PROJECT NUMBER:
DATE: 5/13/25

SPECIFICATION PACKAGE FOR BUILDING O2 REFRESH PROJECT

LONG BEACH CITY COLLEGE

LAC CAMPUS BLDG. O2
4900 E. CONANT STREET, LONG BEACH, CA 90808

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

1.1 SUMMARY

A. This Section includes the following:
   1. Plastic-laminate cabinets, countertops, and casework.
   2. Solid-surfacing-material countertops.
   3. Lectern table.

1.2 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program.

C. Quality Standard: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
   1. Before delivery to job-site, Millwork supplier:
      a. Licensees of WI shall issue a certified compliance certificate indicating millwork products being furnished for this project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
      b. Non-Licensees of WI shall provide evidence that they have arranged for inspection by WI inspector after completion of fabrication and installation. If conditions are found to be compliant, inspector will issue Compliance Certificate indicating millwork products being furnished for this project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
   2. Each elevation of casework and each countertop shall bear certified compliance label.
   3. Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs.

D. Certified Seismic Installation Program (CSIP):
   1. Before wood or metal stud walls are closed up provide a written Woodwork Institute Certified Seismic Installation Program (CSIP) report confirming that acceptable backing is provided in all locations required for casework installation or identifying those locations where backing is missing or improperly located.a. Backing shall consist of a minimum of either 3 x 6 Flat Douglas Fir or 16GA., 50 KSI sheet metal .
   2. On completion of installation provide a Woodwork Institute Certified Seismic Installation Program Certificate, identifying the work covered and certifying that installation meets the requirements of the WI CSIP attachment details and schedules.
   3. All fees charged by the Woodwork Institute for their Certified Seismic Installation Program are the responsibility of the millwork installer and shall be included in their bid.

1.3 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of interior architectural woodwork that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. High-Pressure Decorative Laminate:Formica Corporation.
1. Abet Laminati. (Basis of Design)
2. Nevamar Company, LLC; Decorative Products Div.
3. Wilsonart International; Div. of Premark International, Inc.
4. Arpa.
5. Or equal.

B. Solid Surfacing Materials:
1. Avonite. (Basis of Design)
2. E. I. du Pont de Nemours and Company.
3. Formica Corporation.
4. Nevamar Company, LLC; Decorative Products Div.
5. Wilsonart International; Div. of Premark International, Inc.
6. Or equal.

C. Particleboard:
1. Rodman Industries, Inc.
2. Acadia Board Company.
3. PrimeBoard, Inc.
4. Or equal.

D. Cabinet hardware:
1. Accuride.
2. Hafele.
3. Or equal.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Core and Substrates: Comply with the following:
1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

D. High-Pressure Decorative Laminate (HPDL): NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
1. At all exposed cabinet face and countertops.

E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
1. Type: Standard type, unless Special Purpose type is indicated.
2. At countertops in wet areas.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Adjustable Shelf Pilaster Standards: Side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
1. Product: KV #255 by Knape & Vogt or equal.
a. 23 gauge high strength steel.
b. 39/64" wide x 11/64" deep.
c. BHMA Grade 1 approved.
d. Self supports: KV #256.

B. Shelf Support Pins:
1. Product: KV #330 by Knape & Vogt or equal.
a. Stainless steel.
b. Pin diameter for 5 mm hole (approx 13/64 inch).

C. Grommets: Plastic, 2 inch diameter, locations as indicated. If locations are not indicated, as selected by Architect during shop drawing review.
1. Doug Mockett, Sugatsune, Wood Technology, or equal.

D. Drawer and Door Pulls: For all, including accessible casework.
1. "U" shaped wire pull, aluminum with satin finish, 4 inch centers.

E. Sliding Door Pulls: Circular shape for recessed installation, aluminum with satin finish.

F. Cabinet Locks:
1. All doors and drawers to be lockable.
2. Provide keyed cylinder with two keys per lock.
3. All locks to be keyed alike within each room. Each room to be keyed differently.
4. All locks to be master keyed per building. Provide 4 sets of master keys.
5. Provide 250 blank keys.
6. Finish: chrome.

G. Hinges: Concealed (fully mortised) self-closing type, BHMA No. 652, steel with polished finish.
1. Products: Blum or equal.

H. Drawer Slides: BHMA A156.9, B05091.
1. Heavy Duty (Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides. Model 3640 by Accuride or equal.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 PLASTIC-LAMINATE CABINETS

A. WI Construction Style: Style A, Frameless.

B. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

C. WI Door and Drawer Front Style: Flush overlay.

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces Other Than Tops: Grade HGS, 0.048 inches (1.2 mm) thick.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS, 0.048 inches (1.2 mm) thick.
4. Edges: Self-edge banded.

E. Semi-Exposed Surfaces: Any of one of following.
1. Low pressure decorative polyester overlay.
2. Low pressure decorative melamine overlay.
3. HPL cabinet liner.
4. Solid Phenolic core (SPC).
5. Vinyl at cabinet backs and drawer bottoms only.

F. Concealed Surfaces: Any of one of following.
1. Solid Wood or Plywood: Any hardwood or softwood species, with no defects affecting strength or utility. Hardwood and softwood lumber kiln dried to 7 and 10 percent moisture content, respectively.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Medium-Density Fiberboard: ANSI A208.2.
4. Solid Phenolic core (SPC).

G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated on Drawings.

2.6 PLASTIC-LAMINATE COUNTERTOPS

A. High-Pressure Decorative Laminate Grade: HGS, 0.048 inches (1.2 mm) thick.

B. Provide Exterior grade plywood at wet locations and comply with following:
1. No seams shall occur within 18 inches of sink cut-outs.
2. Sink cut-outs shall be coated with opaque sealer.

3. Back splash shall coordinate with size of soap and paper tower dispensers for solid attachment.
4. Corners of tops shall be cut at 45 degrees if projecting or in pathway.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated on Drawings.

D. Edge Treatment: Self-edge banded.

E. Laminate Substrates: Medium-density fiber board (MDF). Do not use plywood.

F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.7 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Solid-Surfacing-Material Thickness: 3/4 inch.

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
1. As indicated on Drawings.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

D. Integral Cove: Provide shop fabricated integrally molded coves at back and ends where against walls or other vertical surfaces, with 3/8” radius between top and splash.

2.8 LECTERN TABLE:

A. Material: Plastic laminate.

B. Configuration and Layout: See attached sketch at end of section.

END OF SECTION 064023

SECTION 096517 - LINOLEUM FLOORING

1.1 SUMMARY

A. Section Includes:
   1. Linoleum tile flooring.

1.2 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace flooring installation that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 5 years.

B. Installer’s Warranty: 1 year.

1.3 MANUFACTURERS

A. Linoleum Floor Covering: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Forbo Flooring, Inc. (Basis of Design)
   2. Armstrong World Industries, Inc.
   3. Johnsonite, a Tarkett Company.
   4. Or equal.

1.4 LINOLEUM FLOOR COVERING

A. Product: Marmoleum Dual Tile by Forbo Flooring, Inc. (Basis of Design)
   1. Description: Homogeneous tile of primarily natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendered onto a polyester backing. Pattern and color shall extend throughout total thickness of tile material.
   2. Thickness: 2.5mm.
   3. Size: As indicated on Drawings.
   4. Gauge: 1/10 inch (2.5 MM).
   5. Backing: Polyester backing.
   6. Adhesive: Forbo Linoleum, Inc., L910 adhesive.
   7. Finish: Topshield.
   8. Warranty: 15 Years.
   9. Eco Attributes: Manufactured from sustainable, natural resources, biodegradable at the end of its life.
   10. Slip Resistance: .6 for flat surfaces, for compliance with Americans with Disabilities Act (ADA) of 1990 per manufacturer's testing criteria.
   11. Fire Resistance:
      a. Smoke Density: 450 or less (ASTM E 662/NFPA 258).
      b. Critical Radiant Flux: Class 1 Rating (ASTM E 648/NFPA 253).
   12. Pattern(s) and Color(s): As indicated on Drawings.

1.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions indicated.
   1. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

END OF SECTION 096517

SECTION 096519 - RESILIENT FLOORING ACCESSORIES

1.1 SUMMARY

A. This Section includes the following:
   1. Resilient wall base and accessories.

1.2 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of resilient floor tile that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

1.3 MANUFACTURERS

A. Type TS Resilient Wall Base and Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Roppe. (Basis of Design)
   2. Burke Mercer Flooring Products.
   3. Flexco.
   4. Nora.
   5. Or equal.

B. Stair Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Norament by Nora Rubber Flooring, Freudenberg Building Systems, Inc. (Basis of Design)
   2. Burke Mercer Flooring Products.
   3. Johnsonite.
   4. Roppe Corporation.
   5. Or equal.

1.4 RESILIENT WALL BASE

A. Product: Pinnacle Plus Wall Base by Roppe.
   1. 100% Type TS thermoset vulcanized SBR rubber - not a blend.
   2. PVC free.
   3. Contains 10% natural rubber, a renewable resource, which can contribute to the LEED Green Building Certification System.
   4. Sizes: As indicated on Drawings.
   5. All colors, including Highlights, are inherent throughout the base.
   6. Style and Colors: As indicated on Drawings**.**
   7. Molded inside and outside corners.

1.5 RESILIENT STAIR ACCESSORIES

A. One-Piece Nosing, Tread, Riser, and Stringer:
1. Surface Type:
a. Round Pastilles: Raised round pastilles, 4.0 mm (0.16 inches) overall thickness, 0.5 mm (0.02 inches) raised pattern thickness. Rubber content approximately 46%.
2. Treads: FS RR-T-650.
3. Standard: ASTM F 2169, standard specification for resilient stair treads, type TS.
4. Abrasion Resistance: Taber abrasion test, ASTM D 3389, H-18 wheel, 500 gram load, 1000 cycles, gram weight loss not greater than .60.
5. Hardness: ASTM D 2240, Shore A, not less than 85.
6. Slip Resistance: Static coefficient of friction (James Test), ASTM D 2047, equal to or greater than 0.6, ADA guidelines compliance.
7. Asbestos-Free: Products shall contain no asbestos.
8. Flammability: ASTM E 648; NFPA 253; NBSIR 75 950 result to be not less than 0.45 watts per square centimeter, Class 1.
9. Smoke Density: STM E 662, NFPA 258, NBS smoke density, less than 450.
10. Burn Resistance: Cigarette and solder burn resistance.
11. Halogen-Free: Products shall contain no halogens.
12. PVC-Free: Products shall contain no poly-vinyl-chloride.
13. IAQ: Product shall meet GreenGuard requirements.
14. CA 01350: Product shall meet CA 01350 specification requirements.
15. Color: As selected by Architect from manufacturer’s full range of colors.

1.6 RESILIENT MOLDING ACCESSORY

A. Types:
1. Reducer strip for resilient floor covering
2. Joiner for tile and carpet.

B. Material: Rubber.

C. Profile and Dimensions: As indicated.

1.7 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed resilient tile and as recommended/ required by the manufacturer for warrantee acceptance or provided by resilient tile manufacturer for the type of carpet being installed.
1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
a. VCT and Asphalt Tile Adhesives: 50 g/L.
b. Cove Base Adhesives: 50 g/L.
c. Rubber Floor Adhesives: 60 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

SECTION 096813 – TILE CARPETING

1.1 SUMMARY

A. This Section includes modular, carpet tile.

1.2 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, and delamination.
   3. Warranty Period: Lifetime.

B. Installer’s Warranty: 1 year.

1.3 MANUFACTURERS

A. Carpet Tile: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Interface.(Basis of Design)
   2. Bentley Prince Street.
   3. Collins & Aikman.
   4. Shaw.
   5. Mohawk.
   6. Bolyu.
   7. J+J Invision.
   8. Or equal.

1.4 CARPET TILE

A. Low-Emitting Materials: Carpet tiles shall be Green Label certified.

B. Product: Entropy by Interface or equal.
   1. Construction: Tufted Tip Sheared.
   2. Yarn Treatment: Protekt with Duratech Soil and Stain Protection.
   3. Gauge: 1/12.
   4. Stitches: 19.16.
   5. Pile Density: (UM 44D) 7129.
   6. Yarn Weight: 20 oz./sq.yd.
   7. Pile Thickness: (ASTM D-418) .102 inches.
   8. Backing Structure: GlasBac.
   9. Size: As indicated on Drawings.
   10. Base Color Method: 100% solution dyed.
   11. Antimicrobial: Intersept.
   12. Warranty Lifetime.
   13. Pattern and Color: As indicated on Drawings.

1.5 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

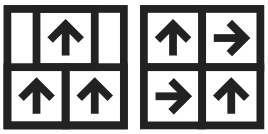
B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and as recommended/ required by the manufacturer for warrantee acceptance or provided by carpet tile manufacturer for the type of carpet being installed.
   1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
      a. Total VOCs: 50g/L.

END OF SECTION 096813

Sew Straight

Interface

Installation Method



Brick Quarter turn

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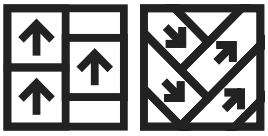
Product Sew Straight **Color** Satin **Collection** Sew Straight & Primary Stitch Collection
Backing GlasBac™

Product Specifications		
Product Number	1462002500	
Product Construction	Tufted Textured Loop	
Yarn System	Post-Consumer Content Nylon	
Yarn Manufacturer	Universal	
Dye Method	100% Solution Dyed	
Soil/Stain Protection	Protekt²®	
Preservative Protection	Intersept®	
More Product Specifications		
	Imperial	**Metric**
Tufted Yarn Weight	15 oz/yd²	509 g/m²
Machine Gauge	1/12 in	47.2 ends/10cm
Pile Height	0.14 in	3.6 mm
Pile Thickness	0.079 in	2 mm
Stitches	8 /in	31.49 ends/10cm
Pile Density	6,835 oz/yd³	253,440 g/m³
Size	19.69 in x 19.69 in	50cm x 50cm
Performance Specifications		
Flooring Radiant Panel	(ASTM E-648) Passes	
Smoke Density	(ASTM E662) ≤ 450	
Flammability	Passes Methenamine Pill Test (DOC-FF1-70)	
Lightfastness	(AATCC 16 - E) ≥ 4.0 @ 60 AFU's	
Static	(AATCC - 134) < 3.0 KV	
Dimensional Stability	AACHEN Din 54318 < 0.10%	
Traffic Classification	Severe	
Fiber Modification Ratio	1.7 to 1.9	
Preservative Efficacy	(AATCC 174 Parts 2&3) 99% Reduction/No Mold 7 Days (ASTM E-2471) Complete Inhibition	
Health + Environmental Specifications		
Embodied Carbon (Cradle to Gate)	4.38 Kg CO_2/M^2	
Total Recycled Content	63.53 %	
Recycled Content (Pre Consumer)	62.67 %	
Recycled Content (Post Consumer)	0.86 %	
Indoor Air Quality	Green Label Plus #GLP0820	
Material Composition	Free of Added Heavy Metals, Formaldehyde, Fluorinated Chemicals (PFAS), and Halogenated Flame Retardants.	
Disclosure of Environmental Impacts	Environmental Product Declaration	
Disclosure of Product Ingredients	Health Product Declaration	
Environmental Certifications	NSF/ANSI 140 Gold GreenCircle Certified Recyclable	
LEED v4	Contributes to multiple IEQ and MR credits	
End of Life	Carpet to Carpet Recycling through ReEntry®	
Technical Information		
Installation	Interface Installation Guidelines	
Maintenance	Recommended Interface Maintenance Guidelines	
Reclamation	Recyclable through ReEntry® - Call 1.888.733.6873 (U.S.) / 1.866.398.3191 (Canada)	
Warranty	15 Year Standard Carpet Warranty	
Installation Method	Quarter Turn Brick	
Manufacturing Location	ISO 9001 & 14001 Certified facilities in Troup County, Georgia, United States	

Northern Grain 4.5 mm

Interface

Installation Method



Ashlar Herringbone

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Product Northern Grain 4.5 mm **Color** Chiffon Oak **Collection** Northern Grain

Product Specifications	
Product Number	A026
Product Construction	High Performance Luxury Vinyl Tile
Class / ASTM F1700	Class III Printed Vinyl Plank
Wear Layer Thickness	22 mil
Total Thickness	4.5 mm
Backing Class	Commercial Grade
Finish	Ceramor™
Nominal Dimensions	25 cm x 1 m (9.845 in x 39.38 in)
Performance Specifications	
IIC Sound Rating	(ASTM E492-09) 64 IIC
Slip Resistance	(ASTM D2047) >0.55 wet/dry, ADA Compliant
Static Load Limit	(ASTM F970) 1500 psi
Flexibility	(ASTM F137) Passes
Resistance to Heat	(ASTM F1514) Passes
Resistance to Light	(ASTM F1515) Passes
Radiant Flux	ASTM E648 Class I
Smoke Density	(ASTM E662) ≤ 450
Size & Squareness	(ASTM F2055) Passes, +/- 0.016 in. per linear foot
Thickness	(ASTM F386) Passes
Dimensional Stability	(ASTM F2199) Passes
Residual Indentation	(ASTM F1914) Passes
Resistance to Chemicals	(ASTM F925) Passes
Health + Environmental Specifications	
Embodied Carbon (Cradle to Gate)	9.2 Kg CO_2/M^2
Total Recycled Content (Pre Consumer)	39%
Indoor Air Quality	GREENGUARD Gold FloorScore® SCS-FS-04366 CDPH 01350 compliant
Material Composition	Free of Ortho Phthalates, Added Formaldehyde and Heavy Metal Stabilizers
Disclosure of Environmental Impacts	Environmental Product Declaration
Disclosure of Product Ingredients	Health Product Declaration
Environmental Certifications	NSF/ANSI 332, Meets Certification Guidelines
LEED v4	Contributes to IEQ: Low Emitting Materials; M&R: EPD and EPR
Packaging	
Quantity per Carton	26.91 ft^2 (2.5 m^2)
Pieces per Carton	10
Weight Per Carton	40.12 lb (18.2 kg)
Cartons per Pallet	40
Pallets per Truckload	20
Technical Information	
Installation	Interface LVT Installation Guidelines
Maintenance	Recommended Interface LVT Maintenance Guidelines
Reclamation	Recyclable through ReEntry® - Call 1.888.733.6873 (U.S.) / 1.866.398.3191 (Canada)
Warranty	15 Year Standard LVT Warranty
Installation Method	Ashlar Herringbone

Entropy

Interface®

Installation Method

Non Directional

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Product Entropy **Color** 7204 Metamorphosis **Backing** GlasBac®RE

Product Specifications		
Product Number	146480250H	
Product Construction	Tufted Tip-Sheared	
Yarn System	Post-Consumer Content Type 6,6 Nylon	
Yarn Manufacturer	Universal	
Dye Method	100% Solution Dyed	
Dye Lots	Mergeable	
Soil/Stain Protection	Protekt²®	
Preservative Protection	Intersept®	
	Imperial	**Metric**
Tufted Yarn Weight	20 oz/yd²	678 g/m²
Machine Gauge	1/12 in	47.2 ends/10cm
Pile Height	0.21 in	5.3 mm
Pile Thickness	0.107 in	2.7 mm
Stitches	9.7 /in	38 ends/10cm
Pile Density	6,729 oz/yd³	251.2 g/m³
Total Thickness	0.28 in	7.11 mm
Size	19.69 in x 19.69 in	50cm x 50cm
Performance Specifications		
Flooring Radiant Panel	(ASTM E-648) Class 1	
Smoke Density	(ASTM E - 662) ≤ 450	
Lightfastness	(AATCC 16 - E) ≥ 4.0 @ 60 AFU's	
Static	(AATCC - 134) < 3.0 KV	
Dimensional Stability	AACHEN Din 54318 <.10%	
Traffic Classification	Severe	
Fiber Modification Ratio	1.7 to 1.9	
Preservative Efficacy	(AATCC 174 Parts 2&3) 99% Reduction/No Mold 7 Days (ASTM E-2471) Complete Inhibition	
Environmental Specifications		
Total Recycled Content	68%	
Recycled Content (Post Industrial)	35%	
Recycled Content (Post Consumer)	33%	
Indoor Air Quality	Green Label Plus #GLP0820	
Ingredients and Life Cycle Impacts	Environmental Product Declaration	
Other Environmental Claims	3rd Party Verified Climate Neutral NSF/ANSI-140 Platinum - Sustainable Carpet Assessment Standard	
End of Life	Carpet to Carpet Recycling	
Technical Information		
Installation	See recommended Interface Installation Guidelines online	
Maintenance	See recommended Interface Maintenance Guidelines online	

Reclamation	Recyclable through ReEntry® 2.0 - Call 1.888.733.6873 (U.S.) / 1.866.398.3191 (Canada)
Warranty	15 Year Standard, Non-Prorated Warranty
Standard Backing	GlasBac®RE
Backing Options	GlasBac®RE, GlasBac®, NexStep®
Tile Size Options	50cm x 50cm
Manufacturing Location	ISO 9001 & 14001 Certified facilities in Troup County, Georgia, United States

SECTION 099100 - PAINTING

1.1 SUMMARY

A. This Section includes the following:
   1. Surface Preparation.
   2. Field application of paints, stains, varnishes, and other coatings.
   3. Patch and repairing of existing surfaces prior to painting.
   4. See Schedule - Surfaces to be finished, at end of Section.

1.2 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace paint that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer Warranty: 1 year.

1.3 MANUFACTURERS

A. Paints: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Dunn-Edwards (Basis of Design)
   2. Glidden (ICI) Paints.
   3. Sherwin Williams.
   4. Frazee Paint.
   5. Vista Paint.
   6. Or equal.

1.4 PAINTS AND COATINGS

A. Ready mixed, except field-catalyzed coatings.

B. Prepare pigments:
   1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogenous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

1.5 PAINT SYSTEMS – EXTERIOR

A. Concrete, Plaster, and Terracotta:
   1. Flat – Modified Copolymer / 100% Acrylic:
      a. First Coat: FLEX-PRIME Select, Flexible Crack-Resistant Primer (FPSL00) or EFF-STOP SELECT Interior /Exterior Primer Sealer (ESSL00).
      b. Second Coat: SPARTASHIELD Exterior Flat Paint (SSHL10).
      c. Third Coat: SPARTASHIELD Exterior Flat Paint (SSHL10).

B. Wood – Paint Finish:

1. Semi-Gloss:
   a. First Coat: EZ-PRIME Premium, Exterior Wood Primer (EZPR00).
   b. Second Coat: SPARTASHIELD, Exterior Semi-Gloss Paint (SSHL50).
   c. Third Coat: SPARTASHIELD, Exterior Semi-Gloss Paint (SSHL50).

C. Ferrous Metal:
1. Semi-Gloss – Alkyd Emulsion / 100% Acrylic:
   a. First Coat: BLOC-RUST Red Oxide or White (BRPR00-1-RO or BRPR00-1-WH
   b. Second Coat: SYN-LUSTRO, Rust Preventive 100% Acrylic Semi-Gloss Paint (W-9). SPARTASHIELD Exterior Semi-Gloss Paint (SSHL50).
   c. Third Coat: SYN-LUSTRO, Rust Preventive 100% Acrylic Semi-Gloss Paint (W-9). SPARTASHIELD Exterior Semi-Gloss Paint (SSHL50).

D. Non-Ferrous (Galvanized) Metal:
1. Semi-Gloss – Alkyd / 100% Acrylic:
   a. Pretreatment: SUPREME CHEMICAL, METAL CLEAN AND ETCH (ME 01).
   b. First Coat: GALV-ALUM Premium, Non Ferrous Metal Primer (GAPR00). ULTRA GRIP Premium (UGPR00) Interior Exterior Primer.
   c. Second Coat: SYN-LUSTRO, Rust Preventive 100% Acrylic Semi-Gloss Paint (W-9).SPARTASHIELD Exterior Semi-Gloss Paint (SSHL50)
   d. Third Coat: SYN-LUSTRO, Rust Preventive 100% Acrylic Semi-Gloss Paint (W-9). SPARTASHIELD Exterior Semi-Gloss Paint (SSHL50)

1.6 PAINT SYSTEMS - INTERIOR

A. Gypsum Board:
1. Flat - Acrylic Copolymer:
   a. First Coat: VINYLASTIC Select, Interior Wall Sealer (VNSL00).
   b. Second Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
   c. Third Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
2. Velvet Sheen:
   a. First Coat: VINYLASTIC Select, Interior Wall Sealer (VNSL00).
   b. Second Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
   c. Third Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
3. Eggshell:
   a. First Coat: VINYLASTIC Select, Interior Wall Sealer (VNSL00).
   b. Second Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
   c. Third Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
4. Low Sheen:
   a. First Coat: VINYLASTIC Select, Interior Wall Sealer (VNSL00).
   b. Second Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
   c. Third Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
5. Semi-Gloss:
   a. First Coat: VINYLASTIC Select, Interior Wall Sealer (VNSL00).
   b. Second Coat: SPARTAWALL, Interior Semi-Gloss (SWLL50).
   c. Third Coat: SPARTAWALL, Interior Semi-Gloss (SWLL50).
6. Gloss:
   a. First Coat: VINYLASTIC Select, Interior Wall Sealer (VNSL00).
   b. Second Coat: SPARTASHIELD, Interior - Exterior Gloss Paint (SSHL60).
   c. Third Coat: SPARTASHIELD, Interior - Exterior Gloss Paint (SSHL60).

B. Masonry Concrete Tilt-up / Plaster:
1. Flat:
   a. First Coat: EFF-STOP Select Masonry Primer/Sealer (ESSL00).
   b. Second Coat: SPARTAWALL, Interior Flat Paint (SWLL10).

c. Third Coat: SPARTAWALL, Interior Flat Paint (SWLL10).

2. Velvet Sheen:
   a. First Coat: EFF-STOP Select Masonry Primer/Sealer (ESSL00).
   b. Second Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
   c. Third Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
3. Eggshell:
   a. First Coat: EFF-STOP Select Masonry Primer/Sealer (ESSL00).
   b. Second Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
   c. Third Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
4. Low Sheen:
   a. First Coat: EFF-STOP Select Masonry Primer/Sealer (ESSL00).
   b. Second Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
   c. Third Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
5. Semi-Gloss:
   a. First Coat: VINYLASTIC Select, Interior Wall Sealer (VNSL00).
   b. Second Coat: SPARTAWALL, Interior Semi-Gloss (SWLL50).
   c. Third Coat: SPARTAWALL, Interior Semi-Gloss (SWLL50).
6. Gloss:
   a. First Coat: VINYLASTIC Select, Interior Wall Sealer (VNSL00).
   b. Second Coat: SPARTASHIELD, Interior - Exterior Gloss (SSHL60).
   c. Third Coat: SPARTASHIELD, Interior - Exterior Gloss (SSHL60).

C. Concrete Block, CMU:
1. Flat:
   a. First Coat: Smooth blocfil select concrete block filler (SBSL00).
   b. Second Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
   c. Third Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
2. Velvet Sheen:
   a. First Coat: Smooth blocfil select concrete block filler (SBSL00).
   b. Second Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
   c. Third Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
3. Eggshell:
   a. First Coat: Smooth blocfil select concrete block filler (SBSL00).
   b. Second Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
   c. Third Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
4. Low Sheen:
   a. First Coat: Smooth blocfil select concrete block filler (SBSL00).
   b. Second Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
   c. Third Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
5. Semi-Gloss:
   a. First Coat: Smooth blocfil select concrete block filler (SBSL00).
   b. Second Coat: SPARTAWALL, Interior Semi-Gloss Paint (SWLL50).
   c. Third Coat: SPARTAWALL, Interior Semi-Gloss Paint (SWLL50).
6. Gloss:
   a. First Coat: Smooth blocfil select concrete block filler (SBSL00).
   b. Second Coat: SPARTASHIELD, Interior - Exterior Gloss Paint (SSHL60).
   c. Third Coat: SPARTASHIELD, Interior - Exterior Gloss Paint (SSHL60).

D. Wood – Paint Finish:
1. Flat:
   a. First Coat: ULTRA-GRIP Series Premium, Multi Purpose Primer (UGPR00).
   b. Second Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
   c. Third Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
2. Velvet Sheen:
   a. First Coat ULTRA-GRIP Series Premium, Multi Purpose Primer (UGPR00).
   b. Second Coat SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).

c. Third Coat SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).

3. Eggshell:
   a. First Coat: ULTRA-GRIP Series Premium, Multi Purpose Primer (UGPR00).
   b. Second Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
   c. Third Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
4. Low Sheen:
   a. First Coat: ULTRA-GRIP Series Premium, Multi Purpose Primer (UGPR00).
   b. Second Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
   c. Third Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40) .
5. Semi-Gloss:
   a. First Coat: ULTRA-GRIP Series Premium, Multi Purpose Primer (UGPR00).
   b. Second Coat: SPARTAWALL, Interior Semi-Gloss Paint (SWLL50).
   c. Third Coat: SPARTAWALL, Interior Semi-Gloss Paint (SWLL50).
6. Gloss:
   a. First Coat: ULTRA-GRIP Series Premium, Multi Purpose Primer (UGPR00)
   b. Second Coat: SPARTASHIELD, Interior - Exterior Gloss Paint (SSHL60)
   c. Third Coat: SPARTASHIELD, Interior - Exterior Gloss Paint (SSHL60)

E. Wood – Stain & Clear Finishes:
1. Satin – Polyurethane:
   a. Stain: ZENITH Interior Wiping Oil Stain.
   b. First Coat: DEFTHANE, Polyurethane Clear Satin.
   c. Second Coat: DEFTHANE, Polyurethane Clear Satin .
   d. Third Coat: DEFTHANE, Polyurethane Clear Satin.
2. Semi-Gloss:
   a. Stain: ZENITH Interior Wiping Oil Stain
   b. First Coat: DEFTHANE, Polyurethane Clear Semi-Gloss.
   c. Second Coat: DEFTHANE, Polyurethane Clear Semi-Gloss.
   d. Third Coat: DEFTHANE, Polyurethane Clear Semi-Gloss.
3. Gloss:
   a. Stain: ZENITH Interior Wiping Oil Stain.
   b. First Coat: DEFTHANE, Polyurethane Clear Gloss.
   c. Second Coat: DEFTHANE, Polyurethane Clear Gloss.
   d. Third Coat: DEFTHANE, Polyurethane Clear Gloss.
4. Eggshell –Lacquer Satin:
   a. Stain: ZENITH Interior Wiping Oil Stain .
   b. First Coat: VALPRO, Sanding Sealer (NAS2750).
   c. Second Coat: VALPRO, NAF2756 (20 Sheen).
   d. Third Coat: VALPRO, NAF2756 (20 Sheen).
5. Semi-Gloss –Lacquer Semi-Gloss:
   a. Stain: ZENITH Interior Wiping Oil Stain.
   b. First Coat: VALPRO, Sanding Sealer (NAS2750).
   c. Second Coat: VALPRO, NAF2752 (60 Sheen).
   d. Third Coat: VALPRO, NAF2752 (60 Sheen) .

F. Ferrous Metal
1. Flat:
   a. First Coat: BLOC-RUST Premium, Rust Preventative Metal Primer (BRPR00-1 series).
   b. Second Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
   c. Third Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
2. Velvet Sheen:
   a. First Coat: BLOC-RUST Premium, Rust Preventative Metal Primer (BRPR00-1 series).
   b. Second Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
   c. Third Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).

3. Eggshell Sheen:
   a. First Coat: BLOC-RUST Premium, Rust Preventative Metal Primer (BRPR00-1 series).
   b. Second Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
   c. Third Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
4. Low Sheen:
   a. First Coat: BLOC-RUST Premium, Rust Preventative Metal Primer (BRPR00-1 series).
   b. Second Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
   c. Third Coat: SPARTAWALL, Interior Low Sheen Paint (SWLL40).
5. Semi-Gloss:
   a. First Coat: BLOC-RUST Premium, Rust Preventative Metal Primer (BRPR00-1 series).
   b. Second Coat: SPARTAWALL, Interior Semi-Gloss Paint (SWLL50).
   c. Third Coat: SPARTAWALL, Interior Semi-Gloss Paint (SWLL50).
6. Gloss:
   a. First Coat: BLOC-RUST Premium, Rust Preventative Metal Primer (BRPR00-1 series).
   b. Second Coat: SPARTASHIELD, Interior - Exterior Gloss Paint (SSHL60).
   c. Third Coat: SPARTASHIELD, Interior - Exterior Gloss Paint (SSHL60).

G. Non Ferrous Metal:
1. Flat – 100% Acrylic / Acrylic Copolymer:
   a. Pretreatment: SUPREME CHEMICAL, METAL CLEAN AND ETCH (ME 01).
   b. First Coat: ULTRA-GRIP Premium, Multi Purpose Primer (UGPR00-1).
   c. Second Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
   d. Third Coat: SPARTAWALL, Interior Flat Paint (SWLL10).
2. Velvet Sheen – 100% Acrylic / Acrylic:
   a. Pretreatment: SUPREME CHEMICAL, METAL CLEAN AND ETCH (ME 01).
   b. First Coat: ULTRA-GRIP Premium, Multi Purpose Primer (UGPR00-1) .
   c. Second Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
   d. Third Coat: SPARTAWALL, Interior Velvet Sheen Paint (SWLL20).
3. Eggshell – 100% Acrylic / Acrylic:
   a. Pretreatment: SUPREME CHEMICAL, METAL CLEAN AND ETCH (ME 01).
   b. First Coat: ULTRA-GRIP Premium, Multi Purpose Primer (UGPR00-1).
   c. Second Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).
   d. Third Coat: SPARTAWALL, Interior Eggshell Sheen Paint (SWLL30).

1.7 COLORS

A. To be selected by Architect from manufacturer's full range of colors or as indicated on Drawings.

END OF SECTION 099100

SPARTASHIELD® Exterior 100% Acrylic Paints that are Right for the Project

SPARTASHIELD® is a line of exterior 100% acrylic paints that is ultra-low VOC (volatile organic compounds). It is formulated to provide superior hide and durability combined with an exceptional balance of sag resistance and flow & leveling.

SPARTASHIELD is a line of durable, versatile products that is ideally suited for use on commercial and residential projects, such as schools, hotels, hospitals, and single family or multi-tenant housing.

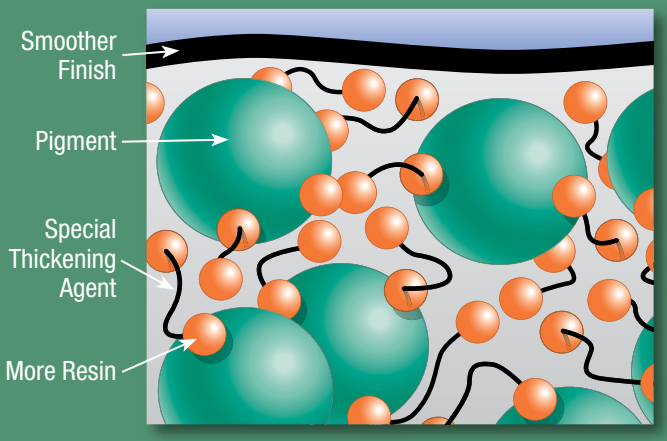
All **SPARTASHIELD** products are easy to apply and dry to a smooth, uniform finish.

Why SPARTASHIELD® is the right product for the project

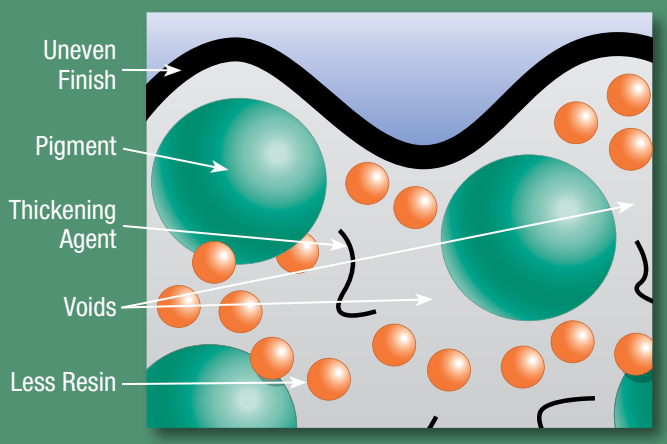
SPARTASHIELD® is a more durable, better hiding paint than the competition. The high quality resins and pigments used in our formula provide for a better hiding paint that is very easy to apply. This means that you will use less paint and get the job done faster.

SPARTASHIELD® is formulated to achieve a very good balance between sag resistance and flow & leveling. Special thickening agents are used that interact better with the resin particles to prevent excessive sag or running while providing very good flow & leveling when applied. You can achieve a smooth, uniform finish more quickly so the job looks great the first time.

Dunn-Edwards® SPARTASHIELD®



Competition



END OF SECTION 096519

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the following plumbing fixtures:
1. Water Closets
2. Urinals
3. Lavatories
4. Service Sinks
5. Kitchen Sink
6. Drinking Fountains

1.2 QUALITY ASSURANCE

A. References: This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

ANSI A112.19.5-90	Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards).
ANSI/ASME A112.6.1-88	Supports for Off-the-Floor Plumbing Fixtures for Public Use.
ANSI/ASME A112.18.1-89	Finished and Rough Brass Plumbing Fixture Fittings.
ANSI/ASME A112.19.1-87	Enameled Cast Iron Plumbing Fixtures.
ANSI/ASME A112.19.2-90	Vitreous China Plumbing Fixtures.
ANSI/ARI 1010-84	Drinking-Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers.
ANSI/ARI 1020-84	Application and Installation of Drinking Fountains and Drinking Water Coolers.
ANSI/AWWA C561-92	Disinfecting Water Mains.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

C. Verify that field measurements are as instructed by the manufacturer.

D. Accessible plumbing fixtures shall comply with all of the requirements of CBC Division 6.

E. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.

F. Fixture controls shall comply with CBC Sections 11B-601.3 for Drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children’s water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

G. Accessible sinks shall be 6-1/2” deep maximum. Sinks shall be mounted with the front of the higher of the rim and counter surface 34” maximum above the finish floor or ground.

H. Water supply and drain pipes under lavatories and sinks hall be insulated or otherwise configured to protect against contact. These shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

1.3 SUBMITTALS

A. Submit under provisions of paragraph 22 05 00-1.1.

B. Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 22 05 00.

B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.5 WARRANTY

A. Provide three year warranty on all fixtures under provisions of Section 22 05 00.

PART 2 – PRODUCTS

PLUMBING FIXTURES:

2.1 WATER CLOSET (WC-1) Accessible.

A. Bowl:
1. Manufacturer: American Standard #2257.103 "AFWALL ADA" or approved equivalent.
2. ANSI/ASME A112.19.2; wall mounted, siphon jet vitreous china closet bowl, elongated rim, 1-1/2 inch top spud, plastic bolt caps.

B. Flush Valve:
1. Manufacturer: Moen Commercial Model # 8311AC12 exposed flush-o-meter, hard-wired, sensor operated or approved equal.
2. ANSI / ASME A112.19.2 and MSV-29193, Exposed diaphragm type, chrome plated closet flush-o-meter with PERMEX™ Synthetic Rubber Diaphragm with Dual Filtered Fixed Bypass.

C. Seat:
1. Manufacturer: Church #9500SSCT or approved equal
2. Solid white plastic, open front, extended back, self-sustaining hinge, stainless steel bolts, without cover.

2.2 WATER CLOSET (WC-2)

A. Bowl:
1. Manufacturer: American Standard #2257.103 "AFWALL ADA" or approved equivalent.

2. ANSI/ASME A112.19.2; wall mounted, siphon jet vitreous china closet bowl, elongated rim, 1-1/2 inch top spud, plastic bolt caps.

B. Flush Valve:
3. Manufacturer: Moen Commercial Model # 8311AC12 exposed flush-o-meter, hard-wired, sensor operated or approved equal.
4. ANSI / ASME A112.19.2 and MSV-29193, Exposed diaphragm type, chrome plated closet flush-o-meter with PERMEX™ Synthetic Rubber Diaphragm with Dual Filtered Fixed Bypass.

C. Seat:
3. Manufacturer: Church #9500SSCT or approved equal
4. Solid white plastic, open front, extended back, self-sustaining hinge, stainless steel bolts, without cover.

2.3 URINAL (U-1) Accessible.

A. Fixture:
1. Manufacturer: Kohler “Bardon” Model # K-4991-ET, 0.125 gallon per flush or approved equal.
2. ASME A112.19.2M; vitreous china.

B. Flush Valve:
1. Manufacturer: Moen Commercial Model # 8316AC exposed flush-o-meter, hard-wired, sensor operated or approved equal.
2. ANSI / ASME A112.19.2 and MSV-29193, Exposed diaphragm type, chrome plated closet flush-o-meter with PERMEX™ Synthetic Rubber Diaphragm with Dual Filtered Fixed Bypass.

C. Support:
1. J.R. Smith Figure, Mifab or approved equal
2. ANSI/ASME A112.6

2.4 URINAL (U-2)

A. Fixture:
1. Manufacturer: Kohler “Bardon” Model # K-4991-ET, 0.125 gallon per flush or approved equal.
2. ASME A112.19.2M; vitreous china.

B. Flush Valve:
1. Manufacturer: Moen Commercial Model # 8316AC exposed flush-o-meter, hard-wired, sensor operated or approved equal.
2. ANSI / ASME A112.19.2 and MSV-29193, Exposed diaphragm type, chrome plated closet flush-o-meter with PERMEX™ Synthetic Rubber Diaphragm with Dual Filtered Fixed Bypass.

C. Support:
1. J.R. Smith Figure, Mifab or approved equal
2. ANSI/ASME A112.6

2.5 LAVATORY (L-1) Accessible.

A. Basin:

1. Manufacturer: Kohler “Kingston” Model # K-2007 or approved equal.
2. ANSI/ASME A112.19.2; vitreous china, wall mounted lavatory, with single faucet hole, front overflow, self-rimming and faucet ledge.

B. Trim:
1. Manufacturer: Moen Commercial Model CA8302 electronic faucet or approved equal.
2. ASME A112.18.1/CSA B125.1; Hand Washing Faucet. ADA Compliant, Chrome Plated Solid Brass Construction. 0.5 GPM Vandal Proof Non-Aerating Spray. Integral inlet shanks with standard ½” NPSM supply inlets and coupling nut for 3/8” or ½” flexible riser.
3. Below Deck thermostatic mixing valve.

C. Drain:
1. Manufacturer: McGuire PW 155WC or approved equal.
2. ASME A112.18.1; Cast Brass Heavy Duty Finish Chrome Plated Offset Wheelchair Strainer with polished chrome cast brass elbow, 17 gauge 1 ¼” seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer.
3. Supplies: McGuire LF2167LK AB 1953 compliant or approved equal.
4. Insulation: Exposed piping: McGuire Model No. PW2125WCPRO or approved equal.

D. Support:
1. Mifab MC-40, MC-41, MC-42 or approved equal
2. ANSI/ASME A112.6

2.6 LAVATORY (L-2)

A. Basin:
1. Manufacturer: Kohler “Kingston” Model # K-2007 or approved equal.
2. ANSI/ASME A112.19.2; vitreous china, wall mounted lavatory, with single faucet hole, front overflow, self-rimming and faucet ledge.

B. Trim:
1. Manufacturer: Moen Commercial Model CA8302 electronic faucet or approved equal.
2. ASME A112.18.1/CSA B125.1; Hand Washing Faucet. ADA Compliant, Chrome Plated Solid Brass Construction. 0.5 GPM Vandal Proof Non-Aerating Spray. Integral inlet shanks with standard ½” NPSM supply inlets and coupling nut for 3/8” or ½” flexible riser.
3. Below Deck thermostatic Mixing Valve.

C. Drain:
1. Manufacturer: McGuire PW155WC or approved equal.
2. ASME A112.18.1; Cast Brass Heavy Duty Finish Chrome Plated Offset Wheelchair Strainer with polished chrome cast brass elbow, 17 gauge 1 ¼” seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer.
3. Supplies: McGuire LF2167LK AB 1953 compliant or approved equal.
4. Insulation: Exposed piping: McGuire Model No. PW2125WCPRO or approved equal.

D. Support:
1. Mifab MC-40, MC-41, MC-42 or approved equal
2. ANSI/ASME A112.6

2.7 SERVICE SINK (MS-1)

A. Basin
1. Manufacturer: Kohler “Whitby” Model # K-6710 or approved equal;
2. Corner floor mounted, size 28”x28”x13”, acid resistant white enameled cast iron, 3” strainer.
3. Rim Guard: Kohler Model # K-8940.

B. Trim
1. Drain: flat grid drain.
2. Faucet: Moen Commercial Faucet Model 8232 wall mounted fitting, vacuum breaker spout with pail hook, wall brace and ¾” male hose thread outlet.
3. Mop Holder: Moen Model 8198 or approved equal.
4. Hose & Hose Holder: Stern Williams Model T-35 or approved equal.
5. Splash Panels for non-FRP walls: Stern Williams Model BP-1-28 stainless steel or approved equal.

2.8 SINK (S-1)

A. Basin:
1. Manufacturer: Kohler “Kingston” Model # K-2007 or approved equal.
2. ANSI/ASME A112.19.2; vitreous china, wall mounted lavatory, splash guard, with single faucet hole and front overflow.

B. Trim:
1. Manufacturer: Chicago Faucet Model 350-E35VP317XKABCP or approved equal.
2. ASME A112.18.1/CSA B125.1; Hand Washing Faucet. ADA Compliant, Chrome Plated Solid Brass Construction. 1.5 GPM Vandal Proof Non-Aerating Spray. Integral inlet shanks with standard ½” NPSM supply inlets and coupling nut for 3/8” or ½” flexible riser.

C. Drain:
1. Manufacturer: McGuire PW155WC or approved equal.
2. ASME A112.18.1; Cast Brass Heavy Duty Finish Chrome Plated Offset Wheelchair Strainer with polished chrome cast brass elbow, 17 gauge 1 ¼” seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer.
3. Supplies: McGuire LF2167LK AB 1953 compliant or approved equal.
4. Insulation: Exposed piping: McGuire Model No. PW2125WCPRO or approved equal.
5. Below deck thermostatic mixing valve.

D. Support:
1. Mifab MC-40, MC-41, MC-42 or approved equal
2. ANSI/ASME A112.6

2.9 SINK (S-2)

A. Basin
1. Manufacturer: Elkay countertop mounted stainless steel 6” deep sink model LRAD-2022 or approved equal.

B. Trim
1. Manufacturer: Chicago Faucet No. 350-E35VP317XKABCP or approved equal.
a. Strainer: Elkay LK-35
2. ASME A112.18.1; Chrome plated center set faucet with 3/8” copper inlet. Provide complete with mounting plate. Chicago Faucet 1006 CP angle stops and flexible riser. Cast brass, LA pattern P-trap, chrome plated where exposed with 1-1/2” IPS escutcheon tube and flange.

2.10 DRINKING FOUNTAINS (DF-1):

A. Drinking Fountains:
1. Manufacturer: Elkay model LZSTL(R)8WS “EZH20” or approved equal.

2. Description: Bi-level, Accessible vandal-resistant wall-mounted drinking fountain with bottle filler option.
a. Material: Stainless steel with ASME 112.19.2M for drinking fountains with backsplash.
b. Receptor Shape: Rectangular.
c. Back Panel: Stainless-steel wall plate behind drinking fountain.
d. Bubblers: Two, with adjustable stream regulator, located on deck.
e. Control: Sensor Activation.
f. Supply: NPS 3/8 with ball, gate, or globe valve.
g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
h. Support: Type I, water cooler carrier. Refer to "Fixture Supports" Article.
i. Electrical: 115V for integral bottle-filler solenoid valve.
j. Chiller: 8.0 GPH output.

2.11 DRINKING FOUNTAINS (DF-2):

A. Drinking Fountains:
1. Manufacturer: Haws model 3500 or approved equal.

2. Description: Bi-level, Accessible vandal-resistant pedestal-mounted drinking fountain.
a. Material: Stainless steel with ASME 112.19.2M for drinking fountains with backsplash.
b. Receptor Shape: Rectangular.
c. Back Panel: Stainless-steel wall plate behind drinking fountain.
d. Bubblers: Two, with adjustable stream regulator, located on deck.
e. Control: Push button.
f. Supply: NPS 3/8 with ball, gate, or globe valve.
g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
h. Support: None
i. Electrical: None
j. Chiller: No chiller required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install each fixture with a trap, easily removable for servicing and cleaning.

C. Provide stainless steel braided flexible supplies to fixtures with loose key stops, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall carriers and bolts.

F. Seal fixtures to wall and floor surfaces with sealant as specified in Division 7, color to match fixture.

G. Solidly attach water closets to wall and floor. Provide water supply to handicap water closets on side closest to adjacent wall.

H. Wrap trap and hot water supply to sinks at handicap locations to insulate against burning the individual.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust work under provisions of Division 1.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean work under provisions of Division 1.

B. At completion clean plumbing fixtures and equipment.

3.7 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Division 1.

B. Do not permit use of fixtures during construction.

3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water system in compliance with ANSI/AWWA C651

END OF SECTION 224000

SECTION 260010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 1.

C. Definitions, guarantees, submittals, clean-up, "As-Builts" and all other applicable requirements of and Division 1 apply to the work of this section.

D. Related Sections:
1. Section 0312000: Earth Moving
2. Section 033000: Cast-in-Place Concrete.
3. Section 099100: Painting
4. Division 23: Mechanical.

1.2 BASIC ELECTRICAL REQUIREMENTS

A. Quality Assurance:
1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.
2. Refer to other sections of the Specifications for other qualification requirements.

B. Drawings and Specifications Coordination:
1. For purposes of clearness and legibility, Drawings are essentially diagrammatic and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer’s data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.
2. Verify final locations for rough-ins with field measurements and with the requirements of the equipment to be connected.
3. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.
4. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.
5. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.
6. Coordinate electrical equipment and materials installation with building components and the Work of other trades.
7. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
8. Coordinate connection of electrical systems with existing underground utilities and services.

C. Terminology:
   1. Signal Systems: Applies to clock, bell, fire alarm, annunciator, sound, public address, buzzer, telephone, television, inter-communication, elevator access controls, lighting control systems and security systems.
   2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.
   3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the California Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.

E. Structural Considerations for Conduit Routing:
   1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, conform to ACI 3.8-11 Section 6.3 for conduits and pipes embedded in concrete and Section 2308.9.10 for notches and bored holes in wood; for steel, as detailed on the structural steel Shop Drawings.
   2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.
   3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.

F. Electrically Operated Equipment and Appliances:
   1. Furnished Equipment and Appliances:
      a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.
      b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.
   2. Equipment and Appliances Furnished by Others:
      a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be provided. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.
      b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-

button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems with 120V, single phase circuit from nearest electrical panel, furnished under Division 26. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.

d. Mechanical equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise.

e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

G. Protection of Materials:

1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

H. Cleaning:

1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.
2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.
3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

1.3 WARRANTIES

A. Provide one year warranty on all work performed, unless noted otherwise in specific sections.

1.4 DISCREPANCIES

A. Where a conflict in requirements occurs between the specifications and drawings, or in the specifications or on the drawings, and a resolution is not obtained from the Engineer before the bidding date, the more expensive alternate will become the contractual requirement.

B. Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.

C. The Contractor shall check all drawings furnished him immediately upon their receipt and shall promptly notify the Engineer of any discrepancies. Figures marked on drawings shall in general be followed in preference to scale measurements. Large scale drawings shall in general govern small scale drawings. The Contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

1.5 SUBMITTALS

A. Submit shop drawings, manufacturer's data certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable technical society publication references, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval. Contractor shall be responsible for reviewing and certifying submittals as conforming to the drawings and specifications prior to submittal and shall verify conformance of equipment as delivered with final shop submittals, specifications and plans. Contractor shall report to Engineer any deviations prior to initiation of construction. Contractor is responsible for promptly reporting to Architect any news of late equipment delivery which is likely or certain to delay installation.

1. Submit shop drawings and product data grouped and referenced by the technical Section numbers. Products must be highlighted on the product data sheets.
2. Submittal/shop drawing shall consist of cover sheet with specification number and the submitted products within the submittal shall be highlighted. Submittals shall be grouped per the related specification number.
3. Proposed Products List: Include Products as required by the individual section in this Division.
4. The Contractor shall be responsible for all equipment ordered and/or installed prior to receipt of shop drawings returned from the Engineer bearing the electrical engineer's stamp of "reviewed". All corrections or modifications to the equipment as noted on the shop drawings shall be performed and equipment removed from the job site when required by the Engineer, without additional compensation.
5. Shop Drawings: Drawings shall be a minimum of 8.5 inches by 11 inches in size with a minimum scale of 1/8-inch per foot, except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, duct work, and other items that must be shown to assure a coordinated installation. In wiring diagrams, identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, revise drawings to show acceptable equipment and resubmit.
6. Manufacturer's Data: For each manufactured item, provide current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves if applicable, and catalog cuts.
7. Standard Compliance: When materials or equipment provided by the Contractor must conform to the standards of organizations such as American National Standards Institute (ANSI) or Underwriters' Laboratories (UL), submit proof of such conformance to the Engineer for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified. In lieu of the label or listing, submit a certificate from an independent testing organization, which is competent to perform acceptance testing and is approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard.
8. Certified Test Reports: Before delivery of materials and equipment, certified copies of all test reports specified in individual sections shall be submitted for approval.
9. Certificates of Compliance or Conformance: Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this contract. Pre-printed

certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; or "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified. Manufacturer shall use Form 260010-A for equipment installation certification. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance or conformance.

1.6 GUARANTEE

A. Except as may be specified under other sections in the Specifications, guarantee all equipment furnished under the Specifications for a period of one year from date of project acceptance against defective workmanship and material and improper installation. Upon notification of failure, correct deficiency immediately and without cost to the Owner.

B. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner for their service agency as directed. Furnish manufacturer's warranties for all equipment furnished under this project.

1.7 MANUFACTURER'S RECOMMENDATIONS

A. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Advise the IOR before starting the Work of this Division.

B. Exposed conduits shall be painted to match the surfaces adjacent to installation.

C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.

D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the IOR. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to students and staff.

E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be 3 inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling or similar prior to lay out.

F. Electrical equipment shall be braced and anchored per 2013 CBC CH 16A, Section 1616A.1.23 through 1616A.1.26 seismic requirements, or as otherwise indicated on the Drawings.

3.2 WORK RESPONSIBILITIES

A. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgement must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference with structural conditions. The contractor is responsible for the correct placing of his work and the proper location and connection of his work in relation to the work of other trades. Advise appropriate trade as to locations of access panels.

B. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost, providing the change is ordered before the conduit runs, etc. and work directly connected to same is installed and no extra materials are required.

C. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.

D. Do not install light outlets or fixtures until mechanical piping and duct work is installed; then lights shall be installed in locations best suited for equipment arrangement or as directed by the Engineer.

E. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with any work, carefully check and verify all dimensions, sizes, etc. with the shop drawings to see that the equipment will fit into the spaces provided without violation of applicable codes.

F. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Engineer immediately and cease work on all parts of the contract which are affected until approval for any required modifications to the construction has been obtained from the Engineer.

G. Be responsible for any cooperative work which must be altered due to lack of proper supervision or failure to make proper provisions in time. Such changes shall be under direction of the Engineer and shall be made to his satisfaction.

H. Perform all work with competent and skilled personnel.

I. All work, including aesthetic as well as electrical and mechanical aspects of the work, shall be of the highest quality consistent with the best practices of the trade.

J. Replace or repair, without additional compensation, and any work which, in the opinion of the Engineer, does not comply with these requirements.

3.3 OPERATION AND MAINTENANCE MANUAL

A. Provide operation and maintenance manual of all equipment and lighting fixtures furnished on this project

3.4 POSTED OPERATING INSTRUCTIONS:

A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions as directed. Attach or post operating instructions adjacent to each principal system and equipment including startup, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each system or equipment. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

3.5 MANUFACTURER'S RECOMMENDATIONS:

A. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

3.6 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site with proper identification, which shall include names, model numbers, types, grades, compliance labels, and similar information needed for District identification; all products and materials shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion.

