specified shall straight, single trunks, with even branching, no split crotches, co-dominate leaders, or closely spaced branches, and shall have a central leader that has not been cut, bent, scared, or broken.

G. Plant material shall be true to botanical and common name and variety as specified in "Annotated Checklist of Woody Ornamental Plants in California, Oregon and Washington," published by the University of California School of Agriculture (1979).

H. Nursery Grown Stock shall be grown under climatic conditions similar to those of the project. Container stock shall be in vigorous, healthy condition, not root-bound or with root system hardened off. Liner or flat plant material shall be well established in removable containers with roots sufficiently developed to hold homogenous soil sections.

2.10 TURF AND NATIVE EROSION CONTROL SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Mixture: Provide seed of grass species, cultivars, and (if listed) proportions by weight as listed on the drawings.

1. Minimum germination: 70%.
2. Maximum inert material: 4%.
3. Weed or crop seeds: less than 1% (No noxious weed seeds allowed).
4. Date tested: within the previous twelve months.

C. Seed shall be fast germinating and establishing Texas & Kentucky Hybrid Blue grasses from seed.

D. Approved Seed – True Blue Barvette HGT Blend.

1. Supplier shall be Wilbue-Ellis-916-991-9841.

2.11 BIOFILTRATION SOD

A. All sod shall be supplied without netting, or with biodegradable netting that shall decompose to less than 50% strength within 30 months of installation.

B. Biofiltration Sod (No-mow)

1. shall be as follows:
   a. Purple Needlegrass – Nassella pulchra
   b. Molate Fescue – Festuca rubra
   c. California Barley – Hordeum californicum
   d. Meadow Barley – Hordeum branchyantherum
2. Available from: Delta Bluegrass Company (800) 637-8873.

2.12 STAKING MATERIALS

A. Tree stakes: round and uniform with chamfered top and conical point, two-inch diameter, 8 or 10 foot length as required for height of tree, Lodgepole Pine or Douglas Fir, treated for resistance to

decay with Alkaline Copper Quaternary (ACQ) or Copper Azoles (CA-B). Stakes treated with arsenic or chromium compounds will be rejected.

B. Tree Ties: Vinyl impregnated Nylon or Vinyl, black, 1" wide, UV resistant, waterproof, tensile strength 300 pounds, bursting strength 300 psi. 24" for trees 15 gallons and smaller, 32" length for 36" box to 48" box trees. Tree ties shall be Arthur Enterprises "Super Tree Tie", V.I.T. Enterprises "Cinch Tie", or equal.

C. Tree Guys: 18 gauge, six-strand galvanized steel wire with minimum 2 x 2 x 18" long treated stakes

2.13 WATER

A. Provide or use only from approved water source.

2.14 MULCH

A. Shall be "wood chip mulch" available from green waste recyclers.

B. The mulch shall consist of fibrous, woody mixture of varied size, maximum 3", with the following characteristics:

1. Physical Properties:

Percent Passing	Sieve Size
90-100	1-inch diameter
80-100	1/2-inch diameter
20-60	1/4-inch diameter

2. Chemical Properties:

a. Acidic, maximum pH 5.0
b. Maximum ash 7% based on dry weight
c. Minimum moisture content 30% at time of delivery based on fresh weight.

2.15 HYDROSEED COMPONENTS

1. Wood cellulose fiber mulch: shall be specially prepared wood cellulose fibers with no growth or germination inhibiting factors and dyed green to facilitate visual metering during application. Wood cellulose fiber shall disperse rapidly in water to form a homogeneous slurry and remain in such state when agitated by a hydraulic mulcher. Fiber mulch shall have a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2. Binders/Tackifiers: non-asphaltic, non-toxic, and free of plant growth or germination inhibitors. "Super Tack," (Rantec Corporation), "Triple Tac" (NaturesOwn), "AM-TAC" (AZ-TAC Products, Inc.), or as recommended by fiber-mulch manufacturer for slurry applications.

3. Fungicide: "Subdue" (Ciba-Geigy) or equal.

4. Weed Control: selective preemergence herbicides: Enide (Upjohn), Dymid (Elanco Products Co.), Treflan, Eptan, Surflan, or equal.

