

PROJECT MANUAL  
INCLUDING SPECIFICATIONS

FOR

**BEAR CREEK HIGH SCHOOL AGRICULTURAL  
FACILITY**

**10555 Thornton Rd.  
Stockton, CA 95209**

**Client Project Number:**  
N/A

ARCHITECT

**SVA ARCHITECTS**  
2030 Franklin Street, Suite 210  
Oakland, CA 94612  
Telephone: 510.267.3180

**SVA Project Number:**  
2020-40119

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DSA Back Check Submittal

Specification Approval for:  
Lodi Unified School District  
Bear Creek High School Agricultural Facility



Robert Simons, AIA  
Architect, SVA Architects Inc.

C-18301



Raymond Swartz  
Electrical Engineer, tk1sc

E 15610



Daniel G. Lewin  
Civil Engineer, Hohbach-Lewin Engineers

C 38406



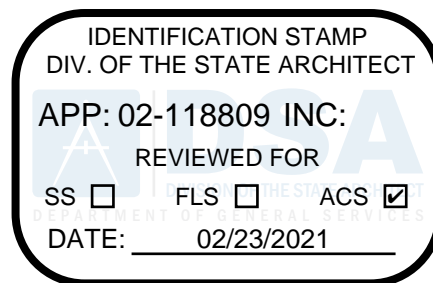
Catherine McLaughlin  
Landscape Architect, Farmscape

LA 6274



Roger Carter  
Mechanical Engineer, tk1sc

M 30980



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**END OF SECTION**

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SECTION 01 11 00

SUMMARY OF WORK

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Project consists of construction of ***Bear Creek High School Agricultural Facility*** as indicated in Contract Documents.
  - 1. Owner reserves right to remove and retain possession of existing items prior to start of Contract.
  - 2. Removal of hazardous material shall be per separately provided hazardous material abatement report prepared by others. Architect shall not be involved in determination, removal or disposal of hazardous materials.

1.2 REQUIREMENTS INCLUDED

- A. This section includes administrative provisions:
  - 1. Work sequence.
  - 2. Contractors use of premises.
  - 3. Field engineering.
  - 4. Regulatory requirements and reference standards.
  - 5. Owner furnished Contractor installed products (OFCI).
  - 6. Owner pre-ordered products.

1.3 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner and Architect.
- B. Perform construction in phases as indicated.

1.4 CONTRACTORS USE OF PREMISES

- A. Limit use of premises for Work and construction operations and to allow for work by other contractors.
- B. Coordinate use of premises and access to site under direction of Owner and Architect.

1.5 FIELD ENGINEERING

- A. Provide field engineering services; establish lines and levels by use of recognized engineering survey practices.
- B. Locate and protect control and reference points.

**1.6 REGULATORY REQUIREMENTS AND REFERENCE STANDARDS**

**A. Regulatory Requirements:**

1. Architect has contacted governing authorities and reviewed design requirements of local, state and federal agencies for applicability to Project.
2. Contractor shall be responsible for contacting governing authorities directly for necessary information and decisions bearing upon performance of Work.

**B. Reference Standards:**

1. For Products specified by association or trade standards, comply with requirements of referenced standard, except when more rigid requirements are specified or are required by applicable codes.
2. Applicable date of each standard is that in effect as of date on proposal or date on Contract where no proposal is available, except when a specific date is specified.

**1.7 OWNER FURNISHED CONTRACTOR INSTALLED PRODUCTS (OFCI)**

**A. Select products are to be furnished and paid for by Owner and installed by Contractor:**

1. Refer to Drawings and Specifications.

**B. Owner's Responsibilities:**

1. Arrange for and deliver shop drawings, product data, and samples to Contractor.
2. Arrange and pay for product delivery to site.
3. Inspect products jointly with Contractor on delivery.
4. Submit claims for transportation damage.
5. Arrange for replacement of damaged, defective, or missing items.
6. Arrange for manufacturer's warranties, inspections, and service.

**C. Contractor's Responsibilities:**

1. Review shop drawings, product data, and samples.
2. Receive and unload products at site.
3. Inspect jointly with Owner for completeness and damage.
4. Handle, store, and install products.
5. Finish products as required after installation.
6. Repair or replace items damaged by Work of this Contract.

**1.8 OWNER PRE-ORDERED PRODUCTS**

**A. Select products have been pre-ordered by Owner:**

1. Refer to Drawings.

- B. Owner has negotiated purchase orders for these products for incorporation into Project.
  - 1. Purchase orders are assigned to Contractor; costs shall be included into base bid.
  - 2. Contractor's responsibilities are same as if Contractor negotiated purchase orders.

**END OF SECTION**



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SECTION 01 20 00

PAYMENT PROCEDURES

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Special administrative and procedural requirements necessary to prepare and process Application for Payment.

1.2 SCHEDULE OF VALUE

- A. Coordination: Coordinate preparation of Schedule of Values with preparation of Contractor's Construction Schedule.
  - 1. Correlate line items in Schedule of Values with other required administrative forms and schedules, including application for Payment forms with Continuation Sheets, Submittals Schedule, and Contractor's Construction Schedule.
  - 2. Submit Schedule of Values to Architect at earliest possible date but no later than seven days before date scheduled for submittal of initial Application for Payment.
- B. Format and Content: Use Project Manual table of contents as guide to establish line items for Schedule of Values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include following Project identification on Schedule of Values.
    - a. Project name and location.
    - b. Name of Architect.
    - c. Architect's Project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  - 2. Submit draft of AIA Document G703 Continuation Sheets.
  - 3. Provide breakdown of Contract Sum in enough detail to facilitate continued evaluation of Application for Payment and progress reports. Coordinate with Project Manual table of contents.
    - a. Provide several line items for principal subcontract amounts where appropriate.
  - 4. Round amounts to nearest whole dollar; total shall equal Contract Sum.
  - 5. Provide separate line item in Schedule of Values for each part of Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

6. Provide separate line items in Schedule of Value for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of Work.
7. Each item in Schedule of Values and Application for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in Schedule of Values or distributed as general overhead expense at Contractor's option.
8. Schedule Updating: Update and resubmit Schedule of Values before next application for Payment when Change Orders or Construction Change Directives result in a change in Contract Sum.

### **1.3 APPLICATIONS FOR PAYMENT**

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  1. Initial Application for Payment: Application for Payment at time of Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Date for each progress payment is indicated in Agreement between Owner and Contractor. Period of construction Work covered by each Application for Payment is period indicated in Agreement.
- C. Payment Application Forms: AIA Document G702 and AIA Document G703 Continuation Sheets as form for Application for Payment.
- D. Application Preparation: Complete every entry on form. Execute by person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  1. Entries shall match data on Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
  2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal:
  1. Contractor shall provide ten copies of Application for Payment one week prior to Payment Request ("Draw") Meeting, for review of team members.
  2. Contractor shall provide ten wet signed copies of Application for Payment at Payment Request ("Draw") Meeting.
    - a. Provide each copy with transmittal form listing attachments and recording appropriate information about application.

- b. Copies shall include waivers of lien and similar attachments if required.
- F. Waivers of Mechanic's Lien: With each Application for Payment submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of Contract and related to Work covered by payment.
- 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit final or full waivers.
  - 3. Owner reserves right to designate which entities involved in Work must submit waivers.
  - 4. Waiver Forms: Submit waivers of lien on forms executed in manner acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following.
- 1. List of subcontractors.
  - 2. Schedule of Values.
  - 3. Contractor's Construction Schedule (preliminary if not final).
  - 4. Schedule of unit prices.
  - 5. Submittals Schedule (preliminary if not final).
  - 6. List of Contractor's staff assignments.
  - 7. List of Contractor's principal consultants.
  - 8. Copies of building permits.
  - 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of Work.
  - 10. Initial progress report.
  - 11. Report of preconstruction conference.
  - 12. Certificates of insurance and insurance policies.
- H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted including but not necessarily limited to following.
- 1. Evidence of completion of Project closeout requirements.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement accounting for final changes to Contract Sum.
4. AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims.
5. AIA Document G706A, Contractor's Affidavit of Release of Liens.
6. AIA Document G707, Consent of Surety to Final Payment.
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Completion.
9. Final liquidated damages settlement statement.

**END OF SECTION**

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SECTION 01 25 00

SUBSTITUTION PROCEDURES

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. General: Procedures are described for requesting substitution of unlisted materials in lieu of materials named in Specifications or approved for use in addenda.
  - 1. Provide products listed in Contract Documents, products by manufacturers listed in Contract Documents, and products meeting specified requirements.
    - a. Contract Amount: Base on materials and products included in Contract Documents.
    - b. Where materials and products are listed in Contract Documents, materials and products by manufacturers not listed shall not be used without Owner's and Architect's approval of Contractor's written request for substitution.
  - 2. Purpose: After bidding, substitutions will only be considered where Owner will receive benefit or because specified materials are no longer available due to no fault of Contractor.
  - 3. Purpose: Substitutions will only be considered where Owner will receive benefit or because specified materials are no longer available due to conditions beyond Contractor control.
    - a. Owner benefits either from a Contractor proposed reduction of the Contract amount or from a reduction in Contract time based on acceptance of proposed substitution.
    - b. List proposed cost or time reductions on request for substitution.
    - c. Requests not including a proposed cost or time reduction will not be considered unless Contractor submits supporting information indicating specified materials are not available.
- B. Related Sections:
  - 1. Section 01 60 00: Product requirements.

1.2 SUBSTITUTIONS

- A. Within a period of 35 days after award of Contract, Owner and Architect will consider formal requests for substitutions only from Contractor as specified in 1.1 Summary.
  - 1. Owner and Architect will consider only one request for substitution for each material; where requests are denied Contractor shall be required to provide specified materials.

2. After initial 35-day period, requests will be considered only when a product becomes unavailable through no fault of Contractor; more than one request for substitution will be considered if necessary.
- B. Prior to submittal of second Request for Payment Owner and Architect will consider formal requests for substitutions from Contractor as specified in 1.1 Summary.
  1. Owner and Architect will consider only one request for substitution for each material; where requests are denied Contractor shall be required to provide specified materials.
  2. After payments begin, requests will be considered only when a product becomes unavailable through no fault of Contractor; more than one request for substitution will be considered if necessary.
- C. Submit each request with sequentially numbered "Substitution Request Transmittal" acceptable to Owner and Architect; submit separate request for each product and support each request with:
  1. Product identification with manufacturer's literature and samples where applicable.
  2. Name and address of similar projects on which product has been used, and date of installation.
- D. Submit itemized comparison of proposed substitution with product specified and list significant variations.
- E. Submit data relating to changes in construction schedule.
- F. Note effect of substitution on other work, products, or separate contracts.
  1. Note if acceptance of substitution could require revision of Contract Documents, Drawings, details or Specifications.
- G. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract price.
  1. Include costs to other contractors and costs for revisions to Drawings, details or Specifications.
- H. Substitutions will not be considered for acceptance when:
  1. They are indicated or implied on submittals without a formal request from Contractor.
  2. They are requested directly by a subcontractor or supplier.
  3. Acceptance will require substantial revision of Contract Documents.
- I. Substitute products shall not be ordered without written acceptance of Owner and Architect.

- J. Owner and Architect will determine acceptability of proposed substitutions and reserves right to reject proposals due to insufficient information.

### **1.3 CONTRACTOR'S REPRESENTATION**

- A. Requests constitute a representation that Contractor:
  - 1. Has investigated proposed product and determined it meets or exceeds, in all respects, specified product.
  - 2. Will provide same warranty or longer warranty for substitution as for specified product.
  - 3. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.
  - 4. Waives claims for additional costs that subsequently become apparent.
  - 5. Will pay costs of changes to Contract Documents, Drawings, details and Specifications required by accepted substitutions.

### **1.4 ARCHITECT'S DUTIES**

- A. Review Contractor's requests for substitutions with reasonable promptness.
  - 1. Architect will recommend that Owner accept or reject substitution request.
  - 2. Upon request, Architect will provide cost for changes to Contract Documents, Drawings, details and Specifications required for substitutions.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

## CONTRACTOR'S SUBSTITUTION REQUEST

(Use separate form for each request)

Date: \_\_\_\_\_ Request No.: \_\_\_\_\_

TO: **Architect** \_\_\_\_\_  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

PROJECT: \_\_\_\_\_ Project No.: \_\_\_\_\_  
CONTRACTOR \_\_\_\_\_

SPECIFIED ITEM: \_\_\_\_\_

Section: \_\_\_\_\_ Page: \_\_\_\_\_ Paragraph: \_\_\_\_\_ Description: \_\_\_\_\_

Drawing Number(s): \_\_\_\_\_ Detail Number(s): \_\_\_\_\_

The undersigned request consideration of the following:

PROPOSED SUBSTITUTION: \_\_\_\_\_

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS: \_\_\_\_\_

SAVINGS or CREDIT to OWNER for ACCEPTING SUBSTITUTE: \$ \_\_\_\_\_

PROJECT COMPLETION CHANGE for ACCEPTING SUBSTITUTE Days \_\_\_\_\_

Attached data includes description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. Proposed substitution has been fully checked and coordinated with the Contract Documents.
2. The proposed substitution does not affect dimensions shown on Drawings.
3. The proposed substitution does not require revisions to mechanical or electrical work.
4. The undersigned will pay for changes to the building design, including architectural and engineering design, detailing, and construction costs caused by the requested substitution.
5. The proposed substitution will have no adverse effect on other trades, construction schedule, or warranty.
6. Maintenance and service parts will be locally available for the proposed substitution.
7. The proposed substitution will have no adverse effect on LEED credits (applies to LEED Projects ONLY)
8. The proposed substitution will have no adverse effect on Green Building Requirements where applicable.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Attachments: The attached data is furnished herewith for evaluation of the proposed substitution.

☐ Catalog ☐ Drawings ☐ Samples ☐ Reports ☐ Tests ☐ Other: \_\_\_\_\_

Submitted by: \_\_\_\_\_

\_\_\_\_\_  
(Firm) (Authorized Legal Signature)

\_\_\_\_\_  
(Address) (Telephone)

For use by the Architect: ☐ Accepted ☐ Accepted as Noted ☐ Rejected: Submit Specified Item

BY: \_\_\_\_\_  
(Authorized Signature)

Date: \_\_\_\_\_ Remarks: \_\_\_\_\_



**END OF SECTION**

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**SECTION 01 26 00**

**CONTRACT MODIFICATION PROCEDURES**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: This section specifies administrative and procedural requirements governing Contract modification procedures.
  - 1. Requests for Information (RFI).
  - 2. Change Order.
  - 3. Construction Change Directive.
- B. Related Requirements:
  - 1. Section 01 25 00: Substitution procedures.
  - 2. Section 01 30 00: Administrative requirements.

**1.2 MINOR CHANGES IN WORK**

- A. Architect will issue supplemental instructions authorizing minor changes in Work, not involving adjustment to Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions or similar form.

**1.3 REQUESTS FOR INFORMATION**

- A. Contractor may submit a written Request for Information (RFI) in format approved by Architect relating to perceived inconsistencies and omissions in Contract Documents.
  - 1. A record of RFI's is to be maintained by Contractor along with information regarding origin of request, date of request, and date request was received from Architect. Number RFI's sequentially based on date of request.
- B. Requests for Information shall be used only as a means of obtaining clarification of information not included in Contract Documents and shall not be used to assist Contractor in preparation of shop drawings or other information required by Contract.
  - 1. Contract Documents are intended to contain enough information to show aesthetic and design intent and to provide information such that construction procedures (means and methods) may be reasonably inferred.
  - 2. Contract Documents are not intended to provide specific information related to means and methods of construction nor are they intended to be exhaustive in content.
- C. Contractor shall carefully review requests for information by subcontractors and suppliers to ascertain if information is in Contract Documents prior to submitting a Request for Information to Architect based on requests by others.
  - 1. Contractor may suggest possible solutions to fit Project conditions where appropriate.

- D. Architect reserves right to return RFI's that do not reasonably relate to necessary clarification of intent of Contract Documents and to charge Contractor for time and materials involved in answering RFI's where information is in Contract Documents.
  - 1. RFI's shall not be used as a request for substitutions; refer to Section 01 25 00 – Substitution Procedures.

#### **1.4 CHANGE ORDERS**

- A. Owner-Initiated Proposal Requests: Architect will issue detailed description of proposed changes in Work that require adjustment to Contract Sum or Contract Time. If necessary, description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal requests issued by Architect are for information only. Do not consider changer order proposal requests as instruction either to stop work in progress or to execute proposed change.
  - 2. Within 10 days of receipt of a proposal request, submit estimate of cost necessary to execute change to Architect for Owner's review.
    - a. Include list of quantities of products required and unit costs, with total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental and amounts of trade discounts.
    - c. Include a statement indicating effect of proposed change in Work will have on Contract Time.
- B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to Contract, Contractor may propose changes by submitting a request for a change to Architect and Owner.
  - 1. Include statement of reasons for change and effect of change on Work. Provide a complete description of proposed change. Indicate effect of proposed change on Contract Sum and Contract Time.
  - 2. Include a list of quantities of products required and unit costs with total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental and amounts of trade discounts.
  - 4. Comply with requirements in Section 01 25 00 - Substitution Procedures if proposed change requires substitution of unspecified product or system for specified product or system.
- C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests; other substitute formats shall be submitted to Owner and Architect for approval prior to use.

- D. Change Order Procedures: Contractor shall be directed to proceed with Work upon Owner's approval of Proposal.
  - 1. Architect will issue Change Order for signatures of Owner and Contractor on AIA Form G701 or similar form, including approved Change Order proposals for that time period.
  - 2. Amounts of each Change Order shall be indicated in each Request for Payment including payment status for each individual Change Order.

**1.5 CONSTRUCTION CHANGE DIRECTIVE**

- A. Construction Change Directive: When Owner and Contractor disagree on terms of Proposal Request, Architect may issue a Construction Change Directive per AIA Form G714 or similar form.
  - 1. Construction Change Directive instructs Contractor to proceed with change in Work, for subsequent inclusion in Change Order.
  - 2. Construction Change Directive contains a complete description of change in Work. It also designates method to be followed to determine change in Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of Work required by Construction Change Directive. Coordinate scheduling with Construction Manager to allow monitoring by Owner if desired.
  - 1. After completion of change, submit itemized account and supporting data necessary to substantiate cost and time adjustments to Contract.

**END OF SECTION**

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SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. This section describes general procedural requirements for ongoing submittals.
  - 1. Schedule of values.
  - 2. Product data and manufacturer's literature.
  - 3. Shop drawings.
  - 4. Samples.
  - 5. Manufacturers' certificates.
  - 6. Excess materials and attic stock.
  - 7. Design build (delegated design) procedures.
  - 8. Deferred approval requirements.
- B. Related Requirements:
  - 1. Section 01 31 00: Project management and coordination.
  - 2. Section 01 32 10: Construction Schedule – Bar Chart.
  - 3. Section 01 40 00: Test reports, manufacturer's field reports, and mock-ups.
  - 4. Section 01 70 00: Manufacturers' instructions.
  - 5. Section 01 77 00: Closeout requirements including Project Record Documents.
  - 6. Section 01 78 00: Warranties.

1.2 GENERAL SUBMITTAL PROCEDURES

- A. Submittals: Transmit each item using form approved by Architect; submit sample to Architect for approval prior to use.
  - 1. Identify Project, Contractor, subcontractor, major supplier.
    - a. Attach sequential identification number for each new submittal.
    - b. Identify each resubmittal using original submittal number and sequential identification clearly indicating item is resubmitted.
  - 2. Identify pertinent Drawing sheet and detail number, and Specification section number as appropriate.
  - 3. Identify deviations from Contract Documents.
  - 4. Provide space for Contractor and Architect review stamps.