3.7 CUTTING AND PATCHING

A. Cutting and patching of electrical equipment, components, and materials shall include the removal and legal disposal of selected materials, components, and equipment.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Repair or restore other work, or surfaces damaged as a result of the work performed under this contract.

3.8 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose off the Project site.

B. Remove equipment and implements of service, and leave entire work area neat and clean, to the satisfaction of the Owner Authorized Representative.

3.9 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION 260010

SECTION 270000 - GENERAL COMMUNICATIONS REQUIREMENTS

PART 1 - GENERAL

1.1. SUMMARY

A. The work covered under this Section shall consist of a design, furnishing of all material, labor, and installation for completion of an operable end to end structured cabling system. This includes - but is not limited to - furnishing and installing cable, cable supports, cable ties, innerduct, racks, cabinets, termination components, ancillary equipment, testing, and labeling and documentation of cables and connectors, for a complete end-to-end solution.

B. Refer to the contract documents for locations of Telecom Rooms (TRs), Equipment Room (ER), and telecommunication outlets (TOs). Note that the port and cable count at each TO may vary by location.

C. Complete installation shall comply with the Owner provided latest telecommunication and IT standards documents.

D. It shall be the responsibility of the contractor, to work with the Owner and provide the necessary assistance to make any connections from the owners' outside plant, service provider to establish services which shall ride on the new cabling system. These activities include, but are not limited to patch cords, cross connects, general wiring, documentation, and cable pair identification.

1.2. RELATED DOCUMENTS

A. General and Supplementary Conditions

B. Long Beach City College District Standards. Liberal Arts Campus / Pacific Coast Campus.

1.3. RELATED SECTIONS

A. Division 01 – General Conditions

B. Division 07 – Penetration Firestopping

C. Division 26 - Grounding and Bonding

D. Division 26 - Raceway and Boxes

E. Division 26 - Wiring Devices

F. Division 27 - Communications

1.4. ACRONYMS AND DEFINITIONS

A. BICSI: Building Industry Consulting Service International

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection

C. EMI: Electromagnetic interference

D. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect

E. IDC: Insulation displacement connector

F. LAN: Local area network

G. NRTL: Nationally Recognized Testing Laboratory, an independent agency, with the experience and capability to conduct the testing indicated, as defined by OSHA in 29 CFR 1910.7

H. RCDD: Registered Communications Distribution Designer, a BICSI-certification

I. RMC: Rigid metallic conduit

J. TR: Telecom Room

K. UTP: Unshielded twisted pair

L. Category 6A UTP, as defined by TIA standards

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1.5. CONTRACTOR QUALIFICATIONS

A. The contractor shall be a company specializing in the installation of communication cable and accessories with a minimum of five years documented experience on similar systems.

B. Must be a current certified partner of the solutions being furnished and installed in order to meet the requirements for the extended warranty and service programs.

C. Must hold a current communications cabling license within the State the project is taking place and must be verifiable for good standing.

D. Contractor must have a current affiliation with BICSI.

E. Within the project's onsite team, 15% of installers shall hold a BICSI Installer 1 certification, 15% of installers shall also hold a BICSI Installer 2 certification (Both Optical Fiber and Copper). 10% of the team shall hold a BICSI ITS Technician certification and a minimum of (1) team member shall hold a current and valid BICSI RCDD certification.

F. All BICSI certified field installers shall take on roles of Foreman or Team Lead to ensure installations are deemed compliant per codes and standards.

G. Contractor must have satisfactorily completed (3) projects within the past 5 years of similar scope and amount within the same state.

H. The selected Contractor shall provide a Project Manager to act a single point of contact for all activities performed under this section. The Project Manager shall be a Registered Communications Distribution Designer (RCDD). The RCDD shall have a minimum of 3 years experiences in design and installation. The designer must have sufficient experience in this type project(s) as to be able to lend adequate technical support to the field forces during installation, during the warranty period and during any extended warranty periods or maintenance contracts. The Contractor must attach a resume of the responsible designer to the Contractor's submittal for evaluation.

I. The Project Manager, or designee thereof, shall be required to attend project meetings as required until project closeout/signoff.

J. Should the Project Manager assigned to this project change during the installation, the new Project Manager assigned must meet all qualifications stated in this section, and must also submit a resume for review by the Consultant.

K. If, in the opinion of the Consultant, the Project Manager does not possess adequate qualifications to support the project, the Consultant reserves the right to require the Contractor to assign a designer whom, in the Owner's opinion, possesses the necessary skills and experience required of this project.

1.6. REGULATORY REFERENCES

A. ANSI/NFPA 70

B. City of Long Beach Building Code.

C. Division of the State Architect Compliance Publications.

D. ANSI/IEEE C2 - National Electrical Safety Code (NESC)

E. NFPA 70-2011 - National Electrical Code (NEC)

F. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, published February 2009 and all latest addenda derived from ANSI/TIA 568-B.

G. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, published February 2009 and all latest addenda derived from ANSI/568-B.

H. ANSI/TIA-568-C.2 – Balanced Twisted Pair Telecommunication Cabling and Components Standard, published August 2009 and all latest addenda derived from ANSI/TIA 568-B.

I. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard, published June 2008 and all latest addenda derived from ANSI/TIA 568-B.

J. ANSI/TIA/EIA 569-B - Commercial Building Standard for Telecommunications Pathways and Spaces.

K. ANSI/TIA-606-B – Administration Standard for Telecommunications Infrastructure, published June 2012 including all latest addenda derived from TIA-606-A.

L. ANSI/TIA-607-B – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

M. ANSI/TIA-758-A Customer Owned Outside Plant Telecommunications Infrastructure Standard.

N. IEEE 142 “Green Book”- Recommended Practice for Grounding of Industrial and Commercial Power Systems.

O. UL 444 - Standard for Communications Cable.

P. Rural Electrification Administration (REA) PE-89 - specification for filled telephone cables with expanded insulation.

Q. Rural Electrification Administration (REA) PE-39 - specification for filled telephone cables

R. NEC Article 250 and Article 800.

S. CEC Article 18-27-300.22©(1)

T. NEC Article 250 for System Grounding.

U. NEC Articles 770 and 800 for Cable Listing Requirements.

V. Work performed should additionally comply with and follow guidelines established in the latest edition/revision, as of the date of the Contract Documents, of the following publications:

1. BICSI Telecommunications Distribution Methods Manual (TDMM)
2. BICSI Outside Plant Design Reference Manual (OSPDRM)
3. National Electrical Contractors Association (NECA)/BICSI ANSI/NECA/BICSI-568-2006 Standard for Installing Commercial Building Telecommunications Cabling

W. All materials shall be new and listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

X. Notify Consultant of all material believed to be inadequate, unsuitable, in violation of law, ordinances, rules or regulations of authorities having jurisdiction.

1.7. CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Consultant for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Consultant for a decision before proceeding.

1.8. SUBMITTALS

A. Submittals shall include complete documentation of the system, products and accessories in a single submittal. Incomplete submittals will be returned unreviewed.

B. Prior to the start of work the Contractor shall submit shop drawings in an electronic form. Plans shall be fresh designs by the contractor; they cannot be overlays of the Consultant's package which are indicative as the contract documents. Shop drawings shall contain:

1. Full size floor plans showing proposed cable routing, wire basket routes, labeling of all outlets, locations of pullboxes.
2. Full size floor plans and elevations of all telecommunication room racks and cabinets; also include all walls with equipment.
3. Elevations shall indicate part numbers and quantities for all equipment.
4. Elevations of all type of outlet faceplates which shall include the configuration for jacks, blanks and the intended outlet labeling schemes.
5. Floor plans shall include all ladder rack or overhead cable distribution hardware within the telecommunications rooms to be installed per manufacturer's instructions.
6. Outside plant manhole and handhole designs coordinated with electrical as well as the site environment.
7. Outside plant conduit arrangement details within ductbank and within the manholes and handholes as necessary.
8. Outside plant conduit ductbank overall routing coordinated with electrical as well as the site environment.
9. All seismic bracing and support details shall be provided in coordination with the general contractor as needed.

C. Submittals shall include faceplates mockups sent to the Consultant for final review. Mockups shall have the manufacturer's cable markings clearly visible. The following are standard items that are to be submitted.

1. Wall mounted outlet complete with faceplate, terminated jacks, blanks, and labeling for all types of outlets in project. Outlet should also contain 24" minimum of the cable proposed for the project.
2. Wireless outlet complete with jacks, blanks, and labeling.
3. Wall phone (stainless steel) outlet.
4. Modular furniture outlet complete with faceplate, jacks, blanks and labeling.
5. Raceway outlet complete with faceplate, bezel, jacks, blanks and labeling.
6. Floorbox outlet complete with faceplate, mounting plate, jacks and labeling.

D. Where applicable, dimensions should be marked in units to match those specified.

E. Work shall not proceed without the consultant's "no exception taken" of the submitted items.

F. Floor plans will be provided to the Contractor in electronic (AutoCAD, ".dwg") formats to be utilized by the contractor in creating complete submittals and as-built documentation. These modified documents shall be provided to the Owner as part of the Record Documents.

G. Plans shall be fresh designs by the contractor, they cannot be overlays of the consultant's package which is indicative as contract documents.

H. All submittal documentation shall bear the stamp of a currently verifiable BICSI RCDD.

I. Contractor must submit documentation to support all Contractor Qualifications and Requirements under Section 1.5 which is to include but not limited to the following:

1. End to end solution and partner documentation indicating contractor's staff has gone through proper channels and training support a minimum 25 year warranty and service program by the manufacturers.
2. BICSI affiliations by contractor.
3. BICSI cabling team's RCDD, Installer 1, Installer 2 (Optical Fiber and Copper) and ITS Technician certifications.
4. Current copy of the State contractor's license for Communications Cabling.
5. Documentation of (3) similar projects within the past 5 years in the same State.

J. Contractor shall include data sheets and literature of test equipment to be used for fiber and copper cabling and components.

1.9. MANUFACTURER CERTIFIED WARRANTY

A. The manufacturer shall be a company specializing in communication cable and/or accessories with a minimum of five years documented experience in producing cable and/or accessories similar to those specified below.

B. The system shall be comprised of components from a single manufacturer or a combination of manufacturers entering into a partnering agreement that allows for a warranty of the system.

C. System warranty program documents must be from that of the cabling and component manufacturer and associated partners. Cabling and component warranty programs offered by the contractor alone are not acceptable.

D. The warranty period shall be for not less than 25 years and warranty the cabling system and components will perform to the stated specifications for the warranty period.

1.10. QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

B. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

C. Requirement for specialists shall not supersede building codes and regulations governing the Work.

D. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and

1.11. QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

C. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work.

D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1.12. OWNER STANDARDS

A. Work performed should additionally comply with Owner Standards.

PART 2 - PRODUCTS

2.1. NOT USED

PART 3 - EXECUTION

3.1. GENERAL

A. Contractor shall follow standard industry installation practices as described in the latest release of the BICSI TDMM.

B. Contractor shall be responsible for identifying and reporting to the Site Coordinator(s) any existing damage to walls, flooring, tiles and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, pathways or other hardware must be repaired by the Contractor. Repairs must match preexisting color and finish of walls, floors and ceilings. Any contractor-damaged ceiling tiles are to be replaced to match color, size, style and texture.

C. The installation shall be supervised on site by a BICSI certified installer.

D. The contractor shall have on staff a BICSI certified RCDD. RCDD certification shall be current and each submittal shall bear the stamp of the RCDD.

E. Outlets shall be mounted flush on a wall-mounted box, on Surface Raceway and in Modular Furniture. Information Outlet locations are identified on Project Drawings.

F. Avoid abrasion and other damage to cables during installation. Any cable damaged during installation shall be removed and a new cable installed.

G. Cables shall be a continuous run. No in-line splices are permitted except were explicitly indicated on the drawings.

3.2. DELIVERY AND STORAGE

A. Receive, handle, and store telecommunications system items and materials at the project site. Materials and items shall be so placed that they are protected from damage and deterioration.

3.3. INSTALLATION

A. The drawings for work under Division 27 Sections related to communication systems are diagrammatic and are intended to convey the scope of work and indicate the general arrangement of conduit, boxes, equipment, termination hardware, fixtures and other work included in the Contract.

B. The Contractor shall verify all dimensions and clearances before procuring any equipment.

C. Location of items required by the drawings or specifications not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to the approval of the Architect/Telecom Design Engineer.

D. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.

1. Where space conditions appear inadequate, the Architect/Telecom Design Engineer shall be notified before proceeding with installation.
2. Minor conduit and cable tray rerouting and changes shall be made at no additional cost to the Owner.
3. As necessary, adjust elevations of rack-mounted termination hardware and horizontal wire management panels so as to compensate for rack unit sizes of actual hardware used, as compared to hardware rack unit sizes depicted in Contract Drawings.

E. Perform all work with skilled mechanics of the particular trade involved in a neat and workmanlike manner.

F. Perform all work in cooperation and coordination with other trades and schedule.

G. Furnish other trades advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, routes for conduit and cable tray raceway, and also furnish information and shop drawings necessary to permit trades affected to install their work properly and without delay.

H. Where there is evidence that work of one trade will interfere with the work of other trades, all trades shall assist in working out space allocations to make satisfactory adjustments and shall be prepared to submit and revise coordinated shop drawings.

I. With the approval of the Architect/Consultant and without additional cost to the Owner, make minor modifications in the work as required by structural interferences, by interferences with work of other trades or for proper execution of the work.

J. Work installed before coordinating with other trades so as to cause interference with the work of such other trades shall be changed to correct such condition without additional cost to the Owner and as directed by the Architect.

K. Minor changes in the locations of outlets, fixtures and equipment shall be made prior to rough in at the direction of the Architect/Consultant and at no additional cost to the Owner.

L. Contractor shall cooperate with other trades and coordinate work so that conflicts with other work are eliminated.

M. Equipment shall be installed with adequate space allowed for removal, repair or changes to equipment. Ready accessibility to removable parts of equipment and to wiring shall be provided without moving other equipment which is to be installed or which is in place. Contractor shall verify measurements. Discrepancies shall be brought to the Architect/Telecom Design Engineer's attention for interpretation.

N. Determine temporary openings in the buildings that will be required for the admission of apparatus furnished under this Division, and notify the Architect/Consultant accordingly. In the event of failure to give sufficient notice in time to arrange for these openings during construction, assume all costs of providing such openings thereafter.

O. Location of telecommunication outlets and raceway pathways are approximate and exact locations shall be determined on site.

P. Contractor shall refer to contract documents for details, reflected ceiling plans, and large scale drawings.

3.4. COORDINATION

A. The Contractor shall be responsible for the coordination of telecommunications work with the work of all other trades and shall, in preparing the drawings, check the work of other trades in order to avoid possible installation conflicts arising therefrom. It shall be understood that the work shown on the shop drawings has been so coordinated. In the event of conflicts or interference that cannot be resolved in the field, the Contractor shall request a written clarification from the Architect/Consultant.

B. Coordinate service entrance arrangement with local exchange carrier(s).

1. Meet jointly with local exchange carrier representatives and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute to other participants.
3. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

C. Where work covered by this Section connects to equipment furnished under other Sections, verify telecommunications work involved in the field and make proper connection to such equipment.

END OF SECTION 270000

SECTION 328400 – PLANTING IRRIGATION- –RECYCLED WATER

1.1 DESCRIPTION:

A. Work in This Section: Division 1 applies to this Section.

1. Supply all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of Landscape Irrigation System, complete as shown on the Drawings and/or as specified herein.

2. The principal items of work included in this section, but not exclusively, are:

a. Complete fully automatic landscape irrigation system including trenching, backfilling, compacting, for mains, laterals, conduits, and risers, valves, fittings, sprinkler heads, drip bubblers and drip•line tubing, quick couplers, low voltage electric wiring, 2-wire controller and decoders systems and all necessary specialties and accessories.
b. Cut, cap, and rework existing irrigation within and adjoining the project site in order to maintain uninterrupted irrigation coverage in adjacent areas.
c. Sleeves beneath walkways, roads, and driveways where required whether shown on the drawings or not. Include all sleeve locations on as-build drawings.
d. Salvaging existing irrigation heads and control valves and deliver to District.
e. Recycled water warnings, postings, signage, tagging and inspections
f. Flushing, testing, and adjusting of the system.
g. Guarantees.

1.2 RELATED WORK

A. Section 12 93 00. - Site Furnishings.
B. Section 32 93 00 - Plants.
C. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work. Protect under drip line of old growth trees.
D. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.

1.3 REFERENCES

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

ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

ASTM D1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC)

Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC)

Compounds.

ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

ASTM D2219 Standard Specification for Poly (Vinyl Chloride) Insulation for Wire and Cable, 60 Degrees C Operation.

ASTM D2220 Standard Specification for Poly (vinyl chloride) Insulation for Wire and Cable 75 Degrees C Operation.

ASTM D2241 Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure –Rated Pipe (SDR Service).

ASTM D2464 Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

ASTM D2466 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

ASTM D2467 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

ASTM D2468 Standard Specification for Acrylonitrile-Butaoliene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40.

ASTM D2609 Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.

ASTM D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

B. Local Plumbing Code

C. Uniform Plumbing Code

D. National Sanitation Foundation (NSF) Manual

E. Underwriters Laboratories (UL): Electrical wiring, controls, motors, and devices shall be U.L. listed, and so be labeled.

1.2 QUALITY ASSURANCE AND REQUIREMENTS:

A. Work force

1. Experience: The landscape establishment firm shall have a full time foreman assigned to the job for the duration of the contract. He shall have a minimum of four (4) years' experience in landscape establishment supervision shall be thoroughly familiar with the

type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.

2. Labor force: The landscape establishment firm's labor force shall be thoroughly familiar and trained in the work to be accomplished and perform the task in a competent, efficient manner acceptable to the BMT.

3. Supervision: The foreman shall directly employ and supervise the work force at all times. Notify The BMT of all changes in supervision.

4. Identification: Provide proper identification at all times for landscape establishments firm's labor force. Be uniformly dressed in a manner satisfactory to the BMT.

5. Installer Qualifications (for solvent and rubber gasket joints): Each person is to be trained by the manufacturer's representative in techniques for making correct joints prior to performing work on the site.

B. Permits and Fees: Contractor shall obtain and pay for any and all permits and all inspections as required.

C. Manufacturer's Directions: The manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the Drawings and Specifications.

D. Ordinances and Regulations: All local, municipal and state laws, and rules and regulations governing or relating to any portion of this Work are hereby incorporated into and made a part of these Specifications, and their provisions shall be carried out by the Contractor. Anything contained in these Specifications shall not be construed to conflict with any of the above rules and regulations or requirements of the same. However, when these Specifications and Drawings call for, or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these Specifications and Drawings shall take precedence.

E. Explanation of Drawings:

1. Due to the scale of the Drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his Work and plan his Work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are diagrammatic and indicative of the Work to be installed. The Work shall be installed in such a manner as to avoid conflicts between Irrigation systems, planting, and architectural features. Recycled water pressurized mainlines are to be a minimum of ten feet from adjoining potable water plumbing. Long Beach Water Department standards must be followed when recycled water pressurized piping crosses RECYCLED potable water piping. Long Beach Water must be contacted if new recycled water pressurized mainline is within ten feet of RECYCLED potable water piping. Long Beach water must approve appropriate sleeving and recycled pressurized piping within those areas.

2. All Work called for on the Drawings by notes or details shall be furnished and installed whether or not specifically mentioned in Specifications.

F. Work of this Section which is allied with the Work of other trades shall be coordinated as necessary.

1. Coordinate work of this Section with all existing and new underground utilities and trades responsible for their installation.

G. Underwriters Laboratories: Electrical wiring, controls, motors, and devices shall be UL listed and so labeled.

H. Discrepancies:

1. Verify scaled dimensions and quantities prior to start of work.

2. Notify the BMT of discrepancies between Drawings and Specifications and actual job site conditions that would affect the execution of the irrigation work. Do not work in areas where discrepancies occur until instructed by the BMT in the event.

1.4 SUBMITTALS: Refer to Section 01300 for procedures.

A. Provide the following submittals for review and approval:

1. Irrigation Materials Lists
2. Record Drawings- including all sleeve locations
3. Controller Charts
4. Operating & Maintenance Manuals
5. Equipment to Be Furnished

B. Materials List:

1. Make submittals no later than 30 calendar days prior to start of work to which they apply.
2. Submit 5 complete lists of irrigation materials and equipment for approval by the BMT; include manufacturer's name and address, model number, specific trade names, catalog numbers complete with illustrations and necessary descriptive literature and clearly mark or underline proposed items.

B. Record Drawings: Refer to Section 01780.

1. Contractor shall provide and keep up to date and complete "as-built" record set of black-line prints or PDF files which shall be corrected daily and show every change from the original Drawings and Specifications and exact "as-built" locations, sizes, and kinds of equipment. This set of Drawings shall be kept on the site and shall be used only as a record set.

2. These Drawings shall also serve as Work progress sheets and shall be the basis for measurement and payment for Work completed. These Drawings shall be available at all

times for site reviews and shall be kept in a location designated by the Architect. Should the record as-built progress sheets not be available for review or not up to date at the time of any site reviews, it will be assumed that no Work has been completed and the

Contractor will be assessed the cost of that site visit at the current billing rate of the Architect. No other inspections shall take place prior to payment of that assessment.

3. The Contractor shall make neat and legible notations on the as-built progress sheets daily as Work proceeds, showing the Work as actually installed. For example, should a piece of equipment be installed in a location that does not match the plan, the Contractor must indicate that equipment has been relocated in a graphic manner so as to match the original symbols as indicated in the irrigation legend. The relocated equipment and dimensions will then be transferred to the original as built plan at the proper time.

4. Before the final site review, transfer information from the “as-built” prints to procured from the BMT. The original print “as-built” plan shall be submitted to the BMT for approval prior to the making of the controller chart. The dimensions shall be made so as to be easily readable even on the final controller chart (See section C below)

5. The Contractor shall dimension from two permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:

a. Connection to existing water lines.
b. Connection to existing electrical power.
c. Gate valves.
d. Routing of sprinkler pressure lines. (Dimension max., 100' along routing.)
e. Sprinkler control valves decoders and associated ground rods.
f. Routing of control conduit & wiring.
g. Quick coupling valves.
h. Other related equipment as directed by the Architect.
j. Sleeve locations

6. On or before the date of the final site review, the Contractor shall deliver the corrected and completed as-built to the Architect. Delivery will not relieve the Contractor of the responsibility of furnishing required information that may be omitted from the Drawings.

7. When record drawings have been approved by the Architect, transfer all information to a set of reproducible drawings following requirements set forth in Division one.

a. Make dimensions accurately at the same scale used on original drawings, or larger. If photo reduction is required to facilitate controller chart housing, notes or dimensions must be a minimum 1/4 inch in size.

C. Controller Charts:

1. Record Drawings shall be approved by the Architect before controller charts are prepared.
2. Provide three (3) 11 inches x 17 inches controller charts at.

3. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils.
4. The chart is to be a reduced drawing of the actual as-built system, of a maximum size that will fit inside controller housing, double sided if required for readability.
5. The chart shall be a black-line print and a different color shall be used to indicate area of coverage for each station, using pastel or transparent colors.
6. Show the areas controlled by the controller valve sequence. Make the chart a reduced drawing of the actual "as-built" system. However, in the event the controller sequence is not legible when the drawing is reduced, enlarge it to a size that will be legible when reduced.
7. The chart shall show the area controlled by the automatic controller and shall be the maximum size which the controller door will allow.

D. Operation and Maintenance Manuals/ Guarantee:

1. Prepare and deliver to the Architect within 10 calendar days prior to completion of construction, three hard cover binders with three rings containing the following information:
2. Provide the following in each manual:
    a. Index sheet, stating Irrigation Contractor's name, address, telephone number, list of equipment with name and addresses of local manufacturer's representative.
    b. Equipment list providing the following for each item:
        i. Manufacturer's name.
        ii. Make and model number.
        iii. Name and address of local manufacturer's representative.
        iv. Spare parts list in detail.
        v. Detailed operating and maintenance instructions for major equipment.
3. The guarantee for irrigation system shall be made to accordance with Section 01780. A minimum one-year guarantee is required.
    a. The manufacturer shall warrant materials against manufacturing defects for a period of one year from date of Substantial Completion. The Contractor shall guarantee workmanship for one year after the approval of the inspection to be held at the completion of the specified maintenance period and be responsible for the following tasks:
        i. Replacement or repair of any broken or malfunctioning parts installed under this Contract, including piping and fittings, heads, valves, and controllers.
        ii. Adjustment of heads to ensure proper coverage of the system.
        iii. Repair of damaged work, installed by others that may be caused by stuck or malfunctioning heads or valves, such as wash outs, and erosion.

iv. Settling of backfilled trenches, which may occur during warranty period, shall be repaired by Contractor, including complete restoration of finish grade treatment.
v. Repair settlement of backfilled trenches including the complete restoration of damaged planting, paving, or other improvements which may occur during a 90 day period, after final acceptance by the BMT, to the BMT's satisfaction, without expense to the Owner

b. The Contractor shall be responsible for coordinating material warranty items with manufacturer and distributor. The Contractor will be on call to replace or repair any faulty equipment or installation within 24 hours after notification by the BMT during the maintenance period.
c. The District reserves the right to make temporary repairs as necessary to keep the irrigation equipment in operating condition. The exercise of this right by the District will not relieve the Contractor of responsibilities under the terms of the guarantee.
d. The guarantee for the irrigation system shall be made in accordance with the attached form. The General Conditions and Supplementary Conditions of these Specifications shall be filed with the BMT. Prior to acceptance of the irrigation system.
e. Expenses due to vandalism during construction and the maintenance period 4. In addition to the above mentioned maintenance manuals, provide the Owner's maintenance personnel, through the BMT, with instructions for major equipment, and show evidence in writing to the Architect at the conclusion of the project that this service has been rendered.

5. Provide with a reduced legible copy of the "As-Built" Irrigation Plan hermetically sealed in a plastic cover to be affixed to the inside of each controller cover.

E. Equipment to Be Furnished:

1. As part of this contract: upon completion of work for this section of the contract the Contractor shall supply the following items to the BMT

a. 2 sets of special tools required for removing, disassembling, and adjusting each type of sprinkler and valve supplied.
b. Two, 5 foot valve keys for operation of shut-off valve.
c. 2 keys for each for automatic controller and cabinet.
d. Hose and Swivel Assemblies: Supply 1 set of hose and swivel assemblies for every 5 quick coupling valves.
e. Spray/ Rotator Sprinkler Body: Equal to two percent of amount installed for each type and size indicated, but no fewer than ten units.
f. Spray/ Rotator Sprinkler Nozzle: Two for each type and size installed for each type indicated.

g. Bubblers: Equal to two percent of amount installed for each type and size indicated, but no fewer than ten units.
h. Emitters: Equal to two percent of amount installed for each type and size indicated, but no fewer than ten units.
i. Fertigation unit, Supply 1 year of ez-flo products based on manufacturers suggestion of rate and product. 1 year includes 90 day maintenance period.
j. 10% or minimum 5 total of spare 2-wire decoders

2. The above mentioned equipment shall be turned over to the College at the conclusion of the project. Before final acceptance can occur, evidence that the College has received material must be shown to the Architect.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Contractor is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and, if installed shall be replaced with new piping. PVC pipe is not to be used if overly exposed to the sun and exhibits evidence of sun-bleaching.

1.6 INSPECTION

A. Notify the BMT 48 hours prior to time of the following required inspections:

1. Pressure supply line installation and testing.

2. Automatic controller and wire installation.

3. Lateral line and sprinkler installation.

4. Coverage test.

B. Notify the BMT 7 days prior to the time of final inspection.

1.7 EXISTING UTILITIES AND PLANT MATERIALS

A. Exercise care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by Contractors operations or neglect. Check existing utilities drawings for existing utility locations. Contractor to verify all existing utilities through Dig Alert (800)-227-2600, two days before beginning construction.

B. Protect in place utilities and plant materials not designated for removal or modification against damage resulting from work of this Contract.

C. Repair or replace existing improvements not designated for removal, which are damaged or removed as a result of Contractors operations. When a portion of a sprinkler system must be

removed, the remaining lines shall be capped. Repairs and replacements shall be at least equal to existing improvements, and shall match them in finish and dimension.

D. Existing trees, lawns, and shrubbery that are not to be removed shall be protected from damage or injury. If damaged or removed because of the Contractor's operations, they shall be restored or replaced in as nearly the original condition and location as is reasonably possible.
E. Specimen Tree Protection: certain trees within the job site may be designated as being "specimen" trees by the BMT, Facilities Department, and or Architect.

1. It is the responsibility of the contractor to fence off the specimen trees with a six-foot tall metal, temporary, chain-link fence around the outside dripline of the specimen tree.
2. Specimen trees are to be watered regularly by the contractor by means of a temporary irrigation system or by hand with a garden hose and water breaking nozzle.
3. Reasonable health of the specimen tree is to be maintained by the contractor. If the specimen tree shows signs of damage or decline, the contractor is to immediately bring the information forward to the BMT.

F. Costs for protecting, removing, and restoring existing improvements shall be included in Contractor's Bid.

1.8 VERIFICATION OF DIMENSIONS AND QUANTITIES

A. Verify scaled dimensions and quantities prior to start of work.

B. Notify the BMT of discrepancies between Drawings and Specifications and actual job site conditions that would affect the execution of the irrigation work. Do not work in areas where discrepancies occur until instructed by the BMT.

1.9 WATER, POWER SERVICE, INTERNET ETHERNET CONNECTIVITY

A. Service connection points shall be as shown on Drawings unless otherwise directed by the utility company.

B. Contractor shall be responsible for installing 120-Volt electrical service and all labor and materials including connections.

C. Contractor responsible for locating nearest internet Ethernet Internet network switch and running appropriate cabling in conduit from the switch to the irrigation controller.

1. Contractor Responsible for coordinating with BMT and the District I.T. department regarding location of appropriate switch to land Ethernet connection, port designation, IP Address, and associated firewalls

D. Upon final acceptance of work, transfer billing to the BMT.

1.10 INTENT OF DRAWINGS

A. Due to the scale of Drawings, it is not possible to indicate offsets, fittings, and sleeves, which may be required. Contractor shall investigate the finished conditions affecting the work and furnish fittings and other items, required to provide a complete irrigation system. Drawings schematically show the work to be installed

1.11 COORDINATION

A. Coordinate the irrigation installation with other sub-contractors including paving, utilities, site backfilling, landscape grading and landscape work.

2.01 MATERIALS:

2.1 GENERAL

A. Irrigation plans have been prepared utilizing specific design standards, calculations, and criteria, including but not limited to the following: precipitation rates, flow rates, head spacing and coverage, flow rates, nozzle size and defined water window time frame. The Contractor shall be responsible for ensuring the installation of a complete and operating irrigation pump and irrigation system that meets or exceeds the design intent, standards, and parameters required by the plans and specifications.

B. The Contractor shall provide and install a complete and operating irrigation system, utilizing the same manufacturer and system parts as noted in the Drawings.

C. If all of the parameters, specifications and design intent of the Drawings are met, the following list of manufacturers with acceptable equipment model, series, size and designation, irrigation controllers; electrical connections; quick coupling valves; irrigation heads; drip and emitter irrigation piping and equipment) would be acceptable for use.

1. Pipe & Fittings:

a) Piping: D. All irrigation pressurized mainlines and laterals are to be reclaimed water PVC pipe to be color coded “purple” in color and marked on two sides with reclaimed water warning statements “CAUTION – RECLAIMED WATER”. Reclaimed water piping must be accepted by the local reclaimed water governing agencies

i. PVC pipe shall be installed in a manner which will provide for expansion and contraction as recommended by the pipe manufacturer.

ii. Centerload all plastic pipe prior to pressure testing.

iii. Parallel lines shall not be installed directly over each other.

iv.

b) Fittings: All PVC fittings shall be standard weight Schedule 80 for constant-pressure mainline fittings and Schedule 40 for non-pressure lateral fittings and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the “deep socket” bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2466 and D2467.

c) Pressure Main Line Piping and Fittings: Sizes 2" and smaller shall be Schedule 40 PVC; 2 ½” and greater shall be Class #315 PVC (PURPLE)

d) Non-Pressure Lines (buried): Shall be PVC SCH. 40 (PURPLE)
e) No class 200 PVC piping installation permitted.
f) All pipe and fittings shall conform to specific requirements as follows:
   i. PVC (Solvent Weld): Pipe: Manufactured from virgin polyvinyl chloride compound in accordance with ASTM D 1785or ASTM D 2241, cell classification 12454B, hydrostatic design stress rating not less than 2,000 P.S.I.
   ii. In solvent welding, use only the specified primer and solvent cement and make all joints in accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15-minutes setup time before moving or handling and 24 hours curing time before filling.
   iii.
   iv. PVC nipples shall be schedule 80 with machine threads.
   v. All PVC pipe must be labeled with the following markings:
      (a) Manufacturer's name.
      (b) Nominal pipe size.
      (c) Schedule or class.
      (d) Pressure rating in A.S.T. (Not required on drip tubing).
      (e) NSF National Sanitation Foundation) approval (Not required on drip tubing).
      (f) Date of extrusion.
      (g) Imprinted on two sides the words "CAUTION RECLAIMED WATER, DO NOT DRINK".
   vi. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation method prescribed by the manufacturer.
   vii. Galvanized Pipe and Fittings: No galvanized pipe or fittings are to be used on this project.

2. Pressure Main Line Piping & Fittings downstream of water meter:

a) PVC constant pressure main line pipe 2 inches and larger: Rubber-ring joint PVC Class 200, or solvent weld joint PVC Class 315.
b) PVC pipe 1.5" and smaller: schedule 40 PVC solvent weld type.

3.Non-pressure lateral line below grade: schedule 40 PVC solvent weld type.

a) Sleeves for piping under paving and slabs: Schedule 40 PVC.

b) Two-Wire Conduit one and a quarter inch: PVC 1220-160 psi plastic pipe.

c) Pipe (solvent weld type) manufacture from virgin poly-vinyl chloride in accordance with ASTM

d) D-1784 or ASTM D-2241, cell classification 12454B; hydrostatic design stress rating not less than 2000 p.s.i.

e) Fittings: Standard weight, Schedule 40 injection molded PVC. Comply with ASTM D-1784, cell classification 13454B.

f) Threads (where required): Injection molded type.

g) Tees and Ells: side gated.

h) Threaded Nipples: Standard weight, Schedule 80 with molded threads. Fittings (2" and larger) slip type may be used, but must be similar in all respects to those manufactured by Cal Am Manufacturing Company and installed in accordance with their recommendations.

i) J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape. No liquid Teflon materials permitted.

4. Warning Tape

a) Purple plastic reclaimed water warning tape a minimum of 3 inches wide, permanently marked" RECLAIMED WATER - DO NOT DRINK" in English and Spanish. Tape is to be provided for all pressure main lines. Tape to run four to six inches directly above the pressurized mainline for the full run of the pressurized mainline piping.

b)Detectable underground utility marking tape, minimum 4.85 mil overall thickness, by Christy Type Ill, Magnatec, or equal.

5. Joint Cement and Primer

a) All solvent welded pipe connections of PVC pipe including both non-pressure plastic pipe and fittings (lateral lines) and pressure plastic pipe and fittings (main line) is to be coated with a purple primer and then with a 100% active solvent cement, gray in color.

6. Electrical Wiring and Service

a) High Voltage: All high voltage electrical service required for automatic controller and other equipment noted on drawing for irrigation is to be provided as part of this work.

b) Low Voltage, 2-Wire Irrigation Valve Communication:

i. Connections between controller and field decoders are tobe made with Paige P7354D 2-Wire Cable within one and a quarter inch PVC conduit. The conduit is to have sweeps into each valve box, no hard ninety degree angles.

ii. Connections between field decoders and remote control valves are

to be made with #14 AWG direct burial wires and the maximum wire run between the decoder and the valve shall be 100-feet.

iii. The POC decoder shall operate a single master valve and flow meter (model FM).

iv. The maximum wire run between the POC decoder and flow meter shall be 20-feet while the maximum wire run between the decoder and the master valve shall be 100-feet.

v. Splices, on 2-wire cable as well as valve control wires are to be waterproofed using 3M Scotchcast Connector Sealing Pack 3570-N All splices shall be within a plastic valve box or splice box.

vi. A ground rod, 5/8 inch X 8 foot solid copper shall be required every 300- feet along the 2-Wire path as well as a single ground rod at the end of the cable run. Brass clamps specifically designed to secure the copper wire to the grounding rod shall be used. There shall be no kinks or sharp bends in the wire.

vii. A single controller shall be able to operate up to 70, 2-station decoders and it shall be intended that all wire runs between valves and 2-Wire decoders shall be direct pulls and have no splices except at the decoder location.

viii. The station decoder shall be a 2-station decoder, Calsense CS-2W-2ST, able to operate 2-solenoids using unique colored wires for each.

ix. The point of connection decoder shall be Calsense CS-2W-POC, able to operate the master valve and flow sensor.

x.

7. Automatic Controller Assembly

a) Confirm with BMT and Facilities Team if an existing field controller will be used on the project or if the contractor is responsible for supplying an irrigation controller.

b) Campus Standard Central Control Irrigation Controller: Calsense CS3000. Contractor to follow all Calsense installation directions. Calsense representative to certify proper installation and equipment operation before commencement of 90-day maintenance period.

i. Wall mount irrigation controller standard installation. Controller to be mounted within an equipment room or utility area safe from vandalism and within 300 feet of a Campus network intermediate distribution frame (IDF) room.

ii. Calsense Irrigation Controller to be equipped with CS3-2W-OPT Interface for 2-Wire Operation

iii. Central Control Communication Standard: Central Control Communication via 10/100 Mbps Ethernet Device, Calsense CS3-EN.

iv. Controller to Controller Communication via Calsense Spread-Spectrum radio CS3-SR

v. Calsense Flowsense Option, CS3-FL, for flow sharing communication

8. Gate Valves

a) 2-1/2 inches and smaller: Bronze, Non-rising stem, Threaded Gate Valve, Nibco . Dura Coupling Manifold System O-ring mipt x swivel union on either side of valve.
b) 3 inches and larger: ASTM A126 Class B iron body, 150 pound O.W.G., with flanged joints, non•rising stem, bolted bonnet, and double disc, equipped with operating nut, or as otherwise approved.
c) Gate valves 2.5" and larger are to have all metal components wrapped in 10 Mil plastic and set in concrete to provide support.

9. Thrust Block Construction: All pipe, fittings, and valves shall be carefully placed in the trenches with concrete thrust blocks to be poured at all fittings that result in a change of flow direction in the main line on pipe larger than three (3) inches. Any concrete that is judged to be of inferior quality shall be replaced at OWNER's request. The thrust blocks shall be left exposed for forty eight (48) hours for inspection.

10. Quick Coupling Valves

a) Two piece type brass body, 150 pound class, with 3/4 inch female threads opening at base, permitting operation with a special connecting device (coupler).

i. Coupler Threads: Lug type.
ii. Hinge Cover: Provide with purple thermoplastic cover.
iii. Cover is to be permanently marked with "DO NOT DRINK!" warnings in English and Spanish.

11. Pop-up Spray Heads

a) Head is to be similar in all respects to type noted in legend on drawing.
i. Rainbird Institutional RD 1800, designed for harsh conditions, recycled water, and high pressure operation
ii. Body is to be plastic with 1/2 inch i.p.s. side and bottom inlets - use bottom inlet only.
iii. Utilize Rainbird Rotary nozzles where design will allow
iv. Nozzle is to be plastic, adjustable, with degree of arc as noted on drawings.
v. Nozzles on shrub heads is to rise either 6 or 12 inches, as noted on drawings.
vi. Where noted on plans, body is to be equipped with built-in check valve and pressure regulator.

b) Provide adjustable arc nozzles for all heads where a standard arc pattern would overspray onto buildings or adjacent hardscape. Use bottom inlet for heads only - do not use side inlet.

c) Pop-up sprinkler heads are to be installed on a triple swivel riser consisting of (3) PVC SCH 40 1/2" street elbows with a minimum of a 6" threated PVC Nipple and a 12" nipple on 12" pop-up assemblies.

12. Gear Driven Heads

a) Heads is to be similar in all respects to types noted in legend on drawing.
b) Body is to be plastic pop-up gear driven type with stainless steel risers and screwed bottom inlet. Provide with arc and radius adjustment screws.
c) Nozzles is to be plastic interchangeable, low angle trajectory, as noted in legend on drawings.
d) Provide built-in check valve and pressure regulator where noted on plans.
e) Provide stainless steel body

13. Drip Irrigation Components

a) Drip Line System:

i. Netafim 17mm Diameter Drip Line Tubing TECHLINE HCVXR-RW: .77 GPH, 12" on center drip emitters factory installed with technology to prevent roots entering the emitters, check valves to prevent back-siphonage, placed 4"-6" beneath soil/mulch layer. Rainbird GS50, Galvanized Stakes placed 2' on center to anchor tubing to the ground securely. Purple stripes on brown tubing to indicate recycled water use.
ii. Drip tubing not placed within dripline of trees equipped with tree pop-up bubblers.
iii. Netafim 17mm drip line barbed fittings utilized for tubing tees, elbows, couplings, and transitions to hard piping.
iv. PVC SCH 40 header system linking drip tubing to valve water source and exhaust header linking drip tubing to manual flush valve, Netafim automatic flush valve, Model TL050MFV-1
v. Manual flush valve to be located at furthest point from water valve source. Flush valve to be located in a 7"purple valve box with gravel base. Valve box to be branded:"RECLAIMED WATER CAUTION DO NOT DRINK" in English and Spanish, international symbol "Do Not Drink" a glass of water with a slash through it,
vi. NETAFIM Techline CV Operational Pressure Indicator Mister Stake located adjacent to the remote control valve. Netafim model 10-CV-01. Techline HCVXR and CV Mister: Fogging Nozzle Emits A Fine Mist. Indicates system operation and minimum required system pressure. Creates A Moistened Area Surrounding The Fogger Showing zone operation. Operation, techline HCVXR emitters open at 21.8 psi line pressure CV emitters open at 14.5 psi line pressure. Indicator stake's check valve opens and activates the fogging nozzle at 22 psi line pressure. Fogging rate: less than 2.0 GPH, creating

a moistened area approximately 2’ outward from nozzle. Check Valve: opens at 22 psi, closes at 10 psi. Fogging nozzle maximum flow rate: 2.0 GPH @ 60 psi. Pre-assembled with fogging nozzle, check valve, anchoring stake, tubing and barb connector.

14. Valve Boxes
    a) Provide type and size for all valves as noted on the drawings. Boxes are to be fabricated from a durable plastic resistant to weather, sunlight, and chemical action of soils and is to be purple in color, Carson or approved equal. Heat Branded:"RECLAIMED WATER CAUTION DO NOT DRINK" in English and Spanish, international symbol “Do Not Drink” a glass of water with a slash through it, Cover to be lockable with bolt or similar mechanism.
    b) Gate valve boxes is to be round. Heat stencil "GV" on lid.
    c) Remote control valve boxes is to be rectangular. Heat stencil "RCV", "RECLAIMED WATER CAUTION DO NOT DRINK" in English and Spanish, international symbol “Do Not Drink” a glass of water with a slash through it, and correct control station number (as connected to controller) on lid. Cover to be lockable with bolt or similar mechanism.
    d) Quick coupler valve boxes is to be round. Heat stencil "QCV" and "RECLAIMED WATER CAUTION DO NOT DRINK" in English and Spanish, international symbol “Do Not Drink” a glass of water with a slash through it on lid. Boxes to have locking covers with bolt of similar mechanism.

15. Reclaimed Water Identification Tags

    a) Provide purple plastic reclaimed water warning tags. Tags is to be permanently marked "RECLAIMED WATER - DO NOT DRINK" in English and Spanish. Marked international symbol “Do Not Drink” a glass of water with a slash through it.
    b) In addition to reclaimed water tags, also provide a separate station identification tag.
    c) Tags is to be permanently marked with the correct control station number (as connected to controller).
    d) All tags is to be permanent, non-corrosive, plastic, as manufactured by Christy's or approved equal.
    e) Provide at all remote control valves inside valve boxes & attach to valve.

2.2 PIPES, TUBES, AND FITTINGS

A. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 40.

1. PVC Socket Fittings: ASTM D 2466, Schedule 40.

2.3 POINT OF CONNECTION EQUIPMENT

1. Gate valve installed at point of connection to isolate system.

2. Long Beach Water Supplies Recycled Water at 60 PSI or less. Depending on system design and demand a booster pump maybe required. Campus standard is SiteOne designed and specified booster pump.

3. After booster pump and before master valve and flow sensor, Yardney above ground basket strainer to prevent sediment and debris from entering the irrigation system from the city source.

4. Master Valve Specification: Griswold Normally Closed Brass DWS Valve

5. FLOW METER: Calsense PVC-FM. Flow-sensor/flow meter. Follow manufacturer specifications for sizing and installation.

6. EZ-Flo Fertigation System sized by manufacturer and installed to manufacturer guidelines. System to be installed, commissioned, loaded, and operated by the contractor upon installation and through the 90-day maintenance period.

2.4 AUTOMATIC REMOTE CONTROL VALVES

A. Glass filled nylon constructed, Automatic Control Valves:

1. General Application and Description: Rainbird PESB Irrigation Remote Control Valve designed for 2-Wire Applications, Body constructed of durable glass-filled nylon for long life and heavy-duty performance at 200 psi (13.80 bar) pressure. Stainless steel studs molded into the body. Bonnet can be attached and removed more easily without damaging threads. One-piece solenoid design with captured plunger and spring for easy servicing. Prevents loss of parts during field service. External bleed protects the solenoid ports from debris when system is flushed. Internal bleed operates the valve without allowing water into the valve box; allows pressure regulator to be adjusted without turning on the valve at the controller first. Nylon scrubber scrapes a stainless steel screen to clean and break down grit and plant material. Low flow operating capability.

2. Small to Medium Drip Zone Applications, .3-20 GPM: Rainbird XCZ100PRBCOM - Wide Flow Commercial Control Zone Kit with 1 in. Ball Valve, 1 in. PESB Valve & 1 in. Pressure Regulating (40 psi) Basket Filter. Wide Flow Commercial Control Zone Kit with 1 in. Ball Valve, 1 in. PESB Valve & 1 in. Rainbird Quick Check PRB-QKCHK-100 Pressure Regulating (40 psi) Basket Filter. Additional fittings to add to the assembly: (3) Dura Swivel Manifold 1” FPT x O-Ring MPT332-010 Swivel Fitting 1” X 1” NPT Adaptor before and after the ball valve and after the basket strainer.

3. Large Drip Zone Applications, 15.0–40.0 GPM: Rainbird XCZ-PRB-150-COM, (1) Rainbird 1.5” PESB Valve, manifold fittings, and two 1 in. Rainbird Quick Check PRB-QKCHK-100 Pressure Regulating (40 psi) Basket Filter. Additional fittings: pressure side of valve, (1) 1.5” PVC Ball Valve, and (2) Dura Swivel Manifold 1.5” FPT x O-Ring MPT332-015 Swivel Fitting 1.5” X 1.5” NPT on either side of the remote control valve, down-stream of basket strainers (2) Dura Swivel Manifold 1” FPT x O-Ring MPT332-010 Swivel Fitting 1” X 1” NPT

2.5 POP-UP SPRINKLERS

A. General Requirements: Primary irrigation delivery through drip irrigation systems. Sprinkler heads only installed when irrigating trees with bubbler nozzles, for specimen plants which require overhead irrigation, and turf areas. Turf nozzles are to be low precipitation “rotator” type nozzles.

B. Pop-up assemblies for Tree Irrigation: Do not utilize “deep root watering” pre-manufactured systems such as Rainbird Root Watering System RWS for palm tree and specimen tree irrigation. Campus standard of (2) Rainbird RD-1806 SAMPRS with Rainbird 5FB Nozzle placed minimum of two feet from outside edge of the tree root ball on opposite sides for 15-gallon and 24” box trees. (4)-(6) pop-up units for 36” and greater box sized trees as well as large palm tree installations.

2.6 QUICK COUPLERS

A. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler waterseal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

1. Locking-Top Option: Vandal-resistant locking feature. Include two matching key(s).

2.7 DRIP IRRIGATION SPECIALTIES

A. Dripline

1. Flexible tubing to be Techline by Netafim or equal

B. Freestanding Emitters: Device to deliver water at approximately 20 psi.

1. Body Material: PE or vinyl, with flow control.

2. Riser to Emitter: PE or PVC flexible tubing.

C. Drip Tubes with Direct-Attached Emitters:

1. Tubing: Flexible PE or PVC with plugged end.

2. Emitters: Devices to deliver water at approximately 20 psi.

a. Body Material: PE or vinyl, with flow control.

b. Mounting: Inserted into tubing at set intervals.

2.8 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:

1. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade. To be installed within at-grade planting areas.

a. Size: As required for valves and service.

b. Shape: Rectangular

c. Sidewall Material: PE

d. Cover Material: PE.

e. Lettering: IRRIGATION

2.9 PREPARATION

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

2.10 PIPING INSTALLATION

A. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

B. Install piping free of sags and bends.

C. Install groups of pipes parallel to each other, spaced to permit valve servicing.

D. Install fittings for changes in direction and branch connections.

E. Install (2) Dura Brand Swivel X MIP unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

F. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.

G. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

H. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install in control-valve boxes.

I. Water Hammer Arresters: Install between connection to building main and circuit valves above ground or in control-valve boxes.

J. Install piping in sleeves under parking lots, roadways, and sidewalks.

K. Install sleeves made of Schedule 40 PVC pipe and socket fittings, and solvent-cemented joints. Sleeves sizes to be correlated with irrigation piping.

L. Install Green 14-Guage direct burial irrigation wire the entire length of the pressurized mainline. Tape wire to the mainline at 5’ intervals. Bond all wire together with loops in each valve box, gate valves, ball valves, point of connection, and termination point of mainline.

2.11 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

D. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

E. PVC No pressure Piping: Join according to ASTM D 2855.

2.12 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

C. Install multiple-outlet emitter systems with tubing to outlets. Plug unused emitter outlets. Install outlets on off-ground supports.

D. Install drip tubes with direct-attached emitters on ground.

2.13 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Utilize existing Calsense ET CS3000 with 2-Wire option.

2.14 CONNECTIONS

A. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

B. Connect wiring between controllers and automatic control valves.

2.15 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Any irrigation product will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

2.16 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify that controllers are installed and connected.

3. Contact Calsense Representative to visit site and perform a controller installation certification. Calsense: 760-438-0525. Project not approved to begin 90-day maintenance until Calsense controller, valves, and wiring are certified by a Calsense Service Representative.

4. Verify that electrical wiring installation complies with manufacturer's submittal.

2.17 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices.

2.18 CLEANING

A. Completely flush irrigation mainline to remove debris, grit, and other contaminates within the piping. At the end of the mainline or at the furthest point in a lopped system, provide a valve box with a 2" ball valve and 1.5" fire hose connection. This valve will be used to flush the system and remove air from the lines.

B. Completely flush dirt and debris from piping before installing sprinklers and other devices. Completely flush drip irrigation laterals before installing drip tubing.

C. Provide an automatic flush valve at the furthest point from the irrigation control valve on each drip irrigation zone.

2.19 DEMONSTRATION

A. Inform Owner's maintenance personnel as to the general operation of the system including controller and valves.

B. Before start of 90-day maintenance period conduct walk-through with architect, BMT, and Facilities Manager to indicate and confirm:

1. Irrigation Coverage Test as Designed

2. Location of each remote control valve and confirm remote control operation via irrigation controller.

3. Location of drip irrigation control valves, air release valves, flush valves, and operation indicator flags.

2.20 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes may be joined with flanges or unions instead of joints indicated.

C. Underground irrigation main piping, Schedule 40 PVC.

3.01 – EXECUTION

3.1 SITE REVIEW

A. Examine site for conditions that will adversely affect execution, permanence, and quality of work.

1. Verify that grading has been completed and the work of this section can properly proceed.

2. Exercise extreme care in excavating and working near existing structures, utilities, underground piping and conduits, and over waterproofing membrane. Contractor is responsible for damages that are caused by his operations or neglect. Check existing utility drawings for locations.

3. Determine locations of points of connections to all piping installed by others, and determine that pressure supply is available for work of this Section.

B. All scaled dimensions are approximate. The Contractor is to check and verify all size dimensions prior to proceeding with work under this Section.

C. Notify the Architect of any unacceptable conditions preventing the start of work.

D. Do not proceed with work until unacceptable site conditions are corrected or existing utilities are located.

E. General:

1. Notify BMT in writing at least 48 hours before testing will be conducted Conduct tested in presence of the BMT/IOR.

2. Perform work on the irrigation system, including hydrostatic and coverage tests, preliminary operational test of the automatic control system, and the backfill and densification of trenches and other excavations after topsoil work and before planting.

3. Prior to installation, stake out pressure supply line routing and locations of spray heads, tree bubblers, Low flow irrigation system lines.

4. Plant large specimen plants (24 inch box or larger) before installing the irrigation system; reroute irrigation lines conflicting with specimen plant locations to clear the root ball by a minimum of three feet.

5. With the BMT's approval, make adjustments where necessary to conform to actual field conditions unless otherwise noted. Irrigation system layouts shown on Drawings shall be considered schematic or diagrammatic.

6. Make the irrigation system operational with uniform coverage of the areas to be irrigated, prior to planting.

7. Piping on Drawings shown in paved areas running parallel or adjacent to planted

areas, are intended for design clarification only and shall be installed in the planted area whenever possible.

8. Irrigation valves are to be located in planter areas whenever possible. Irrigation valve location within turf areas is to be avoided.

9. Make water and utility connections as shown on Drawings or as approved by the BMT. If utility connections are not shown on Drawings, Design Builder shall estimate 100 feet to each service point. Replace sidewalks, curbs, or paving removed by the installation of the water and electrical meters and service.

3.2 WORK PROCEDURES:

Contractor shall follow local building codes, customary practices and as follows:

A. Preparation, prior to rough grading by Sect. 02200:

1. Locate and cap existing transite main line, below grade, to isolate new work areas from existing irrigation system. Maintain operation of irrigation to existing landscape areas that are to remain, and are not a part of this contract. Refer to Spec. Sect. 02060 for requirements for abatement and disposal of transite pipe resulting from capping of line. Balance of existing transite pipe, no longer operational, to be abandoned below grade, in place. Record location, both vertically and horizontally, on Record Drawings.

2. Remove, salvage, and deliver to District all existing irrigation heads and control valves in areas where new irrigation occurs.

3. Remove all old irrigation mainlines, laterals, sprinkler heads, drip tubing, wiring, and any other components where possible.

4. General, New Work: The Contractor shall connect to existing water supply as shown on the Drawings and as necessary to carry out the intent of the Drawings and Specifications. Check location of lines, valves, other underground utilities, etc., and receive approval of College's Representative before any installation. The Contractor shall check and verify existing water pressure and available gallonage before starting Work and shall inform the Architect if not adequate as designed.

5. Trenches, Subgrades, and Backfill: Excavate trenches, prepare subgrades and backfill true to line and grade with sufficient room for pipe fittings, testing, and inspection operations. Cut bottom of trench so that pipe barrel rests uniformly on trench bottom. Do not backfill until pipe system has been subjected to a hydrostatic test as specified.
6. Thrust blocking of piping 2.5" and above. Contractor to install thrust blocks on irrigation mainlines when the piping changes direction or elevation at pipe fittings. Metal valve and couplers must be wrapped in 10 mil plastic and correctly taped before concrete is poured over the pipe and fitting.

B. Existing Irrigation Mainline

1. The scope of work includes cutting and capping of existing irrigation lines. At the commencement of the project the Contractor is to set up a meeting with the Landscape Architect and the Owner's Representative to discuss the exact locations for cutting and capping

existing lines.