2.16 HYDRAULIC MULCHER

1. Equipment used for slurry application shall be of commercial quality with an internal agitation system, and operational capacity sufficient to agitate, suspend, and homogenously mix slurry.

2. Tank capacity shall be a minimum of 1,000 gallons and shall be truck mounted, or otherwise able to access the site.

3. Distribution line shall be of sufficient size to prevent stoppage, allow for even distribution of slurry, and be free of leaks or loose connections.

4. The pump shall be able to generate a minimum of 150 psi at the application nozzle.

2.17 TREE ROOT BARRIERS

A. As specified and/or shown on the Drawings.

2.18 SAND

A. Shall be fill sand with 100% passing a #4 screen, 85% passing a #8 Screen and less than 4% passing a #200 screen.

1. Quantities: Sports Fields: 2.5" compacted.
2. Order quantities based on 1.35 tons per cubic yard.

B. Pre- approved suppliers (or equal):

1. West Coast Sand & Gravel: contact JR, 916-386-8177
2. TMT. Contact Matt Moore, 408-432-9040
3. CL Smith, Woodland, California. Contact: Doug 530-662-2633

2.19 PLANTER DRAINAGE ROCK

A. Drainage rock shall be 3/4 minus angular or crushed rock and shall be clean, hard, durable, and uniform in quality.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that that planting soils have been cleared of all construction debris, including gravel, concrete, concrete washout, paints, asphalt, etc.

B. Verify that final grades have been established to within 1/10 foot prior to commencing planting operations. Provide for inclusion of all amendments, settling, etc. Contractor shall be responsible for finish grading, including shaping all planting areas, including swales and basins, as indicated on Drawings.

C. Lime treated soils shall be considered unsuitable for planting and shall be removed from all planting areas to a depth of 24" or the depth of treatment, whichever is greater, and replaced with topsoil.

D. Prior to planting, inspect trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning.

3.02 SOIL PREPARATION

A. Pre-plant Weed Control

1. If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide, as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least 15 days to allow systemic kill. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 1/4 inch below the surface of the soil over the entire area to be planted.
2. After irrigation system is operational, apply water for 5 to 10 days as needed to achieve weed germination. Apply contact herbicides and wait as needed before planting. Repeat, if required by City's Representative.

B. Soil Amendment

1. After approximate finished grades have been established, hardened or previously unworked areas shall be broken up by ripping, an excavator, or other suitable equipment to a minimum depth of eight inches.
2. Soil amendments shall be uniformly spread and cultivated thoroughly using a mechanical tiller into the top 6 inches of soil. Areas around existing plants to remain shall be cultivated with hand tools.
3. The following amendment rates establish minimum requirements per 1,000 square feet and are listed for bidding purposes. Specific amendments and fertilizer amounts will be determined after rough grading operations are complete and soil samples are tested by the Contractor and approved by the City's Representative. The amounts listed below are considered minimum amounts for the project, regardless of soils fertility reports, unless directed otherwise by the City's Representative.

a. Nitrogen stabilized organic amendment – 3 cubic yards
b. Planting fertilizer - 18 lbs.
c. Soil Conditioner – 150 lbs.
d. Gypsum - 200 lbs.
e. Soil sulfur - 20 lbs.
f. Iron – 2 lbs.
g. Calcium carbonate – 2 lbs.
h. For annual color areas, in addition to the above, incorporate 3 cubic yards organic amendment and 20 cubic feet of Perlite.

C. Final Grades:

1. Remove all rocks, whole organic materials (roots, stumps, etc.), construction debris, or other deleterious materials 1” or greater from the top 6” of soil in planting areas.

2. Fine grades below adjacent paved areas, sidewalks, valve boxes, headers, clean-outs, drains, manholes, etc. shall be as follows: hydroseeded areas, ½ inch; sodded areas, one inch; shrub and groundcover planting areas, 1/2 inch plus the depth of mulch indicated on Drawings below adjacent improvements.