5. Contractor: Review and stamp submittals from subcontractors prior to submitting to Architect.
  - a. Review submittals and indicate where conflicts occur with Contract Documents and with work of other subcontractors.
  - b. Return submittals that vary significantly from Contract Documents for correction and resubmittal prior to submitting to Architect.
  - c. Submittals that vary significantly from Contract Documents and that fail to indicate thorough Contractor review prior to submission to Architect will be returned without review.
  - d. cursory review and stamping of subcontractor submittal by Contractor shall not be acceptable.
- B. Initial Schedules: Submit initial progress schedule and schedule of value in duplicate within 15 working days after award of Contract.
  1. After review by Owner and Architect revise and resubmit where required.
- C. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.
- D. After Architect review of submittal, revise and resubmit as required, identify changes made since previous submittal.
- E. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply.

### **1.3 TYPES OF SUBMITTALS**

- A. General: Project requires various types of submittals to maintain communications, minimize misunderstandings, avoid unnecessary conflicts, and to ensure complete documentation for Project Record Documents.
  1. Maintain complete set of submittals including required revisions.
- B. Construction Schedules: Submit construction progress schedules for Design Team and Owner review and to maintain entire team up-to-date on construction activities.
- C. Schedule of Values: Submit Schedule of Values indicating division of Work, subcontractors to perform work, products being used, and values attributed to each to inform Design Team and Owner.
- D. Action Submittals: Submittals relating to product data and manufacturer's literature, shop drawings, and samples for Design Team review and comment; do not begin fabrication, delivery, or installation until Design Team review is complete.
- E. Information Submittals: Submittals relating to certifications, qualifications, reports, including test reports, and instructions are for information; Design Team may choose to comment but action is not generally anticipated.

1. Manufacturer installation instructions and recommendations shall be considered information submittals.
- F. Design/Build Submittals: Where portion of Work requires design by specialized professionals submit information necessary to ensure work complies with Contract Documents along with certifications signed by qualified professional.
  1. Calculations: Do not submit calculations unless specifically required by Contract Documents; submit calculations required by applicable authorities directly to applicable authorities;
    - a. Submit certification by qualified professional indicating required calculations have been prepared and work conforms to Contract Documents and applicable codes and regulations.
- G. Maintenance Materials Submittals: Compile maintenance information and materials during Work to ensure complete set of documents, maintenance manuals, and operation instructions.
- H. Closeout Submittals: Compile closeout submittals, organize, and submit to Owner prior to or at time of Substantial Completion. Project will not be considered Substantially Complete until closeout submittals have been received by Owner.
- I. Material Safety Data Sheets (MSDS): MSDS will only be reviewed by Architect when submitted to show compliance with LEED certification requirements.
  1. Non-LEED submittals that include material safety data sheets will be returned for resubmittal.

#### **1.4 SCHEDULE OF VALUES**

- A. Submit typed schedule on AIA Form G703 or another Owner and Architect pre-approved 8-1/2" by 11" paper format; Contractor's standard media-driven printout will be considered on request. Submit within 15 days after award of Contract.
- B. Format: Table of Contents of this Project Manual, with modifications as pre-approved by Owner and Architect; identify each line item with number and title of major Specification sections.
- C. Include in each line item a directly proportional amount of Contractor overhead and profit.
- D. Revise schedule to list change orders for each Application for Payment.
  1. Submit subschedule for each phase of Work.

#### **1.5 PRODUCT DATA/MANUFACTURERS' LITERATURE**

- A. Action Submittals: Mark each copy to identify applicable Products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work.

- B. Information Submittals: Include manufacturers' installation instructions only when required by Specifications or specifically requested by Architect.
  - 1. Maintain copy of manufacturer installation instructions and recommendations in Contractor's field office for review.
- C. Product data shall be submitted as electronic PDF files unless otherwise noted or approved by Architect in advance.
  - 1. Where paper copies are permitted submit number of copies Contractor requires, plus one copy to be retained by Architect.
- D. Submit number of copies Contractor requires, plus one copy to be retained by Architect.

#### **1.6 SHOP DRAWINGS**

- A. Shop drawings shall be submitted as electronic PDF files unless otherwise noted or approved by Architect in advance.
  - 1. Where prints are permitted submit one reproducible print; minimum sheet size 8-1/2" by 11".
- B. Shop drawings shall be submitted in reproducible format acceptable to Architect and Owner; computerized PDF files will be acceptable unless otherwise directed.
  - 1. Prints: Submit one reproducible print; minimum sheet size 8-1/2" by 11".
  - 2. Prints: Submit three reproducible prints; minimum sheet size 8-1/2" by 11".
- C. Distribution: After review, reproduce and distribute.

#### **1.7 SAMPLES**

- A. Submit full range of manufacturers' standard colors, textures, and patterns for Architect's selection.
- B. Submit samples to illustrate functional characteristics of Product, with integral parts and attachment devices.
- C. Coordinate submittal of different categories for interfacing work.
- D. Include identification on each sample, giving full information.
- E. Submit number of samples required by Contractor plus one to be retained by Architect.
  - 1. Maintain one set of approved samples at Project Field Office.



F. Sizes: Provide following sizes unless otherwise specified.

1. Flat or Sheet Products: Minimum 6" square, maximum 12" by 12".
2. Linear Products: Minimum 6", maximum 12" long.
3. Bulk Products: Minimum one pint, maximum one gallon.

G. Full size samples may be used in the Work upon approval.

#### **1.8 MANUFACTURERS' CERTIFICATES**

A. Submit certificates, in duplicate in accordance with requirements of each Specification section.

#### **1.9 EXCESS MATERIALS AND ATTIC STOCK**

A. Excess Materials: Excess materials shall be considered property of Owner; inform Owner of extent of excess materials and methods required for handling and storage; remove from site excess materials not required by Owner for maintenance stock.

B. Attic Stock: Owner may choose to obtain additional attic stock for maintenance purposes where excess materials are not considered adequate.

1. Owner may require as much as 5% extra materials for maintenance purposes. Exact amount of each material shall be determined by Owner based on following meeting and additional costs determined by Contractor.
  - a. Contractor shall be prepared to order up to 5% extra materials on items that may not be readily available in future such as custom colors, off-shore manufacture, anticipated life span under 5 years, and potential for damage.
    - 1) Do not order extra attic stock until extent is determined and agreed to by Owner including which materials require extra stock and exactly how much those materials will cost including shipping and handling.
  - b. Excess Materials: Furnish excess materials only for materials that have a shelf-life of more than three years.
2. Meeting: Conduct meeting prior to beginning Work to discuss extent of materials Owner would like to receive at Project Closeout for attic stock for maintenance materials; where available include personnel from Owner's maintenance crew.
  - a. Estimate amount of excess materials to be anticipated to be ordered in addition to materials for handling and storage and how those materials will be invoiced and identified regarding material and location in Project.
  - b. Determine area necessary for adequate storage, handling, and identifying excess materials and attic stock and discuss with Owner.
  - c. Submit information regarding equipment necessary for handling of excess materials and attic stock due to weight, size, and storage requirements.

- d. Assist Owner in determining where on-site or off-site additional attic stock for maintenance purposes will be delivered and stored.
- 3. Additional Costs: After meeting submit to Owner detailed listing of additional costs for each material Owner may like to receive for attic stock and assist Owner in modifying listing to determine acceptable final costs.
  - a. Include unit prices for desired attic stock where excess materials are not adequate for Owner maintenance stock.
- 4. Substantial Completion: Submit Construction Bulletin at Substantial Completion indicating changes to Contract Amount for attic stock including unit price totals for materials where excess materials are not adequate.
- 5. Final Completion: Ensure attic stock has been received, identified, cataloged, and stored at locations agreed upon with Owner based on Change Order indicating amounts finally agreed to by Owner.

#### **1.10 DESIGN/BUILD PROCEDURES**

- A. Design as Part of Means and Methods of Construction: Select Project components require construction team design as part of means and methods of construction as described in various sections.
  - 1. Terms commonly used such as Design/Build, Delegated Design, and Design/Assist are applicable to these procedures as determined by law but shall be generally referred to in these documents as Design/Build.
    - a. In general Design/Build includes design by licensed professionals with expertise beyond that allowed under standard architectural licensure, and outside of scope of work of other design professionals on the design team.
  - 2. Contractor may be required to provide design services as part of construction for specific work defined as design or design-build where special expertise is required that is not available in the Project design team.
  - 3. Subcontractors, fabricators, and manufacturers may be required to provide design services as part of their work due to special expertise in design services for their specific components, refer to technical sections for Design/Build.
  - 4. Contractor, subcontractors, fabricators, manufacturers, and suppliers shall be responsible for attachments, anchors, fasteners, adhesives, and connectors suitable to applications unless specific items are listed in Contract Documents.
    - a. Where specific items are listed in Contract Documents Contractor, subcontractors, fabricators, manufacturers, and suppliers shall review and submit comments where items listed are not acceptable.
    - b. Where no comments are received, listed items shall be considered acceptable.

- B. Contractor acknowledges and accepts responsibility for specialty design as part of means and methods of construction, as well as coordination of parties involved to achieve architectural design intent indicated in Contract Documents.
  - 1. Design-build work includes sizing, sequencing, and detailing for construction by professional licensed or registered engineer or design professional with special expertise applicable to portion of Work involved.
  - 2. Design-build work shall be constructed in compliance with building codes and regulations in effect and shall be fit and proper for intended use.
  - 3. Design-build work shall include drawings, specifications, and calculations prepared, stamped, and signed by qualified professional licensed or registered engineer licensed in the Project location as appropriate to design-build work.
    - a. Plans, specifications, and calculations shall be acceptable to Owner, Owner's Representative, and applicable authorities.
- C. Where required by Owner Contractor shall submit copies of current insurance policies covering errors and omissions of persons designing design-build work with deductibles and limits per occurrence as mutually agreed by Owner and Contractor.
  - 1. Provide endorsement to insurance providing for 30-day notice to Owner prior to cancellation or material reduction in coverage.
  - 2. Insurance shall be maintained for not less than applicable statute of limitations for claims of latent defects, if such insurance is not written on an occurrence basis during time design-build work is designed and constructed.
- D. Review proposed layouts with Design Team and with various trades prior to commencing work related to design-build work.

**END OF SECTION**

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SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Description of Project management and coordination including but not necessarily limited to the following:
  - 1. General Project coordination procedures.
  - 2. Coordination drawings.
  - 3. Staff names.
  - 4. Administrative and supervisory personnel.
  - 5. Project meetings.
- B. Related Sections:
  - 1. Section 01 30 00: Administrative requirements.
  - 2. Section 01 79 00: Demonstration and training.

1.2 COORDINATION

- A. Coordination: Coordinate construction operations included in various Specifications sections to ensure efficient and orderly installation of each part of Work.
  - 1. Coordinate construction operations that depend on each other for proper installation, connection, and operation.
  - 2. Coordinate work to assure efficient and orderly sequence of installation of construction elements.
  - 3. Make provisions for accommodating items installed by Owner or under separate contracts.
- B. Prepare memoranda for distribution to each party involved as needed, outlining special procedures required for coordination.
  - 1. Include required notices, reports, and list of attendees at meetings; include Architect and Owner in distribution.
- C. Verify characteristics of interrelated operating equipment are compatible; coordinate work having interdependent responsibilities for installing, connection to, and placing such equipment in service.

- D. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings.
  - 1. Follow routing shown for pipes, ducts, and conduits as closely as possible; make runs parallel with lines of building.
  - 2. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated; coordinate locations of fixtures and outlets with finish elements.
- F. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other construction activities and activities of other contractors to avoid conflicts and ensure orderly progress of Work.

### **1.3 SUBMITTALS**

- A. Coordination Drawings: Prepare Coordination Drawings for areas where space availability is limited and necessitates maximum utilization of space for components and where separate entities, products, and materials require coordination.
  - 1. Require each subcontractor with items located in ceiling space to furnish coordination drawings of their items to assist in preparation of Contractor's Coordination Drawings.
  - 2. Indicate relationship of components shown on separate Shop Drawings.
  - 3. Indicate required installation sequences.
  - 4. Ceiling Spaces: Take special care to coordinate structure, ceiling systems, equipment located in ceiling spaces, fire protection systems, mechanical systems, and electrical systems.
- B. Staff Names: Immediately after receipt of notice to proceed or immediately after signing of Contract by Owner and Contractor, submit list of principal staff assignments, including superintendent and other personnel in attendance at Project site.
  - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

### **1.4 SUPERVISORY AND ADMINISTRATIVE PERSONNEL**

- A. Provide supervisory personnel, in addition to Project Superintendent, as required for proper and timely performance of Work and coordination of subcontracts.
- B. Provide administrative staff as required to allow Project Superintendent and supervisory personnel to allocate maximum time to Project supervision and coordination.

### **1.5 PROJECT MEETINGS**

- A. Schedule and administer Project meetings throughout progress of Work:

1. Pre-construction meeting.
  2. Progress meetings at weekly intervals.
  3. Pre-installation conferences.
  4. Coordination meetings.
  5. Special meetings.
- B. Make physical arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes and distribute copies within two days to Architect, Owner, participants, and those affected.
- C. Attendance: Job superintendent, major subcontractors and suppliers as appropriate to agenda; Architect, Owner, and Owner and Architect's consultants as appropriate to agenda topics for each meeting.
- D. Suggested Agenda: Review of Work progress, status of progress schedule and adjustments, delivery schedules, submittals, requests for information, maintenance of quality standards, pending changes and substitutions, and issues needing resolution.

**END OF SECTION**

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SECTION 01 32 10

CONSTRUCTION SCHEDULE - BAR CHART

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**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. References.
- B. Performance requirements.
- C. Qualifications.
- D. Quality Assurance.
- E. Project record documents.
- F. Submittals.
- G. Review and evaluation.
- H. Format.
- I. Cost and schedule reports.
- J. Early work schedule.
- K. Construction schedule.
- L. Short interval schedule.
- M. Requested time adjustment schedule.
- N. Recovery schedule.
- O. Updating schedules.
- P. Distribution.

**1.2 REFERENCES**

- A. Construction Planning and Scheduling Manual - A Manual for General Contractors and the Construction Industry, The Associated General Contractors of America (AGC).
- B. National Weather Service - Local Climatological Data.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Ensure adequate scheduling during construction activities so work may be prosecuted in an orderly and expeditious manner within stipulated Contract Time.

- B. Ensure coordination of Contractor and subcontractors at all levels.
- C. Ensure coordination of submittals, fabrication, delivery, erection, installation, and testing of materials and equipment.
- D. Ensure on-time delivery of Owner furnished materials and equipment.
- E. Ensure coordination of jurisdictional reviews.
- F. Assist in preparation and evaluation of applications for payment.
- G. Assist in monitoring progress of work.
- H. Assist in evaluation of proposed changes to Contract Time.
- I. Assist in evaluation of proposed changes to Construction Schedule.
- J. Assist in detection of schedule delays and identification of corrective actions.

#### **1.4 QUALIFICATIONS**

- A. Scheduler: Personnel with 3 years minimum experience in scheduling construction work of a complexity and size comparable to this Project.
- B. Administrative Personnel: 3 years minimum experience in using and monitoring schedules on comparable projects.

#### **1.5 QUALITY ASSURANCE**

- A. Perform work in accordance with Construction Planning and Scheduling Manual published by the AGC.
- B. In the event of discrepancy between the AGC publication and this section, provisions of this section shall govern.

#### **1.6 PROJECT RECORD DOCUMENTS**

- A. Submit record documents under provisions of Section 01 77 00.
- B. Submit one reproducible and two copies of final Record Construction Schedule which reflects actual construction of this Project.
- C. Record schedule shall be certified for compliance with actual way project was constructed.
- D. Receipt of Record Construction Schedule shall be a condition precedent to any retainage release or final payment.

#### **1.7 SUBMITTALS**

- A. Within 7 days from the Notice of Award submit proposed Early Work Schedule and preliminary Cost Report defining activities for first 60 days of Work.



- B. Within 45 days from the Notice of Award submit proposed Construction Schedule and final Cost Report.
- C. Submit updated Construction Schedule at least 10 days prior to each Application for Payment.
- D. Submit Short Interval Schedule at each Construction Progress Meeting.
- E. Submit Time Adjustment Schedule within 10 days of commencement of a claimed delay.
- F. Submit Recovery Schedules as required by completion of work.
- G. Submit one reproducible and two copies of each schedule and cost report.

**1.8 REVIEW AND EVALUATION**

- A. Early Work Schedule shall be reviewed during Preconstruction Conference with Owner and Architect.
- B. Within 5 days of receipt of Owner and Architect's comments provide satisfactory revision to Early Work Schedule or adequate justification for activities in question.
- C. Acceptance by Owner of corrected Early Work Schedule shall be a condition precedent to making any progress payments for first 60 days of Contract.
- D. Cost loaded values of Early Work Schedule shall be a basis for determining progress payments during first 60 days of Contract.
- E. Participate in joint review of Construction Schedule and Reports with Owner and Architect.
- F. Within 7 days of receipt of Owner and Architect's comments provide satisfactory revision to Construction Schedule or adequate justification for activities in question.
- G. In the event that an activity or element of work is not detected by Owner or Architect review, such omission or error shall be corrected by next scheduled update and shall not affect Contract Time.
- H. Acceptance by Owner of corrected Construction Schedule shall be a condition precedent to making any progress payments after first 60 days of Contract.
- I. Cost-loaded values of Construction Schedule shall be basis for determining progress payments.
- J. Review and acceptance by Owner and Architect of Early Work Schedule or Construction Schedule does not constitute responsibility whatsoever for accuracy or feasibility of schedules nor does such acceptance expressly or impliedly warrant, acknowledge or admit reasonableness of activities, logic, duration, or cost loading stated or implied on schedules.

**1.9 FORMAT**

- A. Shall be fully developed horizontal bar-chart-type schedule prepared under concepts and methods outlined in AGC Construction Planning and Scheduling Manual.
- B. Provide separate bar for each activity or operation.
- C. Activity shall not have a duration longer than 14 days or a value over \$20,000.00 except non-construction activities for procurement and delivery.
- D. Prepare schedule on sheet of sufficient width to clearly show data.
- E. Provide continuous heavy vertical line identifying first day of week.
- F. Provide continuous subordinate vertical line identifying each day of week.
- G. Identify activities by number, description, and cost.
- H. Show each activity in proper sequence.
- I. Indicate graphically sequences necessary for related activities.
- J. Provide legend of symbols and abbreviations used.

**1.10 COST AND SCHEDULE REPORTS**

- A. Activity Analysis: Tabulate each activity and identify for each activity:
  - 1. Description.
  - 2. Interface with outside contractors or agencies.
  - 3. Duration.
  - 4. Start date.
  - 5. Finish date.
  - 6. Actual start date.
  - 7. Actual finish date.
  - 8. Monetary value keyed to Schedule of Values.
  - 9. Responsibility.
  - 10. Percentage complete.
  - 11. Variance positive or negative.
- B. Cost Report: Tabulate each activity and identify for each activity:

1. Description.
2. Total cost.
3. Percentage complete.
4. Value prior to current period.
5. Value this period.
6. Value to date.

**1.11 EARLY WORK SCHEDULE**

- A. Shall establish scope of work to be performed during the first 60 days of Contract.
- B. Shall contain the following phases and activities:
  1. Procurement activities to include mobilization, shop drawings and sample submittals.
  2. Identification of key and long-lead elements and realistic delivery dates.
  3. Construction activities in units of whole days limited to 14 days for each activity except non-construction activities for procurement and delivery.
  4. Approximate cost and duration of each activity.
- C. Shall contain seasonal weather considerations. Seasonal rainfall shall be 10 year average for the month as evidenced by Local Climatological Data obtained from U.S. National Weather Service.
- D. Activities shall be incorporated into Construction Schedule.
- E. No application for payment will be evaluated or processed until Early Work Schedule has been submitted and reviewed.
- F. Shall be updated on a monthly basis while Construction Schedule is being developed.
- G. Failure to submit an adequate or accurate Early Work Schedule or failure to submit on established dates will be considered a substantial breach of Contract.

**1.12 CONSTRUCTION SCHEDULE**

- A. Shall include Early Work Schedule as first 60 days of Construction Schedule.
- B. Shall be a fully developed horizontal bar-chart-type schedule.
- C. Shall indicate a completion date for project that is no later than required completion date.
- D. Conform to mandatory dates specified in the contract documents.