2. The Contractor is to ensure that all adjacent landscaped areas receive irrigation water throughout the entire construction period. The Contractor is to install temporary irrigation lines as required to ensure there is no interruption in water delivery to adjacent planted areas.

3. Contractor to keep live mains which feed other campus landscapes but reside within the project areas active at all times. If the contractor plans on shutting down a main which feeds another campus area, twenty-four-hour notice must be given to the Facilities Representative. If an unexpected shut-down of the mainline is required, the contractor is responsible to immediately contact the Campus Facilities Representative.

C. Point of Connection

1. Connect to water supply points of connection at locations shown on the drawing and make any minor changes in location necessary due to actual site conditions as a part of this contract.

D. Layout

1. All piping or equipment shown diagrammatically on the drawing outside of planting areas is to be installed inside planting areas whenever possible.

2. Lay out each sprinkler head and make any minor adjustments required due to differences between actual site conditions and the Drawings. Minor adjustments is to be maintained within the original design intent.

3. Lay out each system using staking method as approved by Architect. Maintain and protect approved staking layout

E. Line Clearance

1. Provide not less than 4 inches clearance (horizontal and vertical) between each line and not less than 6 inches clearance between lines of other trades, unless otherwise noted.

2. Do not install parallel lines directly over any other line.

3. All pressure mainline piping from the reclaimed water system is to be installed to maintain 10 feet minimum horizontal separation from all potable water piping. Where reclaimed and potable water pressure mainline cross the reclaimed water piping is to be installed below the potable water piping in a class 200 purple PVC sleeve which extends a minimum of 5 feet on either side of the potable water piping. Provide a minimum vertical clearance of 6 inches.

F. Backfilling

1. Size trenches and other excavations to accommodate the irrigation system components, conduits, and other required facilities. Provide additional space to assure proper installation and access for inspections.

2. Trenching for irrigation system shall be done after completion of soil conditioning and finish grading operations.

3. Unless otherwise specified, the minimum depth of cover over pipelines and conduits shall be as follows:

a. Electrical conduit: 24 inches (36 inches under roadways, driveways, and parking lots).

b. Waterlines continuously pressurized: 18 inches (36inches under roadways, driveways and parking lots).

c. Lateral sprinkler lines: 12 inches. (36 inches under roadway and parking lots)

d. Where subslab conflicts, install as deep as possible.

4. Make the bottom of trenches true to grade and free of protruding stones, roots, or other matter which would prevent bedding of pipe or other facilities.

5. Trenches shall not be backfilled until required tests are performed.

a. Backfill trenches so that the specified thickness and density of the topsoil is restored throughout the entire depth of the trench.

b. Backfill may be flood compacted in landscaped areas to a dry density equal to adjacent soil in planting areas. Backfill shall join flush to adjacent grades without dips, sunken areas, humps or other surface irregularities.

c. Mechanical compacted backfill shall be by means of hand-directed mechanical tampers in 4 inch lifts or roller equipment including sheeps foot, grid, smooth wheel (nonvibratory), pneumatic-tired (non-vibratory), and segmented wheel in maximum 12 inch lifts.

6. Compact trench backfill through paved areas in 8-inch layers to 90 percent relative compaction up to sub grade to receive paving and base material.

a. Resurface trenches through paved areas to match existing pavement.

7. If settlement occurs and subsequent adjustments of pipes, valves, irrigation heads, planting areas, or other construction are necessary, Contractor shall make required adjustments without additional cost to the Owner.

8. Buried pipe in trenches is to be center loaded only until all required tests are performed. Trenches is to be carefully backfilled with excavated materials approved for backfilling; consisting of earth, loam, sandy clay, sand or other approved materials, free from large clods or stones.

9. Initial Backfill: Clean, fine granular material as approved by the Landscape Architect. No foreign matter larger than 1/2 inch will be permitted in the initial backfill.

G. EXISTING PAVEMENTS

1. Piping under existing pavements may be installed by jacking, boring, or by hydraulic driving, except as otherwise specified or directed
2. Secure Owner's permission prior to cutting or breaking existing pavements.
3. Make completely clean cuts using power saws, at approved locations only.

4. Replace and restore all surfaces to original condition, including grade and landscaping. Restoration work is to match the original work in every respect, including type, strength, texture and finish.

H. NEW PAVED AREAS

1. Install all main line under paving and slabs in PVC sleeves sized large enough to permit easy extraction without the use of power equipment.

i. Provide a separate parallel sleeve for control wire.

2 .If the only piping installed is over 20 feet long, pressure testing is required for that section at the time of installation. Upon completion of piping installation, the entire system must be tested. If wires under paved areas cannot be continuous, all splices must be enclosed in an approved box.

I. INSTALLATION

1. All plastic pipe and fittings is to be installed in complete accord with manufacturer instructions.
2. Routing of main lines as indicated on the Drawings is diagrammatic. Install lines and assemblies to conform to details on the plan.
3. Installation of Piping:
   i. Plastic Pipe with Threaded Fittings: Assemble using teflon tape applied to male threads only.
   ii. All PVC pipe and fitting is to be thoroughly cleaned of dirt, dust and moisture prior to installation. Installation and solvent welding methods is to be as recommended by the pipe & fitting manufacturer.
   iii. Tape all open ends of pipe to prevent entry of any foreign matter into the system.
   iv. On PVC to metal connections, the Contractor is to work the metal connections first. Use teflon tape on all threaded PVC to metal joints.
   v. Bed pipe in at least 2 inches of finely divided soil to provide a firm, uniform bearing. Surround the pipe with additional finely divided soil to at least 2 inches over the top of the pipe.
   vi. 3Deposit trench backfill to anchor the pipe before the pipeline pressure testing, except that joints shall remain exposed until satisfactory completion of testing.
   vii. When 2 or more pipelines are installed in the same trench, separate the pipelines by a minimum horizontal clear distance of 4 inches. Install them so that each pipeline, valve, or other pipeline component may be serviced or replaced without disturbing the other.
   viii. Make assemblies as specified and in accordance with the manufacturer's directions or as detailed on Drawings.
   ix. During installation of pipe, fittings, valves, and other pipeline components, prevent foreign matter from entering the system. Temporarily cap or plug open ends at cessation of installation operations.
   x. Make changes in pipeline size with reducer fittings. Do not use close nipples or bushings.
   xi. Place mainlines under paving in Schedule 40 PVC sleeves. Oversize the sleeves

2.5x to house the pipe, fittings, and control wires.

xii. Separate dissimilar metals by an approved "Dielectric" coupling.

4. Plastic Pipeline:

i. Join plastic pipe with socket type solvent welded fittings, threaded fitting, rubber ring fittings or by other means specified. Install steel pipe first when plastic pipe is joined to steel pipe.

ii. Cut pipe using a pipe cutter, do not use a saw. Cut square, externally chamfer approximately 10 to 15 degrees and remove burrs and fins.

iii. On PVC to metal connections, work the metal connections first. Teflon tape or approved equal, shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints.

iv. Make solvent welded joints in accordance with ASTM D2855. Use the primer and solvent recommended by the pipe manufacturer. Do not use solvent with threaded joints. Christy's Purple Primer, Weld-On 711 Industrial Grade Low VOC PVC Solvent Cement.

v. Install plastic pipe in accordance with ASTM D2774 and the requirements herein.

vi. Exercise care in assembling pipeline with solvent welded joints so that stress on previously made joints is avoided. Handling of the pipe following jointing, such as lowering the assembled pipeline into the trench, shall not occur prior to the set times specified in ASTM D2855.

vii. Apply primer and solvent to pipe ends so that no material is deposited on the interior surface of the pipe or extruded into the interior of the pipe during jointing. Wipe off excess cement on the exterior of the joint immediately after assembly. Install No multiple assemblies in plastic lines. Provide each assembly with its own outlet.

viii. Protect pipe from tool damage during assembly. Use vises with padded jaws and strap wrenches for installation of fittings and nipples.

ix. Remove and replace plastic pipe which has been nicked, scarred, or otherwise damaged.

x. Snake plastic pipe from side to side in the trench to allow 1 foot of expansion and contraction per 100 feet of straight run.

xi. Do not expose the pipeline to water for 24 hours after the last solvent welded joint is made.

5. INSTALLATION OF VALVES, VALVE BOXES, AND SPECIAL EQUIPMENT

i. Install valves and equipment in accordance with the details in a normal upright position, unless otherwise recommended by the manufacturer, and make readily accessible for operation, maintenance, and replacement.

ii. Install valves of the same size as the pipeline in which they are installed, unless otherwise indicated on Drawings.

iii. Install shut-off valves and sectional automatic control valves using SCH80 PVC unions, below ground.

iv. Install quick-coupler valves and hose bibs projecting above grade 1 foot from curbs, pavement, and walks when possible.

v. Set valve boxes to finish grade on a minimum 12 inch deep layer of gravel and set valves at depth to provide clearance between the cover and valve handle or key when the valve is in the fully open position. Do not cover valve with gravel.

vi. Install a line sized shut-off valve on the pressure side of all sectional remote control valve.

vii. Install a line size shut–off valve in a 10 inch diameter valve box on the up-stream side of main lines crossing streets.

viii. Sprinkler Heads: All sprinklers is to be installed flush with finish grade unless otherwise noted. Spacing of heads is to not exceed the maximum shown on the drawings.

ix. Automatic Controller: Install as per manufacturer's instructions. Remote control valves is to be connected to the controller in the sequence as shown on the drawings.

x. Drip Tubing and Emitters:

a) Locate bubblers at edge of plant root ball. In most cases this means plant pit should be dub prior to trenching for bubbler lateral line.

b) Drip-line tubing shall be installed on surface of soil, and buried in mulch wherever possible.

c) All lines shall be thoroughly flushed prior to placement of bark.

6. IRRIGATION HEAD INSTALLATION AND ADJUSTMENT

i. Flush and pressure test mains and laterals, and risers before installing irrigation heads, Low Flow Irrigation System and Tree Bubblers and before performing water coverage test to the complete satisfaction of the BMT.

ii. Location, Elevation and Spacing:

a) Install the spray heads in accordance with Drawings.

b) Spacing of spray heads shall be installed for head to head coverage. In no case shall the spacing exceed the maximum recommended by the manufacturer.

c) Install irrigation heads adjacent to curbs, walks, paving, and similar improvements on pop-up spray bodies with tops set flush to finished grade.

iii. Riser installation:

a) Install check valves when elevation changes from 5' or greater.

iv. Irrigation Head Adjustment:

a) When irrigation heads are installed and the irrigation system is operating, adjust and balance each section or unit with section control valves fully open to obtain uniform and adequate coverage.

b) Flush and adjust all Sprinkler Heads, Tree Bubbler and Low Flow Irrigation for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.

c. At no time shall the irrigation system to spray water on pavement and structures.

7. CONTROLLER SYSTEM CONNECTION

i. House control wiring in a conduit between the controller and an electrical pull box at the base of the controller. House control wire under paved areas in a Schedule 40 PVC pipe sleeve. Other wiring issuing from the electrical pull box shall be direct burial, installed in the main or\ lateral waterline trenches wherever practicable.

ii. Color code common wire white with control wires red in color. Make splices in control wire with approved waterproof connectors in accordance with the requirements for service wire. Leave at least 2 feet of coiled slack at each splice and point of connection inside the valve boxes.

a. Test wiring for continuity, open circuits, and unintentional grounding prior to connection to equipment.

iii. Leave the control system in operating condition with an operational chart mounted within the controller cabinet upon completion of the work.

iv. Control Valves: Locate control valves in close proximity to walks or to accessible areas; control valves shall never be more than 12" from walks or nearest access as indicated on Drawings and in a manner to make them accessible to manual operations without interference of water spray from heads.

v. Quick Coupling Valves: Install all quick coupling valves as indicated on Drawings and to conform to the full intent and meaning of the Drawings and the Specifications.

vi. Pipe: All pipe shall be laid true and accurate to grade with full length of pipe section lying solidly on a firm base. If grade or joint of pipe is disturbed after laying, it shall be taken up and re-laid.

vii. Clean interior of pipe thoroughly and remove all dirt or foreign matter before lowering pipe into trench, and keep clean during operations by plugs or other approved method. The ends of all threaded pipe shall be reamed out full size and with a long taper reamer so as to be partially bell-mouthed and perfectly smooth. All offsets shall be made with fittings. All water lines shall be thoroughly flushed out before the heads are installed.

viii. Threads on pipe shall be cut with sharp clean dies to conform to American Standards Association Specifications and so that not more than 2 threads are left exposed on the pipe.

ix. Joints in all screwed metallic and metallic to plastic piping shall be made by applying specified pipe joint compound tape to the threaded end with one-half inch lapping before screwing joints together.

x. Do not lay pipe in water or mud. Keep ends of pipe securely closed when work is not in operations to prevent water or other matter from entering the lines.

xi. Long runs of PVC pipe shall be slightly snaked in the trench to allow for contraction.

xii. Replace without cost to the College any pipe that is found to be defective.

xiii. Provide unions and fittings as necessary to make all connections to existing lines and to complete Work as intended on the Drawings.

xiv. Install dielectric couplings and flanges as required at the junction of pipes or fittings made of dissimilar metal.

xv. Risers to sprinkler heads shall be schedule 80 PVC, or as shown in the details, and

offset from laterals as indicated on the Drawings.

xvi. All sprinkler heads next to walks, paths, parking areas, and any areas where people normally walk shall be the pop-up type. No fixed sprinkler risers shall be installed next to such walks, paths, or parking areas.

xvii. Solvent weld joints will be made as follows:

a. Good square cuts, clean and free of debris and shavings and moisture.

b. Main Line Only: Apply p-70 Weldon or equal. Finish make up of joint using Weldon 711 or equal. Hot glue will not be permitted.

1. Tests: Test all sprinkler mains after pipe is laid and joint completed by submitting to a pressure test of one and one half times existing static pressure in the presence of the College's Representative. Do not backfill any trench until the College's Representative has approved the test.

ii. Repair any leaks until lines meet test requirements and the College's Representative's approval. All laterals shall be tested under main pressure for leaks; any leaks shall be repaired. All tests with the exception of the laterals shall be for a duration of 4 hours with a maximum drop of 4 psi allowed.

xviii. Flushing of System:

a. Flushing: After completion, and prior to the installation of terminal fittings, flush the entire pipeline system to remove dirt, scale, or other material. After flushing, conduct the following tests in the sequence listed below. Provide equipment, materials, and labor necessary to perform the tests. Conduct tests in the presence of the BMT.

i. Pipeline Pressure Test: Perform a water pressure test on pressure mains before couplings, fittings, valves, and the likes are concealed. Cap open ends after the water is turned on to the line so that the air will be expelled. Test pressure mains with control valves to lateral lines closed. The constant test pressure and the duration of the test are as follows:

b. Pressure line (Mainline): 4 hours at 150 psi.

i. Spray Coverage Test: Perform the coverage test in the presence of a DISTRICT/BMT after sprinkler heads have been installed and before groundcover has been planted, to demonstrate that each section or unit in the irrigation system is complete and balanced to provide uniform and adequate coverage of the areas serviced. Correct deficiencies in the system.

ii. Operational Test: Evaluate the performance of components of the automatic control system for manual and automatic operation. During the maintenance period, and at least 15 days prior to final inspection, set the controller on automatic operation so that the system will operate during such period. Make repairs, replacements, and adjustments until equipment, electrical work, controls, and instrumentation are functioning as specified.

1. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion Work has been

completed, and prior to installation of sprinkler heads, the control valves shall be opened and full head of water used to flush out the system.

2. Sprinkler heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Architect.

J. COVERAGE TESTS

1. Perform coverage tests after sprinkler system is completed, but prior to any planting, in the presence of the Landscape Architect. System coverage test must occur before start of 90-day maintenance period.
2. Test system to assure that all planting areas are watered completely and uniformly. Make all necessary adjustments, including realignment and relocation of heads, to provide required coverage as directed by the Architect. Coverage test includes turning on the irrigation controller and noting the corresponding valve on the architectural drawings activates.
3. Sprinkler Heads: Install sprinkler heads as directed. Where they adjoin the edges of walks, set turf pop-up heads in 2" from edge and shrub and rotor heads 6" in from edge. Special conditions for installing heads shall be as shown on the Drawings.
4. Space the sprinkler heads as shown on Drawings or as directed and as necessary to gain full water coverage of the sprinkler areas. Adjust heads as necessary, changing sizes and nozzles until Work is approved.
5. Add sprinkler heads as needed or as directed for full water coverage of all areas without extra cost to the Owner.
6. Make final adjustments of all sprinkler heads after soil has settled.
7. Finish Grade: Bring all areas excavated for the installation to a neat and true finish grade to match adjoining areas.
8. Repairs Due to Damage from Tilling Prior to Planting: Per Spec. Sect. 02900, Art. 3.03, all tilling shall be completed prior to adding conditioners and fertilizers, unless occupied by existing trees that remain in place. Any part of the irrigation system, including heads, damaged during tilling shall be replaced with new equipment. Leave entire installation in complete working order, free from any and all defects in material, workmanship, or finish.
9. Irrigation Controller Station: Install as detailed; provide all conduit and wire required to complete the connection to existing on site power; make final connections and start up. Provide training and demonstrate operation to District maintenance staff.
10. Completion: Leave entire installation in complete working order, free from any and all defects in material, workmanship, or finish, regardless of any discrepancies and/or omissions in Drawings and Specifications.

11. Install reclaimed water warning tape continuously for the entire length of all constant pressure mainline piping. The tape is to be attached at the top of the pipe with plastic tape banded around the warning tape and the pipe every five feet on center.
12. Install all specified assemblies in accordance with the Drawings. In absence of detail drawings or specifications pertaining to specific items required to complete the work, perform such work in accordance with best standard practice, as approved by the Architect.

3.3 FINAL INSPECTION PRIOR TO ACCEPTANCE

A. Operational Test:

1. Evaluate the performance of components of the Automatic Control System for manual and automatic operation. During the maintenance period, and at least 15 days prior to final inspection, set the Controller on automatic operation so that the system will operate during such period. Make repairs, replacements, and adjustments until equipment, electrical work, controls, and instrumentation are functioning as specified.

B. Inspection for final acceptance of the irrigation system shall occur together with inspection for final acceptance of plantings at end of the Plant Establishment Period as specified in LANDSCAPING PLANTING Section.

C. Contractor shall operate each system for the BMT at time of final inspection. Items deemed not acceptable by the BMT shall be reworked to the satisfaction of the BMT.

D. Contractor shall show evidence to the BMT that the Owner has received accessories, charts, record drawings, and equipment as required before final inspection can occur.

E. Contractor shall make available hand held remote control for all field inspection

3.6 CLEANUP:

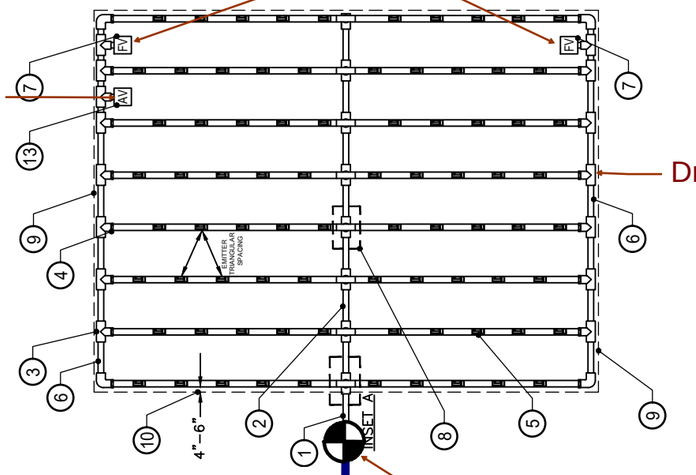
A. Clean-up shall be performed as each portion of Work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept or washed down, and any damage sustained to the Work of others shall be repaired and Work returned to its original condition to the satisfaction of the District and BMT.

Flush Valve

Air Vent

Drip Tubing

At the End of Main Line - 2" Ball Valve in Box for Flushing the System



Drip Filter & Pressure Regulator

New Point of Connection / Tie-In Valve

2 Wire Calsense Controller

Recycled Water Backbone

Pump

Filter

Flow Sensor

Mute Valve

New Main Line / 2 Wire Conduit

Valve & Decoder

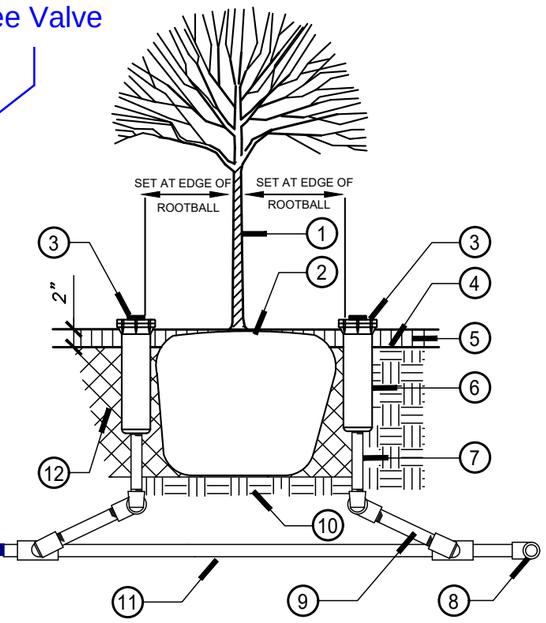
Palm Tree/ Tree Valve

EZ FLOW

Fertilizing System

Roter

Mini Fertilizing System



SECTION VIEW

LEGEND:

1. TREE TRUNK / PALM TREE.
2. TREE ROOTBALL.
3. IRRIGATION POP-UP HEAD WITH BUBBLER NOZZLE - RAINBIRD 5-Q.
4. FINISHED GRADE.
5. 2" LAYER OF MULCH, PER PLANTING PLANS.
6. IRRIGATION POP-UP HEAD - RAINBIRD RD INDUSTRIAL.
7. SCH 80 PVC THREADED RISER - LENGTH AS REQUIRED.
8. PVC LATERAL, PER PLAN.

RECYCLED WATER URBAN IRRIGATION

USER MANUAL

EDITION
2014

DEVELOPED BY:
LOS ANGELES
WATEREUSE
CALIFORNIA

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"On-Site" Supervisor Do's and Don'ts

Do's

- Install and maintain signs at all points of entry (both pedestrian and vehicular)
- Install and maintain labels and tags on recycled, non-potable and potable water systems
- Operate irrigation system:
  - Between 10 p.m. – 6 a.m., or when site is unoccupied, if automatically controlled (unless other restrictions apply)
  - At other times if manually controlled and supervised (that is, trained use site staff is present) to ensure the recycled water doesn't come in contact with the public
  - At any time if use site has restricted public access
- Use quick couplers instead of hose bibbs on recycled water systems
- Contact water purveyor if any water system (non-potable, potable or recycled) modifications are anticipated
- Immediately contact water purveyor, recycled water producer and local Health Department if any of the following has occurred:
- A recycled water line break, spill or off-site discharge of recycled water
- A violation of water recycling requirements
- A cross-connection between the recycled and potable water systems
- Educate/train site workers on safe use and restrictions of recycled water
- Keep site records and as-built drawings up-to-date and accessible
- Assist and cooperate during Periodic Visual Inspections
- Assist and cooperate during periodic Cross-Connection Testing

Don'ts

- Don't drink recycled water
- Don't use recycled water to wash hands or any other parts of body
- Don't remove recycled water identification signs, tags or labels
- Don't cross-connect two dissimilar water systems (recycled to potable)
- Don't allow recycled water to contact drinking fountains, eating areas, or any area in which food may contact the recycled water
- Don't allow recycled water to pond or puddle
- Don't allow excessive amounts of recycled water to runoff the use site property by either overspray or overwatering
- Don't use recycled water on an unapproved site
- Don't put hose bibs on recycled water systems (unless public access is restricted)
- Don't use the same equipment on both recycled water and domestic water systems (for example, quick couplers, tools, etc.)
- Don't modify any water system without prior approval of water purveyor and local Health Department

TABLE OF CONTENTS

FOREWORD

The Recycled Water Urban Irrigation User Manual (Manual) has been prepared to convey the general rules, regulations and guidelines regarding the safe introduction and use of recycled water for landscape irrigation in Los Angeles and other areas in the State of California. This document was prepared by the Los Angeles Chapter of the California Section of the WateReuse Association (LACWRA), which is comprised of water utilities, regulatory interests, and other entities interested in the safe introduction and use of recycled water. At the time of this publication, LACWRA included:

AECOM
Black and Veatch
Burbank Water and Power
California Department of Public Health
California Department of Water Resources
California Regional Water Quality Control Board
California State Water Resources Control Board
Calleguas Municipal Water District
Cannon
Carollo Engineers
Castaic Lake Water Agency
CDM Smith
Central Basin Municipal Water District
City of Cerritos
CH2M Hill
Dudek
Environmental Now
Eurofins Eaton Analytical
Forest Lawn
Glendale Water and Power
Irvine Ranch Water District
John Robinson Consulting, Inc.
Kennedy/Jenks Consultants
City of Lancaster
Las Virgenes Municipal Water District
LEE & RO, Inc.
Long Beach Health Department
Long Beach Water Department
Los Angeles Bureau of Sanitation
Los Angeles Department of Public Health
Los Angeles Department of Public Works
Los Angeles Department of Water and Power
Los Angeles Regional Water Quality Control Board
Metropolitan Water District of Southern California
MWH Americas, Inc.
NALCO
Newhall Land and Farming Company
Pacifica Services, Inc.
City of Palmdale - Public Works Program Management
City of Pasadena
City of Pomona
Precise Landscape Water Conservation, Inc.
Psomas
RBF Consulting, a Baker Company
Red Wolf Studio
RMC Water and Environment
Rose Hills Memorial Park
Rowland Water District
SA Associates
Sanitation Districts of Los Angeles County
City of Santa Monica
Sequia Technologies
Separation Processes, Inc. (SPI)
Surfrider Foundation
Test America
Three Valleys Municipal Water District
United Water
Upper San Gabriel Valley Municipal Water District
Valencia Water Company
City of Vernon
Walnut Valley Water District
Water Replenishment District of Southern California
WateReuse California
West Basin Municipal Water District

Each recycled water customers' representative ("Site Supervisor") is responsible to read and understand this Manual and any water reclamation requirements applicable to their particular site. Questions about the use of recycled water or the Manual should be directed to the "Recycled Water Agency" that serves the customer.

INTRODUCTION

PURPOSE

The purpose of this Manual is to provide the recycled water "User" and "Site Supervisor" a resource for the day-to-day operation and control of that system, in order to protect the health and welfare of the personnel involved with its use, as well as that of the general public, and to protect the quality of local water resources. Recycled water is an important resource for the State of California and, in many cases, its use for non-potable applications is mandated by State law. This Manual provides necessary information to meet existing regulations for the operation of the User's recycled water system.

Every effort has been made to ensure that this Manual is in compliance with, and is not intended to supersede, existing codes, laws, statutes and regulations of the State of California, Regulatory Agencies and local governing bodies, concerning the currently approved use of recycled water. This Manual is also not intended to supersede, but rather augment, the American Water Works Association (AWWA) California-Nevada Section's Guidelines for Distribution of Non-potable Water or Guidelines for the On-site Retrofit of Facilities Using Disinfected Tertiary Recycled Water.

Since legal and regulatory requirements can change without either the approval or knowledge of the Recycled Water Agency (the local producer or purveyor of recycled water), the Recycled Water Agency assumes no liability for errors in this Manual. It is the responsibility of the User to check with its Recycled Water Agency before initiating any operational or physical changes to the use site's system.

This Manual is organized in the following manner:

- The *User's Summary* provides a brief commentary on major topics and indicates a page number to find additional information.
- *General Provisions* covers the basic administrative requirements including authorities, responsibilities and liabilities.
- *Design and Construction* covers the considerations needed when an on-site recycled water system is first installed or modified.
- *Operation and Maintenance* covers the basic conditions for service contained in the State of California's Water Recycling Criteria.
- *Identification and Equipment* gives the basic requirements for marking the water systems and providing signage for the use area.
- *Cross-connection Controls* and *Pressure Testing Procedure* outline the requirements for protecting the potable water system and keeping it separate from the recycled water system.
- *Sample Forms and Site-Specific Details* provides a summary of steps to obtain recycled water, templates of sample forms to help with inspections and a location for information specific to the use site.
- *Local Governing Agencies* provides the names, addresses and phone numbers of agencies responsible for the regulatory administration of water recycling activities.
- *Definitions* are included for terms used within this Manual.

WHAT IS RECYCLED WATER?

"Recycled water," (also called "reclaimed water") as used in this Manual and defined in the Water Recycling Criteria of Title 22, Division 4, Chapter 3 of the California Code of Regulations, (Title 22) refers to tertiary-treated water produced from the three-stage treatment of municipal wastewater (see box, right). *(Although secondary-treated effluent may also be reused, its applications are limited and subject to much greater restrictions, and it will not be addressed in this Manual.)* The facilities that produce recycled water are known as Water Recycling (or Reclamation) Plants that are owned and operated by "Recycled Water Producers". The recycled water produced by these plants is delivered to users through distribution systems owned and operated by "Recycled Water Agencies." Recycled Water Producers and Agencies can be one and the same entity.

Recycled water is virtually colorless and odorless, and is allowed for full-body human contact but ***not*** for direct human consumption. The sensible use of recycled water affords an excellent choice for essentially all non-potable applications. Properly managed, recycled water is safe to use.

The Recycled Water Treatment Process

- **Primary Treatment** removes 70 to 85 percent of the organic and inorganic solids that either settle out or float to the top.
- **Secondary Treatment** mixes the remaining suspended waste solids with microorganisms and air. The micro-organisms convert the waste solids to biomass that settles out.
- **Tertiary Treatment** filters out most of the remaining solids through a granular media (for example, sand or anthracite coal) or a membrane, with the final product water being disinfected with chlorine or ultraviolet light to kill off bacteria, virus and other microorganisms.

WHAT ARE "DUAL SOURCE" SITES?

"Dual source" sites are reuse sites where both potable (domestic or drinking) water and recycled water are present. Dual sources might be necessary on sites where water is normally available for public use. For example, an elementary school may use recycled water for irrigation of its athletic fields, but would need a separate potable system to supply drinking water to its school buildings.

"Dual plumbed sites" is a separate term which refers specifically to a) buildings that have both recycled and potable water serving (separate) interior fixtures, or b) individual residences that use recycled water for outside irrigation, which is dealt with later under *Periodic Cross-Connection Testing* (page 32). The public must not be allowed access to the recycled water system (such as from hose bibbs).

Water quality needs at the use site might also call for two water sources. For example, golf courses may elect to use a potable water supply to irrigate the greens and use recycled water on the fairways. (**Note:** The potable water used for this purpose is referred to as "non-potable irrigation water" after it has passed through the irrigation system backflow preventer. These water lines are to be used only for irrigation and must not be connected to restrooms, drinking fountains, food service areas, etc.)

On sites with dual sources, the potable supply must be protected with an approved backflow prevention device at the parcel boundary.

Cross-connections between the recycled water system and the potable water system are strictly prohibited.

In some cases, the interior plumbing of new buildings has been "dual-plumbed" with the site's recycled water irrigation supply. In these instances, a separate recycled water meter serving the building is required to be installed so that any problems at the site can be isolated and fixed. It also provides the added benefit that should the irrigation need to be shut off at the meter for any reason; it will not interfere with the function of the restrooms. Title 22 requires that this dual-plumbed system must be tested for cross-connections every four (4) years (page 32). ***Retrofits of existing buildings for toilets, urinals, etc. are not permitted.***

BENEFITS OF RECYCLED WATER IRRIGATION

As population growth increases the demand for potable water and the reliability of imported water supplies decreases, the future availability of potable water for irrigation is questionable. Also, the costs of potable water supplies continue to climb, making recycled water more attractive as an alternative water supply.

The amount of recycled water available is generally not affected by drought, meaning customers don't risk losing their expensive landscaping investment due to water shortages and potential mandatory rationing.

Tertiary-treated recycled water can be used for virtually all non-potable applications (see box, right).

Recycled water may also contain an appreciable nutrient content, such as nitrogen, potassium, calcium, magnesium, sulfur, and other macro and micronutrients, which may provide some level of fertilization during the irrigation process. A full recycled water quality analysis can be obtained from the local Recycled Water Agency.

Irrigating with recycled water is making use of a valuable resource that would otherwise be disposed.

TITLE 22 USES FOR TERTIARY-TREATED WATER

Urban Landscape – Parks and playgrounds, schoolyards, unrestricted access golf courses, residential landscaping, freeway and roadway landscaping, cemeteries, ornamental nurseries, sod farms.

Agriculture – Food crops for human consumption, orchards, vineyards, fodder, fiber and seed crops, box nurseries, non-fruit bearing trees, pasture for milking animals, water supply for livestock.

Impoundments – Restricted and unrestricted (full-body contact) recreational impoundments, decorative lakes and fountains, fish hatcheries.

Industrial – Industrial processes (such as paper manufacturing, carpet and textile dyeing, boiler feed), cooling towers and air conditioning, non-residential toilet, urinal and floor drains, structural and non-structural fire fighting, commercial laundries, commercial car washes, concrete mixing, construction (dust control, soil compaction, backfill consolidation around pipelines, including potable), street and sidewalk cleaning, flushing sanitary sewers, snow making.

ARE THERE DISADVANTAGES TO USING RECYCLED WATER?

Unlike potable water, recycled water can only be used for approved uses at approved locations, and under the provisions of established regulations, guidelines, agreements and/or permits. Because of its origins and the level of treatment provided, recycled water is not suitable for direct human consumption. According to the State DPH, there have been no known cases of illness in the State of California due to the proper use of recycled water as of the time of this writing.

In very rare occasions, there may be temporary interruptions of recycled water deliveries, as there are in any utility. Such instances are generally short in duration, and many recycled water purveyors have a back-up water supply for such events.

NEED FOR REGULATIONS

Regulations make the use of recycled water possible by ensuring consistent, reliable water quality while at the same time being fully protective of the public health. California Code of Regulations Titles 22 and 17 are the two sets of State DPH regulations that accomplish this. Title 22 establishes the requirements for recycled water treatment, quality and allowable use, while Title 17 establishes the requirements for backflow protection of the potable water supply.

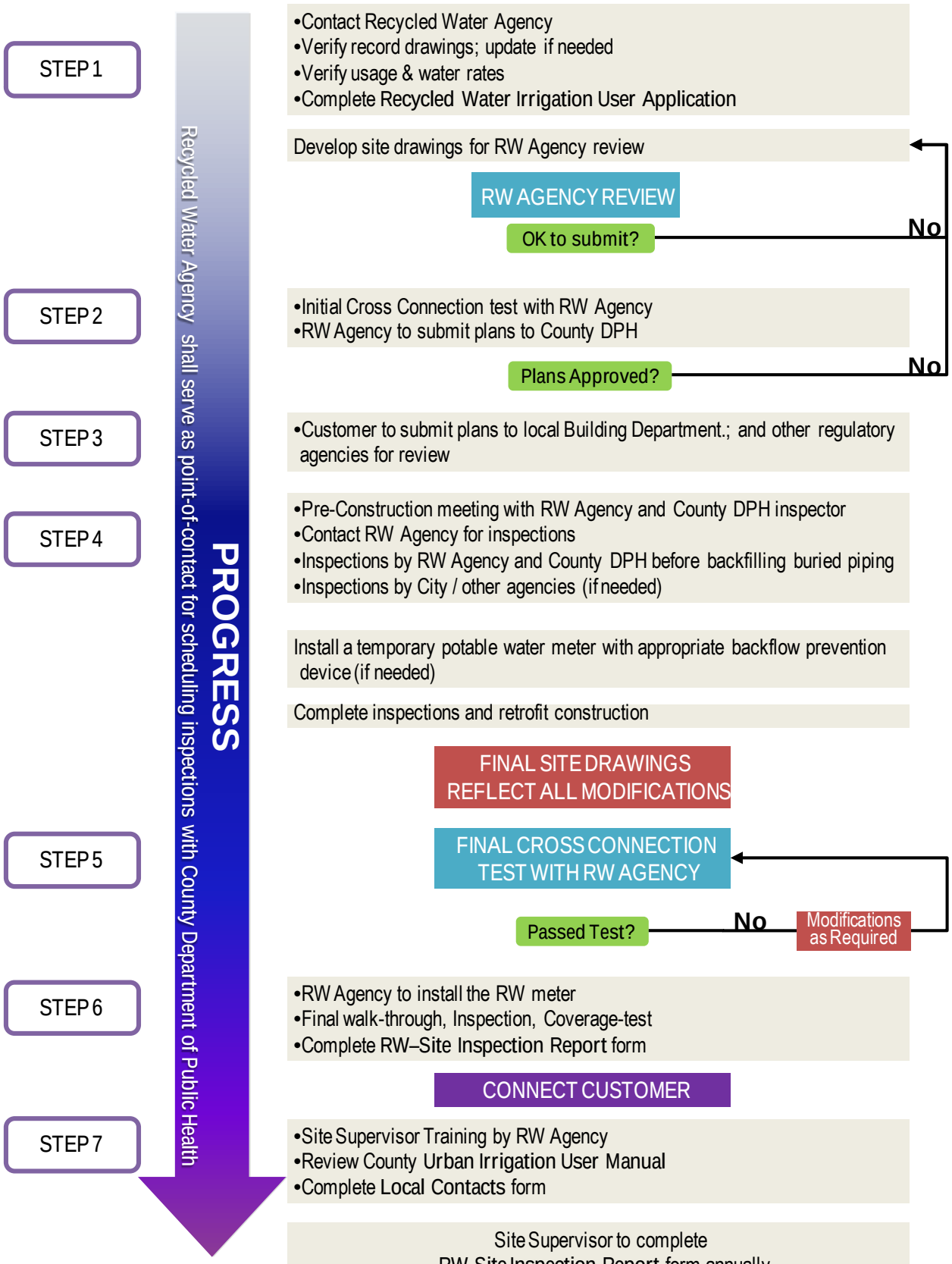
Copies of these regulations may be obtained from your Recycled Water Agency.

USER'S SUMMARY

Recycled water is a safe and effective resource for non-potable uses. Properly managed recycled water has a very limited health risk, if any. To help in the proper management of recycled water, the State of California, the local city or county Health Department and the Recycled Water Agency have developed rules and regulations for the safe use of recycled water. These rules and regulations are in place to insure that the User, its Site Supervisor and employees, and the public are protected from any health risk (real or perceived) that might be associated with the use of recycled water.

- Because recycled water is not suited for human consumption, every effort must be made to prevent the user's recycled water system from being cross-connected with the potable (drinking) water system.
- Plans must be carefully reviewed to ensure against cross-connections and that proper equipment is to be installed (*Design Approval*, page 11).
- The recycled water system must be operated under the authority of a "User's Agreement" (page 9) that outlines any special considerations or requirements for the particular use site.
- The User must designate a "Site Supervisor" (page 15) who is responsible for managing the on-site recycled water system. The Site Supervisor ensures the system is operated within the established guidelines and is properly maintained (*Maintenance*, page 18).
- In cooperation with the User, the Recycled Water Agency and/or Producer will make regular inspections of the site (*Periodic Site Inspection*s, page 19).
- The User must instruct all persons using recycled water on its property of its proper use and precautions (*Personnel Training*, page 16).
- All piping and points of connection must be labeled with ***"RECYCLED WATER – DO NOT DRINK"*** (*Identification and Equipment*, page 22) and the universal "Do Not Drink" symbols (page 30).
- All recycled water use areas accessible to the public must be posted with signs visible to the public and must include the statement ***"RECYCLED WATER – DO NOT DRINK"*** (page 29) and the "Do Not Drink" symbol (page 30).
- An initial cross-connection test must be conducted to determine if there are any unknown connections between existing irrigation and potable piping prior to construction of retrofit work (*Initial Cross-Connection Test*, page 31).
- Prior to connection with the recycled water distribution system, a final cross-connection test must be performed to verify that construction or retrofit work was performed correctly (*Final Cross-Connection Test*, page 32).
- In the event of a cross-connection incident, the User must implement an emergency response plan (page 33).

For the steps that need to be taken in order to retrofit a site for recycled water use (as outlined in Section G), please refer to the flow-diagram on the following page.


STEP 1
•Contact Recycled Water Agency
•Verify record drawings; update if needed
•Verify usage & water rates
•Complete Recycled Water Irrigation User Application
Develop site drawings for RW Agency review
RW AGENCY REVIEW
OK to submit?
No
STEP 2
•Initial Cross Connection test with RW Agency
•RW Agency to submit plans to County DPH
Plans Approved?
No
STEP 3
•Customer to submit plans to local Building Department.; and other regulatory agencies for review
STEP 4
•Pre-Construction meeting with RW Agency and County DPH inspector
•Contact RW Agency for inspections
•Inspections by RW Agency and County DPH before backfilling buried piping
•Inspections by City / other agencies (if needed)
Install a temporary potable water meter with appropriate backflow prevention device (if needed)
Complete inspections and retrofit construction
FINAL SITE DRAWINGS REFLECT ALL MODIFICATIONS
STEP 5
FINAL CROSS CONNECTION TEST WITH RW AGENCY
Passed Test?
No
Modifications as Required
STEP 6
•RW Agency to install the RW meter
•Final walk-through, Inspection, Coverage-test
•Complete RW–Site Inspection Report form
CONNECT CUSTOMER
STEP 7
•Site Supervisor Training by RW Agency
•Review County Urban Irrigation User Manual
•Complete Local Contacts form
Site Supervisor to complete RW-Site Inspection Report form annually and return to RW Agency
PROGRESS
Recycled Water Agency shall serve as point-of-contact for scheduling inspections with County Department of Public Health

SECTION A GENERAL PROVISIONS

REGULATORY AUTHORITY

Rules and regulations for the end use of recycled water are established and/or enforced by the California Regional Water Quality Control Board (Regional Board), the State DPH and the local city or county Health Department. These rules and regulations are typically contained in a permit from the Regional Board issued to the Recycled Water Agency and/or Producer. All facilities using recycled water must be designed and operated to meet the standards of the local governing codes, rules and regulations.

Various regulations for recycled water use may be outlined in the Recycled Water Agency's Recycled Water Ordinance. However, if recycled water service is provided by an Investor Owned Utility (a private water company), the various regulations for recycled water use are outlined in the Recycled Water Agency's Tariff Schedules as approved by the California Public Utilities Commission (CPUC).

From time to time there may be amendments to existing regulations. These amendments may be made without the knowledge or consent of the User or the Recycled Water Agency and will be enforced upon their effective date. The Recycled Water Agency will make every effort to make sure the User is made aware of these changes when they occur.

SYSTEM RESPONSIBILITY

The recycled Water Agency is responsible for the operation and maintenance of its recycled water distribution system up to the point of connection to the User. However, it is the responsibility of the User to maintain its recycled water system downstream of the point of connection with the Recycled Water Agency's distribution system (usually at the meter). The User is responsible for ensuring that the recycled water is used on its site according to all the rules and regulations regarding such use. Specifically, the User is responsible for the following:

- Maintaining the use site's recycled water system.
- Ensuring that all materials used during the design, construction and maintenance of the system are approved or recommended for recycled water use by the AWWA California-Nevada Section's Guidelines for the On-site Retrofit of Facilities Using Disinfected Tertiary Recycled Water.
- Obtaining all permits and payment of all fees required for the establishment, operation and maintenance of the User's recycled water system.[1]
- Reporting all violations and emergencies to the required local governing agencies. A listing of these agencies is provided in Section H.
- Obtaining prior authorization from the Recycled Water Agency and any required regulatory agency before making any modifications to the approved recycled water system (or the potable water system if it is in close proximity to the recycled system).

[1] Permitting and/or fee assistance may be available from the Recycled Water Agency

USER AGREEMENT AND PERMITS

A potential User must complete all of the Recycled Water Agency's requirements (for example, permit application) prior to the issuance of a User Agreement. (**Note:** "User Agreement" is the term used to describe any agreement, contract, permit, ordinance, memorandum of understanding or other such document used by the Recycled Water Agency to present the terms and conditions for the use of recycled water by a User.) The Recycled Water Agency reserves the right to alter the User Agreement on a case-by-case basis.

RATE AND FEE SCHEDULE

If recycled water is provided by a public entity, such as a municipality or water district, all rates and fees concerning recycled water service will be established and fixed by the Recycled Water Agency.

If recycled water is provided by an Investor Owned Utility, all rates and fees concerning recycled water service shall be established and fixed through the CPUC.

PROTECTION OF PUBLIC HEALTH

The Recycled Water Agency reserves the right to take any action necessary with respect to the operation of the User's on-site recycled water system in order to safeguard the public health.

AUTHORIZED USES

The use of recycled water is limited to those uses approved by the Regional Board or the State DPH. Any other use of recycled water is prohibited without the prior approval, on a case-by-case basis, of the Recycled Water Agency and the appropriate Regulatory Agencies.

APPROVED USE AREAS

Recycled water may only be used in areas approved by the Recycled Water Agency, following the User's completion of the Recycled Water Agency's application procedure and its meeting all of the requirements of the applicable Regulatory Agencies.

A User may ***never*** supply recycled water to another owner's adjoining property or to the property of the same User across a street, alley or other public right-of-way without the prior written approval of the Recycled Water Agency and the local city or County Health Department. The User may not give or sell recycled water to another party. Should the property become sub-divided, the service will be considered as belonging to the parcel it enters directly. If such a subdivision occurs, or property ownership is transferred, the Recycled Water Agency must be notified.

In any case, recycled water lines are not permitted to cross lot lines. All recycled water delivered to any site must pass through a recycled water meter.

QUENCHING ARTIFICIAL TURF

Artificial turf in place of real grass is becoming more popular on school athletic fields. "Quenching" of an artificial turf typically occurs during daytime hours and when the athletic fields most likely are in use. In order to minimize public exposure, recycled water should not be used for this purpose. As a best management practice, potable water should be used to quench artificial turf. *(Protection of Potable Water Systems*, page 31 and *Back-up Water Source*, page 12).

LIABILITY

The User is responsible for the operation and maintenance of the recycled water system downstream of the Recycled Water Agency's point of connection with the User, unless such responsibility is clearly outlined in the User Agreement/Permit (*Enforcement*, page 21).

The Recycled Water Agency shall not be liable for any water damage or other damage caused by the User due to defective or broken plumbing or faulty service, nor shall the Recycled Water Agency be liable for damage caused by the User's facilities. This includes changes in the recycled water quality that may occur from sitting in ornamental lakes, storage tanks, pipelines, etc.

WATER SUPPLY CONTINGENCY

If at any time during construction or operation of the recycled water system, real or potential hazards are found, the Recycled Water Agency has the right and the responsibility to immediately suspend, with or without notice, recycled water service in the interest of protecting the public health.

The Recycled Water Agency may supply water to the affected area either temporarily or permanently from the potable water system with appropriate backflow protection *(Protection of Potable Water Systems*, page 31 and *Back-up Water Source*, page 12).

SECTION B DESIGN & CONSTRUCTION

DESIGN APPROVAL

Before the construction of any new or major modifications of an existing recycled water system, the design must be submitted for approval by: a) the Recycled Water Agency, b) the State and local city or county Health Departments, and c) the local city building department. Approval will be contingent upon evidence that all applicable design requirements, rules and regulations for a recycled water system are satisfied. Plans and specifications should include, but not be limited to, the following:

- A detailed description of the intended use of recycled water, including identification of the area of use.
- Details showing the complete potable and recycled water systems. For existing facilities converting to recycled water use, details must include the exact location of all existing water piping systems.
- Details of the intended installation procedures, including as a minimum: backflow preventer locations, color and type of pipe and additional signage to be used.

CONSTRUCTION

The appropriate regulatory and recycled water agencies shall have the opportunity to make periodic inspections of the User's site during the construction phase, if applicable, to ensure both materials and installations are done according to the approved plans and specifications.

The Recycled Water Agency and/or the State, local city or county Health Department or their authorized agents shall inspect the construction and startup of the User's recycled water system to ensure that it is in compliance with the approved construction plans, rules and regulations. In addition, representatives of the Regional Board and the State DPH may be involved.

This site inspection is to ensure that proper equipment was used, spray patterns are adjusted to ensure proper coverage without excessive overspray and there are no cross-connections with the on-site potable water system. Conditions that might create runoff, ponding or windblown spray, especially on slopes, must be corrected. Spray patterns must be checked to make sure that they don't encroach upon public facilities such as drinking fountains, picnic tables or areas outside the approved use area.

RECYCLED WATER DELIVERY SYSTEM OPERATION

The Recycled Water Agency reserves the right to control and schedule the use of recycled water, if control and scheduling are necessary to maintain acceptable working conditions within that agency's recycled water distribution system. The Recycled Water Agency will administer these and other service conditions.

If the available service pressure is higher than the User can accept, the User will be responsible for providing a pressure-reducing valve downstream of the service meter. If available pressure is lower than what the User needs, booster pumping downstream of the meter may be required. Any pumping of recycled water requires the prior written approval of the Recycled Water Agency.

The Recycled Water Agency must ensure that the quality of the recycled water in its distribution system is not compromised by any User. Therefore the Recycled Water Agency may require backflow protection on the User's recycled water system. This backflow protection must be in close proximity to and downstream of the recycled water meter at the parcel boundary or at specific, on-site location(s) where an activity of the User (such as fertilizer injection) could degrade the quality of the recycled water in the distribution system. If necessary, details will be included in the User Agreement.

Backflow prevention devices (almost always a "reduced pressure", or RP, device) must be approved by the Recycled Water Agency and the State DPH and local city or county Health Department. Devices must be properly maintained, inspected quarterly and tested at least annually. Backflow prevention assemblies, when required on recycled water systems, must be conspicuously labeled. Based on the provisions of the User Agreement, the Recycled Water Agency may provide the required test equipment.

Backup Water Source

If potable water is to be used as a backup source to the recycled water system at the use site, it must be done only through an air-gap separation between the two systems and with the prior approval of the State DPH and the local city or county Health Department. The State DPH permits the use of a "swivel-ell" assembly (see sample schematic, next page) that allows for the use site's water supply to be switched between the recycled and potable water systems, ***if certain stringent requirements are met*** (check with your Recycled Water Agency). The swivel-ell, if installed, must be located at the point-of-connection and be visible for frequent inspections.

FIRE PROTECTION SYSTEMS

Some recycled water use sites may also have separate potable water service connections for dedicated, on-site fire protection systems. Depending on the Class of fire protection system on the reuse site, if the fire service includes piping for delivery systems outside of buildings and the manner of on-site recycled water usage, then either single check valve, double check valve or RP backflow assemblies may be required at the fire supply meter.

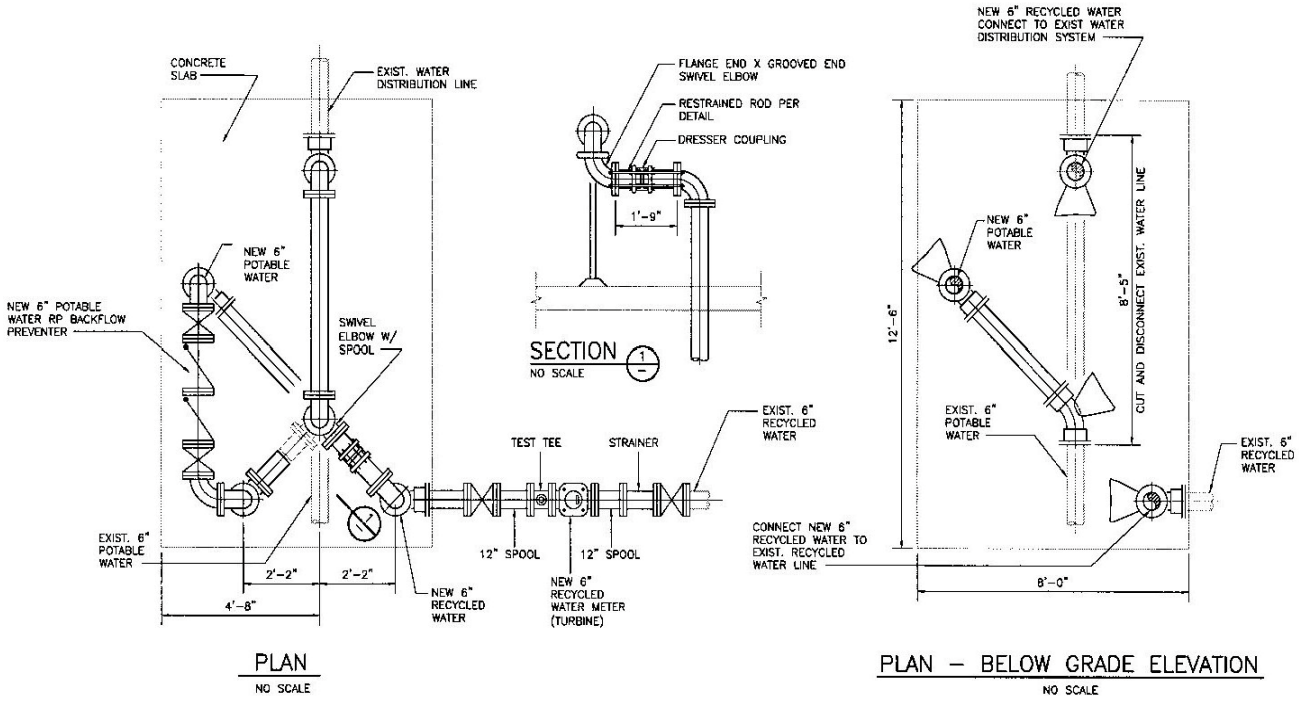
Since requirements vary from place to place, the exact requirements will be provided to the User by the Recycled Water Agency, Regulatory Agency and/or the local city or county Health Department.

PROTECTION OF GROUNDWATER

Irrigation with recycled water within 50 feet or impoundment of recycled water within 100 feet of any drinking water reservoir or well is prohibited. Proposed irrigation with recycled water within 50 feet or impounding recycled water within 100 feet of a non-potable water well requires the approval of the State DPH and local city or county Health Department.

SERVICE STARTUP

Following the acceptance of the User's recycled water system by the Recycled Water Agency, the User may request regular service startup. Upon receipt of the startup request, the Recycled Water Agency will notify the appropriate regulatory agencies, and schedule a final inspection. The startup request shall include the appropriate documentation and any payments and/or fees as indicated in the Recycled Water Agency's User Agreement.



Sample schematic drawing of a "swivel-ell" assembly for a back-up potable water supply.

Example photos of existing "swivel-ell" assemblies for a back-up potable water supply.

SECTION C OPERATION & MAINTENANCE

GENERAL

Recycled water service will be provided by the Recycled Water Agency only to those Users who have a current User Agreement for such service, unless otherwise determined by the Recycled Water Agency's Governing Board. This recycled water service can be revoked any time at the discretion of the Recycled Water Agency.

Recycled water service must be made available only in accordance with all applicable Federal, state and local statutes, ordinances, regulations and contracts, other requirements including the California Water Code, the California Code of Regulations Titles 17 and 22, and requirements and regulations imposed by the Regional Board, the State DPH, the local city or county Health Department and/or the Recycled Water Producer. The User must comply with the conditions of any User Agreement issued by the Recycled Water Agency.

Recycled Water Agencies may not deliver recycled water to Users that do not or will not comply with use site requirements.

CONDITIONS OF SERVICE

The User must comply with the following conditions.

Runoff Conditions

The irrigation systems must be designed, constructed and operated to minimize runoff outside the approved use area to the fullest extent practical. A small amount of irrigation return water leaving the site is not considered to be a violation.

Ponding Conditions

The irrigation systems must be designed, constructed and operated to minimize, ponding within or outside of the approved use area to the fullest extent practical. This does not apply to approved landscape or recreational impoundments such as golf course water hazards or decorative lakes.

Windblown and Overspray Conditions

The irrigation systems must be designed, constructed and operated to minimize windblown spray and irrigation overspray from leaving the approved use area to the fullest extent practical.