3. Final grading shall ensure proper drainage of the site, with positive surface flow to all catchment inlets, areas, and structures. Surface drainage shall be away from all building foundations.

4. All planting areas shall be compacted and settled by application of heavy irrigation or light roller to a minimum depth of twelve inches.

5. Minor excess soil may be incorporated into planting areas to form minor berms not exceeding slopes of 12:1 without prior approval. Dispose of any unacceptable materials or excess soil legally at an offsite location at no additional expense to the owner.

3.03 TURF AREA SOIL PREPARATION AND SOIL AMENDMENT

A. Irrigation

1. Irrigation system installation must be inspected and approved by a representative of the City or the Landscape Architect prior to the backfill of the trenched area and proceeding to the next.

a. All irrigation lateral lines, main lines and swing joints are to be installed prior to amending of the soils.

i. Where the swing joints attach, cap the fitting, drill a 1/4" hole in the cap, and point it upward.

b. Bury swing joints a min of 12” below finish grade, to be deeper than the rototilling machine will reach.

B. Sand and Soil Import

1. Laser grade the field subgrade to 8.5” below final grade shown on plans.

2. Import and evenly spread 6” (Compacted depth measurement) of approved turf area topsoil. Topsoil to be wheel rolled and Laser grade to be 0,5” below finish grade.

C. Soil Amendment

1. Limit preparation to areas which will be planted promptly after preparation.

2. Laser grade new turf areas in preparation of scheduled amendments.

3. Spread approved Gypsum at the rate of 38 lbs./1000 sq. ft. evenly over the field.

4. Spread the approved Potassium at the rate of 16 lbs./1,000 s. ft. evenly over the field.

5. Mix Approved liquid nitrogen with enough water to cover the field at a rate of .5 (1/2) gallon per 1,000 sf.

6. Spread compost at the rate of 8 cubic yards per 1,000 sq. ft for living turf areas.

7. Spread Concentrated Soil Conditioner over the area at the rate of 13 cubic yards per acre with the top dresser for even distribution (no front-end loaders or manual spreading).
    a. Dry spreader for spreading bagged fertilizer material (can be sling type or drop type-1000 lbs. or larger).
    b. Top dresser with a minimum of 4 yards capacity. There is a Speed dresser that holds 8 cubic yards of material or 9 tons, is an 8 ft. wide drop spreader and it can spread 90 tons per hour or 900 tons per day. Nearly dust free
8. Mix the Microbes Food liquid with enough water to apply .5 gallons per acre and spray evenly over the turf area.
9. Mix the dry THI Microbial Starter with enough water to apply 160 lbs per acre evenly over the turf area.

D. Rototilling
1. Turf areas will be roto-tilled at 8” in depth.
2. Two passes in different directions will be required. Rototill approximately 7.5” deep or 1/2" of subgrade on second pass so as not to pick up or disturb subgrade.
3. Rototill with primary equipment as close to edges and valve boxes as can be done safely. Use hand-operated equipment to roto-till adjacent hardscape, valve boxes, and other obstructions.

F. Irrigation
1. Turn on the irrigation system zone by zone and mark each wet spot with flags before moving to the next zone.
2. Carefully remove soil at the wet spot and place it on a tarp next to the hole. Keep amended soil separate from subgrade material and replace in the order removed. Install irrigation equipment, and then dry tamp (moisture will compact this material) the soil around the head and swing joint. Settling shall be evidence of incomplete or incorrect installation and shall be repaired at no additional cost to the City.
3. Conduct irrigation coverage test and verify that no areas of puddling are present. Irrigation system shall be run until the turf area is saturated to verify that no localized ponding occurs within turf areas. Test shall be conducted in the presence of the City’s Representative.

3.04 PLANT INSTALLATION

A. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.

B. Layout of Major Plantings: Locations for trees and outlines of areas to be planted shall be marked on the ground by Contractor before any plant pits are dug. All such locations shall be approved by the City’s Representative. If underground construction or a utility line is encountered during excavation of planting pits, other locations for planting may be selected by the City’s Representative. Layout shall be accomplished with flagged grade stakes indicating plant names and specified container size on each stake.