- E. Should schedule indicate a completion date earlier than any required completion date, Owner or Architect shall not be liable for any costs should project be unable to be completed by such date.
- F. Seasonal weather shall be considered in planning and scheduling of all work. Seasonal rainfall shall be 10 year average for the month as evidenced by Local Climatological Data obtained from U.S. National Weather Service.
- G. Provide sub-schedules to define critical portions of entire schedule.
- H. Indicate procurement activities, delivery and installation of Owner furnished material and equipment.
- I. Level of detail shall correspond to complexity of work involved.
- J. As developed shall show sequence of activities required for complete performance of Work.
- K. Shall be logical and show a coordinated plan of Work.
- L. Show order of activities. Include specific dates of completion.
- M. Duration of activities shall be coordinated with subcontractors and suppliers and shall be best estimate of time required.
- N. Failure to include any activity shall not be an excuse for completing all work by required completion date.
- O. An activity shall meet the following criteria:
  - 1. Any portion or element of work, action, or reaction that is precisely described, readily identifiable, and is a function of a logical sequential process.
  - 2. Descriptions shall be clear and concise. Beginning and end shall be readily verifiable. Starts and finishes shall be scheduled by logical restraints.
  - 3. Responsibility shall be identified with a single performing entity.
  - 4. Additional codes shall identify building, floor, bid item and CSI classification.
  - 5. Assigned dollar value (cost-loading) of each activity shall cumulatively equal total contract amount. Mobilization, bond and insurance costs shall be separate. General requirement costs, overhead, profit, shall be prorated throughout all activities. Activity costs shall correlate with Schedule of Values.
- P. For major equipment and materials show a sequence of activities including:
  - 1. Preparation of shop drawings and sample submissions.
  - 2. Review of shop drawings and samples.
  - 3. Finish and color selection.

- 4. Fabrication and delivery.
  - 5. Erection or installation.
  - 6. Testing.
- Q. Include a minimum of 15 days prior to completion date for punch lists and clean up. No other activities shall be scheduled during this period.

**1.13 SHORT INTERVAL SCHEDULE**

- A. Shall be fully developed horizontal bar-chart-type schedule directly derived from Construction Schedule.
- B. Prepare schedule on sheet of sufficient width to clearly show data.
- C. Identify activities by same description as Construction Schedule.
- D. Show each activity in proper sequence.
- E. Indicate graphically sequences necessary for related activities.
- F. Indicate activities completed or in progress for previous 2 week period.
- G. Indicate activities scheduled for succeeding 2 week period.
- H. Further detail may be added if necessary to monitor schedule.

**1.14 REQUESTED TIME ADJUSTMENT SCHEDULE**

- A. Updated Construction Schedule shall not show a completion date later than the Contract Time, subject to any time extensions processed as part of a Change Order.
- B. If an extension of time is requested a separate schedule entitled "Requested Time Adjustment Schedule" shall be submitted to Owner and Architect.
- C. Indicate requested adjustments in Contract Time which are due to changes or delays in completion of work.
- D. Extension request shall include forecast of project completion date and actual achievement of any dates listed in Agreement.
- E. To the extent that any requests are pending at time of any Construction Schedule update, Time Adjustment Schedule shall also be updated.
- F. Schedule shall be a fully developed horizontal bar-chart-type schedule.
- G. Accompany schedule with formal written time extension request and detailed impact analysis justifying extension.
- H. Time impact analysis shall demonstrate time impact based upon date of delay, and status of construction at that time.

- I. Activity delays shall not automatically constitute an extension of Contract Time.
- J. Failure of subcontractors shall not be justification for an extension of time.
- K. Extensions will be granted only to extent that time adjustments extend Contract completion date.
- L. Owner shall not have an obligation to consider any time extension request unless requirements of Contract Documents, and specifically, but not limited to these requirements are complied with.
- M. Owner shall not be responsible or liable for any construction acceleration due to failure of Owner to grant time extensions under Contract Documents should requested adjustments in Contract Time not substantially comply with submission and justification requirements of Contract for time extension requests.
- N. In the event a Requested Time Adjustment Schedule and Time Impact Analysis are not submitted within 10 days after commencement of a delay it is mutually agreed that delay does not require a Contract time extension.

**1.15 RECOVERY SCHEDULE**

- A. When activities are behind Construction Schedule a supplementary Recovery Schedule shall be submitted.
- B. Form and detail shall be sufficient to explain and display how activities will be rescheduled to regain compliance with Construction Schedule.
- C. Maximum duration shall be one month and shall coincide with payment period.
- D. Ten days prior to expiration of Recovery Schedule verification to determine if activities have regained compliance with Construction Schedule will be made. Based upon this verification the following will occur:
  - 1. Supplemental Recovery Schedule will be submitted to address subsequent payment period.
  - 2. Construction Schedule will be resumed.

**1.16 UPDATING SCHEDULES**

- A. Review and update schedule at least 10 days prior to submitting an Application for Payment.
- B. Approved change orders which affect schedule shall be identified as separate new activities.
- C. Change orders of less than \$20,000.00 value or less than 3 days duration need not be shown unless completion date is affected.
- D. Maintain schedule to record actual prosecution and progress.

- E. No other revisions shall be made to schedule unless authorized by Owner.
- F. Provide narrative Progress Report at time of schedule update which details the following:
  - 1. Activities or portions of activities completed during previous reporting period.
  - 2. Actual start dates for activities currently in progress.
  - 3. List of major construction equipment used during reporting period and any equipment idle.
  - 4. Number of personnel by craft engaged on Work during reporting period.
  - 5. Progress analysis describing problem areas.
  - 6. Current and anticipated delay factors and their impact.
  - 7. Proposed corrective actions for Recovery Schedule.
  - 8. Proposed modifications, additions, deletions and changes in Construction Schedule.
- G. Schedule update will form basis upon which progress payments will be made.
- H. Owner will not be obligated to review or process Application for Payment until schedule and Progress Report have been submitted.

**1.17 DISTRIBUTION**

- A. Following joint review and acceptance of updated schedules distribute copies to Owner, Architect, and all other concerned parties.
- B. Instruct recipients to promptly report in writing any problem anticipated by projections shown in schedule.

**END OF SECTION**

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SECTION 01 35 15

CALGREEN ENVIRONMENTAL REQUIREMENTS

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Comply with CALGreen environmental requirements related to energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental quality.
  - 1. Comply with specific CALGreen requirements as adopted by authorities having jurisdiction and applicable to Project.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Mandatory Measures: Comply with CALGreen Mandatory Measures applicable to Project.
  - 1. Design team and construction team are each required to participate to maximum degree possible to achieve CALGreen environmental requirements.
  - 2. Contract Documents are not intended to limit alternative means of achieving environmental requirements.
    - a. Suggestions from Contractor, subcontractors, suppliers, and manufacturers for achieving environmental requirements are encouraged; team approach is also encouraged.
  - 3. Voluntary Tiers: Verify extent of Voluntary Tiers applicability to Project.
    - a. Construction team is encouraged to work with Owner and Design Team to incorporate additional measures as defined in CALGreen Appendixes.
    - b. Contact Owner and Architect regarding extent of intent of Project to reach Voluntary Tiers, additional work necessary to achieve enhanced Voluntary Tiers, and potential costs involved in achieving each Voluntary Tier.
    - c. Construction team is required to achieve Mandatory Measures and Voluntary Tiers as applicable, and to achieve as much as possible without unacceptable cost impact or schedule impact as determined by Owner.
- B. Requirements: Construction team is required to review CALGreen requirements relative to Project related to following.
  - 1. Energy Efficiency: Comply with California Energy Commission requirements.
  - 2. Water Efficiency and Conservation: Comply with requirements for both indoor and outdoor water use.
  - 3. Material Conservation and Resource Efficiency:



- a. Nonresidential Projects: Provide weather-resistant exterior wall and foundation envelope including prevention of landscape irrigation spray on structures (if any) and prevent water intrusion at exterior entries.
  - b. Provide construction waste management plan as defined by CALGreen with demolition and construction waste diverted from landfill by recycling or salvage for reuse.
  - c. Nonresidential Projects Building Maintenance and Operation: Provide for commissioning requirements as required by CALGreen including but not limited to testing, documentation and training, testing and adjusting.
4. Nonresidential Projects Environmental Quality: Comply with following as adopted by authorities having jurisdiction and as applicable to Project.
- a. Fireplaces: Comply with requirement for fireplaces (if any) to be direct-vent sealed-combustion gas type or sealed wood-burning fireplace, woodstove, or pellet stove.
  - b. Mechanical Equipment Pollution Control: Cover duct and related air distribution component openings to prevent dust and debris accumulation.
  - c. Finish Material Pollution Control: Comply with CALGreen requirements for volatile organic compound (VOC) emissions including but not necessarily limited to following (as applicable):
    - 1) Adhesives, sealants and caulks.
    - 2) Paints and coatings.
    - 3) Carpet systems including carpet, carpet cushion, and adhesives.
    - 4) Resilient flooring systems.
    - 5) Composite wood products formaldehyde limitations.
  - d. Filters: Comply with requirements for mechanically ventilated buildings to have air filtration media for outside and return air prior to occupancy.
  - e. Environmental Tobacco Smoke (ETS) Control: Comply with CALGreen requirements for ETS.
  - f. Interior Moisture Control: Comply with California Building Code requirements and CALGreen requirements for vapor retarder at concrete slab foundations and capillary break (aggregate base).
  - g. Building Material Moisture Content: Do not use water damaged building materials, remove and place wet and high moisture content insulation, and do not enclose wall or floor framing when moisture content exceeds 19%.
  - h. Indoor Air Quality: Comply with CALGreen requirements for outside air delivery and carbon dioxide monitoring.
  - i. Environmental Comfort: Comply with CALGreen requirements for whole acoustical control and interior sound control.

- j. Outdoor Air Quality: Comply with CALGreen requirements for reduction of greenhouse gases and ozone depletion.
- C. Planning and Design: Construction team shall coordinate with Design Team regarding Project Planning and Design methods related to CALGreen requirements related to Project design and shall comply with requirements related to construction.

### **1.3 QUALITY ASSURANCE**

- A. Project Management and Coordination: Contractor to identify one person on Contractor's staff to be responsible for CALGreen issues compliance and coordination.
  - 1. Experience: Environmental project manager to have experience relating to CALGreen building construction.
  - 2. Responsibilities: Carefully review Contract Documents for CALGreen issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to environmental issues; and oversee Project Environmental Goals.
    - a. Submittals: Collect, compile, verify, and maintain sufficient information for submittals indicating compliance with applicable CALGreen requirements.
  - 3. Meetings: Discuss CALGreen Goals at following meetings.
    - a. Pre-construction meeting.
    - b. Pre-installation meetings.
    - c. Regularly scheduled job-site meetings.
- B. CALGreen Issues Criteria: Comply with requirements listed in CALGreen and various Specification sections.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General Issues: Do not use materials with moisture stains or with signs of mold or mildew.
  - 1. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site.
  - 2. Mold and Mildew: Materials that have evidence of growth of molds or of mildew are not acceptable, including both stored and installed materials; immediately remove from site.

## **2.2 SUBSTITUTIONS**

- A. Substitutions Environmental Issues: Requests for substitutions shall comply with requirements specified in Section 01 25 00 – Substitution Procedures, with following additional information required where environmental issues are involved.
  - 1. Indicate each proposed substitution complies with CALGreen requirements.
  - 2. Owner and Architect reserve right to reject proposed substitutions where CALGreen information is not provided and where substitution may impact mandatory requirements or Project voluntary tier requirements.

## **PART 3 - EXECUTION**

### **3.1 PROTECTION**

- A. Environmental Issues: Protect interior materials from water damage; where interior products not intended for wet applications are exposed to moisture, immediately remove from site.
  - 1. Protect installed products using methods that do not support growth of molds and mildews. Immediately remove from site materials with mold and materials with mildew.

**END OF SECTION**

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SECTION 01 40 00

QUALITY REQUIREMENTS

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. This section describes general quality control requirements.
  - 1. General quality control.
  - 2. Manufacturers' field services.
  - 3. Mock-ups.
  - 4. Independent testing laboratory services and inspections.
- B. Related Requirements:
  - 1. Refer to applicable codes and Specifications sections for test requirements.

1.2 QUALITY CONTROL, GENERAL

- A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.3 MANUFACTURER'S FIELD SERVICES

- A. When specified in respective Specification sections, require manufacturer or supplier to have qualified personnel provide on-site observations and recommendations.
  - 1. Observe field conditions, including conditions of surfaces and installation.
  - 2. Observe quality of workmanship.
  - 3. Provide recommendations to assure acceptable installation and workmanship.
  - 4. Where required, start, test, and adjust equipment as applicable.
- B. Representative shall submit written report to Architect or Owner listing observations and recommendations.

1.4 MOCK-UPS

- A. Erect field samples and field mock-ups at locations on site as approved in advance and in accordance with requirements where included in Specifications section.
  - 1. Test mock-ups requiring special equipment may be erected at location having access to necessary equipment; coordinate with Architect.
- B. Field samples and mock-ups not approved and not capable of being acceptably revised shall be removed from site.
- C. Approved field samples and mock-ups may be used as part of Project.

**1.5 TESTING LABORATORY SERVICES AND INSPECTIONS**

- A. Testing laboratory services and inspections specified and required by applicable codes and regulations will be performed by firms independent of firms related to construction operations and shall be acceptable to applicable authorities.
  - 1. Notify Owner immediately where potential conflict of interest may be involved with testing laboratories or inspection services for Project.
  - 2. Owner or Architect may also require independent testing of items where doubts exist that product or system does not conform to Contract Documents.
  - 3. Owner will employ and pay for testing laboratory and special inspectors to provide Project specific testing and inspections under applicable codes and Specification sections except where indicated otherwise.
    - a. Owner employment of testing laboratory and inspectors shall not relieve Contractor of obligation to perform Work in accordance with requirements of applicable codes and Contract Documents.
      - 1) Laboratory and inspectors may not release, revoke, alter, or enlarge on requirements of Contract Documents.
    - b. Retesting required because of non-conformance to specified requirements shall be performed by Owner's testing laboratory.
      - 1) Payment for retesting shall be charged to Contractor by deducting inspection and testing charges from Contract amount.
    - c. Owner provided testing shall be limited to Project specific testing and shall not include general tests or approvals of materials, equipment or systems.
    - d. Owner provided inspections shall be limited to Project design team inspections and special inspectors required by applicable authorities.
- B. Services shall be performed in accordance with requirements of governing authorities and with specified standards.
- C. Reports will be submitted to Architect in duplicate giving observations and results of tests and inspections, indicating compliance or non-compliance with specified standards and with Contract Documents.
  - 1. Where required, testing laboratory and inspectors will submit copy of tests and inspections directly to enforcing agency.
- D. Contractor shall cooperate with testing laboratory and inspection personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.
  - 1. Notify Owner, Architect, inspectors, and testing laboratory sufficiently in advance of expected time for operations requiring inspection and testing services.

**END OF SECTION**

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SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. This section describes temporary construction facilities and temporary controls.
  - 1. Electricity and lighting.
  - 2. Heat and ventilation.
  - 3. Water and sanitary facilities.
  - 4. Construction aids.
  - 5. Temporary enclosures.
  - 6. Barriers.
  - 7. Cleaning during construction.
  - 8. Project identification.
  - 9. Cellular telephone service.
  - 10. Storage.
- B. Related Requirements:
  - 1. Section 01 70 00: Progress cleaning and final cleaning.
  - 2. Section 01 74 10: Waste management.
- C. Provide temporary construction facilities and temporary controls as required to conform to applicable authorities and as required to complete Project in accordance with Contract Documents.
  - 1. Authorities: Contact governing authorities to establish extent of temporary facilities and temporary controls required by authorities.
  - 2. Building Manager: Contact Building Manager to establish extent of temporary facilities and temporary controls required by building management.

1.2 ELECTRICITY AND LIGHTING

- A. Provide electrical service required for construction operations, with branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.
  - 1. Connection to existing electrical service is permitted.
  - 2. Owner will pay costs of energy used from existing on-site services.
  - 3. Provide separate metering and reimburse Owner for costs of energy used from existing on-site services.
- B. Provide lighting for construction operations.

1. Permanent lighting may be used during construction; maintain lighting and make routine repairs.

C. Owner will pay costs of energy used from existing on-site services.

D. Provide separate metering and reimburse Owner for costs of energy used from existing on-site services.

### **1.3 HEAT AND VENTILATION**

A. Provide heat and ventilation as required to maintain specified conditions for construction operation, to protect materials and finishes from damage due to temperature and humidity.

B. Coordinate use of existing facilities with Owner.

1. Supplement with temporary units as required to maintain specified conditions for construction operations, and to protect materials and finishes from damage due to temperature or humidity.

C. Owner will pay costs of energy used from existing on-site services.

### **1.4 WATER AND SANITARY FACILITIES**

A. Provide water service required for construction operations; extend branch piping with outlets located so water is available by use of hoses.

1. Connection to existing facilities is permitted.

2. Owner will pay for water used from existing on-site services.

B. Provide and maintain required sanitary facilities and enclosures.

1. Existing facilities shall not be used.

2. Where existing sanitary facilities are designated to be used during construction operations maintain in sanitary condition. Verify availability with Building Management prior to beginning on-site work.

### **1.5 CONSTRUCTION AIDS**

A. Noise, Dust and Pollution Control: Provide materials and equipment necessary to comply with local requirements for noise, dust and pollution control.

B. Fire Protection: Maintain on-site fire protection facilities as required by applicable authorities and insurance requirements.

C. Security: Protect Site and Work; prevent unauthorized entry, vandalism, and theft.

1. Coordinate with Owner's security program.



- D. Dewatering: Provide and operate drainage and pumping equipment; maintain excavations and site free of standing water.
- E. Use of Existing Facilities: Verify availability of existing facilities for construction operations with Owner prior to beginning on-site construction.
  - 1. Existing stairs shall not be used.
  - 2. Designated existing stairs may be used by construction personnel; coordinate with Owner.
  - 3. Existing elevators shall not be used.
  - 4. Designated elevators may be used, coordinate use with Owner; provide protective coverings for finish surfaces of elevator cars and entrances.

#### **1.6 ENCLOSURES**

- A. Temporary Closures: Provide temporary weather-tight closures for exterior openings for acceptable working conditions, for protection for materials, to protect interior materials from dampness, for temporary heating, and to prevent unauthorized entry.
  - 1. Provide doors with self-closing hardware and locks.
- B. Temporary Partitions: Provide temporary partitions as required to separate work areas from occupied areas, to prevent penetration of dust and moisture into occupied areas, and to prevent damage to existing areas and equipment.
  - 1. Construction: Framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces; Flame Spread Rating of 25 in accordance with ASTM E84.
  - 2. Paint surfaces exposed to view in occupied areas.

#### **1.7 BARRIERS**

- A. Barriers: Provide barriers as required to prevent public entry to construction areas and to protect adjacent properties from damage from construction operations.
  - 1. Fence: Provide minimum 8-foot high commercial grade chain link or painted solid wood fence around construction site; equip with gates with locks.
  - 2. Covered Walkways: Provide lighted covered painted walkways as required by governing authorities for public rights-of-way and for public access to existing building.
- B. Barricades: Provide barricades as required by governing authorities.
- C. Tree Protection: Provide barriers around trees and plants designated to remain; protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.

**1.8 CLEANING DURING CONSTRUCTION**

- A. Control accumulation of waste materials and rubbish; recycle or dispose of off-site.
- B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

**1.9 PROJECT IDENTIFICATION**

- A. Project Sign: Provide minimum 32-square foot Project identification sign of wood frame and exterior grade plywood construction, painted, with computer generated graphics by professional sign maker.
  - 1. Design: As furnished by Architect.
  - 2. Submit to Owner and Architect additional names or changes proposed to Project sign for prior written approval.
  - 3. Erect on site at location established by Architect.
- B. Other Signs: Subject to approval of Architect and Owner.