Unapproved Uses

Use of recycled water for any purposes other than those explicitly described in the Recycled Water Agency's water recycling permit is strictly prohibited.

Use in Unapproved Areas

The delivery and use of recycled water for any reason, including approved uses, in areas other than those explicitly approved in the current effective user permit and without the prior approval of the appropriate Regulatory Agencies, ***is strictly prohibited.***

Supply to Separated Parcels

If a reuse site is separated into two or more distinct parcels by a public right-of-way, then each parcel must be supplied recycled water through its own individual meter. The exception to this rule is when the parcels are connected under the public right-of-way via a pedestrian or vehicular tunnel.

Cross-Connections

Cross-connections, as defined by the California Code of Regulations, resulting from the use of recycled water or from the physical presence of a recycled water service, whether by design, construction practice, or system operation, ***are strictly prohibited.***

If any cross-connection is discovered, the User shall immediately depressurize the recycled water system ***only***, notify the Recycled Water Agency and implement the *Emergency Cross-Connection Response Plan* (see page 33).

DESIGNATION OF SITE SUPERVISOR

It is the User's responsibility to provide surveillance and supervision of its on-site recycled water system in a way that assures compliance at all times with current regulations and the recycled water permit requirements. The User shall designate, with notification going to the Recycled Water Agency, a Site Supervisor to be the contact person with the Recycled Water Agency. The following are requirements of the Site Supervisor position:

- Receive training or be able to demonstrate knowledge of the application and maintenance of a recycled water system.
- Be familiar with the contents of this Manual.
- Be available to the Recycled Water Agency at all times and have the authority to carry out any requirements of the Recycled Water Agency.
- Be responsible for the installation, operation and maintenance of the recycled and potable water systems, and for the prevention of potential hazards.
- Ensure that notification signs at the use site are properly installed and maintained, and that all recycled and potable water facilities are properly labeled, tagged or otherwise identified.
- Be knowledgeable of the provisions contained in Titles 17 and 22 of the California Code of Regulations relating to the safe use of recycled water and maintain accurate records.
- Ensure that all site employees involved with the use of recycled water are instructed in the safe and responsible use and handling of the recycled water.
- Immediately inform the Recycled Water Agency of any failures, violations and/or emergencies that occur involving the recycled or potable water systems.
- Be familiar with the basic concepts of backflow and cross-connection prevention, system testing, and related emergency procedures, and participate in any cross-connection tests.

The Recycled Water Agency must be notified immediately of any change in personnel for the Site Supervisor position. If there is a change in the Site Supervisor, the Recycled Water Agency is responsible to assure that the new Supervisor has been trained in accordance with *Personnel Training* (page 16). The Recycled Water Agency will provide periodic inspections of the User's system and report all violations to the Site Supervisor and all appropriate Regulatory Agency according to applicable procedures established by law, code, permit or practice.

PERSONNEL TRAINING

All new employees must be trained in the proper use of recycled water. Supervisory personnel and the Site Supervisor should ensure that employees are not using recycled water carelessly or improperly. It is the responsibility of the User to train all operations personnel so they are familiar with the use of recycled water. Any training program should include, but not be limited to, the following:

- Operations personnel must be aware that recycled water, although highly treated, is non-potable. ***Recycled water may never be used for human consumption.***
- Operations personnel must understand that working with recycled water is safe if common sense is used and appropriate regulations are followed.
- Operations personnel must understand that conditions such as ponding and runoff are not allowed.
- Good personal hygiene must be followed (for example, washing hands after working with recycled water).
- Operations personnel must understand that there is ***never to be a direct connection*** between the recycled water system and the potable water system.

IRRIGATION SYSTEM OPERATION

Operation of the User's on-site recycled water system must adhere to the following requirements:

- The recycled water system must be operated to prevent overspray or windblown spray into unapproved areas.
- Automatic control systems are to be used and programmed to prevent ponding and runoff of recycled water.
- Even though tertiary-treated recycled water is approved for full-body contact by the State DPH, irrigation may only occur during periods of least use of the approved area by the general public to avoid inadvertent and involuntary contact. This is usually between the hours of 10 p.m. and 6 a.m.; however, areas where public access is generally prohibited or minimized, such as freeway landscaping and commercial nurseries, may be irrigated at any time.
- Irrigation of public areas during other times may be performed if the irrigation system is operated manually and is supervised by trained personnel to avoid inadvertently exposing any members of the general public. This provision must be strictly followed.

Inadvertent public contact with recycled water irrigation spray must always be avoided.

- Consideration should be given to allow a reasonable dry-out time before the area is to be used by the public.
- The recycled water system must not be allowed to operate for periods longer than needed to satisfy the landscape water requirements. Recycled water must never be applied at a rate that is greater than the infiltration rate of the soil. Exceptions to this requirement for purposes such as leaching of soil must be specified in the User Agreement.

HOSE BIBS

Hose bibs or other appurtenances that might allow public access to the recycled water system for possible consumption, unapproved use or cross-connection to the potable water system are strictly prohibited in all areas accessible to the general public. In these areas, only quick-couplers are allowed and must be of a different type than those that may be used on the use site's potable water system (page 26). Hose bibs may be used on the recycled water system in areas that do not allow any public access but must be conspicuously labeled ***"RECYCLED WATER -- DO NOT DRINK"*** in both English and Spanish (or any other language determined by the Water Recycling Agency to be in common use in the area), along with the "Do Not Drink" symbol (page 30).

Hose bibs may only be used with recycled water in areas where they cannot be accessed by the general public (such as this commercial nursery), and even those must be properly labeled.

Workers in these areas must be instructed not to drink from these hose bibs and be provided a safe source of drinking water.

In general, hose bibs supplied with recycled water are strictly prohibited in areas accessible by the general public due to the possibility of people utilizing the hose bib to drink the recycled water. However; Assembly Bill 803 (signed by the Governor in October 2013 and effective January 1, 2014) approved hose bibs for use at cemeteries (for filling vases and urns) that are supplied with disinfected tertiary recycled water and where adequate signage and labeling are in place and regularly inspected by the Recycled Water Agency, State DPH, local city or county Health Department or water purveyor to insure the general public has proper notice.

DRINKING FOUNTAINS

Drinking fountains located within the approved use area must be protected from contact with recycled water by direct application through irrigation or other approved use. Lack of protection of such facilities, whether by design, construction practice or system operation, ***is strictly prohibited.***

The pattern on the walls indicates that this drinking fountain is being sprayed by the irrigation water. If recycled water is to be used, then the spray pattern must be altered or the drinking fountain somehow shielded.

EQUIPMENT CLEANING

Any device, hose, pipe, meter, valve, tank, pump, truck, etc. which has been used with recycled water may not be used to convey potable water nor attached to the potable water system unless it is cleaned and disinfected.

MODIFICATIONS

The User must not make any modifications to its on-site recycled water system (or potable system, if it is in close proximity to the recycled system) without the prior approval of the Recycled Water Agency.

This includes modifications to the approved plans or to an operational system. Detailed plans of any system changes should be submitted to the Recycled Water Agency and the modifications inspected by the Recycled Water Agency before their being placed in operation.

However, routine maintenance of the irrigation system, such as pipeline repairs, sprinkler head replacement and other similar activities that do not result in a substantial change in either the recycled or potable water systems, or any agreed to operating plans, do not need prior approval by the Recycled Water Agency.

Emergency modifications or repairs that must be made by the User to its system in order to prevent contamination, damage or a public health hazard are covered under *Emergency Procedures* (page 20).

MAINTENANCE

The User must implement a preventive maintenance program that will ensure that the recycled water system always remains in compliance. A preventive maintenance program should include but not be limited to the following:

- Regular inspections should be conducted by the User of the entire recycled water system including sprinkler heads, spray patterns, piping and valves, pumps, storage facilities, lakes, controllers, signage, etc. Immediately correct any problems.
- All notification signs, labels and/or tags should be checked for their proper placement and readability. Replace damaged or unreadable signs, labels or tags.
- Special attention should be given to spray patterns to eliminate ponding, runoff and wind-blown spray conditions.
- Establish and maintain an accurate records-keeping system of all inspections, modifications and repairs.
- Broken sprinkler heads, faulty spray patterns, leaking pipes or valves, etc. must be repaired as soon as the malfunction becomes apparent.
- A maintenance program for backflow prevention assemblies that includes at least annual testing by a tester certified by the American Backflow Prevention Association (ABPA) or AWWA must be carried out. Records of annual tests, repairs and overhauls must be kept by the user with copies forwarded to the Recycled Water Agency and the local city or county Health Department.

PERIODIC SITE INSPECTIONS

Following conversion to recycled water use, each site is expected to maintain the requirements put in place to assure safety and avoid cross-connections. The inspection of recycled water sites was established by the State DPH in order to provide a process to reduce the potential for potable water systems to become cross-connected with recycled water (California Water Code Section 13523.1(b)(5)). Inspections are to be performed by the agency responsible for the recycled water permit, or by its designee. The requirement is for "periodic" inspections. This can be done annually in the case of sites with more complex potable and recycled water systems. Some sites present a lesser risk and may be inspected less frequently.

Most sites require that the Site Supervisor to be present during the inspections. However, some sites, like medians, Caltrans' irrigation sites, and smaller parks have only recycled water at the facility. Without potable water on site, there is minimal potential for a cross-connection to occur. These sites can be inspected by the Recycled Water Agency without the participation of the on-site supervisor.

The inspector should bring drawings of the site to locate significant components and for comparison to the actual site. The inspector will check for signs posted at the designated location, that valves and control boxes are correctly labeled and that no significant changes to the site in comparison to the site drawings on file. Should the inspection indicate a modification has taken place that increases the potential for a cross-connection, the Site Supervisor must be contacted immediately to determine the nature of the changes.

A conspicuous change, such as the addition of a new building or drinking fountain since the last inspection, would merit the immediate depressurization of the recycled water system until a shut-down test can be performed (see *Periodic Cross-Connection Test*, page 32) by the local city or county Health Department.

Sites with both recycled water and potable water use (for drinking fountains, restrooms or ornamental fountains, etc.) on-site require the participation of the Site Supervisor (or his designee). These sites present a greater potential for cross-connection and a higher level of participation to protect public safety.

The inspector and Site Supervisor will check for signs posted at the designated location, valves and control boxes are correctly labeled, the backflow prevention device inspection is up-to-date and that no significant changes to the site in comparison to the site drawings on file. At this time, it would be appropriate to determine if there are any future plans for the site. To document the inspection and reinforce the Conditions of Use, the Site Supervisor should sign off on the inspection or other official documentation.

Non-Critical Changes Found During Inspection

If changes are made that are non-critical (such as minor changes to the irrigation system not in proximity to the potable system), the site drawings are to be updated and submitted to the local city or county Health Department.

Critical Changes Found During Inspection

If changes are found during an inspection that would increase the potential for a cross-connection (major changes to either the potable or recycled water pipelines bringing them in closer proximity), the local city or county Health Department should be contacted immediately for consultation. When in doubt, recycled water should be shut off at the meter (leaving the potable water pressurized) until such time as the local city or county Health Department can arrange a shut-down test.

Once the public safety can be assured, the drawings for the site must be updated and provided to the local city or county Health Department.

Should a cross-connection be discovered during the inspection, the ***Emergency Cross- Connection Response Plan*** (page 33) should be immediately invoked by the Site Supervisor.

EMERGENCY PROCEDURES

In case of a major earthquake, the Site Supervisor should immediately inspect the potable and recycled water systems for damage. If either system appears damaged, both water systems should be shut off at their respective points of connection. The Site Supervisor should immediately contact the Recycled Water Agency for further instructions.

Emergency Modifications

Emergency modifications or repairs can be made by the User to the recycled water system without the prior approval of the Recycled Water Agency to prevent contamination, damage or a public health hazard. As soon as possible the User must notify the Recycled Water Agency of the emergency modifications and file a written report.

Unauthorized Discharge

It is the responsibility of the User to report to the Recycled Water Agency all system failures that result in an unauthorized discharge of more than 50,000 gallons of tertiary-treated recycled water (or 1,000 gallons for any lesser quality recycled water). An immediate oral report followed by a written report (email is preferable) is required.

Contamination of Drinking Water

In case of contamination of the potable water system due to a cross-connection on the User's premises, the Recycled Water Agency and the local city or county Health Department must be immediately notified by the User (page 33). The User is to immediately invoke the ***Emergency Cross-Connection Response Plan***.

VIOLATIONS

The Recycled Water Agency reserves the right to decide if a violation of the conditions under which the User Agreement was issued has occurred. Violations may include non-compliance of any of the following prohibitions: runoff conditions, ponding conditions, windblown spray conditions, leaks or spills resulting from broken or damaged pipelines or appurtenances, unapproved uses, disposal in unapproved areas, cross-connections, unprotected drinking fountains and unauthorized or prohibited use of hose bibs, whether willful or by accident. Any willful or accidental act of noncompliance with any existing Federal, state or local ordinance, code, law or statute regulating the use of recycled water constitutes a violation.

NOTIFICATION

It is the responsibility of the Site Supervisor to immediately notify the Recycled Water Agency of any failure or cross-connection in his/her recycled or potable water system, whether or not he/she believes a violation has occurred. It is also the responsibility of the Site Supervisor to immediately notify the Recycled Water Agency of any violation he/she believes has or might imminently occur because of any action the User's personnel might take during the operation of the recycled or potable water systems.

It is then the Recycled Water Agency's responsibility to notify the Recycled Water Producer (if a separate entity) holding the master water recycling permit from the Regional Board and local governing agencies of any violations. These agencies are listed in Section H.

CORRECTIVE ACTION

If the Recycled Water Agency's investigation reveals that a violation has occurred on the use site, that agency must immediately notify the User of the violation and what corrective actions must be taken. It is the responsibility of the User to immediately initiate corrective action to eliminate the violation. If the Recycled Water Agency believes the violation constitutes a hazard to public health, the Recycled Water Agency must immediately stop recycled water service to the User. It will be at the discretion of the Recycled Water Agency to decide if a violation has been adequately addressed.

The Recycled Water Agency may impose a startup fee upon resumption of service to a User whose service has been terminated, depending on the provisions of the User Agreement.

ENFORCEMENT

The Recycled Water Agency shall enforce all existing regulations concerning the use of recycled water and the on-site recycled water systems. Regulations concerning the use of any recycled water or recycled water system shall be applied with equal force and effect to any person, persons or firm, public or private. ***There will be no deviations from these regulations*** except upon written authorization of the Recycled Water Agency, acting within applicable regulations. An appeal procedure may be provided for in the User Agreement or in the Recycled Water Agency's rules and regulations, and the action of the Recycled Water Agency will be final.

CAUSES FOR TERMINATION OF SERVICE

The Recycled Water Agency reserves the right to revoke a User's Agreement if any or all of the service conditions are not satisfied at all times. Service to a User may be terminated any time if:

- The Recycled Water Agency's distribution system is not capable of supplying recycled water.
- The quality of the recycled water does not comply with the requirements of the Regulatory Agencies.
- The User's operation does not conform to all applicable regulations, permit requirements and/or the terms of the User's agreement.
- There is nonpayment of service fees and charges by the User.

SECTION D IDENTIFICATION & EQUIPMENT

GENERAL

All materials, apparatus, piping, valves, controllers, sprinkler heads, pumps etc. for new recycled water irrigation systems must be approved for use in a pressurized recycled water system and installed according to approved plans. The recycled water system must conform to the AWWA California-Nevada Section's Guidelines for the On-site Retrofit of Facilities Using Disinfected Tertiary Recycled Water. Deviations from these standards will not be allowed without prior approval. System installation must conform to the Uniform Plumbing Code and all other local codes, rules and regulations.

The approved use area must be clearly marked. All outlets from the recycled water system must be marked ***"CAUTION – RECYCLED WATER – DO NOT DRINK."*** In addition, signs must be posted at all entrances to the use site indicating that recycled water is used for irrigation purposes. The "Do Not Drink" symbol (page 30) must be present on all signs. Recycled Water Agencies may also choose to require the signs to include translations into the appropriate foreign language(s), as not all locales have Spanish as the second language.

PIPING, BELOW-GRADE

It should be noted that there are no local or state requirements for a use site that is converting to recycled water to dig up and replace its existing irrigation system with new "purple" recycled water piping. However, any and all new piping must be installed according to the approved plans and marked as required. Installation must be in accordance with the latest edition of International Association of Plumbing and Mechanical Officials (IAPMO) Standard IS-8. Fittings, primers and solvents must be IAPMO listed. All new recycled and potable water lines (pressure/non-pressure), new and existing valve boxes and appurtenances must be identified to clearly distinguish between recycled water and potable water systems.

Identification of Recycled Water Lines

All new, buried recycled water lines (pressure/non-pressure) must be extruded purple-colored Schedule 40 (minimum) PVC pipe with continuous wording ***"CAUTION – RECYCLED WATER"*** printed on opposite sides of the pipe. The use of continuous lettering on 3-inch minimum width purple tape with 1-inch black or white contrasting lettering bearing the continuous wording ***"CAUTION – RECYCLED WATER"*** permanently affixed at 10-foot intervals atop all horizontal piping, laterals and mains is an acceptable alternative to the purple pipe. Identification tape must extend to all valve boxes and/or vaults and exposed piping.

Recycled water pipeline installation with continuous purple warning tape.

Piping buried under pavement must be sleeved with the sleeve being at least two (2) inches larger in diameter than the irrigation pipe.

When recycled and potable water lines cross, the recycled water line must be located at least 1-foot below the potable water line. If this separation is not possible, then either the recycled or potable water line must be sleeved to ten (10) feet on either side of the crossover. Parallel recycled and potable water lines must be at least ten (10) feet apart, or at least four (4) feet, if the recycled line is enclosed in a sleeve. See excerpt on next page from State DPH's 2003 Memorandum No. 2003-02: Guidance Criteria for the Separation of Water Mains and Non-Potable Pipelines.

1-inch potable water copper service with POTABLE WATER identification tape affixed

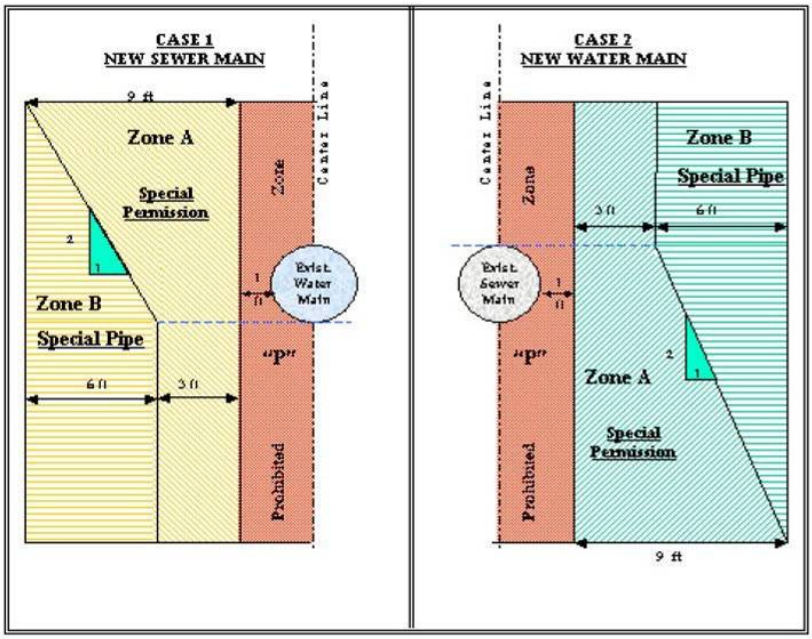
Identification of Potable Water Lines

New buried potable lines must be identified by continuous lettering on 3-inch minimum width blue tape with 1-inch white or black lettering bearing the continuous wording ***"POTABLE WATER"*** permanently affixed at 10-foot intervals atop all horizontal piping, laterals and mains. Identification tape must extend to all valve boxes, vaults and exposed piping. ***"CAUTION – POTABLE WATER LINE BURIED BELOW"*** is also acceptable language. The End User should schedule a pre-construction meeting with the Recycle Water Agency and local city or county Health Department inspector to confirm site specific requirements.

6-inch potable water HDPE mainline with POTABLE WATER identification tape affixed

Identification tape is not necessary for extruded blue-colored PVC with continuous wording ***"POTABLE WATER"*** printed in contrasting lettering on opposite sides of the pipe.

Parallel construction criteria

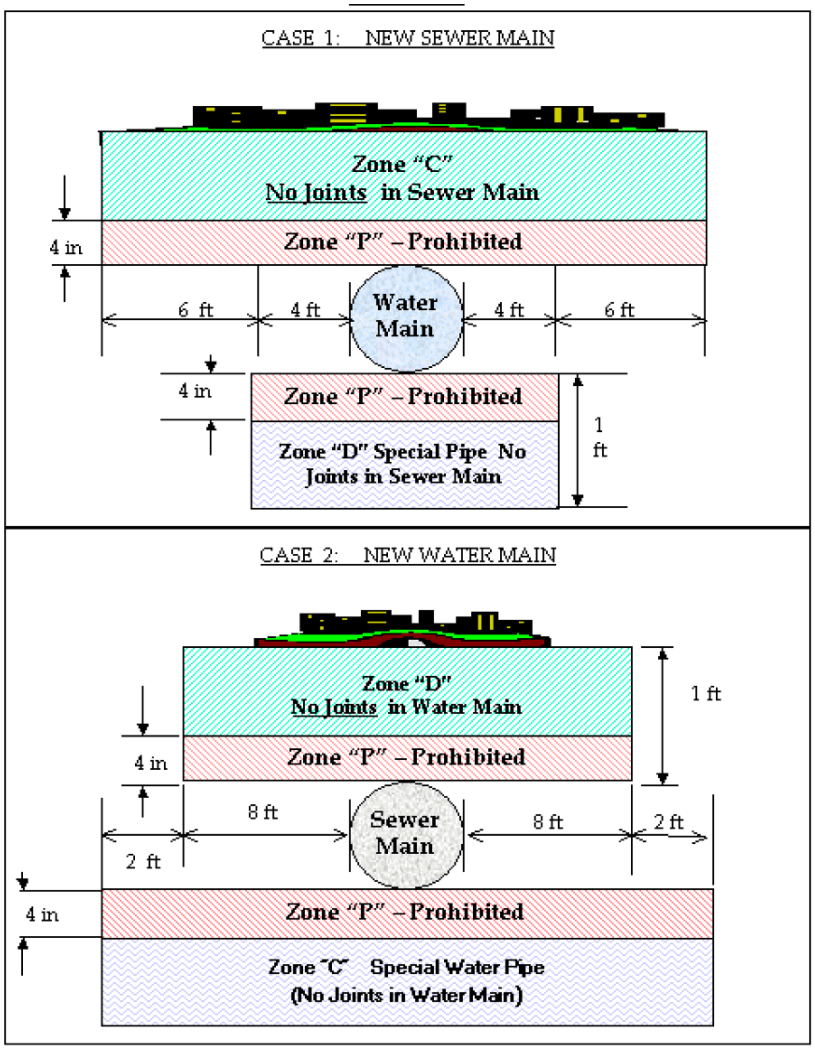


Note:

-Zones identical on either side of center lines.

-Zones "P" is a prohibited zone. Section 64630 (e) (2) California Code of Regulations, Title 22 (Current); or Section 64572 (a) California Code of Regulations, Title 22 (proposed)

Crossings criteria.



Identification of Non-Potable Water Lines

"Non-potable water" is water supplied from the potable water system through an appropriate backflow preventer. All non-potable irrigation/industrial water lines (pressure/non-pressure) must be identified by continuous lettering on 3-inch minimum width yellow tape with 1-inch contrasting lettering bearing the continuous wording ***"NON-POTABLE WATER – DO NOT DRINK"*** permanently affixed at 10-foot intervals atop all horizontal piping, laterals and mains. Identification tape must extend to all valve boxes and/or vaults, exposed piping, hydrants and quick couplers.

Non-potable water identification tag (yellow)

Identification of Existing Below-Grade Water Lines

Existing below-grade piping, whether recycled, potable or non-potable, need not be marked unless the piping becomes exposed, such as during installation of new pipe or maintenance of existing pipe. The exposed section should be appropriately marked (as recycled, potable or non-potable) to the extent feasible.

PIPING, ETC., ABOVE-GRADE

All above-grade recycled water pipelines must be appropriately labeled and color-coded purple to differentiate recycled water pipelines from potable and non-potable water pipelines. If purple pipe is not used, recycled water pipelines are to be wrapped "barber-pole" style with purple warning tape having the words ***"CAUTION – RECYCLED WATER"*** visible in contrasting black letters. Flexible conduits or hoses must be clearly marked ***"CAUTION – RECYCLED WATER"*** with each adapter or fitting painted purple.

Above-grade potable water pipelines must be labeled and color-coded blue to differentiate potable water pipelines from recycled and non-potable water pipelines. Potable water pipelines may be wrapped, "barber-pole" style, with blue identification tape having the words ***"POTABLE WATER"*** visible in contrasting white letters.

Above-grade non-potable water pipelines must be appropriately labeled and color-coded yellow to differentiate non-potable water lines from recycled water and potable water lines. Non-potable water lines may be wrapped, "barber-pole" style, with yellow identification tape having the words ***"NON-POTABLE WATER – DO NOT DRINK"*** visible in contrasting letters.

Potable water reduced-pressure backflow device with a POTABLE WATER identification tag

Potable water hose-bib with a POTABLE WATER identification tag

Exposed valve boxes, vaults, quick coupling valves, outlets and related appurtenances must be color-coded, labeled or tagged, to differentiate recycled water from potable water (that is, ***"CAUTION – RECYCLED WATER – DO NOT DRINK"*** in black or white contrasting lettering on a purple background, or ***"POTABLE WATER"*** in white lettering on a blue background or ***"NON-POTABLE WATER – DO NOT DRINK"*** in contrasting lettering on a yellow background).

Tags must be identified with the appropriate wording on both sides. Tags identifying recycled water must have both the appropriate wording and the "Do Not Drink" symbol (page 30).

VALVES

Quick Coupling Valves

New quick coupling valves, made specifically for recycled water use, should be 3/4-inch or 1-inch nominal size and of brass construction with a normal working pressure of 150 psi. The covers on all new quick coupling valves must be permanently attached and made of purple rubber or vinyl with the words ***"RECYCLED WATER"*** imprinted on the cover, and must be provided with a lock. To prevent unauthorized use, the valve should be operated only with a special coupler key with an acme thread for opening and closing the valve. New quick coupling valves should be installed approximately twelve (12) inches from walks, curbs, headboards or paved areas. All new and existing quick coupling valves must be identified with an identification tag and installed in a valve box. This valve box does not necessarily have to be marked or made of purple PVC, so long as the quick-coupler cap is purple and the valve is appropriately tagged.

Quick couplers may be used on the potable water system at dual source sites if they are of different size and/or thread than the recycled water quick couplers.

Tagged quick coupler and valve box

Gate Valves

New gate valves should be installed in a marked valve box with crushed rock in the base and a notification tag on the valve operator.

Remote Control Valves

New and existing remote control valves should be installed in a marked valve box with crushed rock in the base and an identification tag on the operator. For each valve system, remote control valves should be adjusted so the most remote sprinkler heads operate at the pressure recommended by the manufacturer giving a uniform distribution of water.

Tagged remote control valve

SPRINKLER HEADS

New sprinkler heads must be of the size, type, pressure, radius of throw and discharge as indicated on the approved plans. All new sprinkler heads, either permanent or temporary, should be of the approved type for use with recycled water and create the minimum amount of mist. Drainage through sprinkler heads is prohibited, and an anti-drain valve must be installed in the sprinkler riser as needed. Anchors on sprinkler risers should be provided as needed and maintained. Sprinkler heads must be kept in good repair at all times.

Recycled water sprinkler head with identifying cap

Existing sprinkler heads do not need to be changed when the site is converted to recycled water. Any modifications to existing sprinkler heads shall reflect the guidelines set forth in this manual for recycled water use.

SYSTEM CONTROL DEVICES

New system controllers must be automatic with multiple start/stop times for any 24-hour period and installed according to the approved plans and local codes. Two, color-coded diagrams must be prepared for the station and system for each controller. Each diagram should be sealed in plastic with one copy placed in the controller box and the other given to the Recycled Water Agency. All controllers must be marked with the words ***"RECYCLED WATER"*** in black 1-inch high letters on a purple background.

STORAGE TANKS & IMPOUNDMENTS

All storage tanks, either stationary or portable, must be structurally sound and free from leaks. Each tank must be conspicuously marked with signs with the words ***"RECYCLED WATER – DO NOT DRINK"*** in black letters 2-inches high on a purple background. The "Do Not Drink" symbol (page 30) should be present on all recycled water storage tanks.

Impoundments (lakes) that receive recycled water are classified as "unrestricted" (swimming and body contact allowed), "restricted" (no swimming or body contact, but non-contact activities such as fishing and boating allowed) or "ornamental" (no recreational activities allowed). All of these impoundments must have the recycled water valves and outlets marked or tagged with the words ***"RECYCLED WATER – DO NOT DRINK."*** At restricted and ornamental impoundments, adequate measures must be taken to prevent body contact. All recycled water impoundments must be kept separate from potable water wells (at least 100 feet) and reservoirs.

If any storage tank or impoundment receives both recycled and potable water, the potable water supply must be properly air-gapped to avoid a cross-connection.

OTHER DEVICES

All air/vacuum relief valves, valves, pressure reducing valves, pumps, pump control valves, etc. must be tagged or labeled indicating whether it is on the recycled water, non-potable water or potable water system. Recycled water tags or labels must have a purple background with black lettering stating ***"RECYCLED WATER – DO NOT DRINK."***

The "Do Not Drink" symbol (page 30) must be present.

Potable water tags or labels must have a blue background with ***"POTABLE WATER"*** in white lettering.

Non-potable water tags or labels must have a yellow background with ***"NON-POTABLE"*** in black lettering.

VEHICLE IDENTIFICATION

Any vehicle used to transport recycled water must be clearly marked with labels or signs that contain the words ***"RECYCLED WATER – DO NOT DRINK"*** in black 2-inch high letters on a purple background and include the "Do Not Drink" symbol (page 30). One label or sign should be placed on the tank closest to the driver's door, with a second label or sign being placed on the rear surface of the tank at the outlet. All labels and signs must be placed where they can easily be seen by the personnel using the vehicle.

Any vehicle used for the transportation or storage of recycled water must not be reused for the transportation or storage of potable water, unless it has been flushed, disinfected and tested.

POSTING APPROVED USE AREA

Posting the use of recycled water is required at all entrances to the User's facility, and placed where they can be easily seen. The signs must indicate that ***"RECYCLED WATER"*** is in use. In addition, all signs must include the "Do Not Drink" symbol (page 30) and use the words "do not drink," in both English and Spanish (or other locally used language). Additional signing may be required by the Regulatory Agency on a case-by-case basis.

Recycled water notification signs can use either symbol as shown on the next page.

Recycled water notification signs do not need to include such words as "Caution," "Warning" or "Danger."

"DO NOT DRINK" SYMBOLS

SECTION E CROSS-CONNECTION CONTROL

PROTECTION OF POTABLE WATER SYSTEMS

On "dual source" sites where both potable water and recycled water are present, the potable supply must be protected against accidental cross-connections. In lieu of an air-gap, reduced-pressure principal backflow prevention (RP) devices are generally approved by the State DPH, local city or county Health Department and the Recycled Water Agency. This is done according to the approved site-specific drawings. The backflow prevention device must be located at the parcel boundary as close to the meter as possible.

Backflow prevention devices must be approved by the Recycled Water Agency and by the State DPH or local city or county Health Department before installation. If an RP is installed, it must be tested annually by a backflow prevention device tester certified by the ABPA or the AWWA. Test reports must be provided to the Recycled Water Agency and the regulatory agency requiring the test. Records must be maintained for at least three (3) years by both the User and the Recycled Water Agency.

MOW STRIP

A recycled water use site shall have a physical boundary all around its parcel boundary; such as a sidewalk, mow strip, fence-line with concrete base, etc. The use of mow strips to delineate between a recycled water use area and a potable water use area is required if there is no other physical barrier between the two irrigation systems. The mow strips should be a minimum of 4-inches wide and the depth of the mow strip should limit any inadvertent cross-connections.

Concrete "mow strip" separates potable water and recycled water irrigated areas

INITIAL CROSS-CONNECTION TEST

Prior to retrofit work or construction, an initial cross-connection inspection and test must be coordinated by the Recycled Water Agency, with all appropriate health agencies being notified. This test should follow the general guidelines outlined in Section F. The purpose of the test is to determine if there are any connections between the existing irrigation system and the potable water system prior to construction.

During the lifetime of the recycled water system, the Recycled Water Agency must periodically inspect the recycled water system to ensure compliance with all applicable rules and regulations.

Additionally, the Recycled Water Agency may be required to perform periodic inspections of the system for cross-connections (including shut-down tests, if appropriate), depending on the use site characteristics.

FINAL CROSS-CONNECTION TEST

On sites where both recycled and potable water are present, a cross-connection test must be performed using potable water supplied through an approved backflow prevention device before connecting the User's on-site recycled water system to the Recycled Water Agency's distribution system. This on-site test is to ensure the absolute separation of the recycled and potable water systems. The Recycled Water Agency shall coordinate the scheduling of the cross-connection test. Periodic testing using the same procedures may be required in the future, depending on the use site's characteristics. A written report documenting the test results must be submitted to the Recycled Water Agency, the State DPH and the local city or county Health Department following completion.

A pressure (shut down) test procedure is detailed in Section F.

As an alternative to the pressure test, a dye test may be performed by charging the recycled water system with potable water containing a food grade colored dye. The unpressurized potable water system is then checked for any evidence of the colored dye. If the dye is found, a cross-connection exists. This test itself must be done in a way that does not create a cross-connection.

Upon the successful completion of one of the above tests, insuring no cross-connections between the potable and recycled water systems, the User's irrigation system may be connected by the Recycled Water Agency to the recycled water distribution system.

PERIODIC CROSS-CONNECTION TESTING (PCCT)

Periodic cross-connection shutdown testing must be done at least once every four (4) years for "dual-plumbed" sites, unless visual inspections or major on-site water system changes reveal a need for more frequent testing. The Water Recycling Criteria in Title 22 specifically defines "dual-plumbed" sites as either a) buildings with fixtures served with recycled and potable water or b) individual residences with recycled water in the irrigation system.

Other "dual-source" use sites that don't fall under either of these categories may be required to perform periodic cross-connection tests if the use site characteristics indicate a greater risk of potential cross-connections, or if any reuse site undergoes significant modifications of the potable or recycled water systems. The Recycled Water Agency, in cooperation with the local city or county Health Department, will make the determination if such a test is required.

This test must follow the same procedures use for the final cross-connection test (either shut-down or dye test). Before the test is performed, representatives of the State DPH, the local city or county Health Department, Site Supervisor, Recycled Water Agency and any other required regulatory agency must be notified. The Recycled Water Agency will coordinate the scheduling of the test. A sample Test Notification Form is on page 41.

Written verification of the test results must be provided by the Recycled Water Agency to the Site Supervisor, State DPH, local city or county Health Department, local building authority and any other required regulatory agency. All provisions of Title 17, Chapter 5, Section 7601 of the California Code of Regulations, concerning protection of drinking water systems against cross-connections and backflow, must be strictly complied with.

EMERGENCY CROSS-CONNECTION RESPONSE PLAN

In the event that a backflow incident or cross-connection is suspected or occurs the following procedures must be implemented immediately.

1. Keep the potable water system pressurized.
2. Immediately shut off the recycled water supply to the facility at the meter.
3. If possible, post ***"DO NOT DRINK"*** signs at all potable water fixtures and outlets.
4. Notify the Recycled Water Agency and the appropriate local city or county Health Department by phone (see list on page 42). This notification is to be followed by a written notice within 24 hours. The written notice is to include an explanation of the nature of the cross-connection, date and time discovered, and the steps taken to mitigate the cross-connection(s).
5. Collect water samples from the potable water system and perform a 24-hour bacteriological analysis (as instructed by the Recycled Water Agency). Water samples should be collected from the closest possible point to the cross-connection.
6. Identify the cause and location(s) of backflow and eliminate the cross-connection(s).
7. Conduct a cross-connection test in coordination with the Recycled Water Agency and the appropriate Health Departments to verify that all cross-connections have been eliminated.
8. Obtain approval from the Recycled Water Agency and the local city or county Health Department before returning the recycled water system to service.
9. If the bacteriological analysis conducted in Step 4 is positive, flush the potable water system and disinfect by maintaining a chlorine residual of at least 50 mg/L for 24 hours. Otherwise proceed to Step 11.
10. Flush the potable water system after 24 hours and perform standard bacteriological analysis.
11. If the results from Step 9 are acceptable, proceed to Step 11. Otherwise, repeat Steps 8-9.
12. Obtain final approval from the Recycled Water Agency and the State, local city or county Health Department before removing signs.

SECTION F USE SITE PRESSURE-TESTING PROCEDURE

The following are general guidelines for the testing procedure and may be modified with the approval of the State DPH and local city or county Health Department.

1. Potable water must be used during the initial testing of the on-site recycled water system, with the potable water supply separated from the proposed recycled water system by an approved RP assembly until the system has been checked for cross-connections.

2. The irrigation (future recycled water) system should be drained and remain deactivated for an adequate period of time based on site-specific characteristics to allow for sufficient depressurization.

3. At the end of the shutdown period, all of the irrigation system outlets should be tested throughout the entire site for cross-connections by checking each outlet for flow. This should be done at the quick couplers (located on the normally pressurized main irrigation line) and by cycling the irrigation clocks (observing the spray decrease) to determine if there is any flow. If there is no flow detected in any of the outlets that would suggest a cross-connection, the connection to the irrigation system may then be reactivated.

4. The potable water to the domestic uses on the site will then be shut off at the potable water meter. The domestic water system must be drained and remain deactivated for an adequate period of time based on site-specific characteristics to allow for sufficient depressurization.

5. At the end of the shutdown period, all of the use site's domestic water fixtures should be tested for cross-connections by operating each fixture and checking for flow. The potable water inlet should then be checked to detect if there is backpressure or significant backflow. If no flow is detected at the inlet or in any of the fixtures that would suggest a cross-connection, the potable water connection may then be reactivated.

SECTION G SAMPLE FORMS AND SITE SPECIFIC DETAILS

SUMMARY OF STEPS TO OBTAIN RECYCLED WATER

NOTE: The following sequence of events is general in nature and is for illustration only. Please check with your Recycled Water Agency for the appropriate process.

Potential User contacts the Recycled Water Agency for recycled water service, and the Agency responds in a timely manner.

Potential User must have irrigation plans stamped by a registered landscape architect or a registered civil engineer.

Potential User submits a recycled water application (an example is shown on page 39) and pays the application fee (if applicable). The User agreement is explained and signed at this time.

The potential User shall apply to the Recycled Water Agency for a recycled water meter. A construction meter for potable water and an appropriate backflow prevention device may be required for temporary water and system testing before being served recycled water.

Recycled Water Agency notifies the State, local city or county Health Department of the submitted application.

Potential User submits two sets of plans each to the Recycled Water Agency and to either State DPH or the local city or county Health Department for plan check, and pays the applicable plan check fees.

Recycled Water Agency, State DPH, and the local city or county Health Department complete plan check and return plans to the potential User for corrections.

After all corrections are made the potential User resubmits the marked plan checked prints along with a final set of plans. If no more corrections are to be made, the Recycled Water Agency, State DPH, and the local city or county Health Department will approve the original plans. Four (4) sets of prints of the signed plans each should be submitted to these agencies.

A pre-job meeting (preliminary inspection) is held before construction with the Recycled Water Agency's representative, potential User and the contractor. This meeting is to cover the plan's general notes, specific job requirements and cover any questions. Following this meeting, an initial cross-connection test is to be conducted on existing systems with the state and/or city or county health agencies.

The potential User may begin construction, according to the approved plans, contingent upon any other required permits or approvals being obtained. Approvals for deviations in the approved plans are to be sought as they occur.

All work during construction must be inspected by the Recycled Water Agency and/or the local city or county Health Department ***before*** backfilling any buried piping. If any recycled or potable water piping is installed before plan check approval and/or inspection, all or any portion of the piping system may be required to be exposed and corrected as necessary.

After construction is completed, the Recycled Water Agency and either State DPH or the local city or county Health Department must be notified for the final inspection and cross-connection test utilizing potable water supplied through an approved backflow prevention device on dual source sites. The recycled water meter is installed, potable water severed and conversion made to recycled water. During this walk through flow adjustments are made, tagging is inspected, and coverage is checked. A thorough cross-connection test must be conducted at this time to verify that construction was performed correctly. The Recycled Water Agency and/or the local city or county Health Department will generate a punch list of corrections to be made if necessary.

A follow-up walk through will be called for after all corrections from the first walk-through are completed if required. This walk-through will inspect to see that all corrections are complete, including color-coded plans for each controller that are accurate and placed at each controller cabinet. Upon the successful completion of the inspection and cross-connection tests, the User will be granted permission for the normal operation of the system. At this time the Recycled Water Agency's inspector will discuss with the User and the User's Site Supervisor conditions for operation, inspections etc.

LOCAL CONTACTS

SITE: _____

LOCATION: _____

_____

SUPERVISOR:	**PHONE / EMAIL:**
_____	_____
	_____

RECYCLED WATER AGENCY CONTACTS

WATER OPERATIONS:	**PHONE:**
_____	_____
SUPERVISOR:	**PHONE:**
_____	_____
RECYCLED WATER INSPECTOR:	**PHONE:**
_____	_____
RECYCLED WATER AGENCY'S ENGINEER:	**PHONE:**
_____	_____

RECYCLED WATER IRRIGATION USER APPLICATION

Today's Date: _____
Tract No. _____ Project Name: _____
Location: _____ or Brief Legal Description: _____
_____

Type of Development:
_____

Description of proposed uses of recycled water:
_____

Expected date to commence recycled water service (Month/Year) _____
Estimated Water Requirements:

	Acres	Average AF/YR)	Peak Demand (GPM)
Landscape Irrigation:	_____	_____	_____
Park:	_____	_____	_____
Open Space:	_____	_____	_____
School:	_____	_____	_____

Owner: _____
Address: _____
City: _____
State: _____ Zip: _____
Phone: (____)_____
Contact: _____

Engineer:_____
Address: _____
City:_____
State: _____Zip: _____
Phone: (____)_____
Contact: _____

RECYCLED WATER - SITE INSPECTION REPORT

Site Name: _____ Owner: _____

Address: _____

Site Supervisor: _____ Company: _____

Phone: _____ Email: _____

AREA INSPECTED	NO	YES
- PIPING –		
Piping properly marked?	_____	_____
Valves etc. properly marked?	_____	_____
Has piping been modified?	_____	_____
If yes, are modifications approved?	_____	_____
Points of connection properly marked?	_____	_____
Piping System "Leak"?	_____	_____
- SIGNING -		
Are all signs properly placed?	_____	_____
Are all signs legible?	_____	_____
Are tags visible and legible?	_____	_____
- BACKFLOW PREVENTION -		
Backflow Prevention Device installed?	_____	_____
Does the device appear damaged?	_____	_____
Is the device leaking?	_____	_____
Is the device unobstructed?	_____	_____
Is Recycled Water being used for its approved purpose?	_____	_____

Comments: _____

_____

_____

Recycled Water Meter Number: _____ Reading: _____

Inspected By
Name/Title: _____ Agency: _____

Signed: _____ Date: _____

CROSS-CONNECTION TEST NOTIFICATION FORM

Test Date: _____ Test Time: _____

Site Name: _____

Site Address: _____

_____

_____

Recycled Water Agency:

_____

Contact Person: _____ Phone: _____

Agencies Notified: California Department of Public Health, Drinking Water Field Operations Branch

_____

_____

_____

CROSS-CONNECTION NOTIFICATION RSVP FORM

Site Address: _____

_____

Test Date: _____

Agency/Company: _____

Representatives Attending: _____

_____

(Please return to requesting party within 10 days of scheduled test)

SECTION H LOCAL GOVERNING AGENCIES

(Local Recycled Water Agency to insert own name, address, phone number, and modify contact information below for its own service area)

Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013 (213) 576-6600

Lahontan Region
14440 Civic Drive, Suite 200
Victorville, CA 92392
(760) 241-6583

State of California Department of Public Health
Drinking Water Field Operations Branch
500 N. Central Avenue, Suite 500
Glendale, CA 91203
(818) 551-2016

County of Los Angeles Department of Public Health
Cross-Connection and Water Pollution Control
5050 Commerce Drive Baldwin Park, CA 91706
(626) 430-5290

Long Beach Department of Health and Human Services
Bureau of Environmental Health
2525 Grand Avenue
Long Beach, CA 90815
(562) 570-4095

City of Vernon Health and Environmental Control Department
4305 South Santa Fe Avenue
Vernon, CA 90058
(323) 583-8811

City of Pasadena Public Health Department
1845 North Fair Oaks Avenue
Pasadena, CA 91103
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SECTION I DEFINITIONS

Whenever the following terms, or pronouns used in their place, occur in this Manual the intent and meaning shall be interpreted as follows:

Air Gap Separation – A physical break between a water line and a receiving tank or reservoir which is at least double the diameter of the pipeline vertically above the rim of the tank or reservoir, and in no case less than one-inch.

Applicant – An Owner or authorized representative of a potential reuse site who applies for recycled water service under terms of the appropriate regulations. An approved Applicant becomes a User.

Approved Backflow Prevention Assembly – A device installed to protect the potable water supply from contamination by non-potable water and is approved by the State of California.

Approved Use – An application of recycled water in a manner, and for a purpose, designed in a user agreement issued by the Recycled Water Agency and in compliance with all applicable Regulatory Agency requirements.

Approved Use Area – A site with well-defined boundaries, designated in a user agreement issued by the Recycled Water Agency to receive recycled water for an approved use and acknowledged by all applicable Regulatory Agencies.

Chief Executive Officer – The highest-ranking management official of the Recycled Water Agency.

Construction Use – An approved use of recycled water to support approved construction activities, such as soil compaction and dust control during grading.

Cross-Connection – Any physical connection between any part of a water system used or intended to supply water for drinking purposes and any source or system containing water or substance that is not or cannot be approved as safe, wholesome and potable for human consumption.

Graywater – Untreated domestic wastewater from bathtubs, showers, bathroom wash basins, clothes washing machines, and laundry tubs, but excluding toilets, kitchen sinks, dishwashers, photo development sinks and laundry water from soiled diapers. This is ***not*** the same as treated recycled water.

Infiltration Rate – The rate at which the soil will accept water as applied during irrigation, expressed in inches per hour.

Inspector – Any person authorized by the Recycled Water Agency or the local health agencies to perform inspections on or off the Users site before construction, during construction, after construction and during operation.

Irrigation Period – The time, from start of water flow to end, which a specific area receives recycled water by direct irrigation application, no matter how often the specific area is irrigated – that is, length of the duty cycle.

Irrigation Use – An approved use of recycled water for landscape irrigation as defined for recycled water under Title 22, Division 4, Chapter 3 of the California Code of Regulations.

Landscape Impoundment – An open body of recycled water on a use site that is utilized for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.

Local City or County Health Department – This agency is the local health protection agency for the municipality in question. The four agencies within Los Angeles County are County of Los Angeles and the cities of Long Beach, Vernon and Pasadena.

Non-potable Water – The water that has not been treated for human consumption in conformance with the latest edition of the United States Environmental Protection Agency's Drinking Water Standards, the California Safe Drinking Water Act, or any other applicable standards. This also refers to irrigation or industrial process water derived from a potable water system through an approved backflow prevention device that may be subject to contamination (for example, through back-siphonage).

Off-site – Designates or relates to recycled water facilities up to and including the water meter that are owned and operated by the Recycled Water Agency.

On-site – Designates or relates to facilities owned and operated by a User.

Operations Personnel – Any employee of a User, whether permanent or temporary, or any contracted worker whose regular or assigned work involves the supervision, operation or maintenance of equipment on any portion of on-site facilities using recycled water.

Operator – Any person, persons or firm, who by entering into an agreement with a User is responsible for operating on-site facilities.

Owner – Any holder of legal title, contract purchaser, or lessee under a lease with an unexpired term of more than one (1) year, for property for which recycled water service has been requested or established.

Point of Connection – This is the point where the User's system ties to the Recycled Water Agency's system, usually at the water meter.

Ponding – Unintentional retention of recycled water on the surface of the ground or other natural or manmade surface for a period following the cessation of an approved recycled water use activity such that a hazard or potential hazard to the public health results.

Potable Water – That water that is safe, pure and wholesome, does not endanger the lives or health of human beings and conforms to the latest edition of the California Safe Drinking Water Act, or other applicable standards.

Public – Any person or persons at large who may come in contact with facilities and/or areas where recycled water is approved for use.

Rate and Fee Schedule – The schedule of all rates, charges, fees and assessments to be made concerning the use of recycled water served by the Recycled Water Agency as approved or as amended by the Recycled Water Agency. Note: If the recycled water provided by an investor-owned utility functioning as the Recycled Water Agency, rates and fees are approved or amended by the California Public Utilities Commission.

Recreational Impoundment – An open body of recycled water located on a use site that may be used for unrestricted body contact (swimming, wading) or restricted non-body contact (boating, fishing) recreation.

Recycled Water – Non-potable water that results from a high level of treatment of municipal wastewater and which is approved for purposes other than drinking water through Title 22 of the California Code of Regulations.

Recycled Water Agency – The local purveyor or producer of recycled water for the specified service area (public or private).

Regulatory Agencies – Those public agencies legally constituted to protect the public health and water quality, such as the State Department of Public Health, the California Regional Water Quality Control Board and the local city or county Health Department.

Runoff – Recycled water that is intentionally or incidentally allowed to drain outside the approved recycled water irrigation area.

Service – The furnishing of recycled water to a User through a metered connection to the on-site facilities.

Site Supervisor – A qualified person designated by the User to provide liaison with the Recycled Water Agency. This person should be responsible for the installation, operation and maintenance of the recycled and potable water systems and also prevention of potential hazards should have the knowledge and authority to carry out any requirements of the Recycled Water Agency, and should be available to the Recycled Water Agency at all times.

State Department of Public Health – The State of California Department of Public Health, Drinking Water Field Operations Branch.

Unauthorized Discharge – Any release or spill of recycled water that violates the rules and regulations of the Recycled Water Agency or all applicable Federal, State or local statues, regulations, ordinances, contracts or other requirements.

User – Any person, persons or organization (including, but not limited to, any private company or corporation, public utility, municipality or other public body or institution) issued a recycled water Users' Permit by the Recycled Water Agency. The User and Owner may be the same entity.

User Agreement – An agreement issued by the Recycled Water Agency to a recycled water service Applicant after the satisfactory completion of the service application procedures. This Agreement forms a service agreement between the User and the Recycled Water Agency that legally binds the User to all conditions stated in the Agreement and all applicable Regulatory Agency requirements.

User Agreement (For Users Served by an Investor-Owned Utility) – An agreement shall consist of the signed Application, the User Manual, a copy of the applicable Regional Board water recycling permit and the CPUC approved Tariff Schedules. These form a service agreement between the User and the Recycled Water Agency that legally binds the User to all conditions stated in the Agreement and all applicable Regulatory Agency requirements.

Violation – Noncompliance with any condition or conditions of the User Agreement, water recycling requirements issued the Regional Board and/or Title 22 of the California Code of Regulations by any person, action or occurrence, whether willfully or by accident.

Windblown Spray – Dispersed, airborne particles of recycled water that can be transmitted through the air to locations other than those approved for the direct use of recycled water.

SECTION J TIPS FOR SUCCESSFUL RECYCLED WATER USE

Recycled water that is delivered for beneficial reuse has been "manufactured" at a water reclamation plant, resulting in a quality that meets very strict State DPH standards for safety. It is virtually impossible to distinguish the recycled water, as described in this Manual, from potable water. However, there are general chemical differences that may require Users to make changes in their landscaping practices. The following few pages is not meant to be a comprehensive discussion of issues that might arise when irrigating with recycled water; but, rather, the more common areas of concern.

SALT LEVELS

Salt is a difficult and expensive constituent to remove from water; consequently, it and other minerals that are not often removed by conventional treatment processes. The salinity, or salt levels, in recycled water can vary from treatment plant to treatment plant, but are generally higher than the local domestic water supply. Therefore, Users may want to carefully consider their selection of plants, soil composition and irrigation practices.

Type of Plants

For the most part, turf grass is very tolerant of higher salt levels (see table, page 48), as are many ornamental trees and shrubs. Additionally, experience has shown that most flowering plants thrive with the use of recycled water.

However, not all landscape plants are suitable for irrigation with recycled water. Several varieties are very salt **intolerant** and should be avoided when using recycled water.

Soil Types

The type of soil present at a User's site strongly influences how the salt in the recycled (or any) water affects plant growth and health. Well-draining soil is preferable; however, many areas have a significant clay component in their soil. Clay tends to hold on to salt, and can actually cause the soil to stop draining altogether. This particular phenomenon is the direct result of elevated levels of sodium and is measured by its ratio to calcium and magnesium (Sodium Adsorption Ratio, or SAR). The presence of self-regenerating water softeners that discharge sodium-laden brine into the sewer system can be large contributors to elevated sodium levels in the recycled water.

Problems with soil drainage due to clay soils and an elevated SAR can be rectified by the application of gypsum (calcium), which loosens the bound up clay and allows for water to drain through the soil.

However, when dealing with clay soil drainage issues, some recycled water users have rejected gypsum as it increases the salinity, opting instead for an acid injection system. Buffered acid can be added to break up the bicarbonate binding and salt buildup at the surface level in clay soils and allow improved penetration to the root zone.

Azaleas require acid soil, while recycled water tends to be slightly alkaline

Irrigation Schedule

Many irrigation systems schedule their watering for short periods of time, in some cases almost every night of the week. Salt levels of in the recycled water and the type of soil involved (sand vs. clay) may call for a switch to longer irrigation run times done on a less frequent basis. Short irrigation runs have a tendency to deposit more salt in the root zone, with possible adverse impacts on plant health and growth. Clay soil is more susceptible to this phenomenon than better-draining soils. Heavier watering done less frequently helps to leach the accumulating salts out of the root zone.

This is particularly important in regions of the state that do not experience sufficient precipitation during the rainy season. Rainfall can have the same effect as longer watering periods, if the storms are heavy enough. Periods of drought can exacerbate the build-up of salts but can be addressed with a modified irrigation schedule.

NUTRIENTS

Recycled water may also contain higher nutrient levels such as nitrogen, phosphorous and potassium that are essential components for plant growth. Some treatment processes may reduce the levels of these chemicals, although they are not totally removed.

Fertilizer Value

While nutrient levels vary among treatment plants, there are usually sufficient levels of nitrogen, phosphorous and potassium in the recycled water to provide at least a small measure of fertilizer value to the landscaping each and every time irrigation takes place. Based on nutrient levels in the recycled water being supplied, a Site Supervisor can readily calculate the number of pounds of each constituent being delivered. He or she can then determine how much, if any, and what kind of additional fertilizer needs to be applied.

A common error is to continue the same fertilizer application schedule that was in place when domestic water was being used for irrigation. The addition of applied fertilizer, on top of the extra nutrients in the recycled water, can cause problems with plant health, groundwater quality problems and avoidable costs to the site in buying and using unnecessary fertilizer.

Increased Mowing

Reports from many turf sites using recycled water have reported the need to mow their grass more often. This is the direct result of the additional nutrients in the recycled water being available for uptake by the turf.

Ornamental Lakes

Some use sites have ornamental lakes as part of the landscaping. Care must be exercised if recycled water is used to supply these lakes. The nutrient value in the recycled water readily promotes the growth of algae, which can impair the aesthetics of these lakes. This is particularly a problem in lakes that are shallower than 10 feet, due to excessive sunlight penetration.