C. Planting of Trees and Shrubs:
1. Planting Pit Preparation
    a. Excavation for planting shall include the stripping and stacking of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits and planting beds.
    b. Protect all areas from excessive compaction when trucking plants or other material to the planting site.
    c. All excavated holes shall have vertical sides and shall be of a size that is three times the diameter and 1 and 1/2 times the depth of the root ball for all trees and shrubs. After pits are dug, roughen the sides of the pit, and loosen soil in the bottom of the pit to a depth of

3 inches. Construct foot-tamped mound in the bottom of the pit to support the plant at the proper level.

2. Hardpan Conditions:
    a. Where hardpan exists, whether it is in the form of caliche or other impervious clay, and it is within the top 2 and 1/2 feet of soil, use powered equipment to break through completely at each tree location to allow drainage and root growth. Remove hardpan at least one- and one-half feet greater than the root ball diameter of tree. Backfill with soil mix as specified.
    b. Where hardpan is within the first 12 inches of soil, it shall be completely penetrated for all shrubs and trees.
3. Rock Conditions:
    a. Where rock is encountered, tree planting pits shall be extended in the direction of the underlying rock slope until the bottom of the tree pit is in soil. Tree pits dug in rock shall not be accepted.
4. Percolation Testing and Remediation
    a. Percolation tests are required for all trees. Tree pits shall be filled with water and the drainage rate observed. Percolation rate shall be a minimum of the depth of the tree pit within 24 hours.
    b. If percolation/drainage rate is less, then tree pit drainage shall be installed. Refer to details and plans.
5. Plant Container Removal
    a. Do not handle container plants by the tops, stems or trunks at any time. Lift all plants so that the root ball is supported from the underside. Plants that do not have a satisfactory root system will be rejected. If plants do not have young feeder roots showing at the edge of the container, loosen their roots and score the root ball with a 1/2-inch-deep vertical line to encourage new feeder root development.
    b. Containers: Cut containers on 2 sides with a can cutter designed for the job. Do not injure root ball. Do not cut containers with spade or ax. After removing plant, superficially cut edge roots with knife on 3 sides.
    c. Boxes: Remove bottom of plant boxes before planting. Remove sides of box without damage to root ball after positioning plant and partially backfilling.
6. Planting
    a. Center plant in pit or trench. Root flare shall be approximately 1 inch above finish grade, such that the first lateral root is at or just beneath the surface.
    b. Face plants with fullest growth into prevailing wind.
    c. Set plant plumb and hold rigidly in position until soil has been tamped firmly around ball or roots.
    d. Backfill for trees and shrubs shall consist of amended native soil and granular fertilizer (applied at manufacturer’s recommended rates by container size). If native soil is unavailable, unsuitable, or contaminated, use imported topsoil.
    e. For succulent plants, incorporate coarse washed sand as 33%-50% of the total backfill, mixed evenly.
    f. All plants which settle deeper than the surrounding grade shall be raised to the correct level, such that the root flare is above finished grade. After the plant has been placed, place backfill to cover approximately 1/2 of the height of the root ball. Fill the remainder of the hole with water to thoroughly saturate the root ball and adjacent soil.
    g. The remainder of the hole shall then be backfilled, and tamped firm.
    h. After backfilling, an earthen basin shall be constructed around each plant. Each basin

shall be of a depth sufficient to hold at least 2 inches of water. The basins shall be constructed of amended topsoil. Remove basin in all turf areas after initial watering.

7. Pruning shall be limited to the minimum necessary to remove injured twigs and branches, and to shape the plant material as directed by the City's Representative. Pruning shall not be done prior to delivery of plants.
8. Staking of all trees shall be completed immediately after planting. Remove nursery stakes once tree stakes are in place. All stakes shall be installed plumb and as indicated in the Drawings.
9. Damage to trees and shrubs during installation shall be cause for rejection.