**1.10 CELLULAR TELEPHONE SERVICE**

- A. Cellular Telephone Service: Furnish on-site Project Managers with cellular telephone. Ensure Owner and Architect ability to contact site during construction operations.
  - 1. Schedules: Submit schedules of on-site Project Managers with individual cellular telephone numbers to Owner and Architect; maintain schedules and cell phone numbers up to date during Project on-site operations.

**1.11 STORAGE**

- A. Storage for Tools, Materials, and Equipment: Limit on-site storage to Project area; provide weather-tight storage, with heat and ventilation for products requiring controlled conditions.
  - 1. Maintain adequate space for organized storage and access.
  - 2. Provide lighting for inspection of stored materials.

**1.12 REMOVAL**

- A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion Inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities.
- C. Restore existing facilities used during construction to specified or original condition.

**END OF SECTION**

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SECTION 01 60 00

PRODUCT REQUIREMENTS

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. This section describes basic product requirements governing material and equipment.
  - 1. General product requirements.
  - 2. Product list.
  - 3. Quality assurance.
  - 4. Delivery, storage, and handling.
- B. Related Requirements:
  - 1. Section 01 25 00: Substitution procedures.
  - 2. Section 01 30 00: Submittal of manufacturers' certificates.
  - 3. Section 01 77 00: Operation and maintenance data.

1.2 GENERAL PRODUCTS REQUIREMENTS

- A. Products include material, equipment, and systems.
- B. Comply with Specifications, referenced standards, and applicable codes and regulations as minimum requirements.
- C. Provide new materials except as specifically allowed by Contract Documents.
- D. Materials to be supplied in quantity within a Specification section shall be by one manufacturer, shall be the same, and shall be interchangeable.
- E. Provide equipment and systems composed of materials from a single manufacturer except where otherwise recommended by equipment or systems manufacturer or where otherwise indicated in Contract Documents.
- F. Contractor's Options: Comply with following options; requests for substitutions for named manufacturers and products shall comply with requirements specified in Section 01 25 00 – Substitution Procedures.
  - 1. Products Identified by Reference Standards: Select product meeting referenced standard for products specified only by reference standard.
    - a. Requests for Substitutions to be limited to products not complying with referenced standards.
      - 1) Submit justification for non-compliance with reference standards as part of Request for Substitutions; if product is foreign made submit rationale why foreign standards and basic materials indicates compliance.

2. Named Manufacturers: Where names of manufacturers are specified select any named manufacturer product meeting Specifications for products specified by naming one or more manufacturers.
    - a. Submit Request for Substitution for any manufacturer not named.
  3. Named Manufacturers and Named Products: Select any named manufacturer named product meeting Specifications for products specified by naming one or more manufacturers and products.
    - a. Where only one manufacturer and product is named together with additional manufacturers without specific products, Requests for Substitutions to be limited to products not comparable to that specified.
      - 1) Contractors, subcontractors, suppliers, and manufacturers shall take special care to ensure comparable products are being supplied based on design, performance, quality, and longevity.
      - 2) Substitutions: Submit Request for Substitution for any manufacturer not named and for products not comparable to those specified in design, performance, quality, and longevity.
  4. Basis of Design: Where manufacturer or manufacturer and product both are indicated as Basis of Design, submit Request for Substitution for other manufacturers and products.
  5. "Or Equal" Clauses: Submit request for substitution for manufacturer or product not specifically named in Specifications where terms "or equal", "or approved equal", or similar references are made.
- G. Nameplates: Do not attach or imprint manufacturer or producer nameplates on exposed surfaces in occupied spaces except for required labels and operating data.
1. Equipment Nameplates: Provide permanent nameplate on service connected and power operated equipment located on easily accessible surface inconspicuous in occupied spaces.
    - a. Provide name of product and manufacturer, model and serial number, capacity, speed, rating, and similar information.

### **1.3 SUBMITTALS**

- A. Product List: Within 35 days after award of Contract, submit to Owner and Architect a complete list of major products proposed for installation, with name of manufacturer, trade name, and model.
- B. Product List: Prior to submittal of second Request for Payment, submit to Architect complete list of major products which are proposed for installation, with name of manufacturer, trade name, and model.

1. Tabulate products by Specification number and title.

C. Substitutions: Refer to Section 01 25 00 – Substitution Procedures.

#### **1.4 QUALITY ASSURANCE**

- A. Comply with industry standards and applicable codes except when more restrictive tolerances or requirements indicate more rigid standards or precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Install products straight, true-to-line, and in correct relationship to adjacent materials, with hairline joints, free of rough, sharp and potentially hazardous edges.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1. Seismic Anchors: Conform to code requirements.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Transport products by methods to avoid product damage, deliver in undamaged condition in manufacturer's unopened containers or packaging.
  - B. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
  - C. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
  - D. For exterior storage of fabricated products, place on sloped supports above ground.
  - E. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
  - F. Arrange storage to provide access for inspection; periodically inspect to assure products are undamaged and are maintained under required conditions.
  - G. Provide equipment and personnel to handle products by methods to prevent soiling and prevent damage.
  - H. Promptly inspect shipments to assure products comply with requirements, quantities are correct, and products are undamaged.
  - I. Immediately remove from Project products damaged, wet, stained, and products with mold and products with mildew.
1. Take special care to prevent absorbent products such as gypsum board and acoustical ceiling units from becoming wet.

**END OF SECTION**

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SECTION 01 70 00

EXECUTION REQUIREMENTS

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. This section describes execution requirements.
  - 1. Installer qualifications.
  - 2. Examination.
  - 3. Manufacturer's instructions.
  - 4. Installation.
  - 5. Cleaning.
  - 6. Protection.
- B. Related Requirements:
  - 1. Section 01 50 00: Cleaning during construction.
  - 2. Section 01 77 00: Closeout procedures.
  - 3. Section 01 79 00: Demonstration and training.

1.2 INSTALLER QUALIFICATIONS

- A. Experienced Installers: Installers to have minimum five-years successful experience installing items like those required for Project, except for individuals in training under direct supervision of experienced installer.

1.3 EXAMINATION

- A. Acceptance of Conditions: Beginning installation of a product signifies installer has examined substrates, areas, and conditions for compliance with manufacturer requirements for tolerances and other conditions affecting performance.
- B. Field Measurements: Take field measurements as required to fit Work properly; recheck measurements prior to installing each product.
  - 1. Where portions of Work are to fit to other construction verify dimensions of other construction by field measurements before fabrication; allow for cutting and patching to avoid delaying Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

**1.4 MANUFACTURERS' INSTRUCTIONS**

- A. Manufacturer's Recommendations: When work is specified to comply with manufacturers' recommendations or instructions, distribute copies to persons involved and maintain one set in field office.
  - 1. Conform to requirements specified in Section 01 30 00 for submittal of recommendations or instructions to Architect; submit to Architect only where specified or where specifically requested; otherwise keep in Field Office.
- B. Perform work in accordance with details of recommendations and instructions and specified requirements.
  - 1. Should a conflict exist between Specifications and recommendations or instructions consult with Architect.
- C. Where manufacturer's information notes special recommendations in addition to installation instructions, comply with both recommendations and instructions.

**1.5 INSTALLATION**

- A. Pre-Installation Meetings: Installers and suppliers are to attend pre-installation meetings scheduled by Contractor.
- B. Comply with manufacturers written recommendations and installation instructions unless more restrictive requirements are specified.
- C. Locate Work and components accurately, in correct alignment and elevation.
  - 1. Make vertical work plumb and horizontal work level.
  - 2. Install components to allow space for maintenance and ease of removal for replacement.
- D. Install products at time and under conditions to ensure best possible results; maintain conditions required for product performance until Substantial Completion.
- E. Conduct operations so no part of Work is subject to damaging operations or excessive loads during normal conditions.
- F. Securely anchor permanent construction in place, accurately located and aligned with other portions of Work.
- G. Allow for building movement including thermal expansion and contraction.
- H. Make joints of uniform width; arrange joints as indicated, for best visual effect where not otherwise indicated; fit exposed connections together to form hairline joints except where otherwise indicated.

**1.6 CLEANING**

- A. Cleaning During Construction: Specified in Section 01 50 00 - Temporary Facilities and Controls.
- B. Progress Cleaning: Keep installed areas clean using cleaning materials specifically recommended by manufacturers of product being cleaned; where not otherwise recommended use nontoxic materials that will not damage surfaces.
  - 1. Remove debris from concealed spaces before enclosing space.
  - 2. Supervise construction operations to assure no part of construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.
- C. Final Cleaning: Execute final cleaning at Substantial Completion.
  - 1. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces.
    - a. Vacuuming Equipment: Type with high efficiency particulate arrestor (HEPA) type filters; properly maintained.
  - 2. Clean equipment and fixtures to a sanitary condition, clean filters of mechanical equipment, replace filters where cleaning is impractical.
    - a. Clean ducts.
  - 3. Clean site; sweep paved areas.
  - 4. Remove waste, surplus materials and rubbish from Project and site; recycle to maximum extent feasible.

**1.7 PROTECTION**

- A. Protect products subject to deterioration with impervious cover. Provide ventilation to avoid condensation and trapping water.
- B. Take care to use protective covering and blocking materials that do not soil, stain, or damage materials being protected.
- C. After installation, provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.
- D. Protect interior materials from water damage; immediately remove wet materials from site to prevent growth of mold and mildew on site.

**END OF SECTION**



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**SECTION 01 71 23.16**

**CONSTRUCTION SURVEYING**

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**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. General: The Contract General Conditions and Division 1, General Requirements, including, but not limited to, summary of work, submittals and cleaning, shall form a part of these specifications with the same force and effect as though repeated herein. Work shall be done according to the Contract Documents and to the satisfaction of the Owner. That which is called for in one of the Contract Documents is binding as though called for in all.
- B. Care shall be taken to protect stakes, especially rough grade stakes, since they are used for reference throughout the construction process.
- C. The contractor shall request stakes from the Engineer when it is ready to use them and shall be responsible for their preservation for its future use. All requests shall be made in writing and faxed to the Engineer 48 hours prior to the time staking will be required.
- D. Should the work need to be restaked, for the contractor's use, the contractor shall be responsible for the cost of this restaking. Also, should the contractor destroy stakes, which are needed for improvements other than his own, it shall also be responsible for the cost of replacing the destroyed stakes.
- E. Staking will consist of the following:
  - 1. Demolition and Tree Removal:

Trees will be flagged or marked for saving or removal as specified by the Engineer and the boundary will be lathed for demolition if required. Contractor is to verify with Owner if and when perimeter fencing is to be removed.
  - 2. Rough Grade:
    - a. Top of curb cut or fill for BC, ER, EC and PRC and grade breaks on an offset to face of curb.
    - b. Building pad cut or fill stakes on an offset to pad.
  - 3. Sanitary Sewers:
    - a. The ends of sanitary laterals will be staked on an offset with a cut to flowline, within 5' of each building.
  - 4. Storm Drains:

- a. Main lines will be staked on an offset at 50' stations on tangent with a cut to the invert of the pipe. All staking will commence at the low end of a particular drainage system.
  - b. End of pipes for catch basins will be staked on an offset with a cut or fill to pipe invert.
  - c. Area drains will be staked on an offset with a cut to the invert. Owner's Engineer may adjust top of grate elevations to consider as graded building pad elevations. Therefore, contractor must verify top of grate elevations with Owner's Engineer prior to setting grate to grade.
5. Water Staking:
- a. Mains will be constructed using face of curb stakes with cut or fill to top of curb as control.
  - b. Services to all buildings will be located at an offset with a marker for line only.
  - c. Curb and gutter control stakes will be set at hydrants for hydrant construction.
6. PG&E and Joint Trenches:
- a. Joint trench facilities will be constructed using face of curb stakes with cut or fill to top of curb.
  - b. Curb & gutter control stakes will be set for transformer locations and for vaults larger than #5 boxes.
7. Curb and Gutter:
- a. Curb and gutter will be staked on an offset to face of curb with a cut or fill on each stake to top of curb. Stakes will be placed for parking area curbs and valley gutters with stakes not exceeding 30' on curves in addition to all BCs, ECs, PRC's, ER's and grade breaks.
8. Storm Water Inlets:
- a. Control for storm water curb inlets will be provided by staking horizontal and vertical location of curb and gutter at inlet locations. For inlets not in curbing, horizontal and vertical control will be provided for the inlet flow line and grate at the time storm drain is staked.
9. Building Corners:
- a. Control for building envelopes will be provided as a set of offset stakes to actual corners. A minimum of four stakes will be provided, and one control stake in each building envelope referenced for foundation elevation control.
10. Completion Staking:

- a. Control stakes for completion including any perimeter fences will be provided on an offset at approximate 50 foot intervals.

11. Monumentation:

- a. No monuments are shown on the plans.

1.02 SPECIAL REQUIREMENTS

- A. The Engineer will provide plans which show four "as-built" elevations on each completed "building" pad for Owner's use in determining the acceptability of the work completed. This is to be done once. A minimum of 2 pads must be completed and free from obstruction prior to checking by Engineer. Additional checking for any contractor repair work required by Owner or request to check less than minimum number of pads shall be billed as additional services to contractor. As requested, Engineer shall also provide Owner with the "standard" governmental agency letter commenting on the as-graded building pad's general conformance with the approved Rough Grading Plan.

1.03 EXECUTION

- A. Control points and temporary benchmarks will be set prior to staking the project.
- B. Site engineering under this section shall be performed by a Registered Engineer, or Licensed Land Surveyor of the State of California. The Subcontractor shall furnish his own grade checker, at his expense. Report any irregularities in site dimensions or grades to the Engineer for clarification prior to the start of grading or installation of any portion of the work.

1.04 EXECUTION - SUBCONTRACTOR PROVIDED STAKING

- A. All subcontractor provided staking workmanship shall be of the best quality and meet acceptance of the Contractor.
- B. Scheduling and Coordination:
  - 1. Schedule: Subcontractor shall examine the schedule and check it for timing, accuracy and compatibility with his work and shall coordinate his work with the master schedule.
  - 2. Coordination: Subcontractor shall assist the contractor in coordination and scheduling of all work pertinent to his installation and shall inform the contractor of his requirements sufficiently to result in a well-coordinated job.
- C. Grading Control:
  - 1. All grading, including subgrading and finished grading of all areas, including parking areas, drives and walks, shall be controlled by such intermediate grade stakes and lines as may be necessary to insure slopes, lines and levels required

by finished grade elevations indicated on drawings. Stakes shall be so spaced that a taut line between any two will not sag or drift. Intermediate staking and layout shall be by grading subcontractor.

2. The Subcontractor shall be responsible for preserving all benchmarks, reference points, and construction stakes in the area, and he will be billed for any cost incurred in replacing any such benchmarks, reference points, or construction stakes which are destroyed as a result of his activities. Any construction stakes in addition to those specified herein will be provided to the contractor upon receipt of written request at his expense.
  3. In the event such extra staking is required, the Contractor shall have a company representative onsite to sign the field crew's assignment sheet before the staking is begun. At that time, upon request, the field crew, after conference with the office, will provide said representative with an estimate of the field time required for the services requested.
- D. Inspection and Approvals: The Contractor shall be advised and given notice and presented with copies of all records on substantial completion of this work.
- E. Clean-Up: Subcontractor shall keep his work areas in a workmanlike and safe condition and so that his rubbish, waste and debris do not interfere with the work of others. Upon completion of the work in this section, subcontractor shall remove all rubbish, waste and debris resulting from the operations off the site. Subcontractor shall remove all equipment and implements of services and leave entire area in a neat, clean acceptable condition to meet acceptance of contractor.

**END OF SECTION**

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SECTION 01 73 00

CUTTING AND PATCHING

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Contractor is responsible for cutting, fitting and patching to complete Work and to:
  - 1. Make its parts fit together properly.
  - 2. Uncover work to provide for installation of ill-timed work.
  - 3. Remove and replace defective work.
  - 4. Remove and replace work not conforming to Contract Documents.
  - 5. Remove samples of installed work as required for testing.
  - 6. Provide routine penetrations of non-structural surfaces for installation of piping.
  - 7. Provide routine penetrations of non-structural surfaces for installation of conduit.
- B. Related Requirements:
  - 1. Section 01 50 00: Temporary facilities and controls.
  - 2. Section 02 41 20: Selective building demolition for remodeling.

1.2 SUBMITTALS

- A. Submit written request well in advance of cutting or alteration which affects:
  - 1. Work of Owner or separate contractor.
  - 2. Structural value or integrity of any element of Project.
  - 3. Integrity of weather-exposed or moisture-resistant elements.
  - 4. Efficiency, operational life, maintenance or safety of operational elements.
  - 5. Visual qualities of sight-exposed elements.
- B. Request shall include:
  - 1. Identification of Project and description of affected work.
  - 2. Necessity for cutting or alteration.
  - 3. Effect on work of Owner or separate contractor.
  - 4. Effect on structural integrity, or weatherproof integrity of Project.
  - 5. Alternatives to cutting and patching.
  - 6. Cost proposal, when applicable.
  - 7. Written permission of separate contractor whose work will be affected.
  - 8. Description of proposed work including:
    - a. Scope of cutting, patching, alteration, or excavation.
    - b. Products proposed to be used.
    - c. Extent of refinishing to be included.
- C. Should conditions of Work or schedule indicate a change of products from original installation, Contractor shall submit request for substitution as specified in Section 01 25 00 – Substitution Procedures.
- D. Submit written notice to Architect designating date and time work will be uncovered.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Comply with Specifications and standards for each specific product involved.
- B. Where Specifications and standards have not been provided, provide materials and fabrication consistent with quality of Project and intended for commercial construction.
- C. Provide new materials for cutting and patching unless otherwise indicated.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering work, inspect conditions affecting installation of products, or performance of work.
- C. Report unsatisfactory or questionable conditions to Architect in writing; do not proceed with work until Architect has provided further instructions.

### **3.2 PREPARATION**

- A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of Work.
  - 1. Provide services of licensed engineer for designing temporary support where required by applicable authorities for temporary supports and for shoring; submit engineering calculations directly to applicable authorities upon request.
- B. Protect other portions of Project from damage.

### **3.3 PERFORMANCE**

- A. Execute cutting by methods that provide proper surfaces to receive installation of repairs and finishes.
  - 1. Execute excavating and backfilling by methods which will prevent settlement, and which will prevent damage to other work.
- B. Employ same installer or fabricator to perform cutting and patching work as employed for new construction for:
  - 1. Weather-exposed or moisture resistant elements.
  - 2. Sight-exposed finished surfaces.

- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
- D. Restore work that has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.
- E. Fit work tight to pipes, sleeves, ducts, conduit and penetrations through surfaces.
- F. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes:
  - 1. For continuous surfaces, refinish to nearest intersection.
  - 2. For an assembly, refinish entire unit.

**END OF SECTION**

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SECTION 01 77 00

CLOSEOUT PROCEDURES

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. This section describes Contract closeout procedures.
  - 1. Substantial Completion.
  - 2. Final Completion.
  - 3. Project record documents.
  - 4. Material and finish data.
  - 5. Operation and maintenance manuals.
- B. Related Requirements:
  - 1. Section 01 30 00: Administrative requirements including attic stock.
  - 2. Section 01 78 00: Warranties.
  - 3. Section 01 79 00: Demonstration and training.

1.2 SUBSTANTIAL COMPLETION

- A. Immediately prior to Substantial Completion, schedule agency reviews as required for "temporary certificate of occupancy" or for "certificate of occupancy".
- B. When Contractor considers Work, or a designated portion thereof is substantially complete, submit written notice, with list of items to be completed or corrected.
  - 1. List ("Punch List"): Format pre-approved by Owner and Architect; tabular form with each space listed required.
- C. Within a reasonable time, Owner and Architect will inspect status of completion and may add to "Punch List".
  - 1. Contractor shall pay for Architect's time and direct expenses where more than one Substantial Completion inspection is required.
- D. Should Owner and Architect determine Work is not substantially complete, Contractor will be promptly notified in writing, giving reasons.
- E. Contractor shall remedy deficiencies and send a second written notice of substantial completion; Architect will reinspect Work.
  - 1. Contractor shall pay for Architect's time and direct expenses where more than one Substantial Completion inspection is required.
- F. When Work is determined to be substantially complete by Architect, a Certificate of Substantial Completion will be prepared in accordance with General Conditions.