Several different strategies have been employed at such lakes, with the greatest level of success in algae control coming from combinations of two or more of the following methods:

- Pumping the recycled water from the lake into the irrigation system reduces the amount of time the water (and the nutrients it contains) spends in the lake, consequently reducing algae production.
- Re-circulating the water by means of fountains or waterfalls or installing more extensive aeration systems.

- Preventing the introduction of organic material (such as grass clippings) from entering the lake.
- Stocking the lake with algae eating fish, such as Mosquito fish (*Gambusia affinis*), which can be provided free by the Greater Los Angeles County Vector Control District, catfish, pleco or carp. However, some fish, like koi, bass and bluegill, react unfavorably to higher ammonia levels that may be in the recycled water.
- Using a chemical tinting product, such as Aqua-Shade, to prevent sunlight from penetrating the water column.
- Using a chemical algaecide, such as copper sulfate. (**Warning:** This product is also toxic to other organisms, so the lake water could not be used for landscape irrigation.)
- Because refilling ornamental lakes may not be a significant consumptive use of the recycled water, in some cases it may be preferable to fill the lakes with potable water or even non-potable well water.

IRRIGATION EQUIPMENT

Because of the different chemical make-up of recycled water and the possible presence of higher levels of chlorine, older irrigation valves and sprinklers may experience operational problems following the switch-over to recycled water. Many irrigation equipment manufacturers now stock equipment especially made for use with recycled water, not only with the proper markings, but also using more resilient materials.

Turfgrass Species	Grass Type	ET Rate	Drought Tolerance	Turfgrass Tolerance to Soil Salinity (ECe)
Annual Bluegrass	CS	Very High	Poor	Sensitive < 3 dSm-1
Colonial Bentgrass	CS	Very High	Poor	
Bluegrass	CS	Very High	Fair	
Annual Ryegrass	CS	Very High	Poor	Moderately Sensitive 3-6 dSm-1
Creeping Bentgrass	CS	Very High	Fair	
Red Fescue	CS	Medium	Fair	
Hard Fescue	CS	Medium	Fair	
Perennial Ryegrass	CS	High	Fair	Moderately Tolerant 6-10 dSm-1
Tall Fescue	CS	Very High	Medium	
Kikuyugrass	WS	High	Good	
Zoysia grass	WS	Low	Excellent	
Creeping Bentgrass 'Seaside'	CS	Very High	Fair	Tolerant >10 dSm-1
Alkaligrass	CS	-	-	
Bermudagrass	WS	Low	Superior	
St. Augustinegrass	WS	Medium	Good	
Seashore paspalum	WS	Medium	Excellent	

Salinity tolerance of various turf grasses

Wall Mounted inside an equipment room or enclosure out of harm's way

CS3000

resource management system

The Calsense CS3000 irrigation controller is a powerful resource management system offering an easy and effective way to manage water and labor costs. Controllers not only communicate with one another to shar information, but are also accessible anywhere, any time from any internet-connected device including PCs, laptops, tablets, and smart phones.

description

The CS3000's options are modular which means stations, lights, points of connections, and weather options can be added or removed in the field. A transient protection board is included protecting the controller and attached options against high voltage.

A 2-Wire option allows a single controller to manage up to 128-independent valves, anywhere along a 7,000 foot cable run. Decoders are available as a 2-station and as a POC decoder. By combining multiple 2-Wire POC decoders, a single controller can manage multiple points of connection, as well as operate a two or three-level bypass manifold.

features

- Central communications using Ethernet, Wi-Fi and 3.5G cellular modem
- Available in 8, 16, 24, 32, 40 and 48 conventional stations and/or 2-Wire
- Support for up to 128 stations when using both conventional and 2-Wire or just 2-Wire
- Stations and options are field-replaceable
- Simple to use 'groups' to assign similar characteristics to multiple stations at once
- Easy terminal connections for field wiring
- When using *FLOWSENSE*™, programming changes can be made from any controller on the chain
- 10-year limited warranty

technical specifications

power

- Input requirement: 120VAC single phase, 1 amp
- Station outputs: 24VAC, 2.0 amps max (short protected)

physical

- Height: 16.25" Color: Medium Gray
- Width: 14.50" Material: 16 gauge, powder-
- Depth: 7.25" coated, stainless steel

communication options

• CS3-GR	3.5G cellular modem
• CS3-EN	10/100 Mbps Ethernet device
• CS3-WEN	802.11b/g Wireless Ethernet (Wi-Fi) device
• CS3-SR	Spread-Spectrum radio
• CS3-LR	Local Radio 450-470 MHz
• CS3-M-KIT	Wire-linkable to share communication with multiple controllers

other options

• CS3-2W-OPT	Interface for 2-Wire
• CS3-FL	*FLOWSENSE*™ software to operate multiple controllers sharing flow
• CS3-W-KIT	Weather Interface for ET Gage, Tipping Rain Bucket, and Wind Gage
• CS3-8ST-KIT	8-station card plus terminal
• CS3-L-KIT	Interface for four light circuits

WaterSense Meets EPA Criteria
Certified by ICC-ES

CALSENSE®

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Resource Management Specifications

1.0 FIELD EQUIPMENT

1.1 Automatic Controller

A. Controller(s) shall be the Calsense model CS3000 irrigation controller as indicated on the drawings, and shall be installed per manufacturer's specifications, as shown on the drawings, and as specified herein.

B. The irrigation controller shall have a 10-year, limited warranty.

C. The irrigation controller shall have a large 5.7 inch backlit, ¼ VGA, LCD, sunlight readable display where information can be viewed on the same screen, and with a scrolling side menu design that makes programming intuitive and easy to follow.

D. The controller shall be available in multiple station counts including 8, 16, 24, 32, 40 or 48 stations. If less than 48 stations are purchased initially, additional stations can be added at any time in the field using 8-station kits.

E. The controller shall support up to 128-stations when using 2-Wire. This can be either 128, 2-Wire stations or a combination of up to 48 conventional-wired stations plus 80, 2-Wire stations.

F. Controller software upgrades shall occur via the internet transparently and at no charge.

G. The controller shall have unlimited programs known as Station Groups which can water individually or concurrently to maximize irrigation system capacity and reduce watering time.

H. The controller shall have the ability to assign landscape details as plant material, head type, soil type and exposure to each Station Group to simplify programming of stations with similar characteristics. Each group shall include a variety of other settings including irrigation schedule, percent adjust factor, line-fill times and on-at-a time rules.

I. The controller shall support up to four mainlines simultaneously for managing flow.

J. The controller shall support up to 12 points of connection shared among controllers.

K. The controller shall support up to 3 flow sensors and 3 master valves in a by-pass configuration so as to accurately measure and read the overall range of station flow rates from the lowest flowing station in GPM to the highest flowing station in GPM, using the 2-Wire option and the 2-Wire, POC decoders for all 3 flow devices and master valves.

L. The controller shall automatically calculate cycle and soak scheduling to water each station for a fixed cycle time and allow the water to soak in between cycles, maximizing infiltration and minimizing runoff.

M. The controller shall have a water budget feature that displays monthly water volume allotments in either HCF or gallons for each of the 12 calendar months labeled as January thru December. This monthly guideline shall be calculated three ways, either directly entered, calculated by the controller using a yearly budget and dividing that out to the 12 months proportionately using built-in historical ET, or by calculating the monthly numbers using total square footage and a user selected percent of historical ET.

N. The water budget shall be available per POC controlled and programmed for either every month or every other month pre-programmed as date ranges. If the expected water use

for the period exceeds the water volume budget, the user shall be notified with an alarm before the period ends so changes to the program can be made. The controller shall not terminate irrigation automatically in this process, or if selected as an option, the controller shall proactively and automatically decrease the scheduled irrigation for each station group using the percent reduction programmed, when approaching the set water budget limit with notification of said action.

O. The controller shall have a wide range of water reports and diagnostics available directly at the controller and shall include:
   - A summary of all usage for each irrigation mainline
   - Usage for each point of connection connected to the mainline
   - Station-by-station usage
   - A complete station-by-station history which includes the date and start time of each cycle, programmed minutes, programmed inches, number of cycles, actual flow rate, expected flow rate, and any alerts or issues that occurred during irrigation.
   - Unscheduled water usage and non-controller water usage including quick coupler use and bleeding valves manually

P. The irrigation controller shall have three separate mainline break settings available for proper flow detection of catastrophic issues without interfering with standard irrigation practices and shall be programmed for 1.) 'during irrigation', 2.) 'master valve override' functions, and 3) 'all other times'

Q. The controller shall have flow management capability as a standard feature whereas the controller shall learn each station's expected GPM flow rate automatically at night over several irrigations, and use the mainline GPM capacity programmed, to operate up to six (6) valves at the same time to shorten the water window.

R. The controller shall have the ability to accommodate multiple types of irrigation schedules including irrigating even days, odd days, prescribed days of the week, and interval scheduling ranging from every other day up to every four weeks.

S. Several controllers, up to twelve shall be able to share one or multiple points of connection with multiple flow sensors and master valves. This option shall allow several controllers without the use of a central control computer to share the irrigation programs and flow information for:
   1. Monitoring of system flows.
   2. Shortening water windows by maximizing the number of valves on without exceeding system flow capacity.
   3. Turning OFF valves with excessive flow rates due to broken lateral lines.
   4. Tracking water usage and comparing to a water budget.
   5. Eliminating relays when sharing pumps and master valves.

T. When more than one controller is sharing one or multiple points of connection and the controllers are communicating to each other through hardwire or radio, the data shall be distributed as changes occur making the data available from any controller on the *FLOWSENSE*™ chain so that the user shall be able to view and program a controller's information from any other controller in the group.

U. The controller shall provide permanent memory stores of all controller programming and setup data, including date and time, in non-erasable memory.

V. The controller shall have the ability to create and program an unlimited number of manual programs which allow the user to schedule stations to run for a preset time, up to 6 – times per day, for hydro-seeding, new planting and fertilization scheduling.

W. Electrical alerts, such as short circuits and no currents, shall be standard to help the user troubleshoot field wiring and solenoid problems.

X. The irrigation controller shall provide an optional lights feature to be used to operate up to four light, gate or water feature relays.

1.2 Wall Mount Installation

A. The wall-mounted gray box shall be a completely assembled unit, pre-mounted with the designated controller. The box shall be constructed of weather- and vandal-resistant stainless steel.

B. The wall mount unit shall come complete with transient and lightning protection board and factory-labeled terminals.

C. The transient protection board shall be pre-mounted in the wall mount unit and shall support field replaceable modules which include terminal strips for the connection of irrigation field wires, 2-Wire cable, and weather monitoring devices such as an ET gage, Tipping Rain Bucket, and Wind gage.

D. The wall mount unit shall feature a security-tight locking mechanism, louvered vents, with splash guards, and bee/wasp screens.

E. All wall mount units shall come with a 10-year limited warranty and shall be fully UL-approved.

1.3 Pedestal Enclosure

A. The enclosure shall be of a vandal and weather resistant nature manufactured entirely of 304-grade stainless steel, and the top shall be 12 gauge and the body 14 gauge. The main housing shall be louvered upper and lower body to allow for cross flow ventilation. A stainless steel backboard shall be provided for the purpose of mounting electronic and various other types of equipment. The stainless steel backboard shall be mounted on four stainless steel bolts that will allow for easy removal of the backboard.

B. The 38-inch height with flip top shall provide easy access for programming from a standing position under normal installations.

C. The pre-assembled vandal resistant enclosure factory pre-assembled and supplied by controller manufacturer shall come complete with 24 VAC lightning and surge protection and all terminals shall be factory labeled. The pre-assembled enclosure shall come provided with an On/Off switch to isolate the controller along with a GFI receptacle. Specific radio antenna(s) shall be pre-mounted and connected on enclosure. The enclosure shall include 2-7/8”, 1-1/2” thick, 6-pin cylinder, die-cast steel padlock with unique shackles design.

D. Factory pre-assembled enclosure with controller shall carry a full UL listing.

E. Controller manufacturer shall offer a double-wide, pre-assembled vandal resistant enclosure, 38-inch height with flip top for two controller placements side by side. All necessary wiring between the two controllers in order to share central communications and/or flow and weather data shall be pre-wired by manufacturer for easy installation.

F. The factory pre-assembled enclosures shall carry a ten (10) year limited warranty.

1.4 Grounding

A. Grounding shall consist of one 5/8-inch x 8-foot copper rod installed per irrigation controller and where multiple controllers *are not* connected to the same ground rod.

B. The top of each rod shall be installed inside a 10-inch round valve box, with the rod installed as close as practical to the controller. If a pedestal enclosure is used, the ground

rod may be installed through the pedestal base. Under no circumstances shall the rods be shortened.

C. A #6 AWG solid copper wire shall be used to connect from the ground lug of the transient protection board to the copper rod. Brass clamps specifically designed to secure the copper wire to the grounding rod shall be used. There shall be no kinks or sharp bends in the wire.

D. Each wire may be wrapped around the rod and brazed in place as an alternative to clamping. Braze the wire to the rod for at least one circumference of the rod.

1.5 2-Wire Path & Decoders

A. The 2-Wire option shall provide support for up to one-hundred and twenty-eight (128); 2-Wire stations connected to a single controller and shall provide support for up to 6 points of connection (POC's).

B. The 2-Wire cable shall either be Paige P7354D or Regency's Hunter® Decoder cable with a maximum length of 7,000 ft.

C. A ground rod, 5/8 inch x 8-ft solid copper shall be required every 300-feet along the 2-Wire path as well as a single ground rod at the end of the cable run.

D. The station decoder shall be a 2-station decoder and shall be able to operate up to 2-solenoids using unique colored wires for each.

E. A single controller shall be able to operate up to 70, 2-station decoders and it shall be intended that all wire runs between valves and 2-Wire decoders shall be direct pulls and have no splices except at the decoder location.

F. All electrical connections must be waterproof and moisture-resistant and shall be done with 3M™ Scotchcast™ 3570G Connector Sealing Packs.

G. The 2-Wire decoders shall use #14 AWG direct burial wires to connect to remote control valves and the maximum wire run between the decoder and the valve shall be 100-feet.

H. The POC decoder shall operate a single master valve and flow meter (model FM). A single controller shall be able to operate up to six POC decoders with a maximum of 12-POC's in a chain, controllers using *FLOWSENSE*™ technology.

I. The maximum wire run between the POC decoder and flow meter shall be 20-feet while the maximum wire run between the decoder and the master valve shall be 100-feet.

1.6 Weather Monitoring

A. The manufacturer of the central control system shall provide real-time ET and rain data using multiple, state-of-the-art, high resolution numerical weather data provided by NOAA, all without subscription charges. Unlike other services which use only ground-level weather stations, the NOAA-modeled data shall allow weather to be triangulated to each customer's unique latitude, longitude and elevation, ensuring accuracy even within localized microclimates. ET shall be calculated using the latest FAO Penman-Monteith method which shall use solar radiation, temperature, wind speed, relative humidity and other input parameters.

B. The controller shall be able to interface with an on-site ET gage able to measure daily localized, evapo-transpiration and log the amount of inches lost each day without the use of a central computer.

C. The ET measuring device shall be powered by the selected field controller. ET is measured directly in 0.01" increments and pulses from the gage are sent directly to the field controller.

D. The controller shall be able to store and display daily, on-site ET in a 28-day table which is updated every 24 hours.

E. The user shall be able to view over 100 selections of built-in historical ET tables or program monthly historical ET data for a given area directly, to be used as a backup for that night's calculation in case the ET gage malfunctioned or the real-time value sent normally through the Internet failed.

F. The user shall be able to cap the amount of daily ET used by the controller for that night's calculation by selecting a percent of historical ET for the given area to be used instead of the actual ET received.

G. The irrigation controller shall have the capability to calculate station run times using the average of the last 7 days of ET instead of using a single ET value to calculate the next scheduled, station run times.

H. The controller shall be able to interface directly with a Tipping Rain Bucket and shall accurately measure rainfall in 0.01" increments by means of a tipping and emptying device mounted below the center of the collection dish.

I. The rain-measuring device shall be wired using the 25-feet of 2-conductor cable supplied with the Tipping Rain Bucket to the selected field controller. The controller shall have a weather option able to interface with the device. The cable shall be installed in conduit and the connections are to be made at a terminal strip inside the enclosure. Maximum length of cable run shall be 1000 feet using Paige P7171D communication cable when necessary. 18-gauge multi-conductor irrigation wire in conduit may be used for runs under 100-feet. Runs shall be direct pulls without splices.

J. The irrigation controller shall provide the following programming parameters for rain:
   Stop Irrigation after x.xx inches
   Maximum Rain in One Hour is x.xx inches
   Maximum Rain in 24 Hours is x.xx inches

K. Wind speed shall be monitored by the irrigation controller with the weather option interface and the wind gage installed. The controller shall pause irrigation once the wind speed exceeds a user-set limit. As wind subsides, the controller shall resume irrigation where it left off. Winds from 0-to 135-MPH shall be accurately read. Data from one wind gage shall be shared amongst a group of controllers making up a *FLOWSENSE*™ chain.

L. The wind gage device shall be wired using the 60-feet of 2-conductor cable supplied with the device to the selected field controller. The cable shall be installed in conduit and the connections are to be made at a terminal strip inside the enclosure. Maximum length of cable run shall be 1000 feet using Paige P7171D communication cable when necessary. 18-gauge multi-conductor irrigation wire in conduit may be used for runs under 100-feet. Runs shall be direct pulls without splices.

1.7 Flow Monitoring

A. The flow sensor used shall be supplied by the same manufacturer as the irrigation controller.

B. The flow sensor shall be wired back to the irrigation controller using two #14 AWG wires, one red, and one black in 1" PVC conduit to connect to the irrigation controller. The maximum wire run between flow meter and controller shall be 2000 ft. The flow meter

shall send low voltage digital pulses back to the controller and therefore all electrical connections must be waterproof and be resistant to any moisture entry.

C. It is intended that all wire runs between the controller and flow meter shall be direct pulls and have no splices. If wire splices are unavoidable, they must be installed in a valve box with Spears DS-100 connectors with Spears sealant or 3M Scotchlok No. 3570 connector sealing pack used.

D. Each flow sensor shall have the following characteristics:
   1. Housing to be a Sch 80 polyvinyl chloride tee or bronze tee
   2. Have a pulsing output that operates at 9VDC and a pulse rate that is proportionate to the GPM
   3. Fully compatible with the internal interface at each field controller
   4. Powered by the controller
   5. Replaceable metering insert
   6. Shall feature a six-bladed design with a proprietary, non-magnetic sensing mechanism

E. The irrigation controller shall include native support for Bermad 900-M Reed Switch and Netafim Pulse Reed Switch series hydrometers. Allowable hydrometer sizes shall range from 1.5" to 10". Reed Switches that are supported include 1-pulse per 1-gallon and 1-pulse per 10-gallon switches. Currently only one hydrometer mentioned shall be able to interface with the controller.

2.0 Central Control Communication Options

A. The field controller(s) shall be capable of utilizing a single mode or a combination of communication modes such as 3.5G cellular radio, Ethernet, wireless Ethernet, 450-470HMz Local Radio, point-to-point Spread Spectrum radio, and hardwire communication cable for central control of irrigation via cloud-based, Command Center Online web software.

B. The controller shall be able to utilize a wireless, 3.5G cellular radio in remote areas where an Ethernet or WiFi connection is not possible for direct communication back to a desktop, tablet, or laptop computer via the Internet. Service plans for single and multiple controllers utilizing a 3.5G cellular modem shall be available through the manufacturer as 1-year or 5-year plan.

C. The controller shall be able to utilize an Ethernet communication, CAT5 or CAT6 cable path as part of a district's or campus network system. An Ethernet (RJ45) connection shall be supplied at the controller location, with the network set to have access to this connection. IP reservations with DHCP are preferred along with the hard coded MAC address from the Ethernet device supplied. The secondary preference shall be a static IP address with additional programming requirements. The controller shall utilize an existing WiFi, wireless Ethernet network on a school campus or facility city project. IP reservations with DHCP are preferred along with the hard coded MAC address from the Ethernet device supplied.

D. The controller shall be able to utilize a short-range, Spread-Spectrum radio to communicate with other controllers in line-of-sight proximity providing a reliable communication link instead of a hardwire communication path when sharing data. The spread-spectrum radio option does not require FCC licensing, and offers a secure error correcting frequency hopping radio link immune to outside interference.

2.1 Command Center Online Web Software

A. The central control software shall be a cloud-based package designed to provide complete irrigation control through a web application, without the purchase of proprietary software loaded on a dedicated, desktop computer.

B. The fully-featured web application shall provide communication using a variety of internet-connected options including Ethernet, Wireless Ethernet (WiFi), and 3.5G Cellular Radio.

C. The web application shall allow the user to monitor and program controllers, as well as run various water usage reports from any internet-connected device including PC's, tablets, and smart phones. Weather data collected from an ET Gage, Tipping Rain Bucket, or *WEATHERSENSE* can be shared to any controller on the system.

D. Engineered for easy and reliable access, all that is needed to get started using the software shall be a user name and password to obtain data from controllers in the field. Each customer's service shall be unique and password protected so data is secure.

E. User accounts shall be issued and managed by an administrator account so that only authorized users can access controller information.

F. The cloud-based software shall include the ability to turn stations On and Off remotely using any internet-connected device including PC's and tablets, and a smart phone app. User shall be able to turn on up to six valves simultaneously and view real-time flow information, details if a mainline break occurs, and real-time weather data when using on-site weather devices such as daily ET and rainfall in inches.

G. The web software shall allow a customer to create their own custom dashboard as the home page, providing a snapshot of the most important water and labor management graphs and reports depicting easily the most current status of each controller at each specific project location.

H. System reports shall include complete records of the details for every irrigation cycle, water usage versus water budget amounts, the gallons and percentages of water savings, and what events and changes have occurred at the controller. System administrators shall have management reports listing sites and user for their company.

I. System requirements shall be a broadband internet connection such as DSL, cable, or mobile broadband.

J. Supported web browsers shall include:
   - Microsoft Windows Internet Explorer® 8.0 or higher
   - Google® Chrome™ 34 or later
   - Mozilla Firefox™ 28 or higher
   - Apple® Safari™ 5.1.7 or higher

3.0 Warranty, Service & Training

A. The manufacturer shall provide after-sale support that is a *no charge* service whereas on-going training and education shall be provided by factory direct personnel to the end user(s) at the field controller(s) and using the cloud-based, web software for central control of irrigation.

B. The central control manufacturer shall warrant to the purchaser of its manufactured products against defects in material and workmanship for a period of ten (10) years from the date of original purchase by the owner.

C. All peripheral, accessory, and RF equipment such as radio and 3.5G cellular radio modems, ET gages, flow sensors, and rain buckets (but not limited to) and used in conjunction with central irrigation controllers, shall have distinct warranties of their own and should be noted separately from this warranty.

CS-2W

two wire decoder

The Calsense 2-Wire technology provides easy and cost effective installation and expansion of any landscape project using the Calsense CS3000 irrigation controller with the Calsense 2-Wire decoder system.

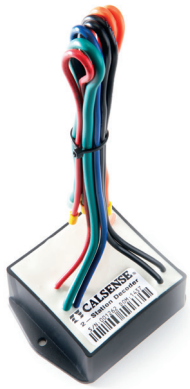
description

The Calsense decoder offers powerful, robust lightning and surge protection, making it durable and reliable.

Each decoder not only receives commands from the controller but also sends real-time information back. Diagnostic information is gathered automatically from each decoder on a continual, real-time basis and recorded and transmitted back to the controller as well as the Command Center Online web application.

Smart technology enables assigning any decoder to a station at the controller in any order after field installation using the serial number of the decoder and colored output wires.

The Calsense decoder is available as either a 2-station decoder or as a POC decoder.



***model* CS-2W-2ST: 2-station decoder**

model CS-2W-POC: POC decoder

features

- Maximum 128-stations on 7,000 feet, 14 AWG 2-Wire cable with a maximum decoder load of 70
- Search for and identify all decoders connected to the controller on the 2-Wire and list them in the controller by serial number
- Built-in surge and lightning protection
- Operate six valves simultaneously including master valves
- Diagnoses electrical solenoid problems like “no current”, “electrical short” or “over-current”
- Ground wire included with each decoder

technical specifications

mounting

- In valve box

dimensions

- Height: 1.4”
- Width: 3.3”
- Length: 4.0”

environment

- Freeze/heat resistant 10°F to 150°F (-12°C to 65°C)

solenoid

- 2-station decoder operates 2-solenoids using unique colored wires for each
- POC decoder operates a single master valve and flow sensor

electrical input

- Nominal voltage: 34 Vpp (24 VAC) from 2-Wire line

electrical output

- Max voltage: 24 VAC

max distance decoder to solenoids

- 100 ft., 14-gauge wire

2-Wire cable

- 14-gauge (1.5 mm) solid copper, jacketed
- Paige P7354D or Regency’s Hunter® Decoder Cable

CALSENSE®

2075 Corte del Nogal, Suite P Carlsbad, CA 92011 (760) 438-0525 (800) 572-8608 Fax: (760) 438-2619 www.calsense.com

CS3-EN

ethernet communication option

The Calsense Ethernet communication device, model CS3-EN, offers a rugged and powerful option which provides connectivity with Calsense's cloud-based Command Center Online using an existing Ethernet network such as a school campus or City. Simple device set-up and configuration is accomplished using the Calsense CS3000 Irrigation Controller.

description

The device ships from Calsense DHCP-ready so there's often nothing required to start communicating. Simply connect it to an existing network using a Category5 (CAT-5) or better Ethernet cable and it automatically connects to the Calsense server. If you prefer to assign an IP address statically, the device can be programmed directly at the controller using the controller's keypad. Remote configuration over a network is also possible using a web browser.

The Ethernet port on the Calsense Ethernet communication option is autosensing so it automatically detects the type of Ethernet network it's connected to and communicates at the highest speed it can. If the connection is lost, the device intelligently attempts to reconnect to the network automatically.

This option also enables the Calsense Command Center Online web application to communicate with a controller through a spread spectrum or local radio system, which consists of one or more spread spectrum or local radio hubs and one or more controllers with the CS3-SR or CS3-LR option. The hub manages data flow between the cloud and surrounding controllers.

technical specifications

network interface

- Interface: 10/100 Mbps Ethernet port
- Connector: RJ-45 Ethernet port
- Standards: IEEE® 802.3

environmental

- Operating Temperature: -40° to 70°C (-40° to 158°F)
- Relative Humidity: 5 to 95%, non-condensing
- IP Rating: 30

transient protection

- Power Input: Up to non-repeated 600-W 10/100 µs pulse protection
- Ethernet Port: 1.5-KV surge isolation
- Serial Port: 15-KV ESD protection

certifications

- Emissions: FCC, CE, IC, C-Tick
- Safety: UL®

warranty

- 2-year limited warranty

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FM flow meter PVC

Calsense Flow Meters, model FM, are used with Calsense irrigation controllers to monitor real-time flow of potable or non-potable water making them important tools in detecting mainline and lateral breaks on an irrigation system. Real-time flows for each station are learned automatically at night when irrigation comes on so constant flow rates are measured in order to provide the most accurate and reliable monitoring of breaks and problems as they occur.

description

The Calsense Flow Meter features a proprietary, non-magnetic sensing mechanism and a six-bladed design. Its unique, forward-swept impeller design provides higher, more constant torque than less efficient four-blade designs, and is less prone to fouling by water-borne debris. The advanced design of the Calsense Flow Meter coupled with an absence of magnetic drag delivers improved operation and consistent repeatability at lower flow rates.

As water flow turns the Flow Meter impeller blades, a low impedance 9VDC signal is transmitted with a frequency proportional to the flow rate. The signal can travel up to 2,000' between the Flow Meter and the Calsense field controller without the need of amplification. Controllers require no additional interface and supply the DC signal directly to the Flow Meter.

The Calsense Flow Meter is available in both PVC and Bronze models. Available in PVC are sizes 1.5-inch, 2-inch and 3-inch. Available in Bronze are 1-inch, 1.25-inch, 1.5-inch and 2-inch sizes.

The Calsense Insert-Type Flow Meter, model FMBX is designed to be used for mainline pipes ranging in size from 3- to 18-inches. It is mounted to the pipe using a pipe saddle or welded-on threaded fitting which are not included and supplied separately. It is constructed of brass and bronze hardware and is provided with a bronze 2-inch NPT externally-threaded hex adapter for mounting.

technical specifications

FM-1B, FM-1.25B, FM-1.5B parameters

- Accuracy: +/- 1% of full scale
- Linearity: +/- 0.7%
- Repeatability: +/- 0.7%
- Flow Range: 0.5 to 15 feet/second
- Max. Pressure: 400 psi@150°F (65.5°C)

FM-2B parameters

- Accuracy: +/- 1% of full scale
- Linearity: +/- 1% Repeatability: +/- 1%
- Flow Range: 1 to 30 feet/second
- Max. Pressure: 200 psi@150°F (65.5°C)

FM-1.5, FM-2, FM-3 parameters:

- Accuracy: +/- 1% of full scale
- Linearity: +/- 0.5%
- Repeatability: +/- 0.5%
- Flow Range: 1 to 30 feet/second
- Max. Pressure: 100 psi@68°F (20°C)

body construction

- FM-B series: Bronze
- FM series: Schedule 80 PVC

(See Calsense Designer's Guide for more details)

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STUBBY

antenna communication accessory

Calsense Stubby Antennas are omni-directional surface mount antennas designed for all indoor and outdoor environments and applications. The maximum cable length is dependent upon signal strength. Stubby antennas come with their own cables; however, they may be extended with prior approval from Calsense.

description

Patented field technology ensures uninterrupted data transmissions in urban canyons and rural drop off areas. Shipped with a threaded permanent stud mount for vandal-resistant mounting on enclosures and brackets. There are several options:

- The Calsense Cellular Stubby Antenna, model GR-STUBBY, is a broadband surface mount cellular antenna which operates at 3-dBi
- The Calsense Spread Spectrum Radio Stubby Antenna, model SR-STUBBY, is 3-dBi
- The Calsense Local Radio Stubby Antenna, model LR-STUBBY, is 3-dBi
- The Calsense Wireless Ethernet Stubby Antenna, model WEN-STUBBY, is 3dB-MEG

tecnical specifications

dimensions

- Height: 2.3”
- Diameter: 1.4”

mounting:

- Surface-mount

warranty

- 5-year limited warranty

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Rain Bird Control Zone Kits

SIMPLIFY INSTALLATION FOR DRIP IRRIGATION

All-in-one compact solution - provides on/off control, filtration and pressure regulation

REDUCE MATERIAL AND LABOR COSTS

- Typically lower cost than individual components
- Compact size - fit more kits per valve box
- Pre-assembled models provide installation time savings

INCREASE CONVENIENCE AND RELIABILITY

Integrated pressure regulation and filtration design – fewer parts and threaded connections mean less chance of leaking

Market Leadership and Widest Control Zone Kit Offering

RESIDENTIAL

Low Flow: 0.2 - 10 gpm

NEW

XCZLF-100-PRF
FLOW: 0.2 - 10 gpm

XACZ-075-PRF
FLOW: 0.2 - 5 gpm

Comes Assembled

XCZ-075-PRF
FLOW: 0.2 - 5 gpm

LIGHT & HEAVY COMMERCIAL

Wide Flow: 0.3 - 20 gpm

XCZ-100-PRB-COM
FLOW: 0.3 - 20 gpm

XCZ-100-PRBR
FLOW: 0.3 - 20 gpm

XCZ-100-PRB-LC
FLOW: 0.3 - 20 gpm

XCZ-100-PRB-MC
FLOW: 3 - 20 gpm

Medium Flow: 3 - 15 gpm

NEW

2-Wire Compatible

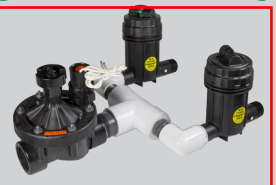
XCZPGA-100-PRF
FLOW: 3 - 15 gpm

XACZ-100-PRF
FLOW: 3 - 15 gpm

Comes Assembled

XCZ-100-PRF
FLOW: 3 - 15 gpm

High Flow: 15 - 40 gpm



XCZ-150-PRB-COM
FLOW: 15 - 40 gpm

All Wide and High Flow Kits are 2-Wire Compatible

CONTROL ZONE SELECTION CHART

Provide Basket Filer on all drip valves

Model	Size (Inlet x Outlet)	Flow Range	Valve	2-Wire Compatible	Filter	Outlet Pressure
COMMERCIAL HIGH FLOW: 15 – 40 gpm						
XCZ-150-PRB-COM	1½" x 2 @ 1"	15 -40 gpm	150-PESB	Yes	1" Quick Check PR Basket Filter (2)	40 psi
COMMERCIAL WIDE FLOW: 0.30 – 20 gpm						
XCZ-100-PRB-COM	1" x 1"	0.3 - 20 gpm	100-PESB	Yes	1" Quick Check PR Basket Filter	40 psi
XCZ-100-PRBR	1" x 1"	0.3 - 20 gpm	100-PESBR	Yes	1" PR Basket Filter	40 psi
XCZ-100-PRB-LC	1" x 1"	0.3 - 20 gpm	100-PEB	Yes	1" PR Basket Filter	40 psi
RESIDENTIAL MEDIUM FLOW: 3 – 15 gpm						
XCZPGA-100-PRF	1" x 1"	3 - 15 gpm	100-PGA	Yes	1" PR RBY Filter	40 psi
XCZ-100-PRF	1" x 1"	3 - 15 gpm	100-DV	No	1" PR RBY Filter	40 psi
XACZ-100-PRF	1" x 1"	3 - 15 gpm	100-ASVF	No	1" PR RBY Filter	40 psi
RESIDENTIAL LOW FLOW: 0.2 – 10 gpm						
XCZLF-100-PRF	1" x 1"	0.2 - 10 gpm	LFV-100	No	1" PR RBY Filter	40 psi
XCZ-075-PRF	¾" x ¾"	0.2 - 5 gpm	LFV-075	No	¾" PR RBY Filter	30 psi
XACZ-075-PRF	¾" x ¾"	0.2 - 5 gpm	ASV-LFV-075	No	¾" PR RBY Filter	30 psi

2-Wire Compatible Residential Control Zone Kits

Residential 2-Wire
XCZPGA-100-PRF
FLOW: 3-15 gpm

Commercial 2-Wire
XCZ-100-PRB-COM
FLOW: 0.3 - 20 gpm

Commercial 2-Wire
XCZ-100-PRBR
FLOW: 0.3 - 20 gpm

COMPATIBLE WITH ALL RAIN BIRD 2-WIRE DECODERS

2-Wire Decoders

- Available in low cost residential option
- Cost reduction due to wire savings
- Ease of troubleshooting
- Fits in a 10" valve box

XCZ-150-PRB-COM
FLOW: 15 - 40 gpm
1½" x 1" (2)

Commercial High Flow: 15 - 40 gpm

XCZ-100-PRB-COM
FLOW: 0.3 - 20 gpm
1" x 1"

XCZ-100-PRBR
FLOW: 0.3 - 20 gpm
1" x 1"

XCZ-100-PRB-LC
FLOW: 0.3 - 20 gpm
1" x 1"
UPDATED

Commercial Wide Flow: 0.3 - 20 gpm

XCZPGA-100-PRF
NEW
FLOW: 3 - 15 gpm
1" x 1"

XCZ-100-PRF
FLOW: 3 - 15 gpm
1" x 1"

XACZ-100-PRF
FLOW: 3 - 15 gpm
1" x 1"

Residential Medium Flow: 3 - 15 gpm

XCZLF-100-PRF
FLOW: 0.2 - 10 gpm
1" x 1"

Residential Low Flow: Flow: 0.2 - 10 gpm

XCZ-075-PRF
FLOW: 0.2 - 5 gpm
¾" x ¾"

XACZ-075-PRF
FLOW: 0.2 - 5 gpm
¾" x ¾"

Residential Low Flow: Flow: 0.2 - 5 gpm

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www.rainbird.com

RAIN BIRD®

Tech Spec

PEB and PESB Series Valves

Designed to Outperform. Engineered to Outlast.

Pressure surges? Effluent water? Clogging debris? No problem. PEB and PESB Series valves offer long life and efficient, trouble-free performance—even under harsh conditions. Constructed of heavy-duty, glass-filled nylon, these valves resist clogging. And the PESB model features a patented scrubber to actively fight dirt, debris and particles.

Features

- Body constructed of durable glass-filled nylon for long life and heavy-duty performance at 200 psi (13.80 bar) pressure
- Stainless steel studs molded into the body. Bonnet can be attached and removed more easily without damaging threads
- One-piece solenoid design with captured plunger and spring for easy servicing. Prevents loss of parts during field service
- External bleed protects the solenoid ports from debris when system is flushed
- Internal bleed operates the valve without allowing water into the valve box; allows pressure regulator to be adjusted without turning on the valve at the controller first
- Low flow operating capability (0.25 gpm; 0.06 m^3/h; 1.2 l/m) for a wide range of applications. For flows below 5 gpm (1.14 m^3/h; 19.2 l/m) or any Xerigation® application, install Rain Bird Y filter upstream
- Slow closing to prevent water hammer and subsequent system damage
- PESB only: Scrubber scrapes its stainless steel screen clean to break down grit and plant material. Prevents debris build-up and clogging

Options (order separately)

- Accommodates optional, field installed PRS-D pressure regulating module to ensure optimum sprinkler performance
- Optional purple flow control handles for non-potable water applications
  - PEB-NP-HAN1(1")
  - PEB-NP-HAN2 (1½" and 2")
- Accepts latching solenoid for use with Rain Bird battery-operated controllers up to 150 psi (10.35 bar)

Operating Range

- Pressure: 20 to 200 psi (1.38 to 13.80 bar)
- Flow: 0.25 to 200 gpm (0.06 to 45.40 m^3/h; 1.2 to 757 l/m)
- Flow with PRS-D: 5 to 200 gpm
- (1.14 to 45.40 m^3/h; 19.2 to 757 l/m)
- Temperature: up to 150° F (66° C)

Electrical Specifications

- Power: 24 VAC 50/60 Hz (cycles/sec) solenoid
- Inrush current: 0.41 A (9.84 VA) at 60 Hz
- Holding current: 0.14A (3.43VA) at 60Hz
- Coil resistance: 30-39 Ohms
- Compatible with ESP-LXD decoders

PEB and PESB Series Valve Pressure Loss (psi)

Flow GPM	100-PEB 1"	150-PEB 1½"	200-PEB 2"
0.25	0.8	-	-
0.5	1.0	-	-
1	1.3	-	-
5	1.7	-	-
10	1.8	-	-
20	2.9	3.9	-
30	5.6	3.6	-
40	10.0	3.5	-
50	15.6	3.6	4.8
75	-	5.4	4.5
100	-	9.6	5.2
125	-	14.6	8.2
150	-	21.2	11.8
175	-	-	15.5
200	-	-	19.5

PEB and PESB Series Valve Pressure Loss (bar)

Flow m^3/h	Flow l/m	100-PEB 2.5 cm	150-PEB 3.8 cm	200-PEB 5.1 cm
0.06	1	0.06	-	-
0.3	5	0.09	-	-
0.6	10	0.10	-	-
1.2	20	0.12	-	-
3	50	0.15	-	-
6	100	0.32	0.26	-
9	150	0.68	0.24	-
12	200	-	0.26	0.33
15	250	-	0.33	0.32
18	300	-	0.42	0.32
21	350	-	0.57	0.34
24	400	-	0.74	0.41
27	450	-	0.92	0.51
30	500	-	1.14	0.64
33	550	-	1.38	0.77
36	600	-	-	0.90
39	650	-	-	1.04
42	700	-	-	1.18
45	757	-	-	1.34

Notes

1) Loss values are with flow control fully open.

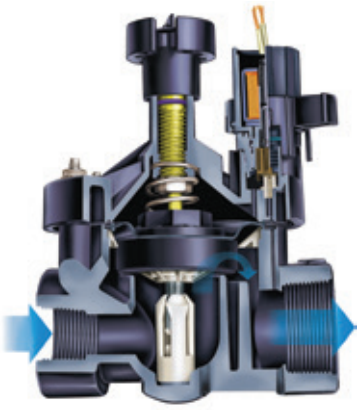
2) PRS-D module recommended for all flow ranges.

Recommendations

1) Rain Bird recommends flow rates in the supply line not to exceed 7.5 ft./sec. (2.29 m/s) in order to reduce the effects of water hammer.

2) For flows below 5 gpm (1.14 m^3/h; 19.21 l/m), Rain Bird recommends use of upstream filtration to prevent debris from collecting below the diaphragm.

3) For flows below 10 gpm (2.27 m^3/h; 37.8 l/m) Rain Bird recommends the flow control stem be turned down two full turns from the fully open position.



PESB Cutaway

Dimensions

Size	Height	Length	Width
100	6½" (16.5 cm)	4" (10.2 cm)	4" (10.2 cm)
150	8" (20.3 cm)	6" (15.2 cm)	6" (15.2 cm)
200	8" (20.3 cm)	6" (15.2 cm)	6" (15.2 cm)

Note: The PRS-D option adds 2" (5.1 cm) to valve height.

Models

• 100PEB and 100PESB	1"	(26/34)
• 150PEB and 150PESB	1½"	(40/49)
• 200PEB and 200PESB	2"	(50/60)

BSP threads available, specify when ordering.

How To Specify

100 - PEB - PRS-D

Size
100: 1" (26/34)
150: 1½" (40/49)
200: 2" (50/60)

Model
PEB
PESB: scrubber model

Optional Feature
PRS-Dial: pressure regulating module *(must be ordered separately)*

Note: Valve and PRS-Dial module must be ordered separately. For non-U.S. applications, it is necessary to specify NPT or BSP thread type.

Specifications

The electric remote control valve shall be a normally closed 24 VAC 50/60 Hz (cycles/sec) solenoid actuated globe pattern design. The valve pressure rating shall not be less than 200 psi (13.80 bar). The valve shall have the following characteristics (circle one):

Flow rate: _____ gpm m^3/h l/m

Pressure loss not to exceed: _____ psi bar

The valve body shall be constructed of heavy-duty glass-filled UV-resistant nylon and have stainless steel studs and flange nuts; diaphragm shall be of nylon reinforced nitrile rubber.

The valve shall have both internal and external manual open/close control (internal and external bleed) to manually open and close the valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.

The valve shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing and a leverage handle for easy turning. This 24 VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 200 psi (13.80 bar). At 24 VAC, average inrush current shall not exceed 0.41 amps. Average holding current shall not exceed 0.28 amps.

The valve shall have a brass flow control stem for accurate manual regulation and/or shut-off of outlet flow. The valve must open or close in less than 1 minute at 200 psi (13.80 bar), and less than 30 seconds at 20 psi (1.38 bar).

The PESB valve shall have a self-cleaning stainless steel screen designed for use in dirty water applications.

The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

Optional Feature Specification

PRS-D Pressure Regulating Module:

100PEB-PRS-D 100PESB-PRS-D
150PEB-PRS-D 150PESB-PRS-D
200PEB-PRS-D 200PESB-PRS-D

When so indicated on the design, the 1", 1½" and 2" electric remote control plastic valves shall have a pressure regulating module (PRS-D) capable of regulating outlet pressure between 15 and 100 psi (±3 psi) (1.04 and 6.90 bar (±0.21 bar)).

The PRS-D module shall have an adjusting knob for setting pressure and Schrader valve connection for monitoring pressure. The pressure shall be adjustable from the PRS-D when the valve is internally manually bled or electrically activated.

Non-Potable Flow Control Handle *

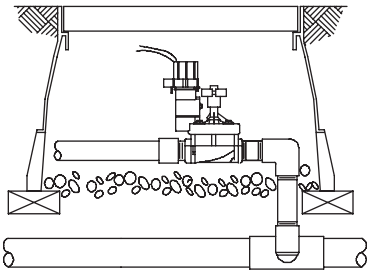
PEB-NP-HAN1 - Fits 1"

PEB-NP-HAN2 - Fits 1½" and 2"

When so indicated on the design, the valve shall have a purple flow control handle to indicate to the user that non-potable water is being used. There shall be no difference between the black and purple handles except for the color.

**Rain Bird offers the PESB-R reclaimed water valve and conversion kits for reclaimed water application. Please see Tech Spec D37338B, the Rain Bird catalog, or visit www.rainbird.com for more information.*

Plastic Electric Remote Control PEB or PESB Valve (with PRS-D)



Rain Bird Corporation
6991 E. Southpoint Road
Tucson, AZ 85756
Phone: (520) 741-6100
Fax: (520) 741-6522

Rain Bird Technical Services
(800) RAINBIRD (1-800-724-6247)
(U.S. and Canada)

Rain Bird Corporation
970 West Sierra Madre Avenue
Azusa, CA 91702
Phone: (626) 812-3400
Fax: (626) 812-3411

Specification Hotline
800-458-3005 (U.S. and Canada)

Rain Bird International, Inc.
1000 West Sierra Madre Ave.
Azusa, CA 91702
Phone: (626) 963-9311
Fax: (626) 852-7343

The Intelligent Use of Water™
www.rainbird.com

NSF®

DURA™

SPECIAL PIPING COMPONENTS

"QUALITY BY DESIGN"

"QUALITY BY DESIGN"

CORPORATE OFFICES AND FACTORY
PO BOX 2097
533 EAST THIRD STREET
BEAUMONT, CA 92223
(951)845-3161
FAX (951)845-7644

STANDARD WARRANTY

Dura Plastic Products, Inc. ("Sellers") warrants to the original Buyer only, that all products shall be free from defects in design and manufacture for a period of three years from the date of delivery, provided that such products are installed, used and/or adjusted only in strict accordance with the appropriate guidelines.

DO NOT USE OR TEST DURA PRODUCTS WITH COMPRESSED AIR OR GAS. DO NOT USE DURA PRODUCTS WITH COMPRESSED AIR OR GAS SYSTEMS.

MODIFICATION OF FITTINGS VOIDS WARRANTY. In no event shall the foregoing warranty extend to any products in any way caused or allowed to be, or installed, operated or used in such a manner as to be, subject or exposed to conditions of misuse, abuse or accident. The sole obligation of Seller, and the exclusive remedy of Buyer under this warranty, under any other warranty, expressed or implied, under any rule of law including strict liability, negligence, indemnity, or otherwise, is the replacement of the defective goods by Seller, or at Seller's sole election, the return of the purchase price of the defective goods.

Any products returned by Buyer to Seller under the foregoing terms shall be returned to Seller's place of business freight prepaid, accompanied or preceded by Buyer's particularized statement of the claimed defect. The risk of loss and freight charges to and from Seller in connection with any returned products shall be borne by Buyer, but Seller shall bear such additional freight charges arising in connection with any such returned products ultimately determined by the Seller to be defective under the terms of the foregoing warranty.

The agreement of Seller to sell its products is expressly conditioned upon the Buyer's assent to, and Seller agrees to sell its products upon, all terms and conditions set forth above and on the face hereof. Buyer's acceptance of any products provided under this sale shall constitute such assent.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. NO WARRANTY OF MERCHANTIBILITY, NO IMPLIED WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, AND NO IMPLIED WARRANTY ARISING BY USAGE OF TRADE, COURSE OF DEALING OR COURSE OF PERFORMANCE IS GIVEN BY SELLER OR SHALL ARISE BY OR IN CONNECTION WITH THIS SALE AND/OR THE SELLER'S AND/OR BUYER'S CONDUCT IN RELATION THERETO OR TO EACH OTHER, AND IN NO EVENT SHALL SELLER BE LIABLE FOR ANY SPECIAL INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING IN ANY WAY IN CONNECTION WITH ANY PRODUCTS OF THE SALE.

MINIMUM BILLING: Minimum billing requirement is $50.00 net.

RETURNED MERCHANDISE: No merchandise will be accepted for return without authorization. Merchandise must be returned freight prepaid and will be subject to a 20% handling charge.

TERMS: Invoices are due and payable thirty (30) days from date of invoice. A two (2) percent prompt payment discount on net amount of invoice **Excluding Freight** will be allowed if paid by the 10th. All orders received after the 25th of the month will be considered as of the 1st of the following month for billing purposes.

FREIGHT: Prepaid on orders for products totaling $1,000.00 net for one shipment to single destination within the contiguous United States.

Possession of this price list shall not be construed as an offer to sell the products listed.

INDEX

Special Piping
Components

DURA PLASTIC PRODUCTS, INC.

P.O.BOX 2097
533 EAST THIRD STREET
BEAUMONT,CA 92223

www.duraplastics.com

DURA

"QUALITY BY DESIGN"

PRODUCT GROUP 1
DURA MANIFOLD SYSTEM

1" MANIFOLD SYSTEM MULTI-PORT MANIFOLDS

#	PART NUMBER	UPC CODE	SIZE	O-RING	BAG	BOX
1	301-010	14450	1" Swivel x 1" Mipt x 1" Swivel	021	-	25
2	301-011 *	14452	1" Slip x 1" Mipt x 1" Swivel	021	-	20
3	301-010-2	40422	1" Swivel x 1" Mipt x 1" Swivel (x2)	021	-	25
4	301-010-3	40423	1" Swivel x 1" Mipt x 1" Swivel (x3)	021	-	25
5	301-010-4	40424	1" Swivel x 1" Mipt x 1" Swivel (x4)	021	-	25

1 1/2" & 2" MANIFOLD SYSTEM

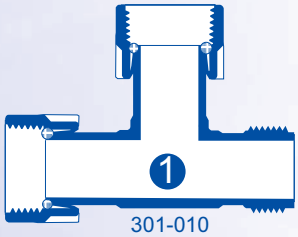
#	PART NUMBER	UPC CODE	SIZE	O-RING	BAG	BOX
6	329-016	13873	1 1/2" Slip x 1 1/2" Swivel	127	-	20
	329-021	13874	2" Slip x 2" Swivel	135	-	20
7	332-015	13228	1 1/2" O-Ring Mipt x 1 1/2" Swivel	224	-	20
	332-020	13229	2" O-Ring Mipt x 2" Swivel	228	-	20
8	350-015	14306	1 1/2" O-Ring Mipt	224	5	25
	350-020	14307	2" O-Ring Mipt	228	5	25
9	127	-	O-Ring for part 329-016	-	25	-
	135	-	O-Ring for part 329-021	-	25	-
	224	-	O-Ring for part 329-015	-	25	-
	228	-	O-Ring for part 329-020	-	25	-
	224	-	O-Ring for part 329-015	-	25	-
	228	-	O-Ring for part 329-020	-	25	-

ALL O-RINGS ARE FACTORY INSTALLED. FOR REPLACEMENT O-RINGS REFER TO ABOVE PART NUMBERS.

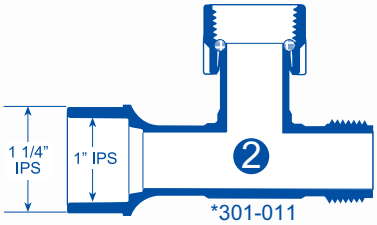
*Indicates the fitting is nesting.

There will be a $5.00 charge for broken bag or box quantities.
Manifold System Components are O-Ring Sealed. DO NOT USE PASTE, DOPE OR TEFLON TAPE.
For METRIC COMPONENTS, place an "M" in front of the part number.

1" MANIFOLD SYSTEM

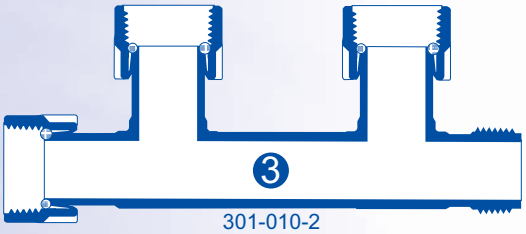


301-010



*301-011

1" MULTI-PORT MANIFOLDS



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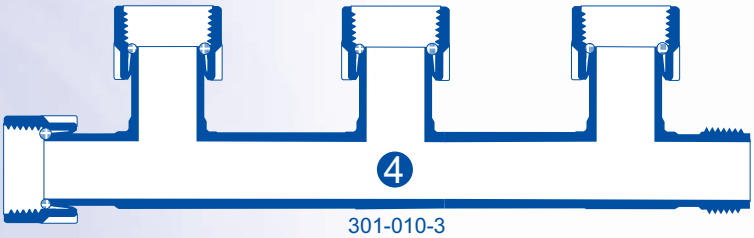

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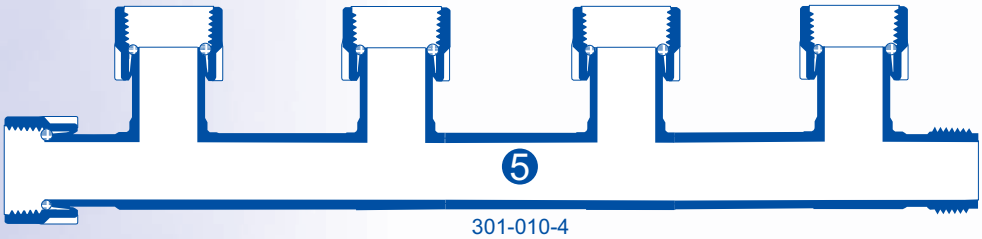
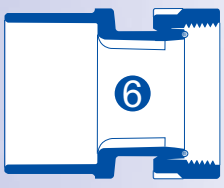


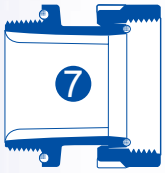
301-010-4

Rated 150 PSI w.p. @73ºF

1 1/2" & 2" MANIFOLD SYSTEM



329-016
329-021



332-015
332-020

350-015
350-020

127 THRU 228

NOTE: ALL ABOVE ITEMS ARE GRAY PVC

DURA

"QUALITY BY DESIGN"

PRODUCT GROUP 1
DURA MANIFOLD SYSTEM

1" MANIFOLD SYSTEM (Continued)

#	PART NUMBER	UPC CODE	SIZE	O-RING	BAG	BOX
1	306-009	14155	1" Mipt x 1" Swivel	021	-	25
2	306-010	14158	1" Swivel x 1" Swivel	021	-	25
3	306-011*	14160	1" Slip x 1" Swivel	021	-	25
4	320-010	13921	1" Swivel x 1" Mipt x 1" Swivel x 1" Swivel	021	-	15
5	320-011*	13923	1" Slip x 1" Mipt x 1" Swivel x 1" Swivel	021	-	15
6	329-010	13876	1" Swivel x 1" Swivel	021	-	50
7	329-007*	13234	3/4" Slip x 1" Swivel	021	-	50
8	329-011*	13878	1" Slip x 1" Swivel	021	25	40
9	332-010	13230	1" Swivel x 1" O-Ring Mipt	021	25	50
	334-010	13231	1" Swivel x 1" Mipt	021	25	50
10	335-005	14280	1" Swivel x 1/2" Insert	021	25	50
11	335-007	14281	1" Swivel x 3/4" Insert	021	25	50
12	335-010	14282	1" Swivel x 1" Insert	021	25	50
13	348-010	13737	1" Fipt	213	25	100
14	08303	11879	1" x 1" for Plastic Threads - GRAY	219	25	75
	08303M	11882	1" x 1" for Metal Threads - BEIGE	124	25	75
15	08303-131	11883	1" x 3/4" for Plastic Threads - GRAY	214	25	75
	08303-131M	11884	1" x 3/4" for Metal Threads - BEIGE	120	25	75
16	ALL O-RINGS ARE FACTORY INSTALLED. FOR REPLACEMENT O-RINGS REFER TO ABOVE PART NUMBERS			⬆	25	-

*Indicates the fitting is nesting.

(slip x swivel x long)

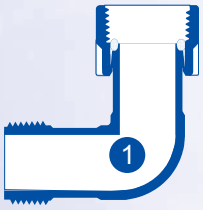
PART NUMBER	UPC CODE	SIZE	BAG	BOX
329-007-14		3/4 x 1 x 14	-	25

(mipt x swivel x long)

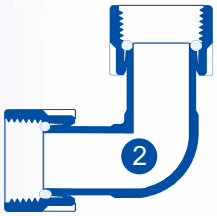
PART NUMBER	UPC CODE	SIZE	BAG	BOX
334-010-14		1 x 1 x 14	-	25

There will be a $5.00 charge for broken bag or box quantities.
Manifold System Components are O-Ring Sealed. DO NOT USE PASTE, DOPE OR TEFLON TAPE.
For METRIC COMPONENTS, place an "M" in front of the part number.