D. Plug and Groundcover Planting:

1. Groundcover plants and plugs shall be grown in flats, liners, or containers as indicated on the Drawings. Flat and liner grown plants shall remain in those flats and liners until transplanting. The flat's soil shall contain sufficient moisture so that it will not fall apart when lifting the plants.
2. Planting shall be in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the Drawings. Triangular spacing shall be used unless otherwise noted on the Drawings.
3. Each rooted plant shall be planted with its proportionate amount of flat or container soil. Plantings shall be immediately sprinkled with water after planting until the entire area is soaked to the full depth of each hole.
4. Care shall be exercised at all times to protect the plants after planting. Any damage to plants by trampling or other operations shall be repaired immediately.

E. Mulch: All planting areas shall be dressed with a 3 inch layer of mulch. Where slopes are 3:1 or steeper, install jute mesh netting under mulch.

3.05 BIOFILTRATION SOD AREAS

A. In addition to general soil preparation and amendments, incorporate six pounds of turf starter fertilizer per 1,000 square feet into the top 2-4 inches of soil.

B. Fine grade sodded areas to remove all ridges and depressions. Roll with 200-pound roller.

C. Lay sod immediately upon delivery. Butt adjacent strips tightly together. Stagger joints a minimum of 18 inches. Where sodded areas exceed 1,000 square feet, lay one "header" strip parallel to all hardscape and header edges.

D. Roll sod after installation with a 200-pound roller to ensure solid and complete contact with soil. Avoid roller marks due to excessively heavy rollers or excessive initial watering.

E. Water thoroughly immediately after installation. If sodded areas exceed 1,000 square feet, water each 500 square installed, instead of completing entire installation prior to watering.

F. Soil should be moistened at least eight (8) inches deep. Repeat irrigation at regular intervals to keep sod moist at all times until established. After sod is established, decrease frequency, and increase amount of water per application as necessary.

G. Post Plant Fertilizer

1. Catalyst liquid nitrogen product
   a. Quantities: 2 gallons/1000 sq. ft. every 30 days of grow in
   b. Approved Product- THI Nitro 23-0-0-7CA or pre bid approved equal

3.06 HYDROSEEDED TURF AND NATIVE EROSION CONTROL AREAS

A. Perform work only when weather and soil conditions are suitable in accordance with locally accepted practice. Hydroseeding operations shall not take place if any of the following conditions are predicted in the next 24 hours:

1. Temperatures exceed 95°F.

2. Temperatures fall below 55°F.
3. Wind speeds are at or above 20 mph.
4. Rain is imminent.

B. Hydromulch shall be applied in one application with mechanical hydraulic mulcher. When applied, the wood cellulose fiber must form an absorptive mat but not a plant inhibiting membrane, which will allow moisture to percolate into the underlying soil. Hydromulch application shall contain the proper proportions of water to form slurry mixture, and the following components at these specified rates:

1. Seed at ten pounds per 1,000 square feet.
2. Starter Fertilizer at four pounds per 1,000 square feet.
3. Wood cellulose fiber mulch at sixty pounds per 1,000 square feet.
4. Binder at rate recommended by manufacturer.
5. Fungicide at one-third pound per 1,000 square feet.
6. Selective pre-emergent herbicide at rate recommended by manufacturer.

C. Slurry mixture ingredients shall be continuously mixed to form completely homogeneous slurry. Slurry mixture shall be applied uniformly over the prepared grades at a minimum rate of one hundred twenty-five gallons per 1,000 square feet. Protect adjacent paving, vertical walls, and miscellaneous non-hydromulch areas from overspray. If overspray occurs, clean up at the end of each day's work.

D. Allow slurry mixture to "set" approximately twenty-four hours, then water thoroughly to insure proper seed germination. Repeat watering at regular intervals to keep seed germinating and growing at all times until plant material is established. After establishment, decrease frequency and increase amount of water per application as necessary to maintain strong growth and appearance and maintain grass in a vigorous growing condition until completion of the Contract.