- G. DSA Projects: Contractor shall complete DSA 6-C Form and upload electronically to DSAbbox within three days of completion of Work.

### **1.3 FINAL COMPLETION**

- A. When Work is complete, submit written certification indicating:
  - 1. Work has been inspected for compliance with Contract Documents.
  - 2. Work has been completed in accordance with Contract Documents and deficiencies listed (in 'Punch List') with Certificate of Substantial Completion have been corrected.
  - 3. Equipment and systems have been tested in presence of Owner's representative and are operational.
  - 4. Work is complete and ready for final inspection.
- B. Special Submittals: In addition to submittals required by Contract, submit following.
  - 1. Provide submittals required by governing authorities to governing authorities with copies included in Project Record Documents.
  - 2. Submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

### **1.4 PROJECT RECORD DOCUMENTS**

- A. Keep documents current; do not permanently conceal any work until required information has been recorded.
  - 1. Owner will provide Contractor with a separate set of Drawings to maintain for Project Record Documents.
  - 2. Store reproducible Drawings, one set of Project Manual, and one copy of each Change Order separate from documents used for construction, for use as Project Record Documents.
  - 3. Indicate actual work on Drawings; indicate actual products used in Project Manual, including manufacturer, model number and options.
  - 4. Update Project Record Documents daily and allow for Architect inspection at least once a month.
- B. At Contract close-out submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.
- C. As-Built Documents: General Contractor shall have electronic "As Built" sets of Contract Documents (Project Drawings and Project Specifications) prepared prior to Final Completion.

1. Contractor shall use one complete electronic set of Contract Documents (Drawings and Specifications) for use for "As-Builts".
  2. As-Built Drawings: Revise Drawings based on Record Documents and field measurements made after installation and indicate actual locations of structural elements, ducts, piping, wiring, and equipment.
    - a. Professional draftspersons experienced in electronic media used for Contract Documents shall revise original Project Drawings based on information recorded on Project Record Documents.
  3. As-Built Specifications: Revise Specifications to indicate manufacturers who provided materials specified along with specifics indicating accessories, options, and finishes used in Project.
    - a. Cross referencing Submittal records is acceptable for accessories only.
  4. Review Submittal: Submit two copies of electronic media of "As-Built" Documents to Architect for review.
    - a. After Architect review, revise where indicated and submit final electronic media to Owner.
- D. Final Completion Submittal: At Project Completion submit both Project Record Documents and As-Built Documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

#### **1.5 MATERIAL AND FINISH DATA**

- A. Provide data for primary materials and finishes.
- B. Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.
  1. Electronic Format: Where available in electronic format, submit USB 3.0 flash drives with information required for material and finish data.
- C. Arrange by Specification division and give names, addresses, and telephone numbers of subcontractors and suppliers. List:
  1. Trade names, model or type numbers.
  2. Cleaning instructions.
  3. Product data.
  4. Maintenance recommendations.

#### **1.6 OPERATION AND MAINTENANCE MANUALS**

- A. Provide manuals for:
  1. Electrically operated items.
  2. Electrical equipment and controls.
  3. Maintenance manuals provided as part of Submittals.

- B. Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.
- C. Provide a separate volume for each system, with a table of contents and index tabs for each volume.
- D. Arrange by Specification division and gives names, addresses, and telephone numbers of Subcontractors and suppliers. List:
  - 1. Appropriate design criteria.
  - 2. List of equipment and parts lists.
  - 3. Operating and maintenance instructions.
  - 4. Shop drawings and product data.
- E. Electronic Format: Where available in electronic format, submit two USB 3.0 flash drives with information required for operation and maintenance manuals.

**END OF SECTION**

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SECTION 01 78 00

WARRANTIES

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Warranties: Compile required, and incidental warranties required by Contract Documents.
  - 1. Manufacturer Warranties: Provide manufacturer's standard warranties where specified including inspections and services included or required as part of manufacturer's standard warranty.
  - 2. Special Warranties: Provide special warranties as required by Specifications sections.
  - 3. These warranties shall be in addition to and not a limitation of other rights Owner may have against Contractor under Contract Documents and which may be prescribed by law, regardless of wording of warranty.
- B. Extended Correction Period: Contractor shall correct failure of materials and systems to perform in a manner consistent with their intended use including but not limited to failure of waterproofing and roofing systems to resist penetration from water.
  - 1. Standard Correction Period: One year after Substantial Completion or Beneficial Occupancy by Owner except where otherwise noted in Contract Documents; coordinate with General Conditions and Supplementary Conditions.
    - a. Items used by Contractor during construction operations shall not be considered substantially completed.
    - b. Correction of Work Period begins with Owner occupancy not completion of component.
  - 2. Extended Correction Period: Requirements are same as standard correction period but for an extended period as indicated in Specifications sections.
  - 3. Contractor Responsibilities: Bear cost of correcting failed work and replacing construction damaged by failure of materials and systems to perform in a manner consistent with their intended use during correction period.
    - a. Requirements for correction period shall apply to Subcontractors, suppliers, installers, and those responsible for failed work.
    - b. Owner and Design Team shall not be responsible for determining degree of responsibility of those involved.

4. Owner's Rights under Law: Correction period shall be in addition to and not a limitation of other rights Owner may have against Contractor under Contract Documents and which may be prescribed by law.

## **1.2 FORM OF SUBMITTAL**

- A. Special Warranty and Extended Correction Period Forms: Provide duplicate copies, notarized or on Contractor and Manufacturer's letterhead without conditions or exceptions to requirements specified.
  1. Assemble documents executed by subcontractors, installers, suppliers, and manufacturers.
  2. Provide table of contents and assemble in binder with durable plastic cover, clearly identified regarding extent of contents.
  3. Electronic Format: Submit USB 3.0 flash drives of warranties, in Microsoft Word.
- B. Manufacturer Warranty Forms: Use manufacturer's standard forms unless otherwise directed in Contract Documents; completed form shall not detract from or confuse interpretations of Contract Documents.
  1. Manufacturer's authorized representative shall sign manufacturer warranties.
  2. Subcontractor and installer shall countersign warranty where specified.
    - a. Provide required warranties for waterproofing and roofing systems countersigned by subcontractor and installer.
- C. Submit final warranties prior to final application for payment.
  1. For equipment put into use with Owner's permission during construction, submit within ten days after first operation.
  2. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
- D. Provide information for Owner's personnel regarding proper procedure in case of failure and instances that might affect validity of manufacturer warranty.
- E. Size: 8-1/2" by 11" for three-ring binder; fold larger sheets to fit.

## **1.3 WARRANTIES AND CORRECTION OF WORK DOCUMENTS**

- A. Warranties and Correction of Work Documents are intended to protect Owner against failure of work and against deficient, defective and faulty materials and workmanship, regardless of sources.
- B. Limitations: Warranties and correction of work requirements are not intended to cover failures that result from:

1. Unusual or abnormal phenomena of the elements.
  2. Owner's misuse, maltreatment or improper maintenance of work.
  3. Vandalism after substantial completion.
  4. Insurrection or acts of aggression including war.
- C. Related Damages and Losses: Remove and replace work which is damaged as result of failure, or which must be removed and replaced to provide access for correction of work.
- D. Reinstatement: After correction of work reinstate warranty or extended correction period for corrected work to date of original expiration, but not less than half original period.
1. Correction of Work Period: The general correction of work period specified shall not be extended by corrective work except to extent required to correct failure and repair or replace materials damaged by failure.
- E. Replacement Cost: Replace or restore failing items without regard to anticipated useful service lives where part of correction of work period, extended correction of work period, and special warranty period unless otherwise noted.
- F. Rejection of Warranties: Owner reserves right to reject unsolicited and coincidental product warranties that detract from or confuse interpretations of Contract Documents.

**END OF SECTION**

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SECTION 01 79 00

DEMONSTRATION AND TRAINING

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Provide equipment and systems demonstration and instruction in accordance with Contract Documents.
  - 1. Video record seminars and system demonstrations.
- B. Related Sections:
  - 1. Section 01 31 00: Project management and coordination.
  - 2. Section 01 77 00: Contract closeout procedures.
  - 3. Refer to Facility Services Subgroups for mechanical and electrical requirements.

1.2 DESCRIPTION

- A. Seminar Agenda and Outline:
  - 1. Prepare a seminar agenda and outline in consultation and cooperation with Owner. Include following:
    - a. Equipment and systems that will be included in seminars.
    - b. Name of companies and representatives presenting at seminars.
    - c. Outline of each seminar's content.
    - d. Time and date allocated to each system and item of equipment.
  - 2. Submit preliminary seminar agenda and outline for review and comment by Owner.
    - a. Revise and resubmit agenda and outline until all seminar requirements have been satisfied and seminar dates and presenters have been finalized.
  - 3. Submit final seminar agenda and outline no later than eight weeks before date of Acceptance of Work.
- B. Seminar Organization:
  - 1. Contractor's presentation leaders shall chair seminars.
    - a. Coordinate qualification of training personnel, seminar contents, and presentations with Owner.
  - 2. Coordinate individual presentations and ensure manufacturer's representatives scheduled to be at training seminars are present.

3. Arrange for presentation leaders familiar with design operation, maintenance and troubleshooting of equipment and systems.
  - a. Where one person is not familiar with all aspects of equipment or system; arrange for specialists familiar with each aspect.
4. Coordinate proposed seminar dates with Owner and select mutually agreeable dates.
5. Video Recording: Arrange for video recording (audio and video) of training seminars and system demonstrations, including seminar and demonstration questions and answers.

**C. Seminar Content:**

1. Architect's Consultants will explain design philosophy of primary systems.
2. Include following information in presentations dealing with specific systems.
  - a. An overview of how system is intended to operate.
  - b. Describe design parameters, constraints and operational requirements.
  - c. Describe system operation strategies.
  - d. Provide information to help in identifying and troubleshooting problems.
3. Include following information in presentations dealing with equipment.
  - a. Explanation of how equipment operates.
  - b. Recommended preventative and routine maintenance.

**D. System Demonstration:**

1. Demonstrate operation of equipment and systems when specified in individual technical sections. Include following in demonstration.
  - a. Start-up and shut down.
  - c. Operation.
  - d. Scheduled and preventative maintenance.
  - e. Troubleshooting.
2. Demonstration may be conducted at time of original starting with Owner's prior approval.

**E. Seminar and Demonstration Questions:**

1. Be prepared to answer questions raised by Owner's personnel at demonstrations and seminars.
2. If unable to satisfactorily answer questions immediately, provide written response within three days.

**F. Use manufacturer's operation and maintenance data as basis of instruction.**



**1.3 SUBMITTALS**

- A. Video Recording: Submit three copies of each video recording in DVD format acceptable to Owner; include label on each DVD and on each container identifying Project and Seminar content.

**END OF SECTION**

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**SECTION 02 40 00**

**DEMOLITION**

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**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Removing above-grade site improvements within limits indicated.
- B. Disconnecting, capping or sealing, and abandoning site utilities in place.
- C. Disconnecting, capping or sealing, and removing site utilities.
- D. Disposing of objectionable material.

**1.02 RELATED SECTIONS**

- A. Section 31 23 00 – Excavation and Fill.
- B. Section 31 23 33 – Trenching and Backfill.

**1.03 RELATED DOCUMENTS**

- A. California Building Code: Site Work, Demolition and Construction.
- B. California Building Code: Pipes and Trenches.

**1.04 DEFINITIONS**

- A. ANSI: American National Standards Institute.
- B. CAL-OSHA: California Occupational Safety and Health Administration.

**1.05 SUBMITTALS**

- A. Follow Submittal procedure outlined in Section 01 33 00 – Submittal Procedures.

**1.06 PROJECT CONDITIONS**

- A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Owner. Avoid damaging materials designated for salvage.
- C. Unidentified Materials: If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the Owner. If necessary, the Owner will

arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

## **PART 2 - PRODUCTS**

### **2.01 SOIL MATERIALS**

- A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 23 00 – Excavation and Fill.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Protect and maintain benchmarks and survey control points during construction.
- B. Protect existing site improvements to remain during construction.

### **3.02 RESTORATION**

- A. Restore damaged improvements to their original condition, as acceptable to the Owner.

### **3.03 UTILITIES**

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.
- B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless authorized in writing by the Owner, and then only after arranging to provide temporary utility services according to requirements indicated.
- D. Coordinate utility interruptions with utility company affected.
- E. Do not proceed with utility interruptions without the permission of the Owner and utility company affected. Notify Owner and utility company affected two working days prior to utility interruptions.
- F. Excavate and remove underground utilities that are indicated to be removed.
- G. Securely close ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick.

**3.04 SITE IMPROVEMENTS**

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.
- C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
- D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

**3.05 BACKFILL**

- A. Place and compact material in excavations and depressions remaining after site clearing in conformance with Section 31 23 33 – Trenching and Backfill.

**3.06 DISPOSAL**

- A. Remove surplus obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

**END OF SECTION**

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**SECTION 06 10 50**

**MISCELLANEOUS ROUGH CARPENTRY**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Provide miscellaneous wood blocking and plywood, including blocking for roofing system and related flashing.
  - 1. Provide plywood panel boards.
  - 2. Preservative treat wood members as indicated.
- B. Related Sections:
  - 1. Section 06 20 00: Finish carpentry.

**1.2 REFERENCES**

- A. Forest Products Society (FPS): National Design Specification for Stress Grade Lumber and its Fastening.

**1.3 SUBMITTALS**

- A. Product Data: Submit wood treatment certifications and instructions for proper use of each type of treated material.
- B. Wood Product Certification: Furnish certification indicating wood products are from "well-managed" forests.

**1.4 QUALITY ASSURANCE**

- A. Lumber Grades: Provide visible grade stamp of an agency certified by FPS.
- B. Lumber Standard: Comply with US Product Standard PS20 for each indicated use, including moisture content and actual sizes related to indicated nominal sizes.
- C. Plywood Standard: Comply with PS1 (ANSI A199.1).
- D. Certified Wood Products: Wood products to be from forests certified "well-managed" by an agency accredited by Forest Stewardship Council (FSC) including SmartWood Program and Forest Conservation Program.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. System Requirements: Provide miscellaneous wood blocking and plywood, including blocking for roofing system and related flashing.

- B. Regulatory Requirements: Comply with applicable code requirements for miscellaneous rough carpentry.
- C. Blocking: Provide dimensional lumber graded in accordance with FPS Grading Rules; Construction Grade, Douglas Fir; minimum S-Dry.
- D. Plywood: Provide minimum APA C-D exterior (CDX) plywood; stress rated where spanning between supporting members; fire retardant treated; minimum 3/4" thick unless otherwise indicated.
- E. Plywood Panel Boards: Provide panel boards for electrical and communication panel boards; APA C-D plugged, interior type plywood with exterior glue, fire retardant treated; minimum 1/2" thick.
- F. Nails, Spikes and Staples: Galvanized; size and type to suit application.
- G. Bolts, Nuts, Washers, Lags, Pins and Screws: Medium carbon steel; galvanized; size and type to suit application.
- H. Fasteners: Provide fasteners as required for complete, secure installation of miscellaneous rough carpentry.
  - 1. Solid Masonry or Concrete: Expansion shield and lag bolt type.
  - 2. Steel: Bolts or powder activated type.

## **2.2 FABRICATION**

- A. Wood Preservation: Treat lumber and plywood to comply with applicable requirements of American Wood Preservers Association and applicable codes.
  - 1. Decay Resistance Treatment: Pressure treat wood in accordance with AWPA U1 using preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium.
    - a. Treat wood members based on AWPA U1 Use Categories as appropriate to Project location and exposure.
    - b. Kiln-dry wood to a maximum moisture content of 19% after treatment with water-borne preservative.
  - 2. Fire Retardant Treatment: Comply with AWPA standards for pressure impregnation with fire-retardant chemicals to achieve flame-spread rating of not more than 25 in accordance with ASTM E84 or UL Test 723.
    - a. Treat interior wood and plywood complying with applicable code requirements for Interior FRTW.
      - 1) Exterior Type: Where indicated for exterior applications, provide fire treated wood passing ASTM D2898 rain test.
    - b. Provide UL label on each piece of fire-retardant wood and plywood.

- c. Kiln-dry treated items to maximum moisture content of 19%.
- 3. Complete fabrication of treated items prior to treatment, wherever possible; if cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment.
- 4. Inspect each piece after drying and discard damaged and defective pieces.

### **PART 3 - EXECUTION**

#### **3.1 PLACEMENT**

- A. Place miscellaneous rough carpentry true to lines and levels.
- B. Correlate location so attached work will comply with design requirements and be properly located.
- C. Construct members of continuous pieces of longest possible lengths.
- D. Fit carpentry work to other work; scribe and cope as required for accurate fit.
- E. Shim with metal or slate for bearing on concrete and masonry.
- F. Securely attach carpentry work to substrates by anchoring and fastening as required by recognized standards.
  - 1. Provide washers under bolt heads and nuts in contact with wood.
- G. Wood Blocking: Provide blocking of S4S lumber not less than 1-1/2" wide and of thickness required to provide adequate support or to properly locate attached material.
  - 1. Provide attachment to other work; form to shapes shown.
  - 2. Countersink bolts and nuts flush with surfaces.
  - 3. Remove temporary blocking when no longer needed.
  - 4. Anchor to formwork before concrete placement.
  - 5. Build into masonry as work progresses, cutting to fit masonry unit size involved.
- H. Plywood: Comply with recommendations of American Plywood Association (APA) for fabrication and installation of plywood work.

**END OF SECTION**

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**SECTION 06 20 00**

**FINISH CARPENTRY**

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**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Lumber and hardware for exterior carpentry for raised planter boxes, compost bin, and landscape edger. All wood used for this project shall be construction-heart redwood in accordance with specifications herein and as shown on the drawings; pressure treated wood strictly prohibited.

**1.02 RELATED SECTIONS**

- A. Section 12 93 00 – Site Furnishings and Equipment

**1.03 REFERENCES**

- A. AWI - Quality Standards.  
B. Woodwork Institute of California (WIC) "Manual of Millwork".  
C. "Western Lumber Grading Rules", Western Wood Products Association, 2011.  
D. American Society for Testing and Materials (ASTM) Standards
1. A153/A153M-09 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  2. A307-10 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
  3. A563-07a – Standard Specification for Carbons and alloy Steel Nuts
  4. A653/A653M-11 – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvanized) by the Hot Dip Process
  5. F1554-07 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
  6. F1667-11 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

**1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical information including label analysis and application instructions.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and provide air circulation within stacks.
- B. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following:
1. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of stain in clean condition, free of foreign materials and residue.
  2. Protect from freezing where necessary. Keep the storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, and application of stain.



3. Manufacturers offering products which may be incorporated in the work include, but are not limited to, the following: Fuller O'Brien, Sherwin Williams, Co., Olympic Stain, or equal.

## **PART 2 PRODUCTS**

### **2.01 LUMBER MATERIALS**

- A. Lumber material and nominal sizes are indicated on drawings, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and pattern as shown, unless otherwise indicated.

### **2.02 ACCESSORIES**

- A. Nails and screws: Size and type to suit application, galvanized finish or stainless steel type 316.
- B. All hardware, column base, bolts, nuts, washers, blind fasteners, lags, and screws: Size and type to suit application; 316 stainless steel, or galvanized finish.

### **2.03 FABRICATION**

- A. Fabricate to AWI standards.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive work and field measurements are as shown on shop drawings.
- B. Beginning of installation means acceptance of conditions.

### **3.02 INSTALLATION**

- A. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- B. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds stripping and blocking with countersunk concealed fasteners and blind annealing as required for a complete installation.

### **3.03 PREPARATION FOR SITE FINISHING**

- A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.
- C. Protection: Installer of finish carpentry work shall advise the Contractor of final protection and maintain conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

**3.04 CLEAN-UP AND PROTECTION**

- A. Cleanup during progress of work, remove from site, rubbish, cans and rags at the end of each workday.
- B. Protection: Protect work of other trades, whether to be stained or not, against damage by stain and finishing work. Correct any damage by cleaning, repairing or replacing, and stain as acceptable to the Engineer.
- C. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

END OF SECTION 06 20 00

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SECTION 12 93 00

SITE FURNISHINGS AND EQUIPMENT

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**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. The work specified in this section is the provision of all material, labor, equipment, and services necessary for furnishing and installing items, as shown on the Drawings and specified herein.