1” MANIFOLD SYSTEM (Continued)



306-009



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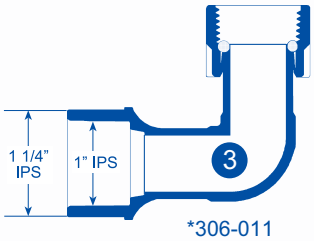

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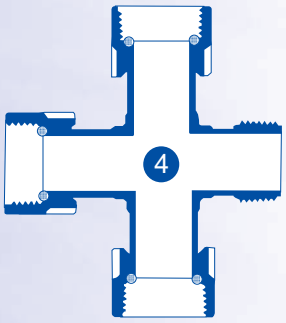

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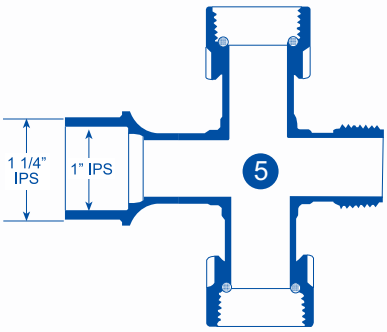
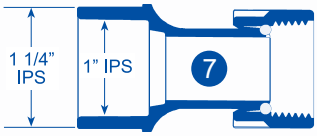


320-011*

329-010



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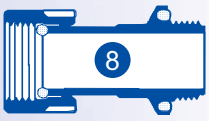

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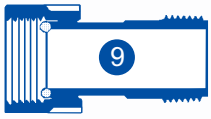

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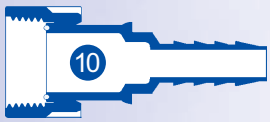

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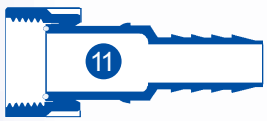

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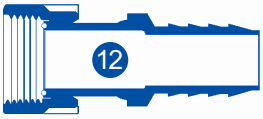


335-010

348-010

08303

08303-131

021

Rated 150 PSI w.p. @73ºF

*Indicates the fitting is nesting.

NOTE: ALL ABOVE ITEMS ARE GRAY PVC

DURA

"QUALITY BY DESIGN"

PRODUCT GROUP 2
3/4" HOSE FITTINGS

3/4" HOSE FITTINGS

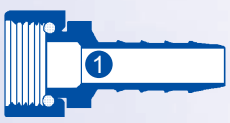
ALL HOSE FITTINGS ARE WHITE PVC

#	PART NUMBER	UPC CODE	SIZE	O-RING	BAG	BOX
1	500-005	13963	3/4" FHT Swivel x 1/2" Insert	210	25	200
2	500-007	13964	3/4" FHT Swivel x 3/4" Insert	210	25	200
3	500-010	13965	3/4" FHT Swivel x 1" Insert	210	25	200
4	501-007	13966	3/4" MHT x 3/4" MHT x 3/4" FHT Swivel	210	25	200
5	502-005	13967	3/4" MHT x 1/2" Insert	-	25	200
	502-007	13968	3/4" MHT x 3/4" Insert	-	25	200
	502-010	13969	3/4" MHT x 1" Insert	-	25	200
6	503-005	13970	3/4" MHT x 1/2" Mipt	-	25	200
	503-007	13971	3/4" MHT x 3/4" Mipt	-	25	200
	503-010	13972	3/4" MHT x 1" Mipt	-	25	200
	503-012	13973	3/4" MHT x 1 1/4" Mipt	-	25	200
	503-015	13974	3/4" MHT x 1 1/2" Mipt	-	25	200
7	508-007	14023	3/4" FHT x 3/4" Fipt	-	25	200
8	510-005	13975	3/4" MHT x 1/2" Slip	-	25	200
	510-007	13976	3/4" MHT x 3/4" Slip	-	25	200
9	512-007	14013	3/4" MHT x 3/4" Fipt	-	25	200
	512-101M	13959	3/4" MHT x 1/2" Fipt (Marlex)	-	25	200
10	513-005	13977	3/4" FHT Swivel x 1/2" Mipt	210	25	200
	513-007	13978	3/4" FHT Swivel x 3/4" MHT	210	25	200
	513-008	13979	3/4" FHT Swivel x 3/4" Mipt	210	25	200
	513-010	13980	3/4" FHT Swivel x 1" Mipt	210	25	200
11	530-005	13981	3/4" FHT Swivel x 1/2" Fipt	210	25	200
12	530-007	13983	3/4" FHT Swivel x 3/4" FHT	210	25	200
13	530-008	13982	3/4" FHT Swivel x 3/4" Fipt	210	25	200
14	533-005	13999	3/4" MHT x 1/2" Spigot	-	25	200
	533-007	13984	3/4" MHT x 3/4" Spigot	-	25	200
15	534-005	13985	3/4" FHT Swivel x 1/2" Mipt	210	25	200
16	534-007	13986	3/4" FHT Swivel x 3/4" Mipt	210	25	200
17	535-003*	13987	3/4" FHT Swivel x 3/8" IPS (Slip)	210	25	200
18	535-005*	13988	3/4" FHT Swivel x 1/2" IPS (Slip)	210	25	200
19	535-006*	13997	3/4" FHT Swivel x 5/8" Irri. Hose/ 3/4 IPS (Spg)	210	25	200
	535-007*	13989	3/4" FHT Swivel x 3/4" IPS (Slip)	210	25	200
20	536-005	13990	3/4" MHT x 1/2" Slip	-	25	200
	536-007*	13991	3/4" MHT x 3/4" Slip	-	25	200
	536-010*	13992	3/4" MHT x 1" Slip	-	25	125
	536-012	13993	3/4" MHT x 1 1/4" Slip	-	25	125
21	548-007	13994	3/4" FHT	210	25	200
22	210	-	O-Ring	-	25	-

⇧ ALL O-RINGS ARE FACTORY INSTALLED. FOR REPLACEMENT O-RINGS REFER TO ABOVE PART NUMBERS

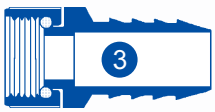
*Indicates the fitting is nesting.

3/4” HOSE FITTINGS

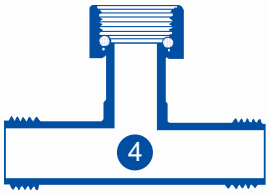


500-005
3/4” FHT Swivel x 1/2” Insert

500-007
3/4” FHT Swivel x 3/4” Insert

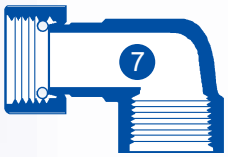


500-010
3/4” FHT Swivel x 1” Insert

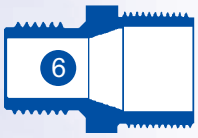


501-007
3/4” MHT x 3/4” MHT x 3/4” FHT Swivel

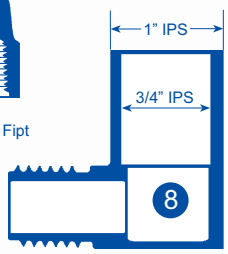
502-Series
3/4” MHT x Insert



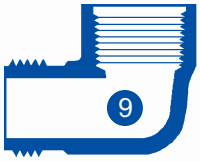
508-007
3/4” FHT Swivel x 3/4” Fipt



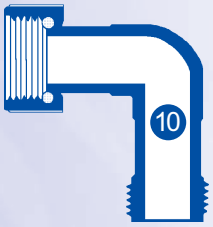
503-Series
3/4” MHT x Mipt



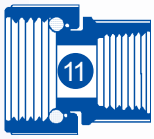
510-Series
3/4” MHT x Slip



512-Series
3/4” MHT x Fipt

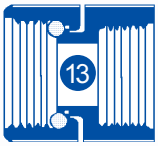


513-Series
3/4” FHT Swivel x MHT & Mipt



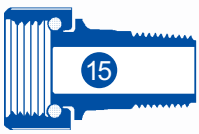
530-005
3/4” FHT Swivel x 1/2” Fipt

530-007
3/4” FHT Swivel x 3/4” FHT

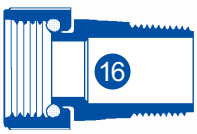


530-008
3/4” FHT Swivel x 3/4” Fipt

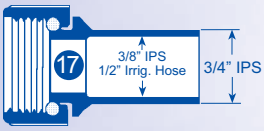
533-Series
3/4” MHT x Spigot



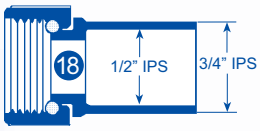
534-005
3/4” FHT Swivel x 1/2” Mipt



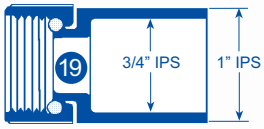
534-007
3/4” FHT Swivel x 3/4” Mipt



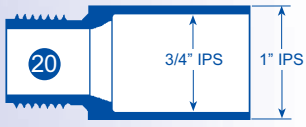
*535-003
3/4” FHT Swivel x 3/8” IPS (Slip)



*535-005
3/4” FHT Swivel x 1/2” IPS (Slip)



*535-007
3/4” FHT Swivel x 3/4” IPS (Slip)



*536-Series
3/4” MHT x Slip

548-007
3/4” FHT Cap

210
O-Ring

All O-Rings are factory installed. *Indicates the fitting is nesting.

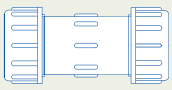
DURA
“QUALITY BY DESIGN”

PRODUCT GROUP 2
3/4” HOSE FITTINGS

DURA

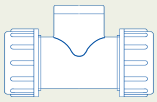
"QUALITY BY DESIGN"

COMPRESSION COUPLINGS, TEES, AND MALE ADAPTERS



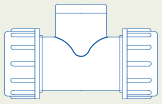
COMPRESSION COUPLING

PART NUMBER	UPC CODE	SIZE	BAG	BOX
SC29-005	40400	1/2	-	160
SC29-007	40402	3/4	-	120
SC29-010	40404	1	-	120
SC29-012	40406	1 1/4	-	40
SC29-015	40408	1 1/2	-	54
SC29-020	40410	2	-	36
SC29-025	40412	2 1/2	-	10
SC29-030	40414	3	-	4
SC29-040	40416	4	-	2
SC29-060	40418	6	-	6



COMPRESSION TEE (Slip)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
SC01-005	40426	1/2	-	144
SC01-007	40428	3/4	-	104
SC01-010	40430	1	-	96
SC01-012	40432	1 1/4	-	64
SC01-015	40434	1 1/2	-	54
SC01-020	40436	2	-	28



COMPRESSION TEE (Threaded)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
TC01-005	40450	1/2	-	144
TC01-007	40452	3/4	-	104
TC01-010	40454	1	-	96
TC01-012	40456	1 1/4	-	64
TC01-015	40458	1 1/2	-	54
TC01-020	40460	2	-	28

COMPRESSION MALE ADAPTER

PART NUMBER	UPC CODE	SIZE	BAG	BOX
SC36-005	40474	1/2	-	360
SC36-007	40476	3/4	-	240
SC36-010	40478	1	-	192
SC36-015	40482	1 1/2	-	144
SC36-020	40484	2	-	96

COMPRESSION GASKETS

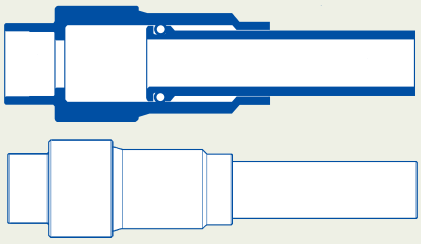
PART NUMBER	UPC CODE	SIZE	BAG	BOX
CG-005	40400	1/2	-	-
CG-007	40402	3/4	-	-
CG-010	40404	1	-	-
CG-012	40406	1 1/4	-	-
CG-015	40408	1 1/2	-	-
CG-020	40410	2	-	-
CG-025	40412	2 1/2	-	-
CG-030	40414	3	-	-
CG-040	40416	4	-	-
CG-060	40418	6	-	-

ANTI-THEFT DEVICES (ATD)

- **SAVES MONEY**
- **EASY TO INSTALL**
- **DURABLE & RELIABLE**

PART NUMBER	UPC CODE	SIZE & DESCRIPTION	BAG	BOX
ATD4-005	13292	1/2" Fipt x 1/2" Mipt	25	250
ATD4-007	13293	3/4" Fipt x 3/4" Mipt	25	200
ATD8-010	13294	1" Fipt x 1" Mipt	10	50
ATD8-012	13295	1 1/4" Fipt x 1 1/4" Mipt	-	25
ATD8-015	13296	1 1/2" Fipt x 1 1/2" Mipt	-	25

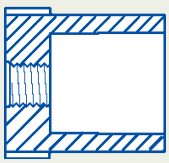
DURA-FIX
QUICK REPAIR TELESCOPING COUPLING



- **SAVES MONEY**
- **EASY TO INSTALL**
- **DURABLE & RELIABLE**

PART NUMBER	UPC CODE	SIZE & DESCRIPTION	BAG	BOX
DF-005	13739	1/2" Slip x 1/2" Spigot	-	25
DF-007	13740	3/4" Slip x 3/4" Spigot	-	25
DF-010	13741	1" Slip x 1" Spigot	-	25
DF-012	13742	1 1/4" Slip x 1 1/4" Spigot	-	15
DF-015	13743	1 1/2" Slip x 1 1/2" Spigot	-	15
DF-020	13744	2" Slip x 2" Spigot	-	10

MICRO SPRAYER ADAPTER



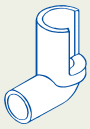
- **EASY TO INSTALL**
- **DURABLE & RELIABLE**

PART NUMBER	UPC CODE	SIZE & DESCRIPTION	BAG	BOX
*235-047	26000	5/16-32 Fipt x 1/2" Slip	10	200

DURA

"QUALITY BY DESIGN"

FLEXIBLE PVC PIPE FITTINGS



90° STREET ELL EXTRA DEEP SOCKET
(Spg x Slip)
GLUE ON

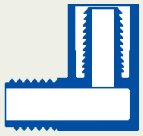
PART NUMBER	UPC CODE	SIZE	BAG	BOX
209-005-4	10410	1/2	10	200
209-007-4	10411	3/4	10	200
209-010-4	10412	1	10	50
•209-073-4	10413	1/2 x 3/8	5	200
209-074-4	10414	1/2 x 3/4	5	200
•209-099-4	10415	3/4 x 3/8	5	200
209-101-4	10416	3/4 x 1/2	5	200
209-102-4	10417	3/4 x 1	5	50
•209-129-4	10418	1 x 3/8	5	200
209-130-4	10419	1 x 1/2	5	100
209-131-4	10420	1 x 3/4	5	100

•FITS: AG PRODUCTS 1/2" OD IRRIGATION HOSE

90° STREET ELL EXTRA DEEP SOCKET
(Mipt x Slip)
GLUE ON

PART NUMBER	UPC CODE	SIZE	BAG	BOX
210-005-4	10430	1/2	10	200
210-007-4	10431	3/4	10	200
210-010-4	10432	1	10	50
•210-073-4	10433	1/2 x 3/8	10	200
210-074-4	10434	1/2 x 3/4	10	200
•210-099-4	10435	3/4 x 3/8	10	200
210-101-4	10436	3/4 x 1/2	10	50
210-102-4	10437	3/4 x 1	10	200
•210-129-4	10438	1 x 3/8	10	200
210-130-4	10439	1 x 1/2	10	100
210-131-4	10440	1 x 3/4	10	100

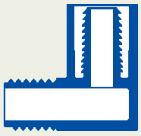
•FITS: AG PRODUCTS 1/2" OD IRRIGATION HOSE



TRANSITION 90° STREET ELL
(Mipt x Twist)
Twist-on Pressure Compensating

PART NUMBER	UPC CODE	SIZE	BAG	BOX
•212-005-1	14244	1/2	10	200
•212-007-1	14245	3/4	10	200
•212-010-1	14246	1	10	50

•FITS: ROBERTS 025-581000 .580 x .690 POLY OR EQUIVALENT



REDUCING TRANSITION 90° STREET ELL
(Mipt x Twist)
Designed for twist-in insertion
Positive pressure sealing

PART NUMBER	UPC CODE	SIZE	BAG	BOX
•212-073-4	14410	1/2 x 3/8	10	200
•212-099-4	14411	3/4 x 3/8	10	200
•212-129-4	10418	1 x 3/8	10	200

•FITS: AG PRODUCTS 1/2" OD IRRIGATION HOSE

TRANSITION COUPLING
(Slip x Twist)
(IPS x 3/8" Flex Tube)
Designed for twist-in insertion
Positive pressure sealing

PART NUMBER	UPC CODE	SIZE	BAG	BOX
•231-073-4	14428	1/2 x 3/8	10	200

•FITS: AG PRODUCTS 1/2" OD IRRIGATION HOSE

PVC FITTINGS FOR POLY TUBE

TRANSITION COUPLING
(Slip x Twist)
(IPS x Poly)
Twist-on
Pressure Compensating

PART NUMBER	UPC CODE	SIZE	BAG	BOX
•*231-005-1	14425	1/2	10	200

•FITS: ROBERTS 025-581000 .580 x .690 POLY OR EQUIVALENT
*INDICATES FITTING IS NESTING

PRE-ASSEMBLED "FLEXIBLE KICK NIPPLE"

PRE-ASSEMBLED
"FLEXIBLE KICK NIPPLE"
1/2" mipt x mipt

PART NUMBER	UPC CODE	SIZE	BAG	BOX
4003-4	23277	4"	25	200
4003-6	23279	6"	25	200
4003-8	23281	8"	-	BULK
4003-10	23283	10"	-	BULK
4003-12	23285	12"	-	BULK
4003-18	23289	18"	-	BULK
4003-24	23291	24"	-	BULK
4003-36	23293	36"	-	BULK
4003-48	23295	48"	-	BULK

Mipt: Male Iron Pipe Thread
Fipt: Female Iron Pipe Thread
Spg: Spigot

DURA

"QUALITY BY DESIGN"

PRODUCT GROUP 6 - Clear Sch 40

CLEAR SCHEDULE 40 FITTINGS

Transparent (blue tint) PVC provides visual control in a wide variety of applications - ideal in food and pharmaceutical plants, laboratories, hospitals, and chemical installations. Not recommended for use in compressed air or gas systems.

Electrically nonconductive, corrosion-resistant pipe has smooth interior walls to permit high flowratesand help prevent accumulation of sediment. Nontoxic pipe meets FDA requirements and can be cold sterilized in ethylene oxide. Flame retardant pipe has UL rating of 94 VO.

TEE
(slip x slip x slip)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C401-005	29598	1/2	10	150
*C401-007	29599	3/4	10	100
*C401-010	29600	1	10	50
C401-015	29601	1 1/2	-	25
C401-020	29602	2	-	15
C401-030	29666	3	-	5
C401-040	29667	4	-	3
C401-060	29595	6	-	1

TEE
(slip x slip x fipt)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C402-005	29603	1/2	10	150
*C402-007	29604	3/4	10	100
*C402-010	29605	1	10	50
C402-015	29606	1 1/2	-	25
C402-020	29607	2	-	20

90° ELL
(slip x slip)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C406-005	29608	1/2	10	250
C406-007	29609	3/4	10	150
C406-010	29610	1	10	50
C406-012	29613	1 1/4	5	50
C406-015	29611	1 1/2	-	50
C406-020	29612	2	5	20
C406-030	29596	3	-	8
C406-040	29614	4	-	3
C406-060	29663	6	-	1

90° ELL
(slip x fipt)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C407-005	29615	1/2	10	250
*C407-007	29616	3/4	10	150
*C407-010	29617	1	10	50
C407-015	29618	1 1/2	5	25
C407-020	29619	2	5	25

45° ELL
(slip x slip)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C417-005	29623	1/2	10	250
*C417-007	29597	3/4	10	100
C417-010	29620	1	10	50
C417-015	29621	1 1/2	10	50
C417-020	29622	2	5	20
C417-030	29661	3	-	8
C417-040	29662	4	-	3
C417-060	29571	6	-	2

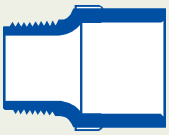
COUPLING
(slip x slip)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C429-005	29668	1/2	10	250
*C429-007	29624	3/4	10	250
*C429-010	29625	1	10	100
C429-012	29626	1 1/4	-	50
C429-015	29627	1 1/2	-	50
C429-020	29628	2	-	25
C429-030	29664	3	-	10
C429-040	29665	4	-	6
C429-060	29590	6	-	4

CLEAR SCHEDULE 40 FITTINGS

FEMALE ADAPTER
(slip x fipt)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C435-005	29629	1/2	10	250
*C435-007	29630	3/4	10	250
*C435-010	29631	1	10	100
C435-015	29632	1 1/2	5	50
C435-020	29633	2	-	25
C435-030	29654	3	-	10
C435-040	29655	4	-	5

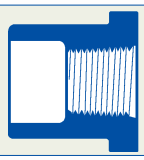


MALE ADAPTER
(mipt x slip)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C436-005	29634	1/2	10	250
C436-007	29635	3/4	10	250
*C436-010	29636	1	10	100
C436-012	29637	1 1/4	-	50
C436-015	29638	1 1/2	-	50
C436-020	29639	2	-	25
C436-030	29656	3	-	16
C436-040	29657	4	-	12

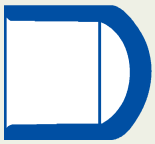
REDUCER BUSHING
(spg x slip)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C437-101	29640	3/4 x 1/2	10	250
C437-130	29641	1 x 1/2	10	250
C437-131	29642	1 x 3/4	10	250
C437-166	29643	1 1/4 x 1/2	5	150
C437-167	29644	1 1/4 x 3/4	5	150
C437-168	29645	1 1/4 x 1	5	150
C437-212	29646	1 1/2 x 1 1/4	10	100
C437-251	29647	2 x 1 1/2	5	50



REDUCER BUSHING
(spg x fipt)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C438-212	29648	1 1/2 x 1 1/4	5	100



CAP
(slip)

PART NUMBER	UPC CODE	SIZE	BAG	BOX
C447-005	29649	1/2	10	250
C447-007	29650	3/4	10	250
C447-010	29651	1	10	250
C447-015	29652	1 1/2	5	50
C447-020	29653	2	5	50
C447-030	29658	3	-	15
C447-040	29659	4	-	9
C447-060	29660	6	-	3

FDA APPROVED

NOTE:
For price & availability of Clear fitting sizes not shown, contact Dura Sales Department: (951)845-3161 FAX (951)845-9391

SOME LINE ITEMS ON THIS PAGE MAY NOT BE GUSSETTED.

***INDICATES FITTING IS NESTING**

mipt: Male Iron Pipe Thread
fipt: Female Iron Pipe Thread
spg: Spigot

DURA WAREHOUSES

① CORPORATE
OFFICE (951)845-3161 FAX (951) 845-7644

② PERRY, GA
OFFICE (478) 988-0282
FAX (478) 987-7003

③ BURLINGTON, IA
OFFICE (319) 758-9060
FAX (319) 758-9058
TOLL FREE (800) 758-9060

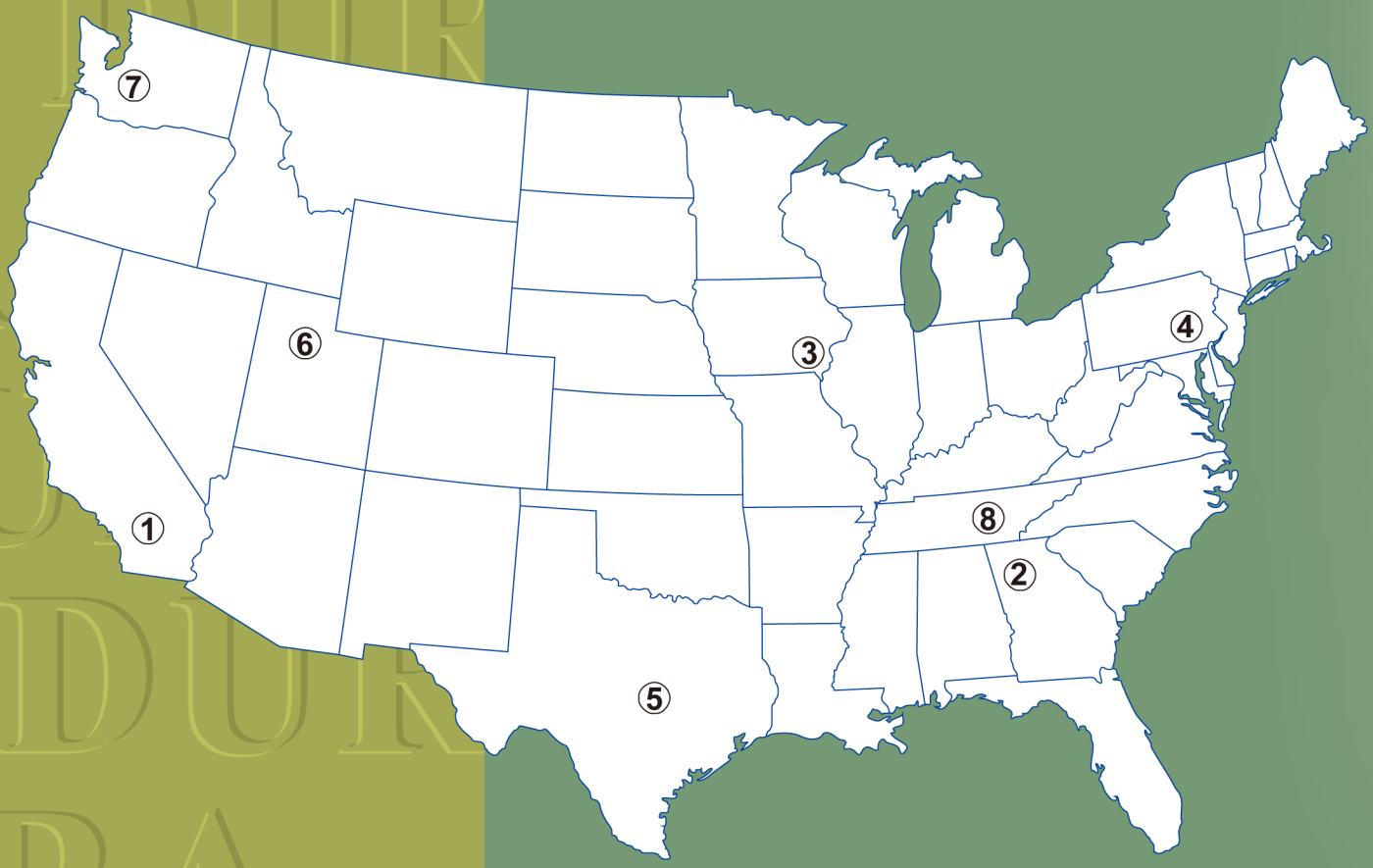
④ FRACKVILLE, PA
OFFICE (570) 874-4651
FAX (570) 874-4652

⑤ CARROLLTON, TX
OFFICE (972) 406-8996
FAX (972) 406-0306
ORDER FAX (800) 709-2220

⑥ SALT LAKE CITY, UT
OFFICE (801) 973-9442
FAX (801) 973-9258

⑦ PASCO, WA
OFFICE (509) 547-7272
FAX (509) 547-0107

⑧ CELINA,TN
OFFICE (931) 243-5544
FAX (931) 243-5542



NATIONAL ORDER DESK
1-(800)854-2323
CALIFORNIA ORDER DESK
1-(800)472-8564

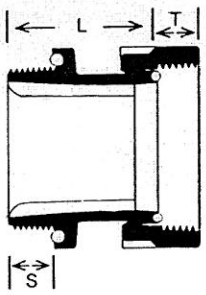
DURA PLASTIC PRODUCTS, INC.

P.O.BOX 2097
BEAUMONT, CA 92223

MANIFOLD STYSTEM SPECIFICATIONS

MANIFOLD ADAPTER

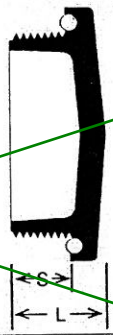
(o-ring mipt x swivel)



PART NUMBER	SIZE	L	S	T
332-015	1 1/2	2.040	0.575	0.575
332-020	2	2.140	0.662	0.575

MANIFOLD CAP

(o-ring mipt)



PART NUMBER	SIZE	L	S
350-015	1 1/2	1.030	0.687
350-020	2	1.050	0.687

Coupling Manifold System

(swivel x o-ring mipt)

Part Number	Size	UPC Code	Bag	Box	Price Class		O-Ring
332-010	1" x 1"	049081 132309	25	50	21	21	

Fitting is Manufctured Sch 40, Gray Material

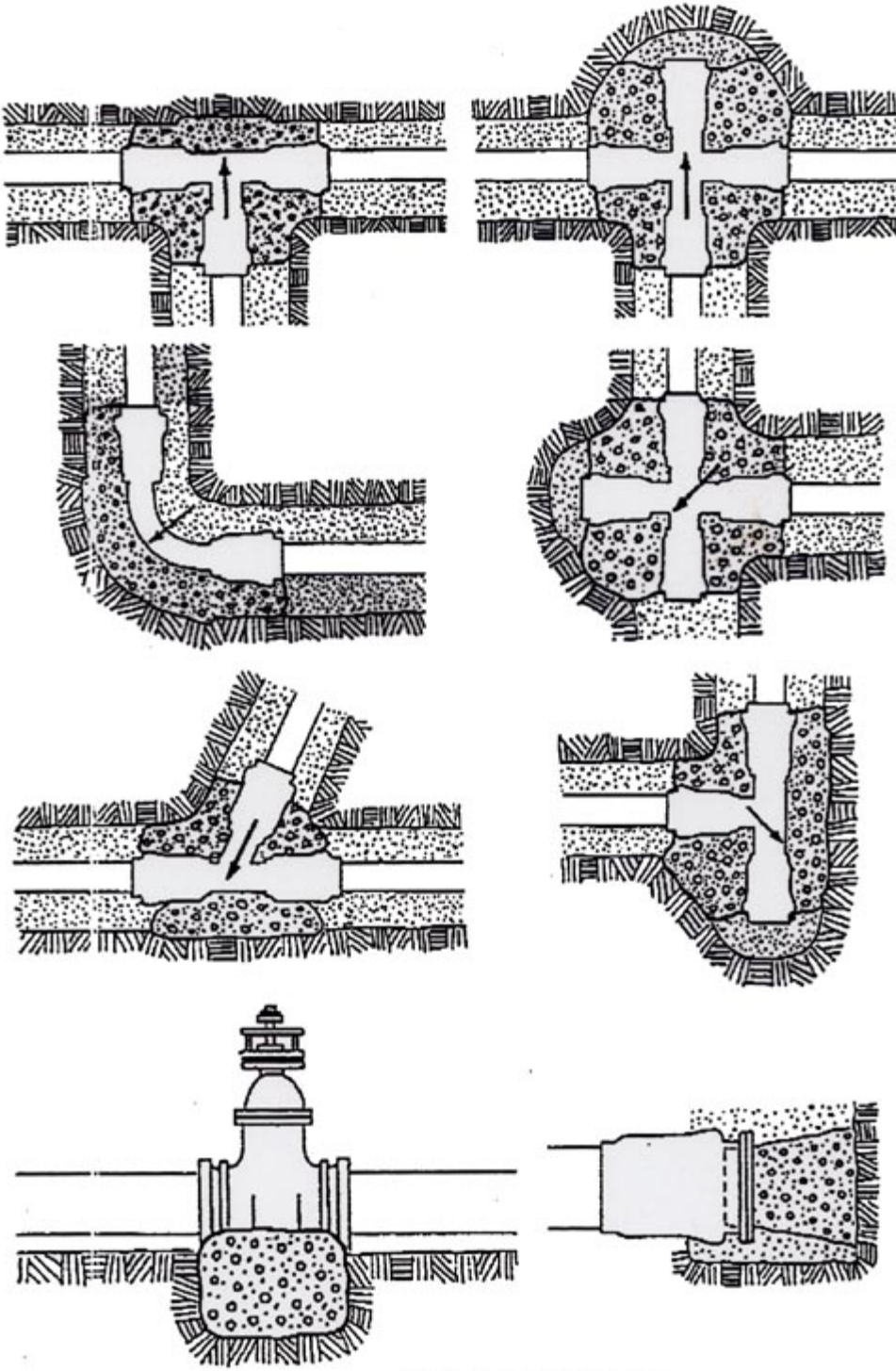
DURA

Nipple Manifold System

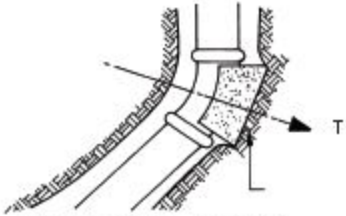
(1" x 1" for Plastic Threads - GRAY)

Part Number	Size	UPC Code	Bag	Box	Price Class	O-Ring
08303	1" x 1"	049081				

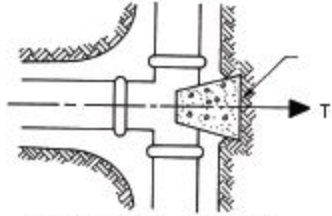
1Fitting is Manufctured Sch 40, Gray Material



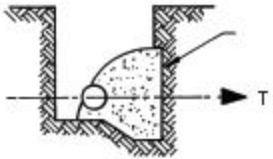
LOCATION OF THRUST



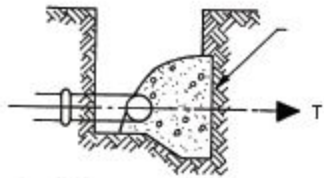
Bend Anchorage - Plan View



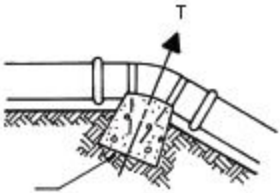
Tee Anchorage - Plan View



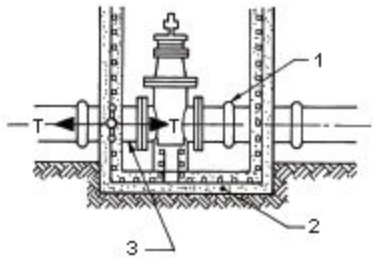
Bend Anchorage - Side View



Tee Anchorage - Side View



Bend in Vertical Plane

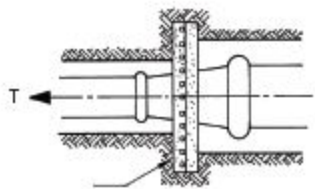


Valve Anchorage

1 - Mechanical Joint or Dismantling Joint

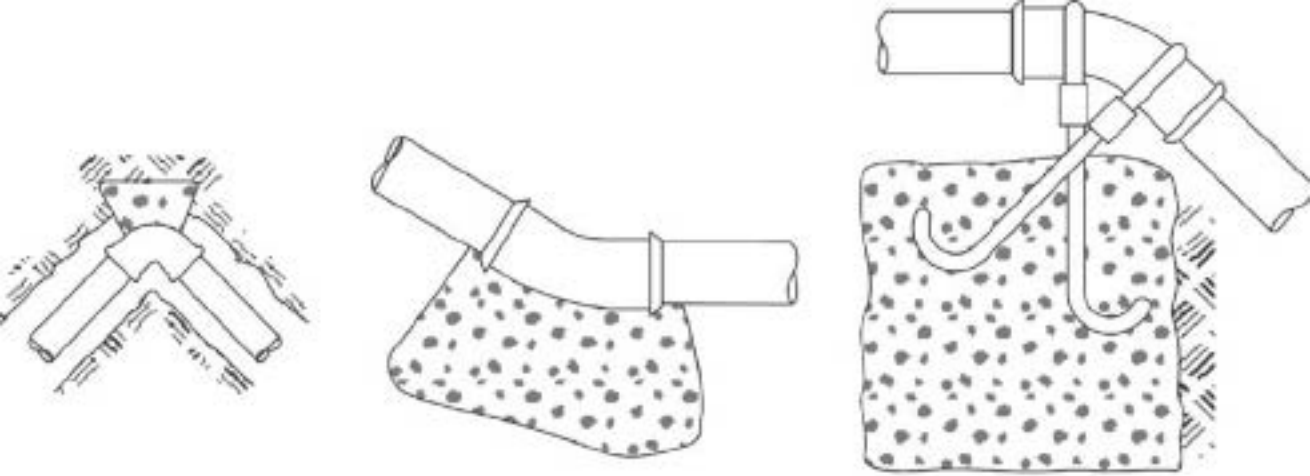
2 - Reinforced concrete valve pit incorporating a thrust wall

3 - Valve connector with thrust (puddle) Flange



Concrete thrust wall set into undisturbed material in the trench wall

Reducer Anchorage



a) Horizontal Bend (Bearing Type)

b) Concave Vertical Bend (Bearing Type)

c) Convex Vertical Bend (Gravity Type)

Each new irrigation main is intended to be equipped with a fertilizer injection system. EZ-FLO is our campus standard. The architect must fill out the attached form and submit it to EZ-FLO to get the appropriate equipment specification.

Customer Name	
Project / Property Name	
Primary Contact (Name)	
Primary Contact (phone/email)	
Date	

Initial Site Survey Data

POC / Location / Name	Acres	Turf (sqft)	Shrubs / Trees / Flowers (sqft)	Mainline Size

Mark Selections with (X)

Program Type: ☐ Sustainable ☐ Organic ☐ Water Treatment ☐ Critter Repel

Property Type: ☐ HOA ☐ School/Muni ☐ Park ☐ Residence

Plant Material: ☐ New Installation ☐ Established Objective: ☐ Push Growth ☐ Maintain

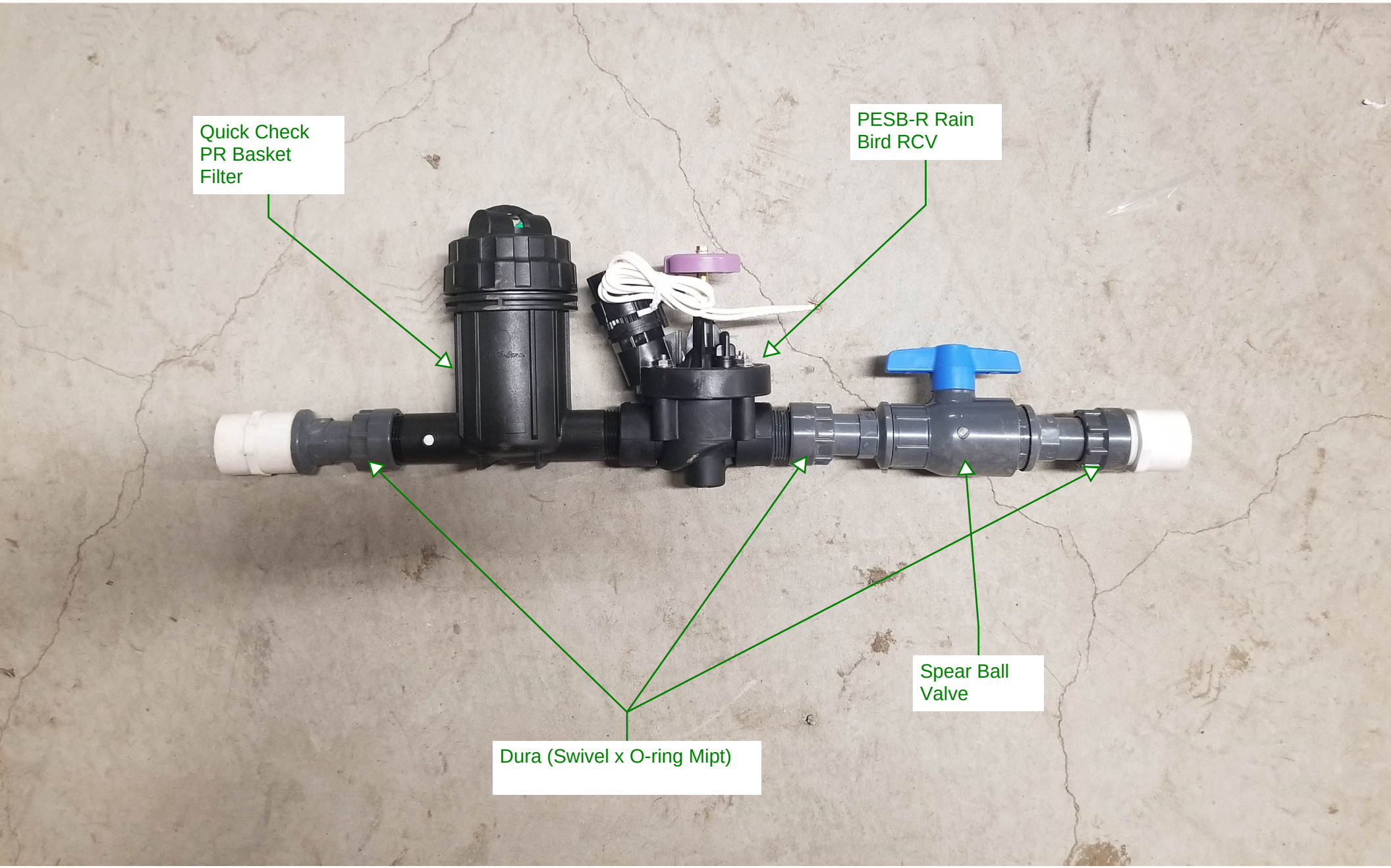
Region: ☐ Southwest ☐ Northwest & Mountain ☐ Midwest ☐ Northeast ☐ Southeast

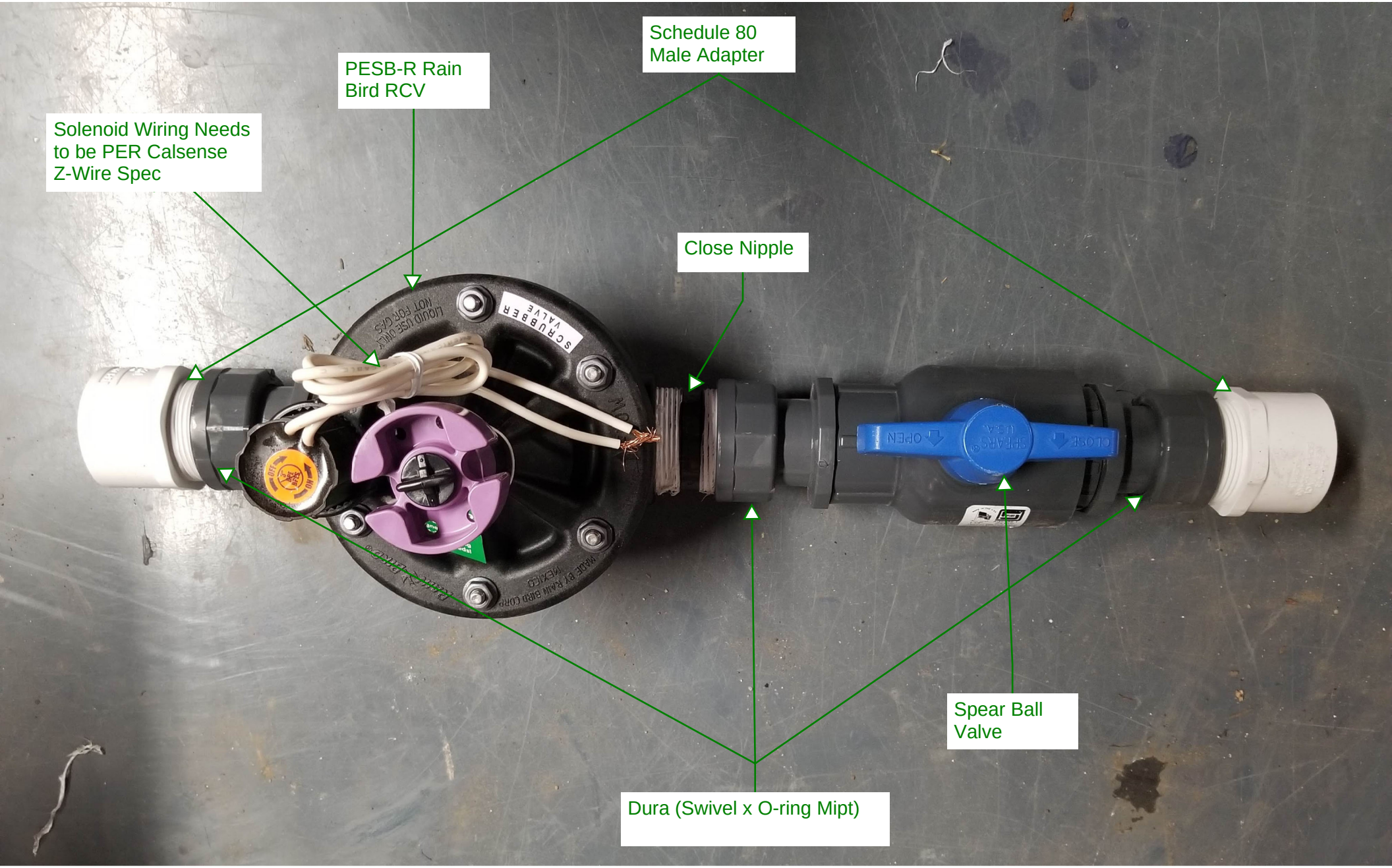
Special Needs: ☐ High Salt ☐ Hard Water ☐ Clay Soil

Notes:

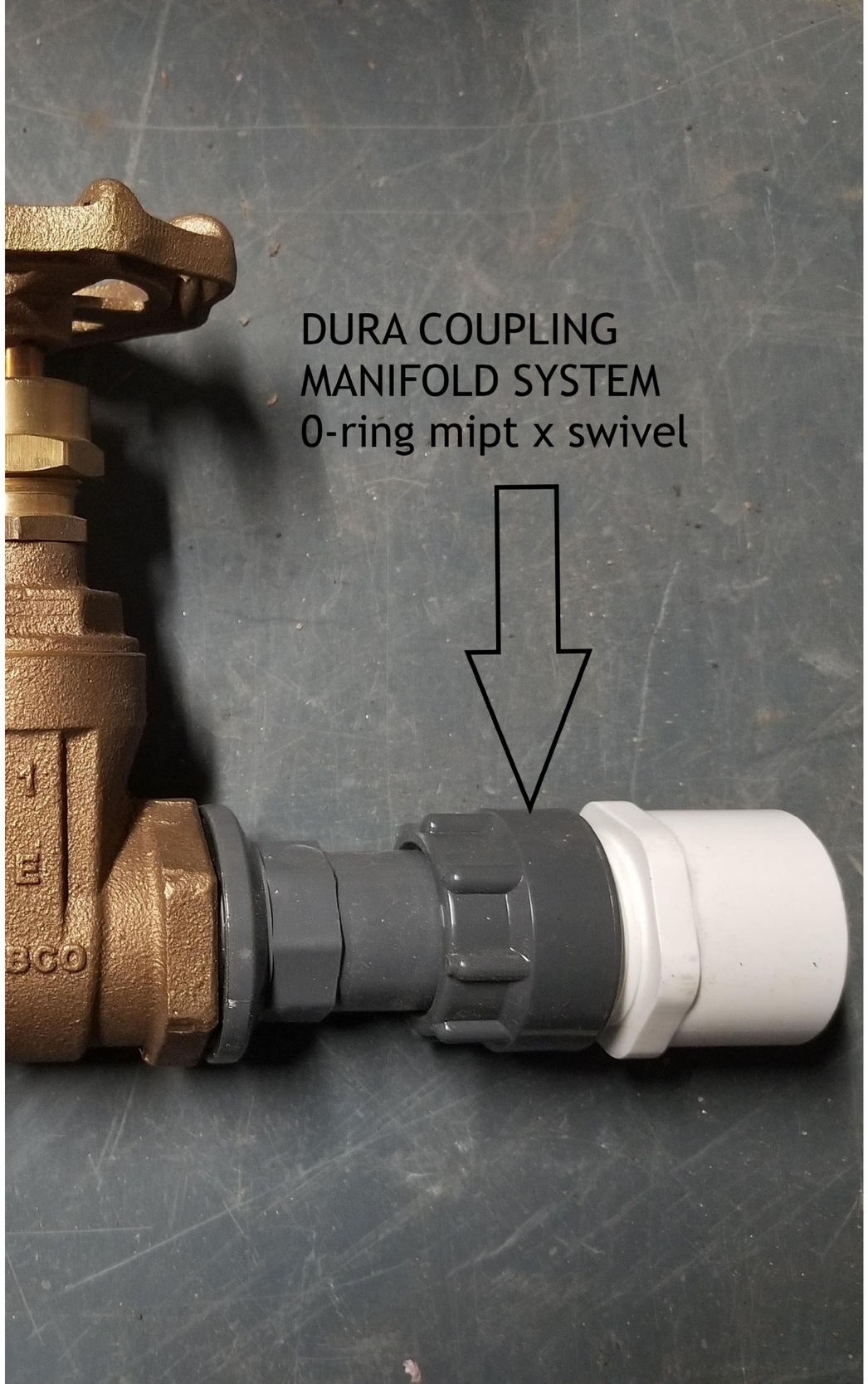
Submit Completed Sheets to: info@ezfloinjection.com

www.ezfloinjection.com **Ph: 866-393-5601** **Fax: 916-652-5754**


Quick Check
PR Basket
Filter
PESB-R Rain
Bird RCV
Spear Ball
Valve
Dura (Swivel x O-ring Mipt)


Schedule 80
Male Adapter
PESB-R Rain
Bird RCV
Solenoid Wiring Needs
to be PER Calsense
Z-Wire Spec
Close Nipple
Spear Ball
Valve
Dura (Swivel x O-ring Mipt)


NIBCO T113
BRONZE 1"
GATE VALVE
SCHEDULE 80
MALE ADAPTER


DURA COUPLING
MANIFOLD SYSTEM
0-ring mipt x swivel

Ball valves for pre valve shut off 1”-1 ½”

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Soil Preparation.
2. Planting.
3. Staking.
4. Hydroseeding.
5. Clean up.

B. Related Sections:
1. Section 328400 – Planting Irrigation
2. Section 329200 – Turf and Grasses

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

F. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

G. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

H. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

I. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

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

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

1.3 ACTION SUBMITTALS

A. Product Data: Prior to installation submit for review and approval specifications and product information on items being used on project. Submit bound with list of items as cover sheet. Conform to Section 01300. For each type of product indicated, including soils.
   1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
   2. Pesticide and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
   3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery

B. Samples of mineral and / or organic mulch.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Material test reports.

C. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year.

1.5 OBSERVATION SCHEDULE

A. Notify Architect in advance for the following inspections, according to the time specified:
   1. Pre-Job conference – 7 days
   2. Final grade review – 48 hours
   3. Plant material review – 48 hours
   4. Plant layout review – 48 hours
   5. Soil preparation and planting operations review – 48 hours
   6. Pre-maintenance – 7 days
   7. Final inspection – 7 days

B. No site visits shall commence without all items noted in previous observation reports either completed or remedied unless such compliance has been waived by the Architect.

1.6 QUALITY ASSURANCE

A. Soil Analysis: For each un-amended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
   1. The soil-testing laboratory shall oversee soil sampling.
   2. Report suitability of tested soil for plant growth.

a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Source Quality:
1. At least 60 days prior to planting submit documentation that all plant materials are available. Materials are subject to inspection after confirmation of ordering.
2. Materials are subject to inspection at place of growth and upon delivery for conformity to specifications. Inspection, approval and rejection can also take place at other times during progress of work.
3. Request, in writing, inspection of plant materials at place of growth. Identify place of growth and quantity of plants to be inspected.
4. As described in the planting notes for tree tagging, the Architect may opt to either visit the tree nursery or review photographs submitted by the Contractor. In either case, visit the nursery and select trees conforming to specifications prior to review by the Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

B. Handle planting stock by root ball.

C. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

D. Deliver fertilizer to site in original unopened containers bearing manufacturer’s guaranteed chemical analysis, name, trade mark, and conformance to State law.

E. Provide copies of receipts for all amendments specified in these specifications or in the agronomic Soils Report.

F. Deliver plants with legible identification labels. Label trees, evergreens, bundles of containers of like shrubs and groundcover plants. State correct plant name and size indicated on plant list. Use durable waterproof labels with water-resistant ink which will remain legible for at least 60 days.

G. Protect plant material during delivery to prevent damage to root ball or desiccation of leaves.

H. Notify Architect 7 days in advance of delivery of plant materials and submit itemization of plants in each delivery.

I. Store plants in shade and protect from weather.

J. Maintain and protect plant material in a healthy, vigorous condition.

K. Exercise care in handling, loading, unloading and storing of plant materials. Replace damaged materials.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
   1. Warranty Periods from date of end of 90-day maintenance period:
      a. Trees: 12 months.
      b. Shrubs, Vines, Ornamental Grasses, Ground Covers, Biennials, and Perennials: 90 days.
      c. Annuals: 90 days.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
   1. Maintenance Period for Trees and Shrubs: 90 days from date of Substantial Completion and punch list with no major item.
   2. Maintenance Period for Ground Cover and Other Plants: 90 days from date of Substantial Completion and punch list with no major item.

B. Continuously maintain all site areas involved in this contract during the progress of work and during the maintenance period until final acceptance of the work by BMT. Improper maintenance or possible poor condition of the project at the termination of the scheduled maintenance period may cause postponement of the final completion date of the Contract. Continue maintenance until acceptable to the Owner.

C. Provide sufficient numbers of workers and adequate equipment to perform work during maintenance period.

D. Maintenance period does not start until all elements of construction, planting, and irrigation for the complete project are in accordance with the contract documents for this project.

E. Request an inspection to begin maintenance period after all planting and related work has been completed in accordance with other contract documents. Maintenance period commences as described in written notification by the Owner.

F. Prior to commencement of maintenance period, ensure that all ground cover and lawn areas have been planted and that all lawn areas show an even, healthy stand of grass seedlings or sod, grass having been mown twice.

G. Any day or days that there is failure to properly maintain plantings, replace suitable plants, perform weed control or maintain hardscape areas will not be credited as part of the 90 days maintenance. The project will not be segmented into maintenance phases.

H. Keep paved areas free of silt, dirt, leaves and other planting area debris. Maintain these areas at least broom clean through the duration of the maintenance period, cleaning no less often than once per week.

I. Guarantee: Guarantee plant material against any and all poor, inadequate or inferior materials and workmanship for one year. Replace plants found to be dead or in poor condition due to faulty materials or workmanship, at no extra cost to owner.

J. Replacement: Replace materials found to be dead, missing or in poor condition during the maintenance period immediately. The Architect is the sole judge of the acceptability of condition. Make replacements of materials within 15 days after condition develops or written notification from Architect has been sent. Architect has the right to make emergency repairs without releasing Contractor's guarantee and warranty to Architect.

K. Prior to date of final inspection, acquire approved reproducible prints and finally record from the job record set, all changes made during construction and deliver them to Architect.

L. Deliver guarantees to Architect.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Legend shown on Drawings and complying with ANSI Z60.1. Provide plant materials in accordance with the State Department of Agriculture's regulation for nursery inspections, rules and ratings. Provide plants with a normal habit of growth, sound, healthy, vigorous and free from insect infestations, plant diseases, sunscalds, and other disfigurements. Ensure tree trunks are sturdy and have well-hardened systems and vigorous and fibrous root systems which are not root or pot-bound. In the event of disagreement as to condition of root system, the root conditions of the furnished plants 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, roots of not less than two plants of each species or variety from each source will be inspected. In the event that the sample plants inspected are found to be defective, the entire lot or lots of plants represented by the defective samples may be rejected. Plants rendered unsuitable for planting due to this inspection will be considered samples and will be provided at no cost to the Owner.