E. Post Plant Fertilizer

1. Catalyst liquid nitrogen product
    a. Quantities: 2 gallons/1000 sq. ft. every 30 days of grow in
    b. Approved Product- THI Nitro 23-0-0-7CA or pre bid approved equal

3.07 TREE ROOT BARRIER INSTALLATION

A. Install as shown on the Drawings. Surround application (encircling plants) is not allowed.

3.08 CLEAN UP

A. All materials and debris accumulated in conjunction with completing this Work, including trash, excess soil, and empty plant containers, shall be ecycled or legally disposed of by Contractor off site.

B. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site.

C. The Contractor shall leave the site area broom-clean and shall wash down all walkways and other paved areas, leaving the premises in an excessively neat, clean, and safe condition.

D. Promptly remove soil, debris, or marks created by work from paved areas, buildings, site furnishings, and other appurtenances.

E. Clean vehicle tires before leaving site to avoid tracking soils onto paved areas.

END OF SECTION
32 90 00

SECTION 32 98 00
LANDSCAPE
MAINTENANCE

PART 1 - GENERAL

1.01 SUMMARY

A. Maintain all plants in a vigorous growing condition throughout the maintenance period. Furnish all labor, materials, equipment, and services required. Provide selective pruning as required to promote desired structure, form, and long-term health. Apply supplemental materials, including fertilizers as needed. Apply herbicides and pesticides only as required to remedy significant problems that cannot be otherwise controlled through integrated pest management approaches. At all times, protect the health of users. Include trash, debris, and weed removal from the entire site, including sidewalks and gutters.

1.02 QUALITY ASSURANCE

A. Contractor shall be experienced in horticulture and landscape maintenance practice and shall provide sufficient workers and equipment under supervision of qualified foreman at all times.

B. All equipment shall be maintained in optimal condition, including freshly sharpened blades.

C. Sterilize all cutting tools prior to starting work at each site, and between cuts if disease is present or suspected.

1.03 MAINTENANCE PERIOD

A. Maintain the entire project throughout the course of work and during the 90 (ninety) calendar day maintenance period or until project acceptance.

B. Maintenance period shall not begin until all construction activity, including punchlist items, have been completed, including initial grow-in of turf areas. At a minimum, turf areas shall show a competitive, healthy, and even stand of grass, and shall have been mown at least twice.

C. Maintenance period will begin only upon written notice of completion by the City's Representative.

D. Any day of improper maintenance, as determined by the City's Representative, shall not count toward the completion of the maintenance period.

E. The City shall inspect the project, at a minimum, every month throughout the maintenance period. The contractor shall attend a final walkthrough of the project at least one week prior to the scheduled end of the maintenance period, and again at the scheduled end of the maintenance period, as scheduled by the City's Representative.

1.04 PROTECTION

A. Protect planting areas and plants against damage until final acceptance. Maintenance includes temporary barriers, fences, and signs as required.

1.05 GUARANTEE AND REPLACEMENT

A. Replace all missing, damaged, or otherwise non-performing materials, including plants, with new materials as specified in the contract documents at no additional cost to the City.

B. All repairs and installation of replacement materials shall occur within seven calendar days of notification.

C. The City's Representative shall be the sole judge as to the condition of materials.

1.06 FINAL ACCEPTANCE

A. Final acceptance shall occur only after the maintenance period has been completed and following observation by and approval of the City's Representative. The maintenance period shall end only upon written notice of final acceptance. Refer to section 01 77 00 – Contract Closeout.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide a monthly record of all chemicals (if any) used on the site.

2.02 FERTILIZER

A. As specified in section 32 90 00 – Planting

2.03 MULCH

A. As specified in section 32 90 00 – Planting.

PART 3 - EXECUTION

3.01 GENERAL

A. All frequencies of work listed in this section shall be considered minimum. Frequency shall be increased as required to ensure a neat and orderly appearance at all times.

B. Nursery stakes and tags shall be removed within the first 15 days of maintenance. Ensure all installed support stakes and ties are securely fastened but allow moderate movement.

3.02 WEEDING

A. All planted areas shall be weeded on a weekly basis. Weeds 3” and larger in any dimension shall be completely removed.

B. Herbicides and pesticides shall only be applied by appropriately licensed operators. Selective herbicide may be used in turf areas to control invasive or noxious weeds. Broad-spectrum herbicides shall only be used in spot applications. No herbicides shall be applied during windy conditions or in a manner that results in overspray or runoff.