The work includes but is not limited to:

1. Raised Planter Box - Accessible
2. Grape Trellis - Wye
3. Grape Trellis - Open Gable

**1.02 QUALITY ASSURANCE**

- A. Workmanship and materials: All workmanship and materials within this Section shall conform strictly to the manufacturer's specifications, installation instructions and guarantees.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical information including label analysis and application instructions.
- B. Shop Drawings for Trellises:
1. Horizontal and vertical layouts; plan and section drawings to scale with dimensions indicated.
  2. Manufacturer to engineer trellis system to industry standards.

**1.04 INSTALLER QUALIFICATIONS**

- A. Engage experienced subcontractors, with minimum 5 years of experience, for site furnishing installation and vineyard trellis installation. Approved subcontractors must have a proven record of Installing site furnishing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

**1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. All site furnishings and equipment shall be delivered in good condition in original unopened packages with labels intact and unloaded at the job site in such a manner that no damage occurs to the product during hauling, handling or unloading at the job site.
- B. Protect materials from adverse weather.

**1.06 SUBSTITUTIONS, ADDITIONS AND DELETIONS**

- A. General: Submit proposals for substitutions within two weeks of Notice to Proceed. Beyond two weeks, substitution requests will not be reviewed. Acceptance by the Landscape Architect and Owner's representative is required prior to proceeding with the work under this section.

**1.07 WARRANTY**

- A. All materials and workmanship in specified this Section shall be warranted for one year minimum from final acceptance or per manufacturer's warranty, whichever is greater.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. The layout and design as shown on the Plans are based on products currently available from the manufacturers listed below. Products of other manufacturers will be considered, if equal, provided that the Contractor shall be responsible for extra costs or delays associated with making necessary changes in design or layout to accommodate the proposed substitutions.
- B. Provide site furniture and equipment as follows or equal:

**1. Site Furnishings & Equipment**

- a. Raised Planter Box - Accessible (4 total)  
Mfr: Veg Trug or approved equal.  
Model: Aluminum VegTrug  
Metal: Aluminum  
Color: Aluminum  
Rep: Missy Baughman  
Tel: 888.908.2008
- b. Grape Trellis - Wye (1 total)  
Mfr: JSC Agricultural Supply or approved equal.  
Model: Wye  
Color: Unfinished line posts and crossarms  
Rep: Kellie Ritchie  
Tel: 559.374.8617  
Email: kritchie@jimssupply.com
- c. Grape Trellis - Open Gable (4 total)  
Mfr: JSC Agricultural Supply or approved equal.  
Model: Open Gable  
Color: Unfinished line posts and crossarms  
Rep: Kellie Ritchie  
Tel: 559.374.8617  
Email: kritchie@jimssupply.com

**PART 3 EXECUTION**

**3.01 LAYOUT OF SITE FURNISHINGS**

- A. Layout: Layout site furnishings according to the locations shown on the drawings. Final layout per Landscape Architect's field directions.
- B. Final Layout: Notify the Owner's Representative to approve the final layout of furnishings prior to installation.

**3.02 PROTECTION**

- A. Protect site furnishings during the construction period to prevent damage and wear.

**3.03 REPLACEMENT**

- A. Replace all defective or damaged site furnishings prior to acceptance.

**3.04 INSTALLATION**

- A. Installation procedures shall be according to manufacturer's directions.
- B. All components of the furnishings shall be installed accurately to produce true plumb and level

installation.

- C. Clean-up: Prior to final inspection and acceptance, remove all rubbish and excess material for disposal as approved, and leave the area in a neat, satisfactory condition.

END OF SECTION 12 93 00

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SECTION 22 00 00

GENERAL PLUMBING REQUIREMENTS

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**PART 1 - GENERAL**

1.1 DESCRIPTION

- A. Division 1 applies to this section. Provide plumbing as indicated, specified and required.

1.2 PRODUCT HANDLING

- A. Protection: Take all precautions necessary to protect the materials of this section before, during, and after installation.
- B. Replacements: In the event of damage, immediately repair all damaged and defective work to the approval of the Architect at no additional cost to the Owner.

1.3 LOCATION AND ACCESSIBILITY

- A. Valves, motors and other devices requiring service, maintenance and adjustment shall be placed in fully accessible positions and locations.
- B. Drawings: Coordinate all space requirements with other trades. All offsets and interferences may not be indicated due to the scale of the drawings.

1.4 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. All governing codes, ordinances, and agencies, in accordance with the provisions of Division 1 of these specifications.
- B. Warranty: The contractor shall furnish a written warranty for labor, materials and equipment provided under this contract in accordance with the provisions of Division 1 of these specifications.

1.5 SUBMITTALS

- A. Manufacturer's Literature: Submit brochures on all materials and equipment to the Architect in accordance with the provisions of Division 1 of these specifications.
- B. Other Submittals:
  - 1. Shop Drawings.
  - 2. Sterilization Test Report.
  - 3. Test Data.
  - 4. Operations and Maintenance Manuals.

5. Record Drawings.

**PART 2 - PRODUCTS**

2.1 GENERAL

A. Fixture Requirements:

1. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with Section 11B-213.3. Each toilet shall comply with Section 11B-603.
2. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6 – Plumbing Elements and Facilities.
3. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.
4. Accessible fixture controls shall comply with Section 11B-601.3 for drinking fountains, 11B-604.6 for water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, and 11B-608.5 for showers.
5. Accessible lavatories and sinks shall be 6 ½" deep maximum. Sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground.
6. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7.
7. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5.

B. Performance:

1. Flush Valves: Flushometer valve type single flush with maximum volume of 1.28 gallons per flush (gpf) for water closets and 0.125 gallons per flush (gpf) for urinals. Refer to fixture schedule on sheet P0.0.
2. Plumbing Fixtures: Refer to fixture schedule on sheet P0.0.
3. Toilet Seats: Refer to fixture schedule on sheet P0.0.
4. Faucets: Public lavatories shall be equipped with faucets with a maximum flow of 0.5 gallons per minute (gpm). Kitchen faucets shall be equipped with a maximum flow rate of 1.8 gallons per minute (gpm). Refer to fixture schedule on sheet P0.0.
5. Showerheads: Showerheads shall be at 1.5 gallons per minute (gpm) or at maximum 2.0 gallons per minute (gpm). Refer to fixture schedule on sheet P0.0.

- C. Pipe Escutcheons: Provide polished chromium plate and brass set screw escutcheons where plumbing pipes pass through walls, floors, ceilings, and partitions in finished portions of building, including pipes at fixtures.
- D. Pipe Identification:
  - 1. Piping identification per California Plumbing Code Requirements and pipes not covered by the Plumbing Code shall be per ANSI standards: Each individual pipeline shall be marked for quick and easy identification as to content, direction of flow, and character of material carried in the pipes by Seton SNA or STR markers.
  - 2. Markers shall be installed and spaced at not more than 20 ft. intervals, but not less than once per room and so located that markers shall be visible from floor level.
    - a. One marker shall be installed at each side of valves, special fittings and at branch take-off. In furred spaces install one band 2 ft. above floor and 19 in. below ceiling line.
  - 3. Color scheme shall be approved. Base color for markers shall be as follows:
    - a. Domestic hot water - Yellow w/Black Letters
    - b. Domestic cold water - Green w/White Letters
    - c. Sanitary sewer - Green w/White Letters
    - d. Sanitary vent - Green w/White Letters
    - e. Storm drains - Green w/White Letters
    - f. Pumped Condensate – Yellow w/Black Letters
    - g. Condensate – Yellow w/Black Letters
- E. Valve Identification:
  - 1. Valve tags: Provide a tag consisting of a 2 in. dia. 20 ga. stainless steel or brass disk for each main and branch line shut-off valve or cock. Fasten tags in place with continuous steel ring or chain around stem of valves and round pipe for cocks. Two inch letters and figures stenciled in contrasting colors on pipe or pipe covering may be substituted for tags on OS&Y valves. Disks shall be stamped with service designation, with 1/4 in. high letters.
- F. Materials: Materials when not otherwise definitely specified shall conform to the applicable standards.
- G. Equal Materials and Substitutions: In addition to manufacturers specified, the following shall also be considered equal, provided corresponding models meet specified requirements. Equivalent substituted equipment named herein shall be



submitted to Architect for approval. Submit alternate selections at time of bid, listing major equipment.

**1. ITEM MANUFACTURER:**

- |                                    |                                 |
|------------------------------------|---------------------------------|
| a. Access Panels:                  | Elmcor, Milcor, Mifab           |
| b. Angle Stops & Supplies:         | Chicago, Brasscraft, Speedway   |
| c. Backflow Preventers:            | Watts, Zurn,                    |
| d. Cleanouts:                      | JR Smith, Watts, Wade           |
| e. Trench Drains                   | JR Smith, Watts, Slot Drains    |
| f. Floor Drains / Floor Sinks:     | JR Smith, Wade, Mifab           |
| g. Faucets:                        | Chicago, Delta, Sloan           |
| h. Hose Bibb:                      | Acorn, JR Smith, Woodford       |
| i. Insulation:                     | 3M, Manville, Fiberglas         |
| j. No-Hub Couplings:               | Husky, Mission,                 |
| k. Pipe Hangers & Supports:        | Tolco, B-Line, Hilti            |
| l. Plumbing Fixtures:              | Kohler, American Standard, Zurn |
| m. Pressure Gauges:                | Marsh, Marshalltown, Trerice    |
| n. Sinks:                          | Elkay, Just,                    |
| o. Soil Pipe:                      | Charlotte, Tyler,               |
| p. Solders:                        | Handy-Harman, Lucas, Milhaupt   |
| q. Strainers:                      | Walworth, Bailey, Mueller       |
| r. Trap Primer:                    | PPP, Mifab, Sioux Chief         |
| s. Valves:                         | Crane, Red-White                |
| t. Water Hammer Arrestor:          | Sioux Chief, Smith, Mifab       |
| u. Water Pressure Reducing Valves: | Watts, ClaVal                   |

**2.2 PIPE AND FITTING SCHEDULE**

- A. Soil and storm drain lines 5 ft. from building: As indicated on Civil drawings. Install in accordance with authorities having jurisdiction.

- B. Soil, waste, vent and storm drain piping to 5 ft. outside building: Cast-iron soil pipe and fittings shall conform and be installed to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International or receive prior approval of the engineer. Wrap all underground piping per paragraph 3.10 herein. Tyler, A. B. & I., Charlotte.
- C. Domestic hot and cold water piping above ground: Type L hard-drawn copper tube, ASTM B88, and wrought copper fittings, ANSI B16.22.
- D. Domestic cold water piping below ground and outside the building:
  - 1. 3 in. and smaller: Type K hard-drawn copper tube, ASTM B88, and wrought copper fittings ANSI B16.22, solder joint type (refer to paragraph 3.09 herein).
  - 2. 4 in. and larger: Bell and Spigot Class 50 ductile iron pipe centrifugally cast, cement-lined inside (refer to paragraph 3.10 herein).
- E. Natural-Gas Piping: .
  - 1. 3-1/2 in. and smaller above ground: Schedule 40 black steel pipe, ASTM A-135, A-795, with Class 150 WOG black banded malleable iron screwed fittings. Paint all exposed piping in accordance with Division 1.
  - 2. 4 in. and larger above ground: Schedule 40 black steel pipe, ASTM A-135, A-795, with schedule 40 butt welded fittings. Paint all exposed piping in accordance with Division 1.
  - 3. Below ground: Drisoplex 6500 PE2406 (L. A. RR #M-110109) polyethylene piping systems with electric fusion socket fusion joints. Provide #12 electric tracer copper wire, spiral wrapped around pipe. Backfill with clean sand 4" around pipe. Installation shall be in accordance with manufacturer's direction and authorities having jurisdiction.
  - 4. Underground steel piping inside to 5 feet outside of building shall be steel pipe and fittings as specified for above ground. Piping shall be wrapped and cathodically protected per Corrosion Engineer's directions.
- F. Indirect and Condensate Drains: Type M copper tube, ASTM B88 and wrought copper fittings, ANSI B16.22, solder joint type. Coordinate condensate trap installation with air conditioning unit manufacturer. All interior condensate drain piping shall be insulated.
- G. Sub-Soil Drainage: Equivalent to Schedule 40 PVC perforated pipe with solid wall fittings and solvent cemented joints. Perforations shall be 3/8 in. diameter on 3 in. centers 90 degrees apart in two rows parallel to pipe axis. Install per manufacturer's directions.
- H. Note: Installation shall be in accordance with the Soils Engineer's recommendations.

**2.3 MATERIALS FOR JOINTS, FITTINGS AND VALVES**

**A. Soil, Waste, Vent and Storm Drain Cast-Iron Pipe:**

1. Above Ground: Type 304 Series stainless steel, "No-Hub" standard duty, shielded couplings shall conform to Cast Iron Soil Pipe Institute, CISPI-310-85 and shall be listed by NSF International with stainless steel corrugated shield, stainless steel bands and tightening devices and ASTM C564 rubber sleeve. Equivalent to Tyler, Husky HD 2000, A. B. & I.
2. Below Ground: Type 304 stainless steel, "No-Hub" by the Cast Iron Soil Pipe Institute, CISPI-310-85 with stainless steel shield, stainless steel band and tightening devices and ASTM C564 neoprene rubber gasket. Equivalent to Husky SD-4000.
3. All underground piping shall be installed with poly pipe wrap in accordance with ANSI/AWWA Standards C105/A21.5-93. Bed and backfill with clean sand, 6 thick all around pipe.

**B. Solder and Flux:**

1. Water Piping: Equivalent to Harris "Bridgit" stay safe lead-free solder alloy (ASTM B 813) with stay clean paste flux. 95-5 solders are not approved. Below ground piping shall have brazed joints with silver solder.
2. Copper Indirect and Condensate Drainage Piping: Lead-free solder with non-corrosive paste flux.

**C. Welded Joints: Welding shall be performed only by qualified welders, and shall comply with ASME Boiler Construction Code, ANSI Code for pressure piping, and state requirements.**

**D. Unions and Gaskets:**

1. 2 in. and under for steel pipe: Screwed malleable-iron ground joint, Class 150 WOG, with brass-to-iron seat, galvanized or black to suit service.
2. 2-1/2 in. and larger for steel pipe: Cast-iron flanged gasket type, conforming to ANSI B16.1, galvanized or black to suit service, or 150 lb. forged steel slip-on flanges.
3. Unions for copper tubing: Cast bronze, ground joint pattern, soldered joint connection, ASTM B62 and ANSI B16.18.
4. Dielectric Unions: Complete with isolators and gaskets of same size as pipe, galvanized or black to suit service. Watts series 3004/LF3004 galvanized or Watts series 3006 black steel.
5. Dielectric Flanges: F.H. Maloney Co., Type E flanges for cathodic insulation.
6. Gaskets: 1/16 in. Garlock #17022.

- E. Strainers: Lead-free Y-type with stainless steel mesh screen with perforations suitable for service requirements.
  - 1. 3 in. and smaller: Wilkins Model YBS-XL, Watts LF777 SI, or equal. 125 psi at 400°F. steam, cast bronze, threaded ends with screwed brass closure plug.
  - 2. 4 in. and larger: Ames series 8000F, Watts 77FSS, or equal. Class 125 cast iron and class 150 cast steel flanges, stainless steel with closure plug.
- F. Valves: Valves shall be lead-free and of same manufacturer or following numbers or equivalent by comparator chart of approved manufacturer. Provide adapters for valves in copper tubing where necessary. All domestic water valves, 2-1/2 in. and smaller, shall be full port ball valves.
  - 1. Eccentric valves, 2 in. and smaller, gas: "SMG" PPG series valve with 316 stainless steel, plug carbon steel, body, screwed or flanged, PTFE seats, U.L. listed.
  - 2. Gate valves, 3 in. and larger, domestic water: Lead-free 200 psi WOG, solid wedge disc, union bonnet, rising stem, flanged. MSS-SP-70. Nibco F619-RW, Watts LFGV-3- or 4-inch.
  - 3. Ball valves, domestic water 2-1/2 in. and smaller: Lead-free Bronze, body and brass materials fullport, solid ball class 150, MPTFE seats and stem packing. MSSSP-110, ANSI/NSF 61-8. Apollo 77CLF-100 Series, Nibco S/T685-80-LF, Watts B6080 Series (Threaded) and B6801 Series (Soldered) or Red and White 5044 AB.
  - 4. Balancing Valve: Bell & Gossett Circuit Setter Plus, bronze, screwed. Watts CSM-61 Series.
- G. Thermostatic Mixing Valves (TMV-1):
  - 1. The thermostatic mixing valve shall control the delivered water temperature to all "public use" lavatory faucets to a maximum of 120 degrees F at 0.5 gpm minimum flow rate. The TMV shall be lead-free. Provide full shut-off in the event of failure. ASSE 1070. Wilkins Model ZW1017XL, ACME Heatguard, or equal.
- H. Check Valves:
  - 1. Drainage Systems:
    - a. Horizontal swing check, ductile iron body, one-piece alloy steel disc, 250 psi, flanged, fusion bonded epoxy coated interior and exterior, domed access cover. ValMatic Swing-Flex VM-502A, or equal.
  - 2. Domestic Water Systems:
    - a. In-Line check valve, 2 in. and smaller, lead-free bronze body, threaded, stainless steel spring. Apollo model CVB-61LF series, Nibco T-480-Y-LF.

- b. Dual Check Valve, 1 in. and smaller, lead-free composite body with corrosion resistant internal parts, two independently operated in-line spring loaded modular checks. Wilkins Model 705-XL, Apollo model DUC-4NLF.
  - c. Swing check valve, 2 in. and smaller, lead-free, Y-pattern, dezincification resistant bronze silicon alloy, threaded, MSS SP-80. Nibco T-413-Y-LF, or equal.
- I. Water Pressure Reducing Valves:
  - 1. 3 in. and smaller: Wilkins Model 500XL-YSBR-XL, lead-free, bronze, stainless steel seat, with strainer.
  - 2. 4 in. and larger: Wilkins Model ZW109 pilot operated, ductile iron body, epoxy coated interior and exterior.
- J. Gas Pressure Regulating Valves: Service regulator internal relief valve type diaphragm assembly and vent valve. Provide a strainer ahead of all regulators. Characteristics as indicated on drawings.

## **2.4 BACKFLOW PREVENTERS**

- A. Reduced Pressure Principle Type: Pipe relief to floor sink, or as indicated on drawings.
  - 1. 2 in. and smaller: Wilkins Model 975-XL2, lead-free, bronze body, 175 psi, replaceable seats.
  - 2. 2-1/2" and larger: Wilkins Model 375-XL, ductile iron body, epoxy coated interior and exterior, flanged, replaceable seats.

## **2.5 HOSE BIBBS**

- A. HB-1: Woodford X34, with vacuum breaker.
- B. HB-2: Woodford R34, with vacuum breaker.

## **2.6 PIPE HANGERS**

- A. Hangers shall be supplied with factory installed isolation and di-chromate finish.
  - 1. 2 in. and smaller: Grinnell F69.
  - 2. 2-1/2 in. and larger: Grinnell F65.
  - 3. Concrete inserts: Grinnell 281 and 282.
  - 4. Riser clamps for copper piping: Grinnell 261P, plastic coated.
  - 5. Riser clamps for other piping: Grinnell 261.

## **2.7 ROOF FLASHING**

- A. Sanitary Vent Flashings: Semco 1100-3 or 1100-5, with one-piece lead flashing and counterflashing sleeve.
- B. Other Pipe Through Roof Flashing: Semco 1100-2 or 1100-4, one-piece 4 lb. lead flashing and counterflashing sleeve.