B. Size of plants will comply with ANSIZ60.1 and correspond with that normally expected for species and variety of commercially available nursery stock or as specified on drawings. The minimum acceptable size of plants measured before pruning with the branches in normal position, must conform to the measurements specified in the plant list. If approved by the Owner, larger sized plants may be used. If larger plants are approved for use, the ball of earth or spread of roots for each plant will be increased proportionately.

C. Plants not meeting requirements of these specifications are considered to be defective whether in place or not. They must be immediately removed and replaced with new acceptable and approved plants of the required size, species and variety.

D. Pruning: Do not prune, trim, top or alter the shape of trees or plants except as approved.

E. Provide plant material true to botanical and common name and variety as specified in Annotated Checklist of Woody Ornamental Plants in California, Oregon and Washington, published by University of California School of Agriculture (latest edition).

F. Nursery Grown and Collected Stock: Grow under climatic conditions similar to those in locality of project; container-grown stock in vigorous, healthy condition, not root-bound or with root system hardened off. Use only liner stock plant material which is well established in removable containers or formed homogenous soil sections.

G. Select trees which are aesthetically desirable and are good examples of the species. Trees with gashes, misshapen trunks or branches, topped leaders, structural defects, badly crossed branches, or other visual defects will not be accepted. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread to assure symmetry in planting.

H. Seed: Label seed and provide in sealed containers with signed copies from vendor certifying that each container is fully labeled in compliance with State Agricultural Code and is in compliance with minimum requirements of these specifications. Wet, moldy or damaged seed will not be permitted. Provide seed mix per plan.

2.2 INORGANIC SOIL AMENDMENTS

A. The following soil amendments are to be used for bid purposes only. Specific amendments and fertilizer will be selected and specified after rough grading operations are complete and Contractor has had soil samples tested.

B. Soil Sulfur: Agricultural grad sulfur containing minimum of 99 percent sulfur expressed as elemental.

C. Iron Sulfate: 20 percent iron expressed as metallic iron, derived from ferric and ferrous sulfate, 10 percent sulfur expressed as elemental.

D. Agricultural Gypsum: Minimum 98 percent calcium sulfate, Calcium Carbonate: 95 percent lime as derived from oyster shells.

2.3 ORGANIC SOIL AMENDMENTS

A. The following soil amendments are to be used for bid purposes only. Specific amendments and fertilizer will be selected and specified after rough grading operations are complete and Contractor has had soil samples tested.

B. Nitrogen Stabilized: 0.56 to 0.84 percent N based on dry weight for wood residual or rice hulls.

C. Particle Size: 95 to 100 percent passing 6.35 mm standard sieve; 80 to 100 percent passing 2.33 mm standard sieve.

D. Salinity: Ensure that saturation extract conductivity does not exceed 3.5 millimohs per centimeter at 25 degrees C. as determined by saturation extract method.

E. Iron Content: Minimum 0.08 percent dilute acid soluble Fe on dry weight basis.

F. Ash: 0 to 6 percent dry weight.

2.4 FERTILIZERS

A. The following soil amendments are to be used for bid purposes only. Specific amendments and fertilizer will be selected and specified after rough grading operations are complete and Contractor has had soil samples tested.

B. Planting Fertilizer: Granular or pelleted fertilizer consisting of the following percents by weight and mixed by commercial fertilizer supplier:
   1. Composition: 6 percent nitrogen, 20 percent phosphorous, and 20 percent potash, by weight.

C. Planting Tablets: Provide slow-release type with potential acidity of not more than 5 percent by weight containing the following percent by weight of nutrients listed:
   1. Size: 21 gram tablets manufactured by Agriform, or approved equal.
   2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphoric acid, and 5 percent potash, 2.6-combined calcium, 1.6 combined sulfur, 0.35-iron elemental from ferrous sulfate, by weight plus micronutrients.

D. Hydroseeding Fertilizer: Provide ammonium phosphate which consists of the following percent by weight and mixed by a commercial fertilizer supplier: 16-nitrogen, 20-phosphoric acid, 0-potash.

E. Sulfate of potash: 0-0-50.

F. Single super-phosphate: Commercial product containing 18 to 20 percent available Phosphoric Pentoxide, or other approved.

G. Urea formaldehyde: 38-0-0.

2.5 PLANTING SOILS

A. Planting Soil (Import or Amended Top Soil) Ensure silt plus clay content of top soil does not exceed 20 percent by weight, with a minimum 95 percent passing the 2.0 mm sieve. Do not allow the sodium absorption ratio SAR to exceed 6. The electrical conductivity (ECE) of the saturation extract cannot exceed 3.0 millimohs per centimeter at 25 degrees C. Ensure boron content is less than 1 part per million as measured on the saturation extract. To ensure compliance with these requirements submit samples of soil for analysis prior to and following backfilling.

2.6 PLANTER MIX

A. Planter Mix for all on-structure planters and plant container: provide custom topsoil (“Disney”) Mix by EarthWorks Soil Amendments, Inc., (951) 782-0260, to include the following pre-blended items:
   85 percent sandy loam topsoil
   15 percent peat moss
   0.5 pounds / cy Triple Super Phosphate (0-45-0)
   0.25 pounds/ cy Potassium Sulfate (0-0-50)
   1.0 pound/cy Agricultural Gypsum
   0.2 pounds/cy P.A.M. (soil aggregating polymer)

B. Roofdeck Soil Mix

1. On-structure Planter Soil (Mix “A”) – (bottom of planter to 8-inches below finish grade) – per cubic yard of mix.
   a. 80% Over-structure Planter Sand (optional – 100% sand if weight is not a consideration).
   b. 20% pumice (optional no pumice).
   c. 2 lbs. Nitroform (38-0-0, 27% WIN).
   d. 2 lbs. 12-12-12 General Planting Fertilizer.
   e. 1 lb. iron sulfate.
   f. 2 lbs. dolomite lime.
   g. 2 lbs. calcium carbonate limestone.
   h. Thoroughly blend mix before placing soil in 12” lightly compacted lifts.
2. On-structure Planter Soil (Mix “B”) – (8-inch layer – place on top of On-structure Planter Soil (Mix “A”) up to finish grade) – per cubic yard of mix:
   a. 70% Over-structure Planter Sand.
   b. 30% Organic Amendment.
   c. 2 lbs. Nitroform (38-0-0, 27% WIN).
   d. 1 lb. iron sulfate.
   e. 2 lbs. dolomite lime.
   f. 2 lbs. calcium carbonate limestone.
   g. Thoroughly blend soil mix before placing soil in one lightly compacted lift.
3. Over-structure Planter Sand:
   a. Washed nursery sand which meets following U.S. Standard Sieve criteria:

Sieve No. (U.S. Standard)	Weight Percent Passing
10	100
18	100
35	92
60	16
100	2.1
140	1.3
270	0.1

2.7 MULCHES

A. Organic Mulch: Provide medium grind bark, consisting of organic, fibrous, woody bark mixture of varied particle size such that 90 to 100 percent passes 1 inch sieve, 80 to 100 percent passes 1/2 inch sieve, and 20 to 60 percent passes 1/4 inch sieve, or approved equal. Mulch shall be free of contaminants and weed seed and shall have a pleasant musty or moldy soil-like odor. Putrid, ammonia and sour-smelling materials will be deemed unacceptable. Recycled construction materials will not be permitted.

2.8 HYDROSEEDING FIBER MULCH

A. Provide Hydro-mulch as manufactured by Conwed, or other approved equal, composed of wood cellulose fiber and containing no germination or growth inhibiting factors. Ensure a consistent texture which disperses evenly and remains suspended in agitated water. Provide with a temporary green dye and the following percentage property analysis: moisture content 9 plus or minus 0.8; 3 o.d. basis, organic matter 99.2 plus or minus 0.8; ash content 0.8 plus or minus 0.2; pH 4.8 plus or minus 0.5; water holding capacity (grams of H20 per 100 grams of fiber) 1150 minimum.

HYDROSEEDING ADDITIVE (BINDER)

B. Provide Ecology Control-M-Binder organic seeding additive.

2.9 GUYING AND STAKING MATERIALS

A. Wood Tree Stakes: lodge pole pine, full treated with Coppernaphthanate Wood Preservative in strict accordance with FS TT-W-572 Type I, Composition B, 2-inch minimal normal size diameter by 10 feet long, no split stakes.

B. Ties: Provide cinch ties, size corresponding to tree box size as manufactured by VIT Company or other approved.

2.10 LANDSCAPE EDGINGS

A. Wood Edging:
1. Provide 2-inch by 4-inch pressure treated Douglas Fir or Redwood construction grade headerboards. Make splices with 1-inch by 4-inch pieces no less than 12 inches long. Place 1-inch by 3-inch by 16-inch stakes at intervals of not more than 5 feet. Cut stakes level and set below top of headerboards.
2. On sharp turns and curves, four 1/2 inch by 4-inch laminated boards, or two 1-inch by 4-inch laminated boards may be permitted.
3. Nail stakes and splices with galvanized common nails. Nail as required for solid installation.
4. Provide header as shown on drawings, laid true to line and grade, protect in-place adjacent improvements, shrubbery and other properties. Place stakes on ground cover side of header.

B. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

C. Aluminum Edging:

1. Standard-profile extruded-aluminum edging, ASTMB221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.

2. Buildings perimeter when adjacent to softscape to receive 16” pea gravel bed with landscape fabric beneath and aluminum edging unless otherwise directed by architect.

D. Plastic Edging: Standard black polyethylene or vinyl edging, horizontally grooved, extruded in standard lengths, with 9-inch steel stakes.

E. Concrete Mowstrip: 6 inch wide by 6 inch thick concrete mowstrip with 1/2 inch tooled edging and #3 continuous rebar.

2.11 MISCELLANEOUS PRODUCTS

A. Sand: Provide washed silica sand.

B. Tree Paint: Provide Morrison Tree Seal, Cabot Tree Paint or other approved.

C. Water: Provide clean, potable water.

D. Root Barrier: Provide UB24-2 by Deep Root Corporation, (800) 458-7668. Install at all trees within 5 feet of concrete paving, curbs or mow strips or as shown on plans. Install barrier with vertical ribs facing toward the tree and with the top edge 1/2 inch above finish grade. Provide linear root barrier adjacent to paving or curbing; root barrier shall not circle the rootball.

2.12 QUALITY CONTROL

A. Provide standard, approved and first-grade quality materials, in prime condition when installed and accepted. Deliver commercially processed and packaged materials in manufacturer's unopened containers bearing the manufacturer's guaranteed analysis. Supply a sample of all supplied materials accompanied by analytical data from an approved laboratory source illustrating compliance, or bearing the manufacturer's guaranteed analysis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain certification that final grades to 1/10 foot have been established prior to commencing landscaping operations. Provide for inclusion of all amendments, settling, etc. Be responsible for shaping all planting areas as indicated on drawings or as required.

B. Inspect trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning.

C. Do not begin planting of trees until deficiencies are corrected or plants replaced.

3.2 PLANTING AREA ESTABLISHMENT

A. Soil Preparation: After proper finish grades have been verified or established, cross-rip all planting areas to a depth of 12 inches, condition and fertilize soil in accordance with recommendations of soil testing laboratory and as approved by Owner. The following is for bid purposes only. Uniformly spread and cultivate amendments thoroughly by means of mechanical tiller into top 6 inches of soil. Application rates per 1,000 square feet:
1. Nitrogen stabilized organic amendment: 4 cubic yards
2. 16-16-16 Commercial Fertilizer: 15 lbs.
3. Agricultural Gypsum: 100 lbs.
4. Soil Sulfur: 20 lbs.

B. At time of planting, ensure that top 2 inches of all areas to be planted or seeded are free of stones, stumps and other deleterious matter 1 inch in diameter or larger, and free from wire, plaster, concrete, wood and similar materials which would cause hindrance to planting or maintenance.

C. Finish Grading: Make minor modifications to grade as may be necessary to establish required final grade. Ensure that finish grade provides proper drainage of the site and surface drainage is away from building. Final grades are to be 1-inch below adjacent paved areas, sidewalks, valve boxes, headers, clean-outs, drains, manholes, etc., or as shown on drawings or required by City. Eliminate erosion scars prior to commencing maintenance period.

D. Pre-Plant Weed Control:
1. After irrigation system is operational, use 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.
2. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 2 inches below surface of soil over entire areas to be planted.
3. After irrigation system is operational, apply water for 10 days as needed to achieve weed germination. Apply contact herbicides and wait as needed before planting. Repeat as required.
4. Maintain weed free site until acceptance by Owner.

3.3 PLANTING INSTALLATION

A. General:
   1. The irrigation system shall be operational and approved prior to planting.
   2. Perform actual planting only during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved.
   3. Distribute in planting areas only as many plants as can be planted and watered that same day.
   4. Ensure that containers which are opened and plants removed are handled with care such that ball of earth surrounding roots is not broken and that plants are planted and watered immediately. Do not open containers prior to placing plants in planting areas.

B. Layout: Mark locations for plants and outlines of areas to be planted before any plant pits are dug. Gain City approval. If underground construction or utility lines are encountered in the excavation of planting areas, other locations for planting may be selected by Owner. Accomplish layout with flagged grade stakes indicating plant names and specified container size on each stake. Confirm location and depth of underground utilities and obstructions.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Trim perimeter of bottom leaving center area of bottom raised slightly to support rootball and assist in drainage away from center. Do not further disturb base. Ensure that rootball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
   1. Excavate approximately two times as wide as rootball diameter.
   2. Do not excavate deeper than depth of the rootball, measured from the root flare to the bottom of the rootball.

B. Subsoil and topsoil removed from excavations may be used as planting soil backfill.

C. Strip and stack approved excavation for planting which is encountered within areas for trenches, tree holes, plant pits and planting beds.

D. Remove from site excess soil generated from planting holes and not used for backfilling.

E. Protect areas from excessive compaction when trucking plants or other materials to planting areas.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
   1. Use planting soil for backfill.
   2. Container Grown: Cut cans on two sides with acceptable can cutter only. Carefully remove rootball from container without damaging rootball or plant. Superficially loosen edge roots on three sides after removing from can.

3. Boxed Trees: Remove bottom of plant boxes before planting. Remove sides without damage to rootball after positioning plant and partially backfilling.
4. Face plants with fullest growth into prevailing wind.
5. Backfill plants with: 6 parts by volume on-site soil, 4 parts by volume organic amendment, 1 pound 6-20-20 fertilizer mix per cubic yard of mix, 2 pounds iron sulfate per cubic yard of mix. Note: This is for bid purposed only. Specific backfill recommendations are made as a result of the soils testing described on the planting plan.
6. Backfill around rootball in layers, tamping to settle soil and eliminate voids and air pockets. Hold plant rigidly and plumb until soil has been firmed around ball or roots. Raise all plants which settle deeper than the surrounding grade. When planting pit is approximately one-half filled, add water to the top of the planting pit and thoroughly saturate rootball and adjacent soil.
7. Set planting tablets with each plant on top of rootball while plants are still in their containers so the required number of tablets can be verified. After water has completely drained, place planting tablets as follows or in amounts recommended in soil reports from soil-testing laboratory.
   1 tablet per 1-gallon container
   2 tablets per 5-gallon container
   3 tablets per 15-gallon container
   4 tablets per 24-inch box
   6 tablets per 36-inch box
   8 tablets per 48-inch box
   Place tablets beside the rootball about 1-inch from root tips; do not place tablets in bottom of the hole.
8. Continue backfilling process. Construct an earthen basin around each plant after backfilling. Provide basin of depth sufficient to hold at least 2 inches of water. Construct basins with amended backfill. Remove basin in all turf areas after initial watering. Water again after placing and tamping final layer of soil.
9. Limit pruning to minimum necessary. Remove injured twigs and branches. Pruning may not be done prior to delivery of plants. Paint cuts over 3/4 inch in diameter with tree paint.
10. Stake or guy trees immediately after planting. Install stakes plumb. Locate stakes so that a straight line drawn between the stakes is perpendicular to the prevailing wind direction.
11. Do not bring iron sulfate into contact with concrete surfaces due to potential staining. Contractor is responsible for cleaning and replacing stained surfaces.

D. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the rootball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the rootball.

3.6 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken twigs or branches. Do not prune for shape. Pruning may not be done prior to delivery of plants. Paint cuts over 3/4 inch in diameter with tree paint.

B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

3.7 GROUNDCOVER AND OTHER SMALL CONTAINER PLANTING

A. Set out and space ground cover and plants from flats or containers smaller than 1-gallon as indicated on planting plan in even rows with triangular spacing.

B. Ensure that groundcover remains in the flats until transplanting. Flats' soil must contain sufficient moisture so it will not fall apart when lifting plants.

C. Use planting soil for backfill. Plant each rooted plant with its proportionate amount of flat soil.

D. Dig holes large enough to allow spreading of roots.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants for damage and trampling.

3.8 HYDROSEEDING:

A. Install large trees and shrubs (5 gallon and larger) if they occur in hydroseeded areas.

B. Install trees and shrubs (1 gallon) and groundcovers from flats if they occur in hydroseeded areas.

C. Provide seed mixes as shown on plan.

D. Apply hydroseed by an approved hydro-mulch company.

E. Apply in a form of slurry consisting of cellulose fiber, see, chemical additives, commercial fertilizer and water. When hydraulically sprayed on soil, ensure that hydro-mulch forms a blotter like groundcover impregnated uniformly with seed and fertilizer and allows the absorption of moisture and rainfall to percolate to the underlying soil.

F. Prepare the slurry at the site by first adding water to the tank when the engine is at half throttle. When water level has reached height of agitator shaft, provide full circulation, then add seed, followed by fertilizer, then mulch. Only add the mulch to the mixture after the seed and the tank is at least 1/3 filled with water. By the time the tank is 2/3 to 3/4 full, all mulch shall be in. Commence spraying immediately when tank is full.

G. Spray uniform visible coat by using the green color as a guide. Apply the slurry in a sweeping motion, in an arched stream so as to fall like rain allowing the wood fibers to build on each other until a good coat is achieved and the material is spread at the required rates.

H. Remove slurry not used within two hours from the site.

I. Fill out the daily worksheets by the nozzle main with the following information: Seed type and amount, mulch type and amount, number of loads and amount of water, seeding additive type and amount, area covered and equipment used, capacity and license number.

J. Do not allow any slurry to be sprayed into any reservoir basin or drainage ditches and channels which may impede the flow of rain or irrigation water. Clean up any spilled slurry.

K. After application of hydro-mulch, wash excess material from previously planted materials and architectural features. Avoid washing or eroding mulch materials.

L. Ensure that application equipment has a built-in agitation system and operating capacity sufficient to agitate, suspend and mix a slurry containing not less than 40 pounds of fiber mulch plus a combined total of 7 pounds fertilizer solids for each 100 gallons of water.

M. Slurry distribution lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic spray nozzles which will provide a continuous non-fluctuating discharge. Capacity requirements is 1,500 gallons, mounted on a traveling unit, either self-propelled or drawing by a separate unit which will place slurry tank and nozzles within sufficient proximity of areas to be seeded.

N. Hydraulic equipment used for pesticide applications shall consist of a clean 150 gallon capacity fiberglass tank, complete with mechanical agitation. Pump volume shall be 10 gallons per minute, while operating at a pressure of 100 pounds per square inch. Distribution lines shall be large enough to carry the volume of water necessary for even chemical distribution. Spray nozzle must cover a 15-foot swath, with a minimum output of 5 gallons per minute at 80 pounds per square inch.

3.9 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas with 3 inch layer of mulch except 2:1 slopes, hydroseeded and turf areas.

3.10 CLEAN-UP

A. After all planting operations are complete; remove all trash, excess soil, empty plant containers, and rubbish from the property. Repair scars, ruts and other marks in the ground and leave ground in a neat and orderly condition.

B. Leave the site in a broom-clean condition and wash down all paved areas within the project site. Leave walks in a clean and safe condition.

3.11 LANDSCAPE MAINTENANCE

A. Weed and cultivate all areas at intervals of not more than a week.

B. Perform watering, mowing, rolling, edging, trimming, fertilization, spraying, pest control, and cleaning no less often than once per week.

C. Provide maintenance log to include dates, work forces, and all the maintenance activities that was performed on site. The maintenance log should be updated weekly and submitted to BMT.

D. Street gutters and curbs are to be included.

E. Maintain adequate protection for people and property, and be financially responsible for damages and injuries. Notify the Architect immediately should damage occur as a result of maintenance operations and provide repair or remuneration.

F. Between the 15th and 20th calendar day of the maintenance period, reseed or resod all spots or areas within the lawn where normal turf growth is not evident.

3.12 TREE AND SHRUB CARE

A. Watering: Maintain a large enough water basin around plants so that enough water can be applied to establish moisture through the major root zone. When hand watering, use a water wand to break force of water.

B. Pruning:
1. Prior to any pruning, obtain written approval from the Architect to proceed.
2. Trees:
a. Propose tree pruning to the Architect should there be health or structural reasons for doing so, including the need to eliminate diseased or damaged growth, eliminate structurally unsound growth, reduce potential for wind toppling or wind damage, or maintain growth within limited space.
b. Tree pruning that is required during the Maintenance Period for tree health or structural reasons, or as directed by the City, shall be performed in accordance with ANSI A-300 ISA standards.
c. Major pruning of deciduous trees shall be during their dormant season.
3. Shrubs:
a. The objectives of shrub pruning are the same as for trees. Do not clip shrubs into balled or boxed forms unless such is required by the design.
b. Make pruning cuts to lateral branches or buds or flush with trunk. Stubbing will not be permitted.

C. Staking and guying: Ensure that stakes and guys remain in place through acceptance and monitor to prevent girdling of trunks or branches and to prevent rubbing that causes bark wounds. All nursery stakes shall be removed.

D. Weed control: Keep all areas free of weeds. Use recommended legally approved herbicides. Avoid frequent soil cultivation that destroys shallow roots. Use mulches per specifications to help prevent weed seed germination.

E. Insect and disease control: Maintain a reasonable control with approve materials.

F. Fertilize as specified by the agronomic soils testing recommendations and as follows for bid purposes:
1. Commencement of maintenance period – 6 pounds per 1,000 square feet with top dress fertilizer.
2. At the end of first 30 days of maintenance period – 6 pounds per 1,000 square feet with top dress fertilizer.
3. At end of maintenance period and at 30 day intervals should maintenance period by extended for any reason – 6 pounds per 1,000 square feet with fertilizer mix.
4. Avoid applying fertilizer to the rootball and base of main stem; rather, spread evenly under plant to dripline. Rates will vary from about a cup of nitrate fertilizer (depending upon nitrogen percentage) around a newly installed small plant to about 1/2 pound of actual nitrogen per inch of truck diameter measured four feet from the ground for mature trees.

G. Replacement of plants: Replace dead, dying and missing plants with plants of a size, condition and variety acceptable to the Architect.

3.13 GROUND COVER CARE

A. Weed control: Control weeds, preferably with pre-emergent herbicides, but also by hand or with selective systemic herbicides. Hoe weeds as little as possible since this may result in plant damage.

B. Watering: Water enough that moisture penetrates throughout root zone and only as frequently as is necessary to maintain healthy growth.

C. Trash: Remove as it accumulates, but no less often than weekly.

D. Edging and trimming: Edge groundcover to keep in bounds.

E. Replace dead and missing plants.

3.14 LAWN AND TURF CARE

A. Turf must be well-established prior to final acceptance.

B. Watering: Water lawns at such frequency as weather conditions required to replenish soil moisture below root zone.

C. Weed control: If needed, control broad leaf weeds with selective herbicides.

D. Mowing:
1. Perform mowing at such times of the day or week as may be requested by the Owner so as not to impede the Owner's operations. Mowing times may be at times other than normal working hours or days. Perform work at Owner's convenience.
2. Clean up grass clippings during and after mowing, and remove legally from site. Use of blowing type equipment in lieu of sweeping or vacuuming is not acceptable.

E. Renovating:
1. If required, remove thatch by verticutting preferable in the Fall of the year, but otherwise in the Spring. At this time, fertilize with nitrate and over-seed if needed. Over-seeding must precede pre-emergent herbicides by at least 4 to 6 weeks. Normally, this means that lawns which have been invaded by crabgrass would be renovated and over-seeded in the Fall and treated for crabgrass control in the following late Winter.
2. Clean up grass clippings during and after mowing, and remove legally from site. Use of blowing type equipment in lieu of sweeping or vacuuming is not acceptable.

3.15 IRRIGATION SYSTEM

A. Inspection: Check all systems for proper operation. Lateral lines must be flushed out after removing the last sprinkler head or two at each end of the lateral. Adjust heads as necessary for unimpeded coverage and no overspray.

B. Controllers: Set and program automatic controllers for seasonal water requirements. Give Owner a key to controllers and instruction on how to turn off system in case of emergency as specified in other sections of these specifications.

C. Repair all damages to irrigation system. Make all repairs within one watering period.

END OF SECTION 329300

Scientific Name	Common Name	Campus Edge	Parking / Bioswales	Semi- Public Open Spaces	Academic Courts	Work Yards	Central Spine Tree	Central Green & Spine	Specimen	Specialty pots and raised planters
TREES										
Triadica sebifera	CHINESE TALLOW TREE		*	*				*		
Brachychiton acerifolius	FLAME TREE	*	*	*	*	*		*	*	*
Brachychiton populneus	KURRAJONG	*	*	*	*	*		*	*	*
Spathodea campanulata	AFRICAN TULIP TREE	*		*					*	
Cercis canadensis 'Forest Pansy'	PURPLE LEAF EASTERN REDBUD		*	*	*			*		*
Afrocarpus falcatus (Podocarpus gracilior)	AFRICAN FERN PINE		*			*				
Cupaniopsis anacardioides	CARROT WOOD	*				*		*		
Chamaerops humilis	MEDITERRANEAN FAN PALM				*				*	
Beaucarnea recurvate	PONYTAIL PALM				*				*	*
Acacia stenophylla	SHOESTRING ACACIA	*	*	*				*		
Pistacia chinensis	CHINESE PISTACHE	*	*	*		*		*		
Cassia leptophylla	GOLD MEDALLION TREE	*	*	*	*					
Handroanthus heptaphyllus	PINK TRUMPET TREE		*	*						
Chilopsis linearis	DESERT WILLOW			*				*		
Handroanthus chrysotrichus	GOLDEN TRUMPET TREE		*	*						
SHRUBS										
	Salvia hybrid sp.	*	*	*				*		
	Salvi apiana California White Sage	*	*	*				*		
	Olea europaea 'Montra’	*		*	*	*		*		
	Callistemon 'Little John'	*	*	*				*		
	Rhaphiolepis umbellate minor			*	*			*		
	Eleagnus pungens and var. “variegata”	*	*			*		*		
	Caesalpinia pulcherrima ‘red Mexican bird of paradise”	*	*	*						
	Punica granatum 'Nana'		*	*		*		*		
	Crassula ovata “common jade plant”	*	*	*	*					
	Callistemon viminalis ‘slim’	*								
	Leucadendron ‘safari sunset’	*	*	*	*			*		
	Tagetes lemmonii ‘mexican marigold’	*		*				*		
	Dasylirion acrotriche ‘desert spoon’			*				*		
	Eremophila sp. ‘emu bush’	*	*	*	*			*		
	Thuja occidentalis Golden Arborvitae	*	*	*	*					
	Sansevieria trifasciata		*		*					

Scientific Name	Common Name	Campus Edge	Parking / Bioswales	Semi- Public Open Spaces	Academic Courts	Work Yards	Central Spine Tree	Central Green & Spine	Specimen	Specialty pots and raised planters
GROUNDCOVER										
	Sedum rupestre 'Angelina'				*			*		*
	Lantana sp.	*		*				*		
	Teucrium chamaedrys ‘prostrate germander’	*	*	*	*	*		*		
	Tradescantia padilla purpuraea			*	*					*
	Graptopetalum paraguayense									
	Ceanothus maritimus ‘maritime ceanothus’	*			*					
	Delosperma sp.		*		*					*
	Achillea sp. ‘yarrow hybrids’	*	*	*	*	*		*		*
	Erigeron karvinskianu ‘santa Barbara daisy’	*	*	*						
	Carissa microphylla ‘green carpet’	*	*	*						
SUCCULENTS										
	Agave 'Blue Glow'			*				*		
	Agave sp.			*				*	*	
	Aloe ‘blue elf’	*	*	*	*			*		*
	Aloe sp.	*	*	*	*			*	*	*
	Dasylirion longissimum Mexican Grass Tree		*	*				*		
	Dasylirion sp. ‘desert spoon’		*	*				*		
VINES										
	Campsis radicans ‘trumpet vine’	*	*							
	Vigna Caracalla ‘snail vine’	*	*							

SECTION 329113 - SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes planting soils specified by composition of the mixes.

B. Related Requirements:
1. Section 311000 Site Clearing for topsoil stripping and stockpiling.
2. Section 329700 Vegetated Roof Assemblies for growing media (soil).

1.2 DEFINITIONS

A. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

B. Imported Soil: Soil that is transported to Project site for use.

C. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

F. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

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

H. USCC: U.S. Composting Council.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

C. Samples: For each bulk-supplied material in sealed containers labeled with content, source, and date obtained; providing an accurate representation of composition, color, and texture.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

2.2 PLANTING SOILS SPECIFIED BY COMPOSITION

A. Planting Soil Type: Existing, on-site surface soil, with the duff layer, if any, retained; modified to produce viable planting soil. Blend existing, on-site surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil.

B. Planting-Soil Type: Imported, naturally formed soil from off-site sources and consisting of sandy loam soil according to USDA textures; and modified to produce viable planting soil.
   1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Bermuda grass, poison oak, nutsedge, Canada thistle, bindweed, bentgrass, ground ivy, perennial sorrel, and bromegrass.
   2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
   3. Unacceptable Properties: Clean soil of the following:
      a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.
c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

4. Amended Soil Composition: Blend imported, unamended soil with the soil amendments and fertilizers in the quantities as recommended in the soils report to produce planting soil.

C. Planting-Soil Type: Manufactured soil consisting of manufacturer's basic topsoil blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials to produce viable planting soil.
1. Additional Properties of Manufacturer's Basic Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
2. Unacceptable Properties: Manufactured soil shall not contain the following:
a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil.
c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.
3. Blend manufacturer's basic soil with soil amendments and fertilizers in the quantities as recommended by the soils report to produce planting soil.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
3. Form: Provide lime in form of ground mollusk shells.

B. Sulfur: Granular, biodegradable, and containing a minimum of 99 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 98 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
1. Feedstock: Limited to leaves.
2. Reaction: pH of 6.0 to 7.5.
3. Salinity: Ensure that saturation extract conductivity does not exceed 3.5 millimohs per centimeter at 25 degrees c. as determined by saturation extract method.
4. Moisture Content: 35 to 55 percent by weight.
5. Organic-Matter Content: 30 to 40 percent of dry weight.
6. Particle Size: 95 to 100 percent passing through a 6.33 mm standard sieve; 80 to 100 percent passing through a 2.33 mm sieve.
7. Iron Content: Minimum 0.08 percent dilute acid soluble Fe on dry weight basis.
8. Ash: 0 to 6 percent dry weight.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of dS/m.

C. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.5 FERTILIZER

A. Planting Fertilizer: Pelleted or granular form consisting of the following percents by weight and mixed by commercial fertilizer supplier: 6-nitrogen, 20-phosphoric acid, 20-potash.

B. Planting Tablets: Provide slow-release type with potential acidity of not more than 5 percent by weight containing the following percents by weight of nutrients listed: 20-nitrogen, 10-phosphoric acid, 5-potash, 2.6 combined calcium, 1.60 combined sulphur, 0.35-iron elemental from ferrous sulfate. Provide in 21 gram tablets manufactured by Agriform or other approved.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements of the Agronomic Soils Report recommendations.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

3.2 BLENDING PLANTING SOIL IN PLACE

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

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 12 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix sulfur with dry soil before mixing fertilizer.
2. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.3 PROTECTION AND CLEANING

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

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

C. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329113

SECTION 333100- SANITARY SEWERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work in this Section includes the requirements for furnishing all labor, materials, and equipment necessary and incidental to installing sanitary sewer structures, pipes and cleanouts.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the applicable provisions of all pertinent codes and regulations.

B. Qualification of Workmen: Employ at least one person who shall be present at all times during execution of this portion of the work, be thoroughly familiar with the type of materials being installed and the best methods for their installation, and who shall direct all work performed under this Section.

1.3 SUBMITTALS

A. Product Data: Submit to the Engineer manufacturer's standard drawings or catalog cuts for all pipe fittings, structures, valves, and cleanouts.

B. Certificates of Compliance: Submit to the Engineer the manufacturer's Certificate of Compliance for each of the materials which are specified to conform to publications referenced under "Products" in this Section.

C. Submit proposed test procedures and all results of all tests to the Engineer.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Ductile Iron Pipe (DIP) for gravity sewer shall be pressure Class 350 and shall have push-on ends; shall comply in all respects with the provisions of ASTM A746-03 and ANSI/AWWA C151. All standard length pipe shall be plain end by bell end with rubber-gaskets in accordance with ANSI/AWWA C111. All plain ends, including short lengths, shall be beveled and all bell ends shall have appropriate rubber gaskets. Short length pipe shall be plain end on both ends. Ductile iron pipe shall be manufactured by American Pipe, U.S. Pipe or equal.

B. All fittings for Ductile Iron Pipe shall be compact ductile iron, shall meet the applicable requirements of ANSI/AWWA C153. Push-on joints for fittings shall have joint dimensions and rubber gaskets conforming with ANSI/AWWA C111.

C. Gravity sewer pipe and fittings shall be lined with PROTECTO 401 Ceramic Epoxy or equal. Epoxy shall be installed by pipe manufacturer by a certified applicator. Minimum 40 mils nominal dry film thickness. Any coating damaged shall be repaired in strict accordance with the manufacturer’s installation instructions.

1. Top-Loading Classification: Covers shall be capable of supporting H-20 traffic loading in compliance with AASHTO M-306 at locations susceptible to traffic loadings.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.5 NONPRESSURE TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 HANDLING OF MATERIALS

A. All pipe, fittings and supplementary items shall be handled in such a manner as not to damage the material. All dirt and trash shall be removed from the pipe prior to installation. Damage to the pipe, pipe lining or coating, if any, shall be repaired to the satisfaction of the Engineer or replaced at no additional cost.

B. Pipes or structural steel plate materials shall not be dropped to, or dragged over the ground, but shall be handled with rolling slings on skids or with cranes.

C. Bent or otherwise damaged pipe materials shall not be used.

D. Distribute pipe and other materials along the line of work and outside the trench as near as practical to the point of placement. Do not deposit site materials on or against pipe.

E. Protect pipe ends until the pipe is placed in its final position.

3.2 EARTHWORK

A. Perform excavation, bedding and backfilling as indicated on the drawings and specified in Division 31, “TRENCH EXCAVATION AND BACKFILL”, of these specifications.

3.3 PLACING PIPE

A. Place the pipe on appropriate bedding graded to conform with the grades and alignment indicated on the drawings and prepared as specified. Exercise care that the pipe has a full, solid bearing along its entire length. Make small depressions for pipe bells when utilized. Make minor adjustments to line and grade by scraping away or filling bedding material. Do not support pipes on blocks or mounds of any nature.

3.4 PIPE JOINTS

A. PVC pipe jointing shall be in conformance with SSPWC Subsection 306-1.2.10.

B. Gaskets must be straight, properly lubricated and without twist.

C. Carefully control pipe handling after the gasket has been affixed to avoid bumping the gasket, knocking it out of position, or loading it with dirt or other foreign material. Remove gaskets so disturbed and clean, relubricate and replace before the joint is attempted.

3.5 INSTALLATION OF MANHOLES

A. Carefully place precast manholes on the prepared bedding to be fully and uniformly supported in true alignment, and ensure that all entering pipes can be inserted on the proper grade.

All lift holes and all joints between precast elements shall be thoroughly wetted then completely filled with mortar, and smoothed and pointed both inside and out to ensure watertightness.

Place and align precast sections to provide vertical sides and vertical alignment of the ladder rungs. The completed manhole shall be rigid, true to dimensions and watertight.

In precast manholes where steel loops have been provided in lieu of lift holes, remove the loops flush with the inside wall surface after the manhole has been completed. No sharp cutoff protrusions will be permitted. If concrete spalling occurs as a result of the loop removal, restore the spalled area with mortar to a uniform smooth surface.

B. Grade Adjustments: Initially construct interceptors and manholes of the type noted on the project drawings so as to provide adjustment space for setting cover fastenings to a finished grade. The manhole grade shown on the contract drawings for manhole construction indicates the approximate top grade for the manhole plus or minus 0.20-foot and the final grade will be set after paving has been completed to final grade.

Where work is in paved areas which have been brought to grade, provide not less than 8 inches or more than 16 inches between the top of the cone or slab and the underside of the manhole casting ring for adjustment of the casting ring to grade.

C. Pipe Connections: Place all pipes entering or leaving the manhole on firmly compacted bedding, particularly within the area of the manhole excavation, which normally is deeper than that of the sewer trench. Take special care to see that the openings through which pipes enter the structure are completely and firmly rammed full of mortar to ensure water tightness.

D. Backfill: Hand-place backfill around the manhole and extending at least into each trench and tamp with selected material up to an elevation of 6 inches above the crown of all entering pipes. Work shall conform to the applicable provisions of Division 31, "TRENCH EXCAVATION AND BACKFILL."

3.6 INSPECTION AND TESTS OF SANITARY SEWERS

A. Inspection: Pipe shall be subject to inspection and rejection in accordance with the provisions of ASTM C 14. Obtain approval of pipe installation from the Engineer prior to backfilling.

B. Tests: Conduct tests on sanitary sewer pipelines and appurtenances in accordance with SSPWC Section 306-1.4. Provide 2 days advance written notice of start of testing to the Owner’s Authorized Representative. The Owner’s Authorized Representative shall observe all tests.

The Contractor shall furnish all necessary equipment and material, and make taps in piping, as necessary, for testing and as specified.

END OF SECTION

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - DESCRIPTION

1.1 SCOPE

A. The Contractor shall provide all labor and equipment necessary and required to install all of the storm drainage facilities in accordance with the Contract Documents. Work shall include, but not be limited to:

1. Installation of drainage system(s) consisting of manholes, drain inlets, catch basins, pipe, end sections, outlet control structure(s), and all necessary and required accessory items and operations, including connection(s) to existing drainage facilities.
2. Installation of building leader drains at building downspouts, where indicated on plans or as described herein, consisting of all pipe, fittings and required accessory items and operations, including connections to the proposed and/or existing drainage system. All downspouts at the front of building, within 5'-0" of a sidewalk shall have leader drain connection to the storm piping.
3. Where shown, installation of underdrains consisting of all pipe, fittings and required accessory items and operations, including connections to the proposed and/or existing drainage system.

1.2 WORK SPECIFIED UNDER OTHER SECTIONS

A. The following related work is specified under other Sections:

1. Division 31: Excavation Support and Protection
2. Division 31: Earth Moving
3. Division 32: Cement Concrete Pavement
4. Division 32: Asphalt Concrete Paving

1.3 OTHER REQUIREMENTS

A. In addition to the requirements specified herein, the Contractor shall comply with the requirements as specified on the Drawings.

PART 2 - CONSTRUCTION DETAILS

2.1 GENERAL

A. The Contractor shall install all drainage structures and pipe in the locations shown on the Drawings. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.

B. The installation of all drainage structures and pipe shall conform to the requirements of all Authorities having jurisdiction.

2.2 TRENCH EXCAVATION AND BACKFILL

A. The provisions of the Article of these Specifications entitled "Earthwork" shall govern all work under this Section.

2.3 STORAGE AND HANDLING

A. Storage - Storage of storm drain pipe and appurtenances on the job shall be in accordance with the manufacturers' recommendations.

B. Handling - All storm drain pipe and appurtenances shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in handling the pipe and appurtenances.

2.4 DAMAGE

A. General - Pipe and/or appurtenances which are defective from any cause, including damage caused by handling, shall be unacceptable for installation and shall be replaced by the Contractor at no cost to the Owner.

Pipe and/or appurtenances that are damaged or disturbed through any cause prior to acceptance of the Work, shall be repaired, realigned or replaced by the Contractor at the Contractor's expense.

B. Minor Imperfections in Concrete Pipe - Concrete pipe with damage which is the result of minor imperfections in manufacture which do not affect the structural integrity of the pipe may be repaired in the field. Repairs shall be sound, properly finished and cured and shall conform to the requirements of these Specifications.

2.5 PIPE INSTALLATION

A. Laying Pipe - Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with the details as shown on the Drawings and the Article of these Specifications entitled "Trench Excavation and Backfill". Pipe shall be laid upgrade unless otherwise directed by the Owner's Field Representative.

Concrete pipe with lift holes shall be laid with the lift holes on top of the pipe. After the pipe is installed, the lift holes shall be sealed with suitable concrete plugs to the satisfaction of the Owner's Field Representative. No lift holes will be permitted in pipes twenty-four (24) inches in diameter or smaller.

Bell and spigot pipe shall be laid with the bell end upgrade; tongue and groove pipe shall be laid with the groove end upgrade. Trimming of the pipe will not be allowed.

Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. Prior to the placing of a length of pipe, the end of the previously laid length shall be carefully and thoroughly wiped smooth and cleaned to obtain an even and close-fitting joint.

No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, so as to prevent movement or disturbance of the pipe.

B. Pipe Extensions - Where existing pipe is to be extended, the same type of pipe shall be used unless otherwise specified.

C. Full Lengths of Pipe - Only full lengths of pipe are to be used in the installation except that partial lengths of pipe may be used at the entrance to structures where necessary to obtain a proper connection to the structure.

D. Pipe Entrances to Structures - All pipe entering structures (e.g. manholes, drain inlets, catch basins, etc.) shall be cut flush with the inside face of the structure, and the cut ends of the pipe and surface of the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges, or imperfections that will impede the flow of water or affect the hydraulic characteristics of the installation.

Only full sections of pipe shall be used where entering a structure which will be exposed to view, such as headwalls, end sections, etc.

E. Bedding and Backfilling - The type of materials to be used as bedding and backfill and the method of placement shall conform to the requirements of the Article of these Specifications entitled “Trench Excavation and Backfill” and as shown on the details of the Drawings.

F. Protection During Construction - The Contractor shall protect the installation at all times during construction. Movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be done at the Contractor’s risk.

At all times when pipe laying is not in progress, all open ends of all pipes shall be closed by approved temporary watertight plugs. If water is in the trench when work is resumed, the plugs shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has been eliminated.

The Contractor shall furnish a sufficient pumping plant and shall provide and maintain at his own expense satisfactory drainage wherever needed in the trench and other excavations during the progress of the Work and at its completion for final inspection. No pipe or other structure shall be laid in water and water shall not be allowed to flow or rise under any concrete or other masonry. All water pumped or bailed from the trench or other excavation shall be conveyed in proper manner to a suitable point of discharge. The flow in all sewers, drains and watercourses encountered on the Work and in gutters along the sides of or across the Work shall be entirely provided for, both temporarily and permanently, as required, by the Contractor at his expense. All offensive water shall be removed from the Work at once.

G. Tolerance - Pipe shall be laid accurately to the line and grade shown on the Drawings. Allowable tolerances shall be one-half (1/2) inch on grade and one (1) inch on line in any section of pipe between structures. No adverse grades shall be allowed. Deviations from these tolerances shall be a basis for rejection of the line of pipe. Any line which has been rejected shall be rebuilt to the correct line and grade by the Contractor at his own expense.

H. Perforated Foundation Drain Piping – shall receive one blanket of Typar filter fabric, 30” wide coved over top of pipe and backfilled with 18” nominal #57 stone prior to general soil backfilling of trench.

2.6 PIPE JOINTS

A. Pipe shall be joined as specified herein:

1. Jointing Corrugated Polyethylene Drain Pipe - Corrugated external polyethylene couplers as provided by the pipe manufacturer shall be used. The joints shall be installed according to the manufacturer’s specifications and as approved by the Civil Engineer.
2. Reinforced Concrete Pipe - ASTM C990-92.
3. PVCP Pipe – ASTM D 3034, SDR-35

2.7 STRUCTURES

A. General Requirements - All drainage structures shall be built in accordance with the details and at the locations shown on the Drawings and as specified herein. Where a specific material of construction is indicated, no substitution will be allowed unless authorized in writing by the Architect. Where more than one type of material of construction is indicated, the Contractor shall have the option of constructing the structure of any one of the materials specified. Precast concrete structures shall require shop drawing review by the Architect.

Cast-in-place concrete and/or masonry shall not be laid when the temperature is below 40 degrees F., or when indications are for lower temperatures within 24 hours, unless protection of concrete and masonry is established. In this event, the Contractor shall take measures to prevent concrete and masonry from being exposed to freezing temperatures for a period of not less than five (5) days after installation. Any damage to the structure because of freezing shall be corrected by the Contractor at his own expense.

All cast-in-place concrete and masonry shall be installed by personnel experienced and skilled in this work.

Manholes, drain inlets and catch basins are to be constructed as soon as the pipe laying reaches the location of the structures.

In constructing manholes, drain inlets and catch basins, the Contractor shall accurately locate each structure and set accurate templates to conform to the required line and grade. Any structure which is mislocated or oriented improperly shall be removed and rebuilt in its proper location, alignment and orientation at the Contractor's expense.

The Contractor shall use extreme care in the handling of precast concrete structures due to carelessness in handling or due to any of the Contractor's operations shall be repaired or replaced by the Contractor at his own expense.

Unless otherwise specified, all structures shall be constructed on concrete foundations. All foundations shall rest on firm soil of uniform bearing. If the soil beneath the foundation is unsuitable, the Contractor shall remove this unsuitable material as directed by the Soils Engineer and replace it with an approved properly compacted granular material conforming to the requirements of the Article of these Specifications entitled "Trench Excavation and Backfill" to the bottom elevation of the structure.

B. Cast-in-Place Concrete Structures - Cast-in-place concrete structures shall be constructed of Class "A" concrete with reinforcing as shown in detail on the Drawings and as specified herein.

Material and construction requirements shall be as specified under the Article of these Specifications entitled "Site Concrete".

C. Precast Concrete Structures - Precast concrete structures shall be installed only after shop drawings have been approved. All precast concrete structures shall be designed and fabricated for an H-20 design load.

The base of the precast concrete structures shall be set on a foundation pad of crushed stone eight (8) inches in compacted thickness. Foundations of all precast concrete structures shall rest on firm soil of uniform bearing. If soil beneath the foundation is unsuitable, the Contractor shall remove the unsuitable material as directed by the Soils Engineer and replace it with an approved properly compacted granular backfill material

conforming to the requirements of the Article of these Specifications entitled “Trench Excavation and Backfill” to the bottom elevation of the crushed stone pad.

After pipes have been installed, all openings shall be properly sealed with non-shrinking cement mortar grout as directed. Grout around pipes which protrude through the walls of the structure and on all joints shall contain “Antihydro”, or other approved additive, to insure watertightness. Cement grout shall contain one (1) part cement to two (2) parts sand by volume and additive in accordance with manufacturer’s recommendations. Mortar shall be applied to the bottom one-third (1/3) of the opening before the pipe is inserted.

The precast concrete top section shall be set sufficiently below finished grade to permit a maximum of four (4) and a minimum of two (2) courses of eight (8) inch brick to be used as risers to adjust the grade of the casting. Manhole frames shall be set on a grout pad as specified herein above.

D. Shallow Circular Structures - For shallow circular structures, the top conical section shall be replaced by a flat reinforced concrete slab with the proper size opening to accommodate the specified casting. The minimum thickness of the reinforced concrete slab shall be six (6) inches and shall be designed for an H-20 design load. In general, and unless otherwise specified or directed by the Site Engineer, the flat slab top shall be used for circular structures whose depth from pipe invert to finished grade is five (5) feet or less.

E. Inverts - Smooth invert channels shall be constructed in all manholes and in all drain inlets and catch basins which do not have sumps, to insure a smooth flow of water through the structure.

Invert channels for precast concrete structures shall be constructed of concrete; invert channels for masonry structures may be constructed of concrete or brick.

Extreme care shall be taken by the Contractor to construct invert channels to the shape, elevations and dimensions shown, specified or ordered by the Site Engineer.

When a curve in the invert channel or some other condition prevents the use of channels as shown on the Drawings, then such channels shall be constructed in accordance with the directions of the Civil Engineer/Architect.

When pipes entering and leaving a manhole are of different diameters, the invert channel shall be constructed so as to provide a smooth transition from the inflow pipe(s) to the outflow pipe.

The invert channel shall be carried up to the elevations shown on the Drawings. Channels shall slope smoothly and evenly from the inflow pipe(s) to the outflow pipe.

Split pipe for channels will be considered only in those instances where the drain line is of concrete pipe and the major inflow pipe and outflow pipe is of the same size and alignment.

Invert channels shall be built for future extensions where shown on the Drawings.

F. Frames and Covers/Grates - Frames and covers/grates for drain structures shall be of the types and sizes indicated on the Drawings. Frames shall be well bedded in mortar and shall be set accurately to the correct alignment and grade. In areas to be paved, frames shall be set by using four (4) points of reference, set 90 degrees apart, to insure accurate setting to proposed pavement grade.

Where drain inlets and/or catch basins are to be placed on curb lines or at edge of pavements, sufficient length of proposed curb or edge of pavement adjacent to the structure shall be established prior to construction of the drain inlet and/or catch basin to insure that the structure is correctly located and oriented.

G. Area, Pop-Up & Drainage Emitters – Provide "National Diversified Sales, Inc. product or as noted on the drawings.

H. Steps - Steps shall be installed in all manholes. Steps shall also be installed in all drain inlets and catch basins greater than four (4) feet in depth unless otherwise specified.

Steps shall be set securely in place during the construction of the wall for masonry structures and during fabrication of the wall section for precast concrete structures.

2.8 CONNECTIONS TO EXISTING FACILITIES

A. General Requirements - The Contractor shall make all required connections of the proposed drainage facilities into existing drainage facilities, where and as shown on the Drawings.

B. Compliance with Requirements of Owner of Facility - Connections made into existing drainage facilities shall be done in accordance with the requirements of the owner of the facility and the jurisdiction. The Contractor shall be required to comply with all such requirements, including securing of all required permits and paying the costs thereof. The cost of making the connections in accordance with the requirements of the owner of the existing facility shall be included in the Contract Sum.

2.9 ALTERATION, RECONSTRUCTION AND/OR CONVERSION OF EXISTING STRUCTURES

A. General Requirements - The Contractor shall alter, reconstruct and/or convert existing structures where as shown on the Drawings. In general, alterations shall be made with the same type of material used in the original construction unless otherwise indicated on the Drawings.

B. Adjustment to New Grade and Alignment - All castings on existing drainage structures that are to remain shall be adjusted to new grade and alignment. When such adjustment is required the castings shall be carefully removed and the walls of the structures reconstructed as required. The castings shall be cleaned and reset in a firm mortar bed to the new grade and alignment. Existing castings which are broken, damaged or otherwise unfit for incorporation into the new work shall be replaced under the Contract Sum.

C. Structures to be Converted - Structures which are to be converted (e.g. manholes to drain inlets or catch basins, drain inlets or catch basins to manholes) shall conform as closely as possible to the design of the proposed structure. Sufficient masonry shall be removed from the existing structure to insure that the walls can be rebuilt to conform to the proposed construction. Furnishing and installation of new castings for the converted structures shall be included in the Contract Sum.

D. Removal of Portions of Wall of Existing Structures - In all cases of alteration, reconstruction and/or conversions of existing structures, existing walls shall be removed to a point where the existing walls will provide sound and adequate foundation for the construction of the new walls.

E. Reconstruction and/or Rebuilding of Existing Invert -Where new pipes are to be installed into an existing structure, the existing invert shall be reconstructed and/or rebuilt as directed to accommodate installation of the new pipes and provide for proper transition of flows into and out of the structure.

F. Damage to Existing Structure and/or Pipe - The Contractor shall exercise extreme care during such alteration, reconstruction and/or conversions so as not to damage any portions of the structure and/or pipe shown to remain. Any such damage shall be repaired by the Contractor at his own expense.

G. Structures to be Cleaned - Upon completion of alteration, reconstruction and/or conversion of existing structures, all structures shall be cleaned of any accumulation of silt, debris or foreign matter of any kind and shall be kept clean of such accumulation until final acceptance of work.

2.10 RELOCATION AND/OR ABANDONMENT OF EXISTING FACILITIES

A. The Contractor shall not abandon, disconnect, obstruct or in any other way interfere with the operation of an existing storm drain facility until such time as adequate permanent or temporary substitute facilities have been constructed and placed in operation.

2.11 LEADER DRAINS

A. General Requirements - The Contractor shall make all required connection(s) of the building leader drain(s) into the on-site drainage system whether shown or not on the Drawings. Work shall include making the leader drain connection(s) into the on-site drainage system, furnishing and installing all leader drain pipe form the on-site drainage system to the building leader drains. The connection(s) shall be made with proper fittings and/or adapters compatible with the building leader drains providing watertight connection(s) and shall be done at no additional cost to the Owner. Connect all downspouts to subterranean storm water collection pipe system, whether shown specifically on drawings or not.

B. Coordination with Building Plumbing Contractor - The Contractor will be required to coordinate his work with the work of the building plumbing contractor to determine the exact location(s) and elevation(s) of the point(s) of entry into the building(s) prior to construction.

C. Connection into On-Site Drainage System - Leader drain connection(s) to the on-site drainage system shall be made at structure(s) or into the pipe where and as shown on the Drawings at every roof leader and downspout on exterior building walls. Pipe connections shall be made with proper size and type tee and/or wye fittings supplied by the pipe manufacturer.

2.12 UNDERDRAINS

A. General Requirements - The Contractor shall install all underdrains where and as shown on the Drawings.

B. Pipe Installation - A minimum of four (4) inch layer of approved underdrain filter material shall be placed and compacted in the bottom of the trench as a bedding for the pipe. Underdrain pipe of the type and size specified shall be embedded firmly in this bedding material to the line and grade shown on the Drawings.

Unless otherwise specified, perforated pipe shall be laid with the perforations down and the pipe sections shall be jointed securely with the appropriate fittings or bands. Upgrade ends of pipe underdrains shall be closed with suitable plugs.

C. Backfilling - After the pipe installation has been inspected and approved, underdrain filter material shall be hand-shoveled around and over the pipe to such a depth that, after compaction, it extends a minimum of four (4) inches above the underdrain pipe. The surface of the underdrain filter material shall then be compacted with a vibrating pad compactor, and the remainder of the filter material shall be placed in lifts not more than six (6) inches in thickness with each lift thoroughly compacted with a mechanical vibrating pad compactor. The height of filter material over all pipe shall be as indicated on the Drawings.

D. Geotextile Fabric - Geotextile fabric shall be placed where and as shown in detail on the Drawings. Ends and sides of fabric shall be lapped a minimum of twelve (12) inches.

E. Pipe Connections and Changes in Alignment - Pipe to pipe connections and changes in pipe alignment shall be made only with prefabricated fittings to be supplied by the manufacturer of the pipe (e.g. tees, wye branches, etc.).

2.13 DRAINAGE FILTERATION SYSTEM

A. The Contractor shall install Contech StormFilter SFMH72 or approved equal, as supplied by CONTECH construction Products,Inc., 11835 NE Widing Drive, Portland, Oregon 97220 (800-548-4667), and installed in accordance to CONTECH's Stormwater Management StormFilter Specification.

2.14 CLEANING AND REPAIR

A. The Contractor shall clean the entire drainage system of all debris and obstructions. This shall include, but not be limited to, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing storm drains or streams. All debris shall be removed from the system.

After the system has been cleaned, the Contractor shall thoroughly inspect the system and all repairs shown to be necessary shall be promptly made by the Contractor.

All work of cleaning and repair as specified herein and as required by jurisdiction inspectors shall be done at the Contractor's expense.

2.15 FINAL TESTS AND INSPECTIONS

A. Upon completion of the Work and before final acceptance by the Owner, the entire drainage system shall be subjected to an inspection in the presence of the Owner's Field Representative. The Work shall not be considered as complete until all design and jurisdiction requirements for line, grade cleanliness, and workmanship have been met.