3.03 MOWING/EDGING

A. Weekly, all turf areas shall be mown to an even height of 2.5”-3.5.” Mulching mowers shall be used to return grass clippings to the soil. If excess or unsightly clippings are generated, clippings shall be bagged and removed. All debris, including clippings, shall be removed from hardscape areas after mowing and edging.

B. Edging shall be performed with every mowing. Turf areas shall be vertically edged. Where mowing is not possible due to obstructions (signposts, etc.), an edger may be used to trim the turf, but not lower than the mowed height. Any material damaged by improper edging shall be replaced at no additional cost to the City.

C. As needed, turf areas shall be hand-weeded or spot-sprayed with a selective herbicide to eradicate weeds. Resulting or any other bare areas shall be re-seeded by broadcast or hand seeding with a seed mix conforming to the originally installed material.

3.04 FERTILIZATION

A. A general-purpose fertilizer (16-16-16 or similar formulation) shall be applied to all shrub and groundcover beds at a rate of 5 lbs. per 1,000 square feet, in intervals not less than 30 days and not more than 45 days, including applications at the beginning of the maintenance period and just prior to final acceptance.

B. Turf starter fertilizer (6-20-20 or similar formulation) shall be applied to all turf areas at intervals not less than 30 days and not more than 45 days, including just prior to final acceptance.

C. Apply fertilizer evenly to the entire root zone.

3.05 PRUNING

A. Trees and shrubs shall in all cases be pruned according to ANSI 300 (Part 1)

B. Trees and shrubs shall be pruned to promote sound structure and planting intent, as follows.

1. In no case shall shrubs be balled, boxed, or cut into geometric forms.
2. Shrubs groups (more than one of the same species planted adjacent to each other) shall be allowed to grow together.
3. At maturity, plants shall fully and completely fill planting areas unless clearly shown otherwise on the drawings.
4. Except as noted below, shrubs shall not be sheared. Instead, branches shall be “headed back” prior to the ultimate desired length by removing the terminal bud and adjacent leaf groups if necessary for shape and to promote lateral branching.
    a. Straight rows of small-leaved evergreen shrubs shall be pruned as hedges, forming a solid and dense mass as either a border or background.
    b. Groundcover shall be edged by shearing as required to maintain walkway clearance and keep a neat appearance.
5. Dead or declining leaves of strap-leafed plants shall be removed in their entirety, but in all cases, the overall shape of the plant shall be maintained as a hemisphere rather than a vase, allowing leaves to arch toward the ground. Tip-prune leaves with sharp pruners only if needed for appearance.
6. Pollarding or heading back of trees shall not be allowed.

C. All crossing or rubbing branches shall be removed, in favor of the stronger or best placed branch.

D. Tree pruning to maintain required clearances shall be performed as required to maintain:

1. Pedestrian passage: seven feet of overhead clearance
2. Vehicular passage: fourteen feet of overhead clearance from the travel way.

E. Pruning to frame views or for other aesthetic purposes shall be done only as directed by the City’s Representative.

3.06 MULCH

A. Mulch shall be reapplied to shrub and groundcover areas throughout the maintenance period as required to maintain the original depths specified.

B. Mulch shall be topped off just prior to final acceptance.

3.07 DEBRIS

A. All clippings, pruning, and other herbaceous or woody material shall be collected and transported to a green waste recycling center at no additional cost to the City.

B. All trash shall be bagged, removed, and legally disposed of off-site.

3.08 IRRIGATION

A. Contractor shall operate, visually inspect, and adjust the system weekly for proper operation and to minimize or eliminate overspray and runoff.

B. Adjust programming as required for optimal plant health, providing deep irrigation without water loss below the root zone, and avoiding overwatering and runoff.

C. Hand watering, if required, shall use a hose-end diffuser, and minimize soil disturbance.

D. Repairs, if necessary, shall be accomplished within twenty four hours, and at no additional expense to the City.

END OF SECTION
32 98 00