## **2.8 PIPE SLEEVES**

- A. Provide at concrete or masonry exterior bearing walls, Adjust-to-Crete, Paramount, or Sperzel Cretesleeve. Wall sleeves shall be flush with finished surface. Sleeves shall be sized to allow 1/2 in. clearance around pipe or insulation. Insulation and covering shall be continuous through sleeves.
- B. At exterior walls below grade provide a modular mechanical seal consisting of interlocking EPDM rubber links shaped to continuously fill the annular space between the pipe and the wall opening with a molded high density polyethylene sleeve water-stop ring, end caps and reinforcing ribs. ASTM B117, ISO 9002. Mechanical seals shall be "Thunderline" Link Seal or approved equal.

## **2.9 ACCESS PANELS**

- A. Access Panels in Plaster Walls and Ceilings: Karp #DSC214PL, Elmdor PW, 24x24 in. with metal access door and frame, prime coated steel and painted to match adjacent surfaces. For fire rated areas use Karp #KRP-150 FR 1-1/2 hour "B" Label access panels, U.L. listed.
- B. Access Panels in Acoustic Tile Ceilings: Karp #DSC-210, Elmdor AT, 24x24 in. with metal access door and frame, 24x24 in. minimum size, prime coated steel, recessed to accept standard tile in full opening door.
- C. Access Panels in Ceramic Tile Walls: Karp #DSC214M, Smith 4730, chrome-plated cover and frame of suitable size for purpose intended, but not less than 8x8 in. size. For fire rated areas use Karp #FRP-150 FR 1-1/2 hour "B" Label access panels, U.L. listed.

## **2.10 CLEANOUTS**

- A. For cast-iron soil pipe, iron body with extra heavy bronze plugs screwed into caulking ferrules; for steel pipe, extra heavy bronze plugs; and for vitrified clay pipe, vitrified clay plugs. Where cleanouts occur in finished interior walls, provide access panels, plates, and frames for flush mounting. Exposed parts of floor cleanouts shall have adjustable top. All cleanouts and cleanout plugs shall be accessible. Cleanouts for drain pipes that pass through a backwater valve shall be identified with a permanent label stating "BACKWATER VALVE DOWNSTREAM." Cleanouts for drain pipes that pass through a grease interceptor shall be identified with a permanent label stating "GREASE INTERCEPTOR DOWNSTREAM." Cleanout shall be the following:
  - 1. In finished floors: Cast-iron with polished nickel bronze round top, non-skid diamond tread set flush with the floor. Provide with carpet marker when located

in future carpeted areas and flashing flange when used with waterproofing membrane.

- a. Smith - 4023
  - b. Zurn - ZN-1402-2
  - c. Mifab – C-1100-R
2. In mechanical equipment areas: Cast-iron with heavy cast-iron round top, non-skid diamond tread set flush with the floor. Provide flashing flange when used with waterproofing membrane.
- a. Smith - 4223
  - b. Zurn - Z-1400
  - c. Mifab – C-1100-XR
3. In walls: Cleanout tee with squared polished nickel bronze access plate with vandalproof screws and frames. Opening 8x8 in. minimum.
- a. Smith - 4558-U
  - b. Zurn - ZN-1447
  - c. Mifab – C-1460-S
4. In exterior grades: Cast-iron body, vandalproof cover, non-skid diamond tread, set flush with grade or finished surface. In non-surfaced area, they shall be cast in a concrete block 14x14x6 in. deep.
- a. Smith - 4248
  - b. Mifab C-1100-XR

## **2.11 WATER HAMMER ARRESTORS**

- A. Precision Plumbing Products (PPP) maintenance free water hammer arrestors, installed as indicated or as recommended by PDI pamphlet WWH-201. In no case shall a flush valve fixture or a quick closing faucet or valve be installed without shock protection.

## **2.12 PRESSURE TEMPERATURE RELIEF VALVE**

- A. Provide domestic water heater with ASME rated pressure/temperature relief valve set to relieve at 125 psi pressure and at 188 degrees to 208 degrees F temperature range.

## **2.13 THERMOMETERS**

- A. H.O. Trerice BX91403-1/21/2 (scale 30 degrees to 240 degrees F) adjustable angle red mercury type with 7 in. chrome-plated bronze case, 3-1/2 in. stem and swivel nut 3/4 in. NPT brass separable socket, and etched scale with graduations as shown or required.

## **2.14 TRAP PRIMER ASSEMBLIES**

- A. Provide for drains and floor sinks where trap primer is not provided from a water closet and as indicated and specified, each including trap primer valve, standpipe, and distribution unit(s) required for the specified distribution. Provide each concealed assembly with access panel, 8 in. by 8 in. size when distribution units are not required and 12 in. by 12 in. size when one or two distribution units are required. Recess box flush in wall for electronic models. Exposed trap primers and piping is not acceptable. Provide trap primer piping same as specified for domestic water, including pipe wrapping.

- 1. TP-1: Precision Plumbing Products model P-1 or P-2, or equal.

## **2.15 PRESSURE GAUGES**

- A. Potter-Roemer 6240-U.L. - F.M. 0-300 psi range, complete with 3-1/2 in. diameter dial and gauge cock. Install pressure gauges where indicated and as required.

## **2.16 INSULATION**

- A. All pipe insulation shall comply with the State of California Energy Conservation Standards. Insulation thicknesses indicated are based on insulation having thermal resistances in the range of R-4.0 to R-4.6 per inch of thickness on a flat surface at a mean temperature of 75 degrees F. Thicknesses indicated are minimum and shall be increased proportionately for materials having R values less than 4.0 per inch of thickness or may be reduced for materials having R values greater than 4.6 per inch thickness. Install pipe insulation after piping is installed, tested and approved and is in clean, dry condition. Firmly butt insulation joints.
- B. Insulate all hot water and interior condensate drain piping with glass fiber pipe insulation with factory applied white jacket, J-M Micro-Lok 650 AP, 1 in. thick for pipe sizes of 1/2 in. to 1 in., and 1-1/2 in. thick for pipe sizes to 1-1/4 in. and larger. Insulate fittings and valves with preformed insulation with PVC premolded one piece fitting cover, J.M. Zeston cover. Adhere longitudinal laps and butts of strips of jacket with factory applied pressure sensitive tape system, J-M AP-T. Flanges and unions shall not be covered.
- C. Insulate all piping under lavatories and sinks accessible to the physically disabled with Truebro LavGuard2 or Plumberex Pro-Extreme, hot and cold water supply and 'P' trap form fitted insulation.
- D. Insulate all interior condensate drain piping with AP Armaflex closed-cell elastomeric foam insulation. Flame-spread index of 25 or less and smoke-developed index of 50 or less. 1/2-inch thick for 4-in. diameter pipe and less.



**2.17 PLUMBING FIXTURES**

- A. General: Plumbing fixtures trim and exposed supplies and wastes shall be brass with polished chrome-plated finish. Provide individual loose key stops or, if so specified, screw driver stops for supplies and, unless integral with valves or faucets, mount under fixture. Separately trap all wastes. Provide exposed supplies and wastes to wall with polished chrome-plated cast brass wall escutcheons. All lavatories shall have 1-1/2 in. 17 gauge chrome-plated cast brass P-traps. All plumbing fixtures shall be white, unless otherwise noted complete with thermostatic mixing valves – Watts #LFMMV.
- B. Wall-Hung Fixtures: Fixtures specified with hangers or supporting arms shall have hangers or arms securely mounted on a 1/4 in. thick by 6 in. wide steel wall plate which extends at least one stud beyond first and last fixture mounting points, or a total of three studs minimum. Attach wall plate to each structural stud it crosses by tack welding each side of stud flange at top and bottom of plate. Fixture or supporting arms shall be securely and firmly attached to steel wall plate in accordance with manufacturer's instructions. If structural studs are not being installed behind wall-hung fixtures, plumbing contractor shall notify Architect and Mechanical Engineer immediately.
  - 1. Basin: ANSI A112.19.2; vitreous china lavatory with 4 inch high back, drillings for center punch, and rectangular basin with splash lip front overflow. For model number see schedule on drawings. Refer to architectural drawings for mounting
  - 2. Trim: ANSI A112.18.1; chrome plated faucet, chrome plated 17 gage L.A. pattern cast brass P-trap and arm with secured escutcheon and rigid supplies. For model number see schedule on drawings.
  - 3. Wall Mounted Carrier: ANSI A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs. For model number see
- C. Wall-Hung Water Closets: Provide with chair carrier supports as required with foot supports anchored to concrete slab with minimum 1/2 in. dia. x 3 in. long cinch anchors per foot including rear anchor for non back-to-back carriers. Install at heights indicated on the Architectural drawings. Conceal fixture bolts with vitreous china caps. Provide with auxiliary foot supports where the distance from wall to carrier exceeds 10 inches.
- D. Floor-Mounted Water Closets: Install on slotted cast-iron floor flanges. Make joints permanently gas and watertight with a preformed wax gasket and held in place with 5/16-in. solid brass bolts concealed with vitreous china bolt caps. Color to match fixture.
  - 1. Bowl: ANSI A112.19.2M; 1.28 gallon per flush, siphon jet, vitreous china closet bowl with elongated rim, 17"-19" high for accessibility, 1-1/2" top spud and china bolt caps. For model number see schedule on drawings.

2. Flush Valve: ANSI A112.18.1; exposed chrome plated, diaphragm type with battery operated sensor, escutcheon, vacuum breaker. For model number see schedule on drawings.
  3. Seat: Solid elongated plastic, open front with self-sustaining hinge, brass bolts. For model number see schedule on drawings.
- E. Urinals: Install with brass nipples. Install at heights indicated on Architectural drawings. Conceal fixture bolts with vitreous china caps. Color to match fixture.
- F. Drains: Where installed in construction with waterproof membrane, provide drains with flashing clamp device with corrosion-resistant clamping bolts.
- G. Fixture Sealer: Install wall-hung fixtures with white silicone sealer between fixture and wall, applied smooth and even.
- H. Fixtures, trim and accessories shall be equal, unless otherwise noted to the following  
– Refer to P0.02 for fixture list and selection.

## **2.18 SPECIALTY ITEMS**

- A. Gas-Fired Water Heater: Refer to Water Heater Schedule on sheet P0.02 for characteristics with high water temperature alarm and mixing valves.
1. Mixing Valves – Bradley S59-3200.
  2. High-Water Alarm – Powers #460LF
- B. Instantaneous electric Water Heater: Point-of-Use electric instantaneous water heater, micro-processor controlled, 98% energy efficient, U. L. listed, factory pre-set outlet temperature of 110° F, field serviceable heating element, high temperature limit switch, turn-on flow rate of 0.3 gpm. Provide with “Watts” LFFS-CFS-S Floodsafe, lead-free braided stainless steel cold water supply connector with compression fittings and “Watts” 3/8”-05-CXT water hammer arrestor on cold water angle stop. Refer to Water Heater Schedule on sheet P0.02 for characteristics.
- C. Domestic Hot and Cold Water Piping:
1. Riser Support: 0.06 inch deflection Type A neoprene pads with load distribution pads under riser clamps.
  2. Horizontal Piping: Minimum 3/8 inch felt between pipe and clevis hanger.
  3. Miscellaneous Attachments: Trisolators.
  4. Seismic Restraints: Suspended piping-cables as required by code.
- D. Water Heater(s):
1. 0.06 inch deflection Type A neoprene pads.

E. Laundry Box:

1. Recessed wall mounted corrosion resistant box complete with hot and cold supplies and 2" waste outlet. For model number see schedule on drawings.

**2.19 VIBRATION ISOLATORS**

- A. Type A: Neoprene pad. Waffle ribbed or other forms. Typically, 1/4 to 5/16 inch thick. Durometers of 40 to 65. Static deflections from 0.01 to 0.07 inches. Nominal design 40 durometer for 0.05 inches static deflections. Provide steel load distribution plates. Size of pad to be specified by isolator supplier based on load per pot. Mason W and WM, Vibrex R, or equal.
- B. Type B: Trisolators. Sheet metal sleeve with felt insert to be installed at attachments of points of hangers or piping. Semco, Elcen, or equivalent shop fabricated device.

**PART 3 - EXECUTION**

**3.1 SURFACE CONDITIONS**

- A. Inspection: All plumbing shall be installed in accordance with the requirements of all governing authorities, the original design, and the referenced standards.
- B. Discrepancies:
  1. In the event of discrepancy, immediately notify the Architect.
  2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
  3. Interferences between installed work of various trades due to lack of coordination shall be resolved by Architect whose decision is final. Relocate or offset any work as required to accommodate work of other trades at no extra cost to the Owner when so directed by the Architect.

**3.2 LOCATIONS AND SPACE REQUIREMENTS**

- A. Contractor shall fully inform himself regarding peculiarities and limitations of spaces available for installation of work under this division. Drawings indicate desired location and arrangement of piping, equipment and other items, and are to be followed as closely as possible. Work specified and not clearly defined by drawings shall be installed and arranged in a manner satisfactory to Architect. In event changes in indicated locations and arrangements are deemed necessary by Architect, they shall be made by Contractor without additional charge provided the change is ordered before work is installed and no extra materials are required.
- B. Verify all spaces, dimensions for all fixtures, equipment, tenant or Owner-furnished equipment and equipment furnished under other sections.
- C. Obtain all necessary rough in data and dimensions for all fixtures, equipment, tenant or Owner-furnished equipment and equipment furnished under other sections.

- D. Maintain ample headroom clearances and accessibility. Maintain ceiling heights.
- E. Constantly check work of other trades to prevent interference with this installation.

### **3.3 PIPE INSTALLATION**

- A. Make pipe runs straight and true. Springing or forcing piping into place is not permitted. Install in manner to prevent any undue strain on equipment. Make joints smooth and unobstructed inside and out, and ream pipe ends thoroughly to remove burrs. Conceal piping in finished portions of the buildings except as otherwise directed or indicated. Cap or plug ends and openings in pipe and fittings immediately to exclude dirt until equipment is installed or final connections are made. Make pipe size reductions with reducing fittings. Use no bushings unless specifically authorized. Use no close nipples. Proceed to rough in as rapidly as general construction of building will permit and complete and test before any lathing, plastering, or drywall, or other finish work is started. Fit work to available space and accurately rough in. Grade and valve water piping so as to provide for complete drainage and control of the system. Provide clamps and/or concrete thrust blocks at dead ends, angles, or other points where separation of joints may occur. Grade vent piping to allow piping to free itself of condensation or water. Pipe and supports shall not be in contact with structure, other piping, conduit, ductwork or other equipment.
- B. Install piping to clear beams unless sleeving is indicated. Constantly check work of other trades to prevent interference with this installation. Obtain approval from Architect if coring or cutting of concrete work is necessary due to failure to install required sleeves prior to the time of concrete pour. Cost of coring and cutting work shall be borne by the subcontractor.
- C. Exposed Plated or Enameled Pipe: Make connections to equipment with special care. Show no tool marks or threads.
- D. Dielectric Unions: Make connections between two dissimilar metal pipes with dielectric unions.
- E. Unions: Provide a union at both sides of automatic valves, at equipment connections and elsewhere indicated or required, unless flanges are indicated.
- F. Floor, Wall and Ceiling Plates: Provide where pipes pierce finished surfaces.
- G. Noise: Install soil, waste, and water piping in manner that prevents any unusual noise from flow of water under normal conditions.
- H. Shutoff Valves: Provide where indicated and required for adequate control of systems and for isolation of fixture groups and equipment.
- I. Buried Piping: Install with minimum 36 in. coverage unless otherwise indicated. Lay piping accurately to grade where invert elevations are indicated. When required, provide thrust blocks per manufacturer's recommendations.
- J. Equipment and Materials: Install per manufacturer's recommendations.

- K. Accessibility: Install work readily accessible for normal operation, reading of instruments, adjustment, service, inspection and repair. Provide access panels where indicated and required.
- L. Pipe Joints: Make screwed joints with a minimum amount of compound applied to the male thread only. All joints shall be made per code requirements. Use of "Bull Head" tees in domestic water system is prohibited.
- M. Pipe Supports: Support or secure to building construction or firmly anchor waste, vent, and water pipes in such a manner that they cannot be displaced. Use of makeshift devices such as wire, rope, wood, and tape, etc., is prohibited.
- N. Pumped Condensate Piping: Install flat with minimal offsets at one elevation within the ceiling space.

### **3.4 HANGERS AND SUPPORTS**

- A. Hold horizontal pipe runs firmly in place using approved steel and iron hangers, supports, and/or pipe rests unless otherwise indicated. Suspend hanger rods from concrete inserts or from approved brackets, clamps or clips. Hang pipes individually or in groups if supporting structure is adequate to support weight of piping and fluid. Except for buried piping, hang or support pipe runs so that they may expand or contract freely without strain to pipe or equipment.
  - 1. Horizontal steel piping: Provide hangers or supports every 10 ft. except every 8 ft. for piping 1-1/4 in. and smaller.
  - 2. Horizontal copper tubing: For 2 in. diameter and over, provide hangers every 10 ft.; for 1-1/2 in. diameter and smaller, every 6 ft.
  - 3. Horizontal cast-iron hub and spigot piping: Provide hangers or supports at each hub.
  - 4. Horizontal cast-iron no-hub piping: Provide hangers or supports at each side of a no-hub fitting. Provide anti-separation bracing at each 90 degree change of direction.
  - 5. Vertical piping: Support at floor with iron pipe clamps.
  - 6. Sway brace in accordance with NFPA 13.
- B. Branches: Provide separate hangers or supports for branch lines 6 ft. or more in length.
- C. Sound and Electrolysis Isolators: Provide at all hangers and supports for hot and cold domestic water lines. Securely attach pipe to walls, studs, etc. All such piping isolated from structure by 1/2 inch felt or "Trisolators".

### **3.5 EXPANSION AND CONTRACTION**

- A. Install piping subject to expansion and contraction with expansion loops made up of bends, fittings, or Victaulic couplings, expansion joints, swing joints, or other approved methods or devices. Branch lines from mains subject to expansion and contraction shall have a swing joint at a point of connection with the main. Risers which pass through one or more floors shall have swing joints at their base. Anchor lines subject to expansion and contraction by approved methods to restrict movement.

### **3.6 CORROSION PREVENTION**

- A. Make joint between cuprous and ferrous materials with approved nylon insulating couplings. Separate contact surfaces of dissimilar metals with non-conducting coating.

### **3.7 CLEANOUTS**

- A. Provide cleanouts where indicated and required. Unless otherwise indicated, cleanouts shall be accessible with extensions to grade, to outside of buildings, or to floors above as indicated or required. Do not locate cleanouts in public lobbies and public corridors unless approved by Architect.
- B. Membranes: Where waterproofing membrane occurs under floor, bring membrane to cleanout without puncturing, and permanently anchor to integral anchoring flange with a heavy cast-iron clamping collar and rustproofed bolts.
- C. Covers: Set cleanout covers with all finished wall, floor or grade. In all cases securely anchor by means of integral lugs and bolts. Where surfacing material such as resilient covering is specified, ascertain thickness being used and set cleanout top so finished floor is smooth.
- D. Use Acorn 3500 thread compound.

### **3.8 ACCESS BOXES AND PANELS**

- A. Provide valve boxes for valves located below grade. Provide metal access panels of size and type hereinbefore specified for valves or shock absorbers located in concealed areas.
- B. Access Boxes and Panels: Set flush with finished wall, floor or ceiling. Those in finished walls shall have door or plate removed during construction or be otherwise suitably covered to protect finish.
- C. Outside General Service Access Boxes: Provide with metal or clay pipe sleeve extensions where added depth is necessary. Do not locate boxes in public walks, driveways or covered passages unless indicated.