PART 3 - MATERIALS

The materials to be used in the construction shall be those indicated on the Drawings and specified herein. The Contractor shall supply to the Architect, prior to installation, certificates of compliance for the materials used. The Contractor shall also submit shop drawings and catalog cuts of all storm drain items and appurtenances (pipe, fittings, joints, castings, steps, precast concrete structures, etc.) to the Architect for approval prior to ordering.

3.1 STORM DRAIN PIPE, FITTINGS AND JOINTS

A. Corrugated Polythylene Drain Pipe and Fittings (CPDP) - shall have a smooth interior and conform to the requirements of AASHTO Designation M-294. Pipe shall be Hi-Q Pipe as manufactured by Hancor or approved equal or as indicated on drawings with same requirements.

B. Underdrains - Pipe, Fittings and Filter Materials

1. Perforated Polyvinyl Chloride Pipe (PPVCP) - shall conform to the requirements of AASHTO Designation M-278, and shall be Perforated Highway Underdrains and Fittings as manufactured by Carlon or approved equal.
2. Filter Material - shall be approved crushed aggregate meeting the requirements of ASTM Designation C-33, size No. 57.
3. Filter Fabric - shall be Mirafi 140N or approved equal.

C. Polyvinyl Chloride Pipe and Fittings For Gravity Lines (PVCP)

1. Shall conform to the requirements of ASTM Designation D-3034 for SDR-35 extra strength pipe and fittings. Pipe shall have integral wall bell and spigot joints. Assembly shall be by means of push-on joints using flexible elastomeric seals conforming to ASTM Designation D-3212.
   All fittings and accessories shall be furnished by the pipe manufacturer. Joint lubricant shall be as recommended by the pipe manufacturer.
2. PVC pipe shall have common profiles for inter-changeability between rough-barrel dimensions, couplings, ends, and elastomeric gaskets to facilitate future repairs. When assembled, the pipe shall have only one gasket per bell and spigot end, and/or two gaskets per coupling.
3. Drainage pipe shall be furnished in standard 3.96m or 6.10m (13’ or 20”) lengths, unless otherwise detailed or required on the Approved Plans.
4. Follow the Manufacturer’s recommendations for the minimum allowable radius for the size of pipe used.
5. All pipe, fittings, and couplings shall be clearly marked in accordance with ASTM D3034, F679, and F794, respectively.
6. All pipe shall have a home mark on the spigot end to indicate proper penetration when the joint is made.

3.2 STRUCTURES

A. General - Where material requirements specified hereinafter conflicts with the requirements of Authorities having jurisdiction, the requirements of the Authority having jurisdiction shall govern.

B. Brick - shall conform to the “Specifications for Sewer and Manhole Brick (made from Clay or Shale)”, AASHTO Designation M-91, Grade MS.

C. Concrete Block - shall be solid block and shall conform to the “Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes”, ASTM Designation C-139.

D. Precast Concrete Structures - Prior to fabrication, the Contractor shall submit four (4) sets of plans of the proposed precast concrete structures to the Site Engineer for approval along with design criteria and certification by the manufacturer that the structure will support the design load. Unless specified otherwise, precast concrete structures shall be designed for an H-20 design load.

Precast concrete manhole sections shall conform to ASTM Designation C-478. Joints for manhole sections shall conform to ASTM Designation C-443.

The minimum compressive strength of the concrete used for all precast structures shall be 4,000 psi. Where steps are required in structures, steps shall be installed during the casting of the structures, aligned as specified herein. Joints in the structures shall be tongue and groove joints, formed in such a manner so that a watertight rubber seal can be applied.

No precast concrete structure shall be fabricated or delivered to the job site until it has been reviewed by the Architect. All structures shall have an identifying number and manufacturer's name on each section.

When precast concrete structures are to be used, the Contractor shall bear all responsibility for the proper locations and sizes of all openings to receive the pipe. The review of shop drawings by the Architect shall not relieve the Contractor of his responsibility in this matter. Should field revisions to the structure be necessary due to improper location of openings or unforeseen field conditions such as line and/or grade changes, deletion of structures, relocation of structures, or addition or deletion of lines to be connected into the structures, then the Contractor will be required to make all necessary and required revisions to the satisfaction of the Architect and at no additional cost to the Owner.

CONTECH Stormwater Stormfilters shall be installed per manufacturer's recommendations and per the plan details. Prior to installation of manhole structure, contractor shall verify number and size of stormfilters to be installed and size manhole to accept specified stormfilters.

E. Manhole Frames and Covers - shall be as specified on the Drawings. Castings shall be gray cast iron, American made by a nationally recognized casting manufacturer conforming to the requirements of AASHTO Designation M-105, Class 30 and shall be true to pattern in form and dimensions as specified, free from pouring faults, sponginess, cracks, blowholes and other defects that affect their strength and other characteristics for the intended use. All surfaces have a workmanlike finish.

All component parts shall fit together in a satisfactory manner and frames and covers shall be of a design that will prevent rocking or rattling under traffic. Frames and covers that are warped or rocking shall be rejected and shall be removed and replaced.

Unless otherwise specified, the word "STORM" shall be integrally cast on the cover in raised letters and centered. Letter size shall be two (2) inches.

If directed, and at no additional cost to the Owner, castings shall be coated with an asphalt paint which shall result in a smooth coating and not be tacky or brittle.

F. Drain Inlet and Catch Basin Frames and Grates - shall be as specified on the Drawings and in accordance with the following requirements and shall be American made by a nationally recognized casting manufacturer:

1. Cast Iron - shall be gray cast iron castings conforming to the requirements of AASHTO Designation M105, Class 30. All requirements of workmanship and material as specified for manhole castings shall apply herein. If directed, and at no additional cost to the Owner, castings shall be coated with an asphalt paint which shall result in a smooth coating and not be tacky or brittle.

All component parts of the frames and grates shall fit together in a satisfactory manner and frames and covers shall be of a non-rocking design so as to prevent rocking or rattling under traffic. Frames and grates that are warped or rocking shall be rejected and shall be removed and replaced by the Contractor.

G. Concrete and Reinforcing - shall conform to the requirements as specified under the Section of these Specifications entitled “Site Concrete”.

H. Mortar - shall be composed of one (1) part Portland cement and two (2) parts sand by volume. Material requirements shall be as follows:

1. Portland Cement - shall conform to the requirements of AASHTO Designation M-85.
2. Mortar Sand - shall conform to the requirements of AASHTO Designation M-45, except that aggregate shall be no coarser than #8 sieve size.
3. Water - shall be clean and shall not contain any oil, acid, alkali, salts, vegetable matter, organic matter or other deleterious substances. When possible, water shall be from a municipal system.

Hand mixing of mortar will be permitted only when the amount of mortar to be used makes machine mixing undesirable. When hand mixing is used, the ingredients must first be thoroughly mixed dry in a tight box. The proper quantity of clean water shall then be gradually added, and the materials shall be hoed or worked until a uniform mixture is secured. Admixtures may not contain calcium chloride.

No greater quantity of mortar is to be prepared than is required for immediate use, and it shall be worked over constantly with hoe or shovel until used. No mortar shall be retempered, and none shall be used more than one and one-half (1-1/2) hours after mixing. All mortar which remains upon stopping work shall be discarded.

I. Steps - Steps in drainage structures shall be as specified herein and on the details of the Drawings and shall meet the requirements for steps and ladders as specified under ASTM Designation C-478.

1. Malleable or Ductile Cast Iron - shall be designed for a minimum design live load of a single concentration of 300 pounds. Material shall be of Iron, Class 25A, in accordance with ASTM Designation A-48 or Malleable Iron, Grade 35018 in accordance with ASTM Designation A-47.
2. Plastic Coated Steel - shall be No. 4 deformed reinforcement bar meeting the requirements of ASTM Designation A-615, Grade 60 which shall be coated with polypropylene plastic meeting the requirements of ASTM Designation D-2146 for Type II, Grade 49108.

All steps shall be true to pattern, form dimensions, and free from defects which would affect their strength. Steps having defects filled with putty or cement of any kind shall be rejected.

END OF SECTION 334100

WINDSCREEN MESH & WALL WRAP SPECIFICATIONS:

Substitutions must meet or exceed material, quality and warranty per BOD spec.

DURATEX

12oz Supreme Mesh

duratexmedia.com

Duratex 12oz Supreme Mesh Banner is a heavy duty coated polyester scrim banner material with a 90/10 air flow made to withstand harsh, windy environments. Extremely tear-resistant product constructed of 1500 x 1500 denier scrim reinforcement and a 10 x 11 weave. Duratex Supreme Mesh is weldable and has blockout characteristics that make it perfect for any double-sided print application like pole banners.

Physical Properties

- Denier: 1500 x 1500
- Weight: 12oz
- Weave: 10x11

Printer Compatibility

Compatible with most Solvent, Eco-Solvent, Latex and UV curable inkjet printers using mesh kits.

Features & Benefits

- Extremely tear-resistant
- Blockout characteristics
- 90/10 air flow
- Double-sided printing
- Mesh weave provides enhanced image quality on front or back

Product Information

126" x 164 ft.
196" x 164 ft.

Product Applications

- Pole banners
- Large building/stadium wraps
- Outdoor signage displays

DURATEX

12oz Supreme Mesh

duratexmedia.com

Physical Properties Data Sheet

Article Name:	Duratex 12oz Supreme Mesh Banner
Description:	12oz, 410g/ m², 1500D x 1500D / 33 x 33 both side printable mesh
Sample Sheet:	Attached

Physical Properties	Data	Unit	Test Method
Unit Weight	410±10	g / M²	DIN EN ISO 2286-2
Polyester Fabric Yarn (W/F)	1500D x 1500D / 33 x 33	Denier/fd per inch	DIN EN ISO 2060
Tensile Strength Warp/Woof	3491 (Warp)	N/5cm	DIN 53354
	2043 (Woof)	N/5cm	
Tearing Strength Warp/Woof	439 (Warp)	N/5cm	DIN 53363
	196 (Woof)	N/5cm	
Caliper, um / mil	0.58±0.005	mm	
Gloss @ 60o / Front side	4.3		UNI GLOSS 60Plus
Opacity %	/		HLD2009
Color of PVC Banner / Front side (L*, a*, b*)	L = 81.1		CM-2500d
	a = -1.5		
	b = -3.4		
Notice: The Product Color Difference Of Each Batch : The ΔE Value should less than 1.0.			
Environmental Condition: Ambient ~24°C / 44%RH			

ORAJET® 3165RA
CALENDERED PVC DIGITAL MEDIA
WITH *RAPID*AIR® TECHNOLOGY

Description
A versatile digital print media designed for a multitude of indoor and outdoor vibrant full-color graphics applications. ORAJET® 3165RA utilizes a thicker 4-mil blended-PVC construction with a dependable solvent-based air-egress adhesive system. ORAFOL *Rapid*Air® air-egress adhesive technology facilitates faster, bubble-free graphic applications. Apply additional UV and graphic abrasion protection with ORAGUARD® 210 or 215 over-laminate. Compatible with today's most popular ink systems: solvent, eco-solvent, latex, and UV curable - users can experience ORAJET® printability advantages with consistent, high-quality digital print production! ORAJET® 3165RA is included in the ORAFOL® (OCS) ORALIFE™ Component System Warranty!

Release Liner
88# PE-coated silicone paper featuring advanced air release technology to facilitate quicker, easier application

Adhesive
Grey, Solvent-Based Permanent with *Rapid*Air®

Durability
- 5 years (unprinted)
  - Up to 4 years (when paired with ORAGUARD® 210)
  - Up to 5 years (when paired with ORAGUARD® 215)

Applications
- Flat, short – to medium-term applications
- Bubble-Free, Easy to install!
  - medium-term outdoor general signage
  - window graphics
  - long-term indoor general signage
  - permanent wall graphics and murals
  - floor graphics *(pair with ORAGUARD 250AS)*
  - stickers & decals
- Not designed for vehicle or trailer wrapping

Recommended Laminates
- ORAGUARD® 210
- ORAGUARD® 215
- ORAGUARD® 215DU (for UV-Curable Inks)
- ORAGUARD® 250AS (anti-skid, textured floor laminate)
- ORAGUARD® 255AS (anti-skid, textured floor laminate)

Printability/Ink Compatibility
Latex, Solvent, Eco-Solvent, UV Curable, UV-Gel, and Screen Printing. **Click Here** to view ORAFOL ICC Profiles.

Splice Free Guarantee
Our Splice Free Guarantee assures you that every roll of ORAJET® digital print media is free from splices. If you identify a verifiable splice, we will promptly replace the roll at no cost and provide you with $500 as a token of our commitment to your satisfaction and uninterrupted printing experience.

ORAFOL Americas – GA
1100 Oracal Parkway
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Phone: 888.672.2251

ORAFOL Americas – CT
120 Darling Drive
Avon, CT 06001
Phone: 800.654.7570

ORAFOL Canada
2831 Bristol Circle
Oakville, Ontario L6H 6X5
Phone: 888.727.3374

techsupport-americas@orafol.com – www.orafol.com

ORAJET® 3165RA CALENDERED PVC DIGITAL MEDIA WITH *RAPID*AIR® TECHNOLOGY

Technical Data

Thickness (without liner and adhesive)	4-mil
Dimensional Stability (FINAT TM-14)	Adhered to steel, no shrinkage in cross direction; In length, <.016"
Temperature Resistance	Adhered to aluminum, -40°F to +176°F, no variation
Fire Behavior (DIN 75200) **Fire Rating**	Adhered to steel, self-extinguishing Meets ASTM E 84-07 Class "A"
Adhesive Power (FINAT TM-1, after 24 h, average)	Adhered to stainless steel: 3.65 lb/in
Tensile Strength (DIN EN ISO 527)	Along: Min. 19 MPa Across: Min. 19 MPa
Elongation at Break (DIN EN ISO 527)	Along: Min. 130% Across: Min. 150%
Seawaterability (DIN 50 021)	Adhered to aluminum, after 100h/73°F, no variation
Shelf Life (68°F/50% relative humidity)	2 years
Minimum Life Expectancy (based on accepted application procedures on vertical surfaces)	4 years (unprinted)
Minimum Application Temperature	50°F
Available Lengths **Available Widths**	150' (50-yard) 30", 54", 60"
Recommended Laminates	ORAGUARD® Series 210, 215, 215DU, 250AS, 255AS
Print Compatibility	Latex, Solvent, Eco-Solvent, UV Curable, UV-Gel

For best results, utilize ORAFOL ICC profiles available at www.orafolamericas.com and allow solvent-based inks to dry for at least 24 hours (48-72 hours preferred) at 70°F before cutting the graphic to the ink or applying a laminate.

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Note

Surfaces to which the material will be applied must be thoroughly cleaned from dust, grease or any contamination which could affect the adhesion of the material. Freshly lacquered or painted surfaces should be completely cured. The compatibility of selected lacquers and paints should be tested by the user, prior to application of the material. Films with structured surface are naturally more sensitive than the unstructured. Accordingly, these films are to be treated carefully both in processing and in cleaning. Impurities affect the appearance of structured films and require more frequent cleaning. Furthermore the application information published by ORAFOL is to be considered. The batch traceability according to ISO 9001 is possible on the basis of the roll number.

IMPORTANT NOTICE

All ORAJET® products are subject to careful quality control throughout the manufacturing process and are warranted to be of merchantable quality and free from manufacturing defects. Published information concerning ORAJET® products is based upon research which the Company believes to be reliable although such information does not constitute a warranty. Because of the variety of uses of ORAJET® products and the continuing development of new applications, the purchaser should carefully consider the suitability and performance of the product for each intended use, and the purchaser shall assume all risks regarding such use.
All specifications are subject to change without prior notice.
WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

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EDIT FOR BLDG. O2

1.9 SCOPE OF WORK

A. Furnish shop drawings and receive approval, prior to fabrication and installation.

B. Furnish all materials and labor and any engineering services to supply a complete and professionally installed system in working order as described herein. Labor furnished shall be specialized and experienced in audiovisual system installation.

C. Furnish and install all wire and cable called out in the Contract Documents.

D. Coordinate all back-box locations with the Electrical Contractor and appropriate general trades.

E. Furnish any additional items, not specifically mentioned herein, to meet system requirements as specified, without claim for additional payment. Such items may include but are not limited to hardware, transformers, line/distribution amplifiers and other devices for proper installation, interface, isolation, or gain structure.

F. Perform initial adjustments and verification tests. Submit verification test report to the Architect five days prior to commissioning.

G. Participate in acceptance testing and perform final adjustments utilizing Audiovisual contractor furnished test equipment and project engineers.

H. Furnish and participate in user training.

I. Furnish system documentation including copies of all relevant drawings and equipment manuals in compliance with the Contract Documents.

J. Furnish maintenance services for the specified period from the date of acceptance.

K. Guarantee all new equipment, software, hardware, components, and workmanship for the specified period from the date of acceptance.

L. Refer to drawing TA0.01 Audiovisual General Notes for the Schedule of Responsibility.

1.10 SUBMITTALS

A. Pre-bid Submittals:
1. Contractors must pre-qualify in order to bid on this project. Contractors must provide proof of the following qualifications and certifications and evidence of experience in similar audio and/or video installations. Submit listed qualifications to Architect for review ten (10) days prior to submission of a bid. Late submittal will result in exclusion from bid.
   a. Credentials & resume for project manager, project engineer, and lead installer which must include NICET, EST, and/or CTS-I certifications.
   b. Proof of the AV Contractor's membership in NSCA or AVIXA (Audiovisual and Integrated Experience Association). Indicate current AVSP level.
   c. Credentials and resume of the AV Contractor, including company history, and relevant project list, indicating continuous engagement in the installation and service of AV equipment for at least five (5) years in systems of similar size, scope, and project type.
   d. Submittal of "Line card" indicating the manufacturers the AV Contractor is a certified dealer for.
   e. Copy of at least one approved shop drawing set of a project of similar size, scope, and project type.
   f. Proof that the AV Contractor holds current certifications necessary to perform Graphic User Interface Programming and Configuration.

2. The following Av Contractors have been pre-qualified for bid on this project:

a. 3G Productions
4575 Loma Vista Ave.
Vernon, CA 90058
(562) 692-9201
Contact: David Myers
dmyers@3glp.com

b. Diversified Systems
5627 Stoneridge Drive, Suite 308
Pleasanton, CA 94588
(925) 730-0098
Contact: Tom Yerkes
tyerkes@diversifiedus.com

c. Professional Audio Designs
11629 W Dearbourn Avenue
Wauwatosa, WI 53226
(414) 476-1011
Contact: Kim Leonard
kim@proaudiodesigns.com

d. Pro Sound / Solotech
11060 Randall Street
Sun Valley, CA 91352
(818) 765-3800
Contact: Shawn Risberg
srisberg@prosound.net

e. Pro Media Audio & Video
777 Arnold Drive, Suite 100
Martinez, CA 94553
(510) 741-2925
Contact: Jim Kinkella
Jim.kinkella@promediaaudiovideo.com

B. Bid Submittals:
1. Contractors shall examine all drawings and read all divisions of this specification in order to avoid omissions and duplications and to ensure a complete job. No allowances shall be made for failure to read and understand the Contract Documents. Discrepancies between drawings and the specifications or obvious omissions shall be referred to the Architect prior to the bid date. Where discrepancies occur and pre-bid instructions have not been obtained, the Contractor agrees to abide by the Architect's decisions.
2. Bid proposals shall include all work and all equipment as specified, as well as any additional equipment and materials not listed here, to be used in assembling the system to fulfill the design intent.
3. The bid submittal shall include the following:
   a. Infrastructure and Major Equipment List and installation bid.
   b. Major Equipment List line item pricing.
      1) Installation costs for General Equipment including hardware and labor shall be furnished.

2) Pricing shall include in-bound freight, shipping, and all delivery charges.
3) Any designation of “Allowance: $XXXX” shall be listed and carried on as line item on the bid. Winning AV Contractor will be required coordinate with the Architect and Owner for selection of equipment falling into Allowance categories.

C. Shop Drawings Submittals:
1. Within thirty (30) days of contract award, submit four (4) copies of detailed shop drawings to the Architect for approval. All shop drawings shall be marked with the related drawing number when submitted.
2. System installation and fabrication shall not begin without written approval from the Architect.
3. Review of shop drawings shall not constitute final approval of system function. Said review does not in any way relieve the Contractor from the responsibility of furnishing material or performing work as required by the Contract Documents.
4. Failure of the Contractor to submit shop drawings in ample time for the evaluation shall not entitle the contractor to an extension of contract time, and no claim for extension by reason of such default will be allowed.
5. At a minimum, shop drawings shall include:
   a. Table of Contents
   b. Itemized list of all equipment and materials to be used in assembling the system.
   c. Catalog cut sheet or data sheet for each listed item.
   d. One-line Signal Flow diagrams for all sound reinforcement systems, visual systems, and auxiliary systems showing point to point wiring interconnections of all equipment with wire run numbers and patch bay designations. Show all transformers, switches, relays, control circuits, and modifications to equipment. Show all equipment items which are required for realization of the functions described herein.
   e. Complete lists of all wire run numbers along with the termination location of each end of each wire run.
   f. Schematic diagrams for any custom circuitry and all typical connections between audio lines, patch bays, visual system lines and rack mounted equipment.
   g. Drawings of all items which are to be custom fabricated or modified. Drawing shall be in scale suitable for fabrication. They shall show materials, finishes, hardware, back boxes, connectors, and panel/control markings. Submit samples of lettering/label size and typeface to be employed on custom plates, panels, and other equipment.
   h. Submit samples of custom work, finishes, or other materials as required by the Architect to verify appearance and quality. All costs for shipping samples shall be the responsibility of the Contractor.
   i. Full size drawings illustrating the physical layout and labeling of patch bays.
   j. Mechanical drawings of all assemblies, major and sub-assemblies, racks, cabinets, and enclosures, indicating provisions for proper cable management, power management, and thermal management.
   k. Mechanical drawings showing all proposed mounting details of all major equipment (e.g. loudspeakers, cameras, projectors, video displays,

projection screens), and associated rigging and interface with adjacent architecture.

l. Vibration and noise control information shall be included and coordinated with the Electrical Contractor.

m. Conduit Routing Plan, to be coordinated with electrical contractor prior to cable pull.

n. Cabling schedule providing information as detailed in AVIXA (formerly known as Infocomm) Standard F501.01:2015 to be coordinated with the Architect and Owner prior to cable pull and termination.

6. The above listed drawings shall be produced on AutoCAD 2004 min. or similar computer drafting program. Scans or photocopies of the Contract Documents are not acceptable.
7. The use of electronic files from other sources (e.g. Architect's backgrounds, Architect's drawings, vendor-supplied panel drawings) shall not absolve the Contractor of the responsibility for ensuring that the Shop Drawings represent a completely engineered coordinated system. The Contractor has final responsibility for providing systems that conform to all requirements in the Contract Documents.
8. The Contractor shall review Electrical Contractor shop drawings for all vibration and noise control equipment and systems information.
9. Proposed Touch Panel Graphical User Interface (GUI) layouts shall be submitted for approval prior to the commencement of control system programming.

D. Substitutions:
1. Substitutions shall be submitted as per the General Conditions of the Contract Documents.
2. The proposed substitutes must be equivalent or superior to the specified products in quality, performance, construction, function, conformance to system objectives and not affect system functionality, signal type, distribution, and features.
3. All substitutions must receive the express written consent of the Architect and Owner.
4. The Architect reserves the right to substitute new products which become available subsequent to the issuance of the Contract Documents, provided that:
a. The contractor has not yet purchased the originally specified equipment.
b. The substitute equipment shall not materially increase the Contractor's cost.

1.11 JOB CONDITIONS

A. Keep the job adequately staffed at all times. Unless illness, loss of personnel, or other circumstances beyond the control of the Contractor intervene, keep the same individual charge throughout.

B. Cooperate with all appropriate parties in order to achieve well-coordinated progress with overall construction completion schedule and satisfactory results.

C. Watch for conflicts with work of other contractors on the job and execute, without fair claim for extra payment, moderate moves or changes as are necessary to accommodate other equipment or to preserve acoustic or visual performance, symmetry, and pleasing appearance.

D. Immediately report to the Architect any design or installation irregularities, particularly architectural elements that interfere with the intended coverage angles of loudspeakers, camera, or projection equipment, so that appropriate action may be taken.

E. Perform any and all cutting, patching, and painting for proper and finished installation of the system and repair any damage done as a result of such installation.

F. Audiovisual System work areas are to be maintained in a clean and orderly condition. Clean up and dispose of trash from all audiovisual system work areas.

1.12 ACOUSTICALLY SENSITIVE SPACES

A. The following areas have been designated as “Acoustically Sensitive Spaces:
   1. Control Rooms
   2. Amplifier Rack Rooms
   3. Electrical Equipment Spaces
   4. Mechanical Equipment Spaces

B. An acoustically sensitive space is defined as a room or space, which requires special construction consideration to meet room acoustic, acoustic isolation, and noise control or vibration control requirements.

C. All conduit runs penetrating acoustically sensitive spaces shall have both ends sealed by means of removable closed cell neoprene foam after all cables have been run to prevent sound transmission from adjacent spaces.

D. All audiovisual wiring devices in acoustically sensitive spaces shall have a gasket sealing the faceplate to the back box to prevent sound transmission from adjacent spaces.

1.13 DELIVERY AND HANDLING

A. The Audiovisual Contractor shall coordinate delivery and installation of all equipment with the Construction Manager and/or Electrical Contractor.

B. If required by the Construction Manager or Electrical Contractor, audiovisual equipment shall be delivered in a minimum of three (3) separate shipments that shall include:
   1. Shipment #1: All items in which conduit is terminated which includes specialty backboxes, wiring device faceplates with receptacles, projection screen cases, etc.
   2. Shipment #2: All items which require structural backing such as rigging components, monitor and projector mounts, etc.
   3. Shipment #3: All items that are not required until the building/area of work is secure and ready for electronic equipment. This shall include equipment racks, wiring device face plates, portable equipment, etc.

C. Audiovisual Contractor shall deliver all material to the job site suitably crated, packed, and protected and bearing the label and the nomenclature of the product(s) found in each carton or crate.

1.14 QUALITY ASSURANCE

A. Parts listed shall be complete and equipment furnished shall conform to manufacturer's specifications.

B. All materials shall be new and shall conform to the applicable provisions of Underwriter's Laboratories (ULEQ) and American Standards Association (ASA).

C. Procure and pay for all permits, licenses, and inspections, and observe any requirements stipulated therein. Conform in all trades with all local regulations and codes.

D. Comply with federal, state, and local labor regulations and applicable union regulations.

E. Installation shall conform to the latest federal, state, and local electrical safety codes of authorities having jurisdiction. Where conflict exists, the most stringent code or regulation shall apply.

1.15 GUARANTEE AND SERVICE

A. The Audiovisual system shall conform to all applicable code requirements, including seismic requirements, and shall be in conformance with industry standards of operation and practice.

B. All new systems and components shall be guaranteed free of defects in materials and workmanship for a period of one (1) year from the date of acceptance and shall be repaired or replaced within forty-eight (48) hours following report of such defects by the owner.

C. Installation of relocated existing equipment shall be guaranteed free of defects in materials and workmanship for a period of one (1) year from the date of acceptance and shall be repaired or replaced within forty-eight (48) hours following report of such defects by the owner.

D. All audiovisual system software updates shall be automatically issued to the Owner free of charge during the warranty period.

E. The Contractor shall be available on call and on eight (8) hour notice during the first month following acceptance of the system, to assist the Owner's representatives in any problems which may arise during the initial period of operation.

F. The Contractor shall provide same day response to service requests, via 24/7 phone support.

G. If during guarantee period any component is out of service for more than seven (7) consecutive days due to unavailability of parts or service, the contractor shall furnish and install identical new component. If an identical component is not available, the contractor will substitute equivalent equipment with written approval of the owner.

H. During the course of the guarantee period, the Contractor shall provide a minimum of three (3) service visits to the site for inspection and adjustment of equipment and programming. Contractor shall submit proposed schedule for these visits and shall notify Owner and Architect in writing at least one (1) month in advance of each visit.

1.16 INSURANCE

A. All equipment and materials shall be fully insured against loss or damage up until acceptance of the system by the Owner or until the Owner relieves the Contractor in writing of this responsibility, whichever is earlier.

PART 2 - EQUIPMENT

2.1 GENERAL

A. Whenever any equipment is specified by manufacturer and model number, it is for the purposes of establishing a standard of quality, performance, construction, and function.

B. All materials and equipment shall be new and of the latest design or model offered for sale by the manufacturer.

C. Equipment models furnished shall operate at the required AC line voltage (i.e. 120 Volts) and frequency (i.e. 60 Hz)

D. Contractor shall furnish at minimum, quantities as indicated in the Contract Documents as required for complete installation.

E. Audiovisual Wire and Cable:
   1. Approved manufacturers:
      a. Belden
      b. Berk-Tek
      c. Liberty
      d. Crestron
      e. Extron
      f. West-Penn
   2. All wire numbers listed in the Contract Documents are Belden unless otherwise noted.
   3. Where required, install plenum rated cable listed and labeled for plenum installation.

F. Electrical Wire and Cable (including ground conductors)
   1. Where conflict exists with any codes or ordinances, such codes and ordinances shall take precedence.
   2. Where conflict exists with Electrical Specifications, the higher standard or more stringent requirement shall apply.

G. Wiring Devices:
   1. Specifications – Duplex Receptacles
      a. Grade: Specification, Hubbel IG5362 or equal

b. Type: NEMA 5-20R
c. Color: Orange

2. Specifications – Plug Mold
   a. Grade: Wiremold V/G 2000 Series or equal
   b. Size: As specified or required.
3. Specifications – Outlet Strips
   a. Grade: UL Listed, Wiremold or equal.
   b. Size: As specified or required.
4. Approved Manufacturers:
   a. Waber
   b. Wiremold
   c. Hubbell
   d. Bryant
   e. GE
   f. Leviton

H. Electrical Plates and Panels:
1. Specifications – Rack mount panels
   a. Material: 11-gauge steel or 1/8” aluminum, minimum thickness.
   b. Finish: Black or to match adjacent equipment.
   c. Size: 19” wide, standard EIA mounting hole spacing, height as specified or required.
2. Specifications – Back Box Enclosures
   a. Material: Code grade steel.
   b. Finish: Black or Galvanized.
   c. Size: As specified or required.
3. Specifications – Plug Box and Termination Panels
   a. Material: 11-gauge steel or 1/8” aluminum, minimum thickness.
   b. Finish: Black (unless otherwise noted by the Architect).
4. Any and all recessed face plates shall have a minimum ¾” reveal beyond the back box to hide the intersection between the wall material and the back box excluding standard decora-style plates.
5. Approved Manufacturers:
   a. Hoffman
   b. Whirlwind
   c. Pro-Co
   d. Wireworks.

I. Any equipment to be located outdoors or in damp locations must carry a NEMA 3R rating and be labeled accordingly.

J. Audio Transformers:
1. All transformers shall be selected for proper installation and load of the circuits as required by as-built conditions and per manufacturer’s recommendations.

K. Control System Programming:
1. All control system programming, installation, testing, and debugging to be performed by a manufacturer certified programmer, supplied either directly by the

AV Contractor staff or via a manufacturer authorized and certified independent programmer.

2. AV Contractor shall furnish complete control system programming, including all source code and on-site coordination, testing, and debugging.
3. AV Contractor shall furnish all programming of control system equipment including:
   a. Nightly system shut down.
   b. Janitorial/Off-hour maintenance control.
   c. Emergency Life/Safety override.
   d. Audiovisual source equipment selection (e.g. Audio Source, Video Source, Display Selection)
   e. Audiovisual source equipment transport control (e.g. play, pause, stop, forward, reverse).
   f. Master Volume control
4. Touch Panel interfaces shall have two (2) modes of operation:
   a. User Mode:
      1) Basic controls of all system components
      2) Streamlined user interface.
      3) Room modes available via single button presets
   b. Tech Mode:
      1) Advanced control and configuration of system components.
      2) Setup of presets
5. Pushbutton interfaces shall have the following control options:
   a. Presentation Mode:
      1) Display of presenter's computer through an audiovisual wiring device to the display
      2) Presenter's microphone through the system to the loudspeakers.
      3) Audio from the presenter's computer through the system to the loudspeakers.
   b. Video Mode:
      1) Display of a video source through the audiovisual system to the display.
      2) Audio from the same video source through the audiovisual system through the system to the loudspeakers.
   c. Aux Mode:
      1) Display of a video source through the system via an auxiliary input.
      2) Audio from the same video source though the system via and auxiliary input to the loudspeakers.
   d. Source Selection Control, which provides the ability to:
      1) Select any source equipment to be displayed on any video display in the system and routing audio from that source through the system to the loudspeakers.
   e. Source Transport Control, which at minimum provides the ability to:
      1) Play, pause, stop, forward, reverse and source equipment in the system.
   f. Master Volume Control of the system.
6. In rooms where a volume control system and digital signal processor (DSP) exist, the control system shall be programmed such that:
   a. The appropriate preset on the DSP system and display system shall be selected based on that activity taking place.

7. Provisions for control from a computer via web interface (e.g. XPanel or similar) shall be included.
8. Control system programming shall accommodate future addition of touch panels and mobile applications (e.g. Extron Link License) for Apple iPhone/iPad and Android devices.
9. AV Contractor shall coordinate with the Owner & Architect regarding all touchpanel graphical user interfaces (GUI), to adhere to LBCC Standards.
10. AV Contractor to schedule meeting with owner and Architect to review control system functionality, operational requirements, and GUI prior to the commencement of work.

L. Audio DSP System:
   1. Audio Inputs
      a. All system audio inputs shall be programmed with limiters.
      b. It shall be possible to matrix any input to any output within the system.
   2. Audio Outputs:
      a. All audio outputs shall be programmed with high pass filters, parametric equalization, delay, and limiters.
      b. It shall be possible to matrix any input to any output within the system.
   3. Assistive Listening or Hearing Assistance System (HA):
      a. In live venues, HA shall receive a matrix of the room microphone and the signal being sent to the primary loudspeakers. DSP shall be programmed to default to room microphone, unless loudspeaker system crosses threshold to take priority over the acoustic sound within the halls.
      b. HA shall be provided and installed in accordance with California Building Code requirements.
   4. The DSP software shall be installed on the AV system control computer, specified in the Major Equipment List.

M. Equipment furnished shall be that specified on drawings and the Major Equipment List (2.2; 274116 Appendix A).

N. Detailed performance specifications shall be those published by the manufacture effective on the date of this document for all equipment specified herein.

O. The AV Contractor shall verify all projection screen dimensions, surface type, and frame style with the Contract Documents and submit the information with the required shop drawings for approval by the architect prior to ordering any material. Failure to coordinate screen information shall not result in additional costs to the Owner.

P. The AV Contractor shall verify all projector lenses for appropriate focal length and intended image size with the Contract Documents, based on field measurements of actual throw distance. Failure to coordinate lens information shall not result in additional costs to the Owner.

Q. All miscellaneous materials including brackets, pole extensions, mounting hardware, electrical connectors, and other items to properly install the equipment specified shall be included as part of this project whether it is listed or not.

R. Existing structural mounting to be reused as conditions permit.

S. If required, Cost Reduction and/or Value Engineering shall be conducted by the Architect and Owner based on final bid amounts.

2.2 MAJOR EQUIPMENT

A. Vendor Quotes & System Design References:
1. Intercom System – Refer to ClearCom Reference # 200109dlr
2. Broadcast Cameras & Accessories – Refer to Hitachi Reference #00001572
3. Radio Studio Furniture – Refer to Graham Studios Reference 3R-RXPC-Cust & 3L-RXPC-Cust
4. Broadcast Furniture – Refer to Winsted Reference 13024502
5. Broadcast Switcher – Refer to Ross Video Reference DLR / Long Beach City College / Building G PCR Project 2022
6. Sitewide Fiber Video Portable Distribution – Refer to Riedel Ref: DLR/LBCC
7. Radio Console System – Refer to Lawo Reference 20-08967
8. Performance Loudspeaker package – Refer to d&b auditechnik Reference # PRJ0052164

B. Major Equipment List:
1. The major equipment list lists selected major system components and their quantities to provide the system design intent as shown in the contract documents. It is the responsibility of the contractor to provide any and all additional accessories, patch cabling, interfaces, and other miscellaneous equipment not described herein to provide a working system as called out in the functional requirements section of this specification (1.7), unless otherwise noted as owner furnished or future equipment. For items not given specific quantities in these documents, it is the responsibility of the contractor to verify those quantities with the owner and architect prior to system installation.

2. Refer to 274116 Appendix A for Major Equipment List .

PART 3 - EXECUTION

3.1 INSTALLATION OF SYSTEMS

A. Locate all apparatus requiring adjustments, cleaning, or similar attention so that it will be accessible for such attention. Equipment racks shall be positioned to permit full access for operation and service.

B. Furnish and install brackets, braces, and supports. Minimum fastening or support safety factor shall be at least five (5). Design shall be approved by the Architect.

C. All supporting structures supplied by the Contractor not having standard factory paint finish shall be painted. Paint specifications shall be supplied by the architect or indicated herein.

D. Provide custom color or finish for any equipment or materials supplied which are exposed to public view. Color and finish of all such equipment or materials shall be approved in writing by the Architect. This does not exclude equipment or materials where standard colors or finishes may be specified herein.

E. Finish of blank panels and custom assembly panels shall match adjacent equipment panels.

F. Switches, connectors, jacks, receptacles, outlets, cables, and cable terminations shall be logically and permanently marked. Custom panel nomenclature shall be engraved, etched, or screened. Markings for these items are detailed in the contract documents to ensure consistency and clarity. Verify any changes in working type size and/or placement with the Architect prior to marking.

G. The equipment specified herein is designed to operate in environments of normal humidity, dust, and temperature. Protect equipment and related wiring where extreme environmental conditions can occur.

H. Coordinate with millwork fabricator for installation of audiovisual equipment into credenzas, lecterns, etcetera.

I. Review and coordinate Graphic User Interface Control System appearance and functionality:

1. Crestron DigitalMedia© System: The DigitalMedia© systems shall be installed, configured, and tested by a DMC-E certified technician and/or engineer, in accordance with the guidelines set forth in the Crestron HD-DTDS Specification.

2. Crestron User-interface graphics will conform to Long Beach City College standards. AV Contractor to coordinate with Architect and College for approval of graphical user interface.

3.2 CONDUIT

A. Review and coordinate audio installation with the Electrical Contractor to ensure proper operation of the audio system.

B. All wiring shall be in conduit unless authorized by the Architect, approved by the Architect in writing, and permitted by code. Exceptions are short runs at equipment terminations where there is no means of connecting conduit to the equipment.

C. Where installed exposed, conduits shall be parallel with or at right angles to walls or ceiling and /or follow surface contours and shall be supported from walls or ceilings by means of approved clamps or hangers. Conduit connections to equipment racks shall be insulated.

D. Minimum size conduit shall be trade size ¾". All conduits shall be sized for maximum 40% fill or less if required by code.

E. Conduits carrying high voltage or high amperage wiring serving equipment subject to abrupt start-up and possible slapping of wiring within conduit shall not pass through Acoustically Sensitive Spaces.

F. Conduits connected to dimmer racks or to transformers shall not pass directly into Acoustically Sensitive Spaces. Conduits connected to dimmer racks or transformers shall not penetrate walls, floors, or slabs of Acoustically Sensitive Spaces within thirty (30) feet of those equipment room walls or slabs. All penetrations in the path of conduits within thirty (30) feet of electrical rooms containing dimmer racks or transformers shall be resilient penetrations.

G. Large numbers of conduits penetrating walls of Acoustically Sensitive Spaces shall be individually sleeved and shall pass through walls, floors, slabs, and ceilings perpendicularly.

H. Conduits shall not be installed to connect or contact rigidly other non-electrical equipment or building systems which are vibration isolated.

I. Coordinate all conduit sizes, locations, and quantities with the Electrical Contractor to provide proper routing, signal separation, and wire group type. Failure to do so shall not allow for additional compensation. Provide a conduit routing plan for approval by the Architect prior to installation. Routing plan shall include intended sizes, separation, and cable fill chart.

J. Existing conduit and cabling infrastructure to be reused is to be done so to the maximum extent possible without compromising audiovisual system performance.

3.3 RESILIENT PENETRATIONS OF WALLS AND SLABS

A. All conduit and cable penetrations shall be sleeved, packed, and caulked airtight to form a resilient penetration at the following locations:
   1. Mechanical Equipment Rooms
   2. Electrical and Dimmer Equipment Rooms
   3. Acoustically Sensitive Spaces
   4. Rooms with Acoustically Isolated Construction.

B. Openings shall be oversized and sleeved to provide an inner diameter of one (1) to two (2) inches greater than the outside diameter of the duct or pipe. The conduit shall be centered in the opening and shall not rigidly contact the wall, floor, or ceiling. The resulting gap shall be packed with glass fiber packing material and foam rod. The gap shall be caulked to an airtight seal using permanently flexile acoustical sealant.

C. Acoustical sleeves may be used in lieu of resilient penetrations described above. Multiple conduit penetrations may be constructed following the detail for multiple penetrations identified in the Contract Documents.

3.4 ELECTRICAL POWER

A. Review and coordinate electrical power system installation including grounding with the Electrical Contractor to ensure proper operation of the audiovisual system.

B. Verify that All AC power circuits designated for audio equipment are wired with the correct polarity and ground. Report in writing any discrepancies found to the Architect for corrective action.
   1. Provide distribution of electrical power within the equipment racks with a minimum of one space AC receptacle for each four (4) in use per branch circuit.
   2. The Electrical Contractor shall ensure that all audio grounding does not intersect with any building ground except at earth.

3.5 STEEL SUPPORTS

A. Fabricate and install any supports so that the installation does not weaken or overload the building structure. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems. No drilling or cutting of concrete beams, joists, or structural steel, nor welding to structural steel, shall be permitted except as authorized in writing by the Architect.

3.6 SEISMIC RESTRAINTS

A. All hanging or free-standing equipment and cabinets furnished, including but not limited to racks, loudspeakers, projection screens, and mounts shall be secured to substantial building structures. The equipment described herein shall resist seismic acceleration in any direction up to a limit of the greater of 1.0G or the limit prescribed by the local governing codes.

B. Loudspeaker hanging details, rack bracing, and other seismic restraints may not be shown on the Contract Documents. The Contractor is responsible for development of these drawings to be submitted and approved by the Structural Engineer.

3.7 BOXES

A. With the exception of portable equipment, all boxes, conduits, cabinets, equipment, and wiring shall be held in place and the mounting shall be plumb and square.

B. All boxes shall be securely mounted to building structure. All boxes shall be installed so that wiring contained in them is accessible. Install blanking devices or threaded plugs in all unused holes.

C. Wiring groups and circuits shall be isolated as indicated herein. Common pull or junction boxes are not permitted except as authorized in writing by the Architect.

D. Clean all box interiors prior to installing plates, panels, or covers.

3.8 WIRING METHODS AND PRACTICES

A. Furnish and install all audiovisual wire and cable ensuring proper pulling tension, bend radius, quantities, types, lengths, routing, wire group separation, and identification.

B. Spare wire runs of each group and type shall be pulled to each termination location. The number of spares shall be ten (10) percent of those in actual use or one, whichever is greater

C. Splicing of cables is not permitted between terminations of specified equipment.

D. Do not pull wire or cable through any box fitting or enclosures where change of raceway alignment or direction occurs; do not bend conductors to less than recommended radius. Employ temporary guides, sheaves, and rollers to protect cables from excess tension, abrasion, or damaging bending during installation.

E. Use wire pulling lubricants and pulling tensions in accordance with the wire and cable manufacturer's recommendations.

F. All wires shall be permanently identified at each wire end by marking with adhesive on crimp-on markers and a chart kept of each wire's function. This applies to wire within a rack assembly as well as wire running in conduit.

G. Wire ends shall be wrapped with appropriate heat shrink tubing. Each shield or drain wire shall be covered with heat shrink to avoid unintentional connections.

H. Use ring or tongue lugs on all barrier strip terminals. Do not exceed two (2) lugs per terminal. Use crimping tools that are designed for the application or solder. Do not cut strands from conductors to fit lug terminals. Spare terminal blocks, equivalent to ten percent (10%) of those in actual use shall be furnished.

I. Form in an orderly manner all conductors in enclosures and boxes, wire ways, and wiring troughs, furnishing circuit and conductor identification. Tie using tie wraps of appropriate size and type. Limit spacing between ties to twelve (12) inches and furnish and install circuit and conductor identification at least once in each enclosure.

J. When the audiovisual cables are pulled, leave a five-foot (5') tail at each end to all field locations and a fifteen-foot (15') tail at all equipment rack locations. Temporary labels shall be applied at both ends of each cable. Permanent labels shall be applied when the cables are cut back and terminated.

K. All labeling of audiovisual cables shall comply with AVIXA F501.01:2015 (Formerly INFOCOMM F501.01:2015) Cable Labeling for Audiovisual Systems Standard.

L. . The numbering system used in compliance with this standard shall be verified with the owner prior to implementation. A schedule of all cabling and its labels shall be provided to the owner and Architect for review prior to pulling and termination of cables.

3.9 GROUNDING

A. Audiovisual system wiring shall conform to the following procedures:
   1. Audio equipment AC ground pins shall connect to AC ground.
   2. Audio equipment chassis shall connect to rack frames.
   3. Audio rack frames shall connect to AC ground bus in panel board by means of #2 gauge (minimum) conductor
   4. Audio shields between AC powered pieces of equipment shall be connected to ground at one end only. Terminate capacitance as required.
   5. Audio signal paths between AC powered pieces of equipment shall be connected using balanced lines and/or transformer isolation as required.

6. No unbalanced signal paths may be connected to patch bays.
7. Isolate all audiovisual system wiring from racks, back boxes, and conduit.
8. Isolate all audiovisual system racks from conduit and other conductive surfaces. Use insulated bushings for conduit connections and a dielectric plinth between racks and conductive flooring.
9. AC isolated ground system shall be isolated from all other facility grounds.

B. All metallic conduit, boxes, and enclosures shall be grounded in accordance with the current National Electric Code (NEC).

C. Metallic enclosures containing active equipment shall be grounded with due regard for the minimization of electrical noise. This may include the provisions of grounding conductors separate from AC ground.

3.10 EQUIPMENT RACKS

A. The equipment racks shall be considered as custom assemblies and shall be assembled, wired, and tested in the Contractor's shop. Final assembly of racks shall take place on site after transportation but will conform to the same test results achieved in the shop.

B. Placement of equipment in equipment racks, as shown in the drawings, is for maximum operator convenience. The insertion of additional equipment not indicated herein or any changes of placement of the equipment must be indicated in writing to the architect before assembly.

C. Racks shall be installed plumb and square without twists in the frame or variations in level between adjacent racks.

D. All wire, cable, terminal blocks, rack mounted equipment, and active slots of card frame systems shall be clearly and logically labeled as to their function, circuit, or system. Labeling on manufactured equipment shall be by engraved plastic laminate or by thermal printer on adhesive tape, with white lettering on black background or dark background that is similar to panel finish.

E. Provide stiffeners to custom panels to prevent panel deformation during normal plugging or switching operations.

F. All field termination shall enter the rack via a bulkhead panel(s) mounted to the rear-rails of the equipment rack.

G. All wires and cable used in assembling custom panels and equipment racks shall be formed into harnesses which are tied and supported in accordance with accepted engineering practice.

H. Harnessed cables shall be combed straight, tie wrapped every eight (8) to twelve (12) inches, and attached to the structure as necessary. Each cable that breaks out from the harness for a termination shall be provided with ample service loop to permit equipment removal from the racks without disconnecting.

I. Harnessed cables shall be formed in either a vertical or horizontal relationship to equipment, controls components, or terminations.

J. Cables shields shall be connected to the isolated ground system with due regard for the ground loops.

K. All system components and related wiring shall be located with due regard from the minimization of induced electromagnetic and electrostatic noise, for the minimization of wiring length, for proper ventilation, and to provide reasonable safety and convenience of the operator.

L. All rack mounted equipment with front panel controls, shall be furnished with security covers to avoid tampering with preset levels. If specific security covers are not included in the equipment list, the Contractor will furnish the manufacturers suitable alternate.

M. Every device shall be installed with regard for proper polarity. Absolute polarity shall be maintained through the entire audio chain.

3.11 INITIAL ADJUSTMENT

A. Verify all circuits and extensions for correct connection, continuity, and polarity. Absolute polarity shall be maintained between all points in the system.

B. Connector polarity shall be maintained except for terminations at equipment manufactured to other standards. Verify that polarity connections are consistent throughout the system.

C. Verify that the audio system is operational and the system gain structure is within the recommendations of major component manufacturers.

D. Verify that the all video sources (cameras, players, etc.) and that all video destinations (Projectors, displays, recorders, etc.) are sending and receiving video signals. EDID parameters for all digital video devices shall be reviewed with the owner to verify resolution requirements at all video output devices. Confirm all equipment managed by the audiovisual control system can receive and send control signal as applicable, and that all control parameters and functionality as requested by the owner in the meeting prior to the beginning of work identified in section 2.1.K.9 of this specification have been implemented.

3.12 VERIFICATION TESTS

A. Confirm that each individual wire and cable run has been labeled and documented in compliance with AVIXA F501.01:2015 (Formerly INFOCOMM F501.01:2015).

B. Confirm that all system outputs are free of spurious signals including oscillations and radio frequency signals. Contractor shall furnish a wide band oscilloscope in order to verify this condition.

C. Confirm that the system is free of audible clicks, pops, hums, and other noises when any operating control is activated, with or without an input signal

D. For all audio and video lines, confirm:
   1. Proper circuits appear at each termination location.
   2. Proper circuits appear at each jack bay location.
   3. Continuity of all conductors.
   4. Proper polarity is maintained.
   5. Absence of shorts between conductors within each circuit.
   6. Absence of shorts between circuit conductors and conduit.

E. Confirm that the loudspeakers and mountings are free of buzzes and rattles when the speaker is swept with sine wave tones over its rated bandwidth at one-half (1/2) its maximum rated power.

F. For all permanently mounted loudspeaker terminations, furnish impedance measurement of each pair of loudspeaker lines with all loudspeakers connected and all amplifiers disconnected. These measurements shall be documented in a table listing impedance for each third octave from 20 Hz to 20 kHz and shall be accurate to the nearest 0.1Ω.

G. For each installed data network cable or fiber optic cable, verify that performance conforms to the relevant TIA/EIA specifications.

H. For all electronic devices mounted in racks and connected to patch bays confirm:
   1. Every audio input and output is balanced.
   2. Proper polarity is maintained throughout the entire audio signal path.

I. Confirm that there are no short circuits between the neutral and isolated ground conductors for each clean power circuit.

J. Confirm every input and output for video system including:
   1. Proper signal to displays.
   2. Proper sync to playback and recording equipment.

3.13 VERIFICATION TEST REPORT

A. Submit five (5) copies of a written report detailing the results of Initial Adjustments and Verification Test including all relevant drawings, charts, test instrument data and photographs. This report shall be completed and submitted to the Architect for review a minimum of five (5) days prior to Acceptance Testing and final tuning. With this report, submit written certification that the installation conforms to the requirements stated herein, is complete in all respects, and is ready for inspection, testing, and tuning.

3.14 ACCEPTANCE TESTING

A. Acceptance Testing shall be performed by the Architect during a period designated by the Architect. Contractor shall furnish a minimum of two (2) technicians for the acceptance testing period.

B. All systems shall be compliant with AVIXA (standard 1M:2009 Uniform Distributed Audio Standard as applicable.

C. The minimum time required for Acceptance Testing is two (2) working days of dedicated quiet. Coordinate this time period so that free access, work lighting, and electrical power are available on site.

D. The AV Contractor shall bear any costs incurred for additional Architect's time and expenses due to failure to have the system functioning in accordance with specification requirements at the time scheduled for Architect's Acceptance Testing and Tuning.

E. Ensure that audiovisual areas are in a clean and orderly condition ready for Acceptance Testing.

F. At the time of Acceptance Testing, submit one (1) copy of the operation and maintenance manual to the Architect (refer to Paragraph 3.15).

G. Furnish test equipment meeting the following minimum specifications on site, at all times during the Acceptance Testing. Prior to Acceptance Testing, provide the Architect with a listing of the equipment model numbers and their software versions (if applicable) to be made available.
   1. Oscilloscope: 1GHz bandwidth sensitivity – 1mV/cm
   2. Digital Multi-meter: 1% accuracy
   3. Function Generator: 1GHz bandwidth, distortion <1%
   4. Real Time Analyzer: 1/3 octave with microphone.
   5. Pink Noise Source: 20 Hz – 20 kHz
   6. Impedance Sweep Meter: 20 Hz – 1 kHz range, 1Ω - 50Ω.
   7. Polarity Checker: Microphone level, Line Level, and Loudspeaker Level.
   8. NTSC bar graphs and other test patterns for video verification.
   9. Ultra High definition (4K60) Video test generator with VGA, DVI, HDMI 2.0, SDI, and 3G-HDSDI outputs

H. Be prepared to verify the performance of any portion of the system by demonstrations, listening, and viewing tests, and instrumented measurements.

I. Make additional mechanical and electrical adjustments within the scope of the work which may be deemed necessary by the Architect as a result of the Acceptance Test. This may include realigning and re-aiming of video or audio systems, changes in system gain structures, grounding, filtering, or interfaces.

J. Final acceptance will be contingent upon issuance by the Architect of a letter of acceptance stating that the work has been completed and is in accordance with the Contract Documents. The warranty period will begin upon issuance of said letter.

3.15 SYSTEM DOCUMENTATION

A. Within fifteen (15) days of the Acceptance Testing, prepare and submit five (5) neatly bound copies of the operations and maintenance manuals to the Owner. Manuals shall be placed in an orderly fashion into a three-ring binder with spine labels indicating contents. These copies are in addition to the one (1) copy furnished to the Architect during Acceptance Testing.

B. Manual shall include but not be limited to the following:

1. Table of contents
2. Written Guarantee and Service Policy
3. Basic power on/off and operational procedures.
4. All Available manufacturer's operation and service literature for each major system component
5. A one-line signal flow diagram with all cable runs and patch points identified by alphanumeric characters
6. A copy of the Verification Test Report
7. Two (2) copies of as-built conduit riser diagram obtained from the Electrical Contractor
8. A copy of the final tuning settings as furnished by the Architect
9. Electronic versions of all documents included in the manual and electronic back up of all software, firmware, and files to restore initial install presets for all applicable devices copied on to (2) USB storage devices.

C. Furnish a framed copy of the as-built signal flow diagram to be mounted in the ***RACK ROOMS 203A & 223A.*** This diagram shall have all cable runs and patch points identified by alphanumeric characters.

3.16 TRAINING

A. The AV Contractor shall provide up to forty-eight (48) hours instruction in the safe and proper operation of the equipment, in particular the audio DSP, sound console, and control systems, to the owner's designated representatives.
   1. AV Contractor shall coordinate with the Architect on developing the instructional outline for training.
   2. AV Contractor shall schedule instruction with the Owner's designated representatives.
   3. Instruction shall not necessarily follow immediately after the system commissioning.
   4. Instruction shall be independent of the system check-out and activation. Duration of system commissioning shall not affect the length of instruction time.
   5. Instruction, at Owners discretion, may occur in multiple time blocks of less than eight (8) hours each.
   6. AV Contractor shall be responsible for making and furnishing video documentation of instruction for future viewing to the Owner. Video documentation can be requested by the owner up to the entire (48) hours of instruction as detailed in this section, and shall be furnished to the owner as individual .mp4 files per training session. Files shall be labeled by the contractor indicating the date of training and a brief description of the content of the video. All files shall be furnished to the owner on a USB storage device provided by the contractor.

END OF SECTION 27 41 16