**3.9 WRAPPING FOR BURIED STEEL AND COPPER PIPING**

- A. All buried steel pipe shall be factory coated with Plexco 20 mil high density polyethylene coating (yellow color). Finished coating shall have continuous imprinting of coating type and applicator and pipe type and manufacturer. All fittings and field joints of buried steel piping shall be cleaned, primed then fully protected by wrapping with two separate wrappings (each half lapped) of 0.010x2 in. wide pressure sensitive polyvinyl tape. All fitting and joint wrapping shall overlap pipe wrapping a minimum of 2 in.
- B. Affidavit: Deliver coated pipe to jobsite accompanied by applicator's affidavit certifying that wrapped pipe has been given high voltage holiday detector test and that pipe was free of holidays when pipe was shipped from applicator's yard. Submit one copy of every affidavit to Architect prior to installation.
- C. Field Joints: Test field applications for holidays by a high voltage holiday test method in Architect's presence.
- D. Damage: Handle wrapped piping with extreme care to avoid damage. Repair and retest marred or damaged pipe wrapping.
- E. Install cathodic protection for steel or ferrous piping per Corrosion Engineer's recommendations and/or applicator contractor familiar with cathodic protection having a minimum of 5 years experience in the fabrication and installation of cathodic protection.
- F. Copper tubing, pipe wrap same as for field wrap steel fittings, no holiday test required. Backfill with clean sand.
- G. Backfill steel and copper piping with clean sand a minimum of 4 inches all around pipe and fittings.

**3.10 PROTECTION FOR UNDERGROUND DUCTILE AND CAST-IRON PIPE AND FITTINGS**

- A. Wrap all pipe and fittings with 8 mil polyethylene encasement in accordance with ANSI/AWWA Standard C105/A21.5-93. Bed and backfill with clean sand at least 6 inches thick surrounding the pipe. Underground iron pipe should also be electrically insulated from dissimilar metals and above ground iron pipe.

**3.11 EXCAVATION AND BACKFILLING**

- A. Perform excavation and backfilling required work under this section unless otherwise specified. Conform to requirements of Division 2 and of public authorities having jurisdiction.

**3.12 SPECIALTY ITEMS**

- A. Install as indicated on the drawings, as herein specified, and as recommended by manufacturer.

**3.13 STERILIZATION**

- A. Domestic Water System: Sterilize each unit of water supply and distribution system with liquid chloride or hypochloride before acceptance for operation in accordance with AWWA C651-92, "Standard for Disinfecting Water Mains." Work shall be done by Contractor and, unless otherwise required by public authorities having jurisdiction, shall conform to the following:

1. Materials:

- a. Liquid chlorine: U.S. Army Specification 4-1.
- b. Hypochloride: Liquid shall conform to Fed. Spec. O-C-11RA (Int. 4).

2. Method: Amount of chlorine shall provide a dosage of 50 ppm minimum. Introduce chlorinating materials into lines and distribution system in approved manner. After a contact period of 24 hours minimum during which period chlorine residual shall be maintained at 5 ppm minimum, flush out systems with clean water until residual content is not greater than 0.2 ppm. Flush entire system open and close valves in lines being sterilized several times during contact period.

3. Test Reports: Furnish one copy of test report of complete and adequate sterilization to Architect before final acceptance of work. Certificates shall bear signature of an official of laboratory responsible for test. Cost of testing laboratory services shall be included in this subcontract.

B. Deionized Water System:

- 1. Recirculate and flush with 3-5% hydrogen peroxide. Circulation period is a minimum of 60 minutes. Flush out for at least 45 minutes with 5 to 10 Megohm DI Water until the hydrogen peroxide is gone. The traces of residual hydrogen peroxide are measured by means of potassium permanganate solution. Into a beaker of dilute purplish permanganate solution, the water (possibly) containing small amounts of hydrogen peroxide is either titrated or "droppered" until a color change occurs. If no color change to "clear" occurs, the peroxide is believed to be flushed out and gone.
- 2. Hot DI Water may be used for flush out also. The temperature should be approximately 180 degrees F with a heat up time of approximately one hour and recirculation of the water for 1 to 2 hours minimum. There is no test needed for final water quality, although flushing of the hot water should be made with water of approximately 10 Megohm. Live steam is not recommended for this cleaning operation.

**3.14 TESTS**

- A. Perform tests to Architect's satisfaction. Make tests in presence of Architect and at a time suitable to him if requested. Furnish necessary labor and equipment and bear costs for testing. Cost of replacing and/or repairing damage resulting therefrom shall be borne by this Contractor. Should the Contractor refuse or neglect to make tests



necessary to satisfy the Architect that requirement of specifications and drawings are met, such tests may be made by an independent testing company and the Contractor charged for all expenses.

- B. Hydrostatic Tests: Make by completely filling piping system with water and eliminating accumulations of air so that leakage, no matter how small, will be apparent on testing gauge immediately. Maintain pressure until pipe under test has been examined, but in no case less than 24 hours. Test systems at following pressure:
- | 1. SYSTEM           | TEST PRESSURE |
|---------------------|---------------|
| Domestic cold water | 150 psig      |
| Domestic hot water  | 150 psig      |
- C. Sanitary Soil, Waste, Vent System Tests: Before installation of fixtures, cap ends of system and fill lines with water to 10 ft. above the section being tested (including vents) and allow to stand until a thorough inspection is made. Make tests in sections if necessary or convenient. However, include interconnections between new sections and previously tested sections in the new test.
- D. Roof Drainage System: Test as specified for sanitary system.
- E. Gas Systems: Test with compressed air for six hours or longer as directed to prove tight without leaks. Use pressure recorder to record pressure of all lines for duration of test. Test at 60 PSIG.

### 3.15 ADJUSTING

- A. Upon completion of work and after cleaning of system, fixtures and equipment, and automatic parts of plumbing system shall be carefully adjusted for normal operation. All flush valves and fixture stops shall be checked for proper operation and final adjustments made where required. System shall operate quietly without vibration or noise.

**END OF SECTION**

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**SECTION 26 00 00**

**GENERAL ELECTRICAL SPECIFICATIONS**

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**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical/Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.
1. Work Included: Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.
  2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.
- B. Electrical Drawings: Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

**1.2 QUALITY ASSURANCE**

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:
1. Institute of Electrical and Electronic Engineers - IEEE
  2. National Electrical Manufacturers' Association - NEMA
  3. Underwriters' Laboratories, Inc. - UL
  4. National Fire Protection Association - NFPA
  5. Federal Specifications - Fed. Spec.
  6. American Society for Testing and Materials - ASTM

7. American National Standards Institute - ANSI
  8. National Electrical Code - NEC
  9. National Electrical Safety Code - NESC
  10. Insulated Cable Engineers Association - ICEA
  11. American Institute of Steel Construction - AISC
  12. State and Municipal Codes In Force In The Specific Project Area
  13. Occupational Safety and Health Administration (OSHA)
  14. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)
  15. California Electrical Code - CEC
  16. Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes
- B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.
1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.
  2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

### **1.3 GENERAL REQUIREMENTS**

- A. Guarantee: Furnish a written guarantee for a period of (1) one-year from date of acceptance.
- B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.
- C. All Core Cutting, Drilling, and Patching:

1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.
2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer.
3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.
4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

**D. Verifying Drawings and Job Conditions:**

1. The Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
2. The Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

**1.4 WORK IN COOPERATION WITH OTHER TRADES**

- A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.
- B. Provide a conduit-only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits, and backboxes required for installing conductors to the controls.
- C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

## **1.5 TESTING AND ADJUSTMENT**

- A. Upon completion of all electrical work, the Contractor shall test all circuits, switches, light fixtures, lighting control and dimming systems including distributed systems, UPSs, generators, SPDs, lighting inverters, transfer switches, motors, circuit breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.
- B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.
- C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
- D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

## **1.6 IDENTIFICATION**

- A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, fire alarm/central monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal and control cabinets.
  - 1. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications. Nameplates shall be engraved with the device designation/identification on the top line, source identification for the device on the 2nd line per CEC Article 408.4 and load designation for the device on the bottom line. Where load designation consists of a branch circuit, omit bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.

Example: Transformer 1TA

Source Disconnecting Location: Switchboard MSA located in Rm 110

Load: Panels 1LA and 1 LB

- 2. All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU sub-feed circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.
- B. Identification nameplates, UON, shall be laminated/extruded modified acrylic that is 3/32" thick, UV-stabilized, matte finish, suitable for use in 180 deg. F ambient, with

beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background (utility/normal and optional standby power systems) for single line of text. Where two lines of text are required, provide minimum 2" high nameplate. Where three lines of text are required, provide minimum 2.5" high nameplate. Provide white letters on red background for all CEC Article 517 essential power systems, Article 700 Emergency Systems, Article 701 Legally required standby systems and Article 708 COPS.

- C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards and motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.
- D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU sub-feed circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV-resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.
- E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or instruction placards, as required for all lock-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be engraved 1/2" high white lettering on a red background using the same material specified for identification nameplates with a self-adhesive backing. Warning/instruction placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any warning/instruction placards. In all cases, clean surfaces before applying warning/instruction placards parallel to equipment lines.
- F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telecom/data/AV racks and cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 3/32" thick Micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.
- G. See wiring device section of this specification for wiring device plate cover labeling requirements.

- H. See drawings for panel board schedule directory installation requirements.
- I. See conduit installation section of this specification for conduit labeling requirements.

#### **1.7 FINAL INSPECTION AND ACCEPTANCE**

- A. After all requirements of the Specifications and/or the Drawings have been fully completed; representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.
- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

#### **1.8 RECORD DRAWINGS**

- A. Drawings of Record: The Contractor shall provide and keep up to date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

#### **1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOW EQUAL**

- A. Approvals: Where the words (or similar terms) "approved", "approval", "acceptable", and "acceptance" are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.
- B. Equal: Where the words (or similar terms) "equal", "approved equal", "equal to", "or equal by", "or equal" and "equivalent" are used, it shall be understood that these words are followed by the expression "in the opinion of the Owner, Architect, and Engineer." For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance/style (includes craftsmanship, physical attributes, color and finish), and the same performance.
- C. Substitution: For the purposes of specifying products, "substitution" shall refer to the submittal of a product not explicitly approved by the construction documents/specifications.
  - 1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified

values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples, if requested, must be included in the submittal. ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.

2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers/distributors of both the specified and proposed equal material for price comparison, as well as a verification of delivery dates that conform to the project schedule.
  3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.
  4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.
- D. Alternates/Alternatives: For the purposes of specifying products, "alternatives/alternates" may be established to enable the Owner/Architect/Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.
- E. No Known Equal: For the purposes of specifying products, "No Known Equal" shall mean that the Owner/Architect/Engineer is not aware of an equivalent product. The Contractor will need to submit a "Substitution" item, per the requirements listed above, if a different product is proposed to be utilized.

#### **1.10 SHOP DRAWINGS/SUBMITTALS**

- A. Shop Drawings/Submittals, unless required otherwise by general project specifications or instructions to bidders, shall be submitted in electronic format (PDF) to include a Letter of Transmittal (PDF), which shall give a list of the drawings submitted with dates and/or system(s) components contained within the submittal. Drawings and material cut sheets shall be complete in every respect and edited/marked to indicate specific items being provided. Printed/Hard copies are not acceptable.
- B. The Shop Drawings/Submittals shall be marked with the name of the project, numbered consecutively, and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.
- C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor's letter of transmittal. If the substitution is



accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.

- D. Only products listed as "Equal" within the contract documents, along with formally approved "Substitutions" will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.
- E. Review comments used in response to shop drawings/submittals are:
  - 1. "No Exception Taken" - Product approved as submitted.
  - 2. "Furnish as Corrected" - Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.
  - 3. "Revise and Resubmit" - Re-submittal required with corrections as noted.
  - 4. "Rejected" - Re-submittal required based upon the originally specified product.
- F. Shop drawings shall be submitted on the following but not limited to:
  - 1. Lighting Fixtures, Lamps, and Ballasts.
  - 2. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information.
  - 3. Transformers.
  - 4. Fire Alarm System/Central Monitoring System.
  - 5. Wiring Devices.
  - 6. Lighting Control System/Dimming System Products.
  - 7. Pullboxes and Underground Vaults.
  - 8. Terminal Cabinets
  - 9. Lighting Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches, SPD Systems.
  - 10. Cable Tray, Flexible Cable Tray and Cable Runway.
  - 11. Power Poles and Floor Boxes.
  - 12. Arc Flash, Short-Circuit and Coordination studies.
  - 13. All other products called out on drawings that call for shop drawing submittal.

**1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS**

- A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating, maintenance, and servicing instructions, as well as four (4) complete wiring diagrams for the following, but not limited to, items or equipment:
  - 1. Lighting Control System/Dimming Systems.
  - 2. Fire Alarm System.
  - 3. Transformers.
  - 4. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information
  - 5. Lighting Inverters, UPS's, PDUs, Generators, Transfer Switches, SPD Systems
- B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

**1.12 INTERRUPTION OF SERVICE/SERVICE SHUTDOWN**

- A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work, shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.
- B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.
- C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ)
- B. Switchgear/Switchboards/Distribution Boards/Motor Control Centers:
  - 1. See general single line notes on single line drawing for more information.
- C. Panel boards – Branch Circuit:

1. See drawings for panel board schedules and specifications.

D. Transformers:

1. See drawings for transformer schedules and specifications.

E. Lighting Fixtures:

1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.
2. Ballasts: See lighting fixture schedule notes. All noisy ballasts shall be replaced at no cost to the Owner.
3. Lamps: See lamp/fixture schedule and lamp/lighting fixture schedule notes.

F. Wiring Devices:

1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process

a. Wiring Devices (Decora)

- |  |           |
|--|-----------|
| 1) Convenience Receptacle                  | #16252    |
| 2) Dedicated Receptacle                    | #16352    |
| 3) Convenience I.G. Receptacle             | #16262-IG |
| 4) Dedicated I.G. Receptacle               | #16362-IG |
| 5) Convenience G.F.C.I. Receptacle         | #GFT1     |
| 6) Dedicated G.F.C.I. Receptacle           | #GFNT2    |
| 7) Tamper Resistant Convenience Receptacle | #TDR15    |
| 8) Tamper Resistant Dedicated Receptacle   | #TDR20    |
| 9) Tamper Resistant GFCI Receptacle        | #GFTR2    |
| 10) Grade Receptacle                       | #GFTR1-HG |
| 11) Grade Receptacle                       | #GFTR2-HG |

12) Weather/Tamper Resistant GFCI Receptacle	#GFWT2
13) Convenience Simplex Receptacle	#16251
14) Dedicated Simplex Receptacle	#16351
15) Single Pole Switch	#5621-2
16) Double Pole Switch	#5622-2
17) Three Way Switch	#5623-2
18) Four Way Switch	#5624-2
19) Pilot Light Switch "On"	#5628-2
20) Pilot Light Switch "Off"	#5631-2
21) Projection Screen Switch	#5657-2
22) Low Voltage Momentary Switch	#5657-2
23) Keyed Switch	#1221-2L (Non-Decora)
24) Door Jam Switch	#1865

- b. Use of dedicated receptacles is required where plans depict a branch circuit supplying only a single simplex or duplex receptacle. Use of controlled receptacles is required where depicted on plans - see controlled receptacle specifications for additional information.
2. I.G. (isolated ground) receptacle bodies shall be of a basic color specified above with an orange triangle to symbolize isolated ground.
3. When shown circuited with an I.G. conductor, receptacles shall be of an I.G. type. As an example, a NEMA L6-30R denoted on the plans and shown circuited with an I.G. conductor shall be an I.G. version of that receptacle.
4. Wiring devices located in wood finished areas shall generally be black unless otherwise indicated by the Architect.
5. Wiring devices located in mirrors shall generally be white with stainless steel cover plates unless otherwise indicated by the Architect.
6. In addition to other device requirements listed elsewhere in this specification, 125V (Volt), 15A (Amp) and 20A Tamper-Resistant wiring devices shall be provided as follows:
  - a. In dwelling units per CEC Article 210.52.

- b. In pediatric care areas per CEC Article 517.18(C).
  - c. In childcare or day care facilities.
  - d. In wet and/or exterior locations.
7. Wiring device cover plates located on recessed boxes shall be commercial grade nylon. Plate color shall match wiring device color UON on plans. Cover plates utilized on surface mounted boxes shall be metal. Plastic cover plates are unacceptable.
8. Except as otherwise noted, all wiring device plates on the project shall be labeled with panel and circuit number(s) utilizing a Brother P-Touch labeling system with 1/2" tape (yellow on black) or equal by Herman-Tellerman or Panduit. Locate label on the concealed side of the wiring device plate. Handwritten labels are unacceptable.
9. The Contractor shall provide duplex receptacle outlets in the appropriate configurations necessary to comply with applicable energy code requirements for controlled receptacles and as shown on plans. All wiring devices indicated to be controlled receptacles shall be NEMA-approved, electrical code-compliant with factory markings on the face of the receptacle(s) with the word "Controlled" or utilize further markings and symbols to indicate which receptacles on each outlet is/are controlled. Stickers, field-applied markings or other non-permanent markings are not acceptable. Where a GFCI receptacle outlet is required to be controlled, provide an adjacent controlled duplex receptacle outlet connected on the load side of the GFCI outlet. Generally, one receptacle in a duplex receptacle outlet is required to be controlled. It may be the lower receptacle or upper receptacle based on manufacturer offering. However, the controlled receptacle location within a controlled receptacle outlet shall remain consistent throughout the project. Where an existing duplex receptacle outlet is required to be controlled, provide a new wiring device with the appropriate control configuration necessary to comply with plans. All controlled receptacles shall be connected to a branch circuit controlled by an occupancy sensor-based or relay panel lighting control system. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell.
10. The following wiring device plates shall have custom engraving:
- a. Key operated switches, switches with pilot lights, and switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate indicating the motor, heater, or ventilator controlled.
  - b. Receptacles on optional standby generator and/or UPS power shall have custom engraved plates with the words "Generator" or "UPS" in black letters. In addition, where located in telecommunications closets, IDFs, server rooms, data centers, labs (wet, dry or electronic) indicate panel board and circuit number.

- c. All stainless steel and nylon device plates shall be engraved using a rotary engraving process except for black lettering on stainless steel device plates which may be accomplished via laser etching process. All lettering shall be 3/16" high. Provide a dimensioned submittal drawing detailing a typical device faceplate with engraving.
- G. Weatherproof Outlet Covers/Assemblies: All Receptacles identified as weatherproof on the drawings shall be weather-resistant, tamper-resistant, GFCI type and equipped as follows:
  - 1. Type WP-A: Recessed wall box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed rain tight while "in use". Unit shall comply with CEC Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation of power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
    - a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
    - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.
    - c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4"C.O. with pull string routed from the second compartment to nearest low voltage pull box. Where shown mounted in a building wall, any blank/unused compartment shall be equipped min. 3/4" C.O. with pull string routed to the nearest accessible ceiling space.
    - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
    - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
    - f. Custom color powder coat finish as selected by Architect - Include all costs in base bid for same.
    - g. In locations with sufficient wall depth, provide 6" wide x 6" tall x 5-1/2" deep recessed wall box (C.W. Cole #TL310-WCS-K1-CUSTOM COLOR).
    - h. In locations utilizing shallow stud walls construction or other walls of insufficient depth, provide 10-3/4" wide x 7-3/8" tall x 3-7/8" deep recessed wall box (C.W. Cole #TL310-WCS-SH-K1 -CUSTOM COLOR).
    - i. See drawings for additional details.
  - 2. Type/Subscript WP-B: Wet location-listed raintight while "in use" cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one gang, weather-resistant, tamper-resistant GFCI receptacle. Hubbell WP26E series.

Polycarbonate covers are unacceptable. Unit shall comply with CEC Article 406.9(A) and (B). Contractor shall powder coat cover assembly to a custom color where receptacle locations are deemed by the Architect to be in aesthetically sensitive or public spaces. Custom color as selected by Architect.

3. Type WP-C: (C.W. Cole #TL310-WCS-PED-ADA-K1-CUSTOM COLOR or #TL310-WCS-PED-K1-CUSTOM COLOR) pedestal device box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while "in use". Unit shall comply with CEC Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
  - a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
  - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.
  - c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box.
  - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
  - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
  - f. Include all costs in base bid for ADA version (22.5" tall) of pedestal box. Prior to ordering material, contractor shall coordinate with Architect and/or AHJ to determine which pedestal box locations do not require ADA compliance and may be changed to the standard (11.5" tall) version of the pedestal box.
  - g. Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.
  - h. See drawings for additional details.
4. Type/Subscript WP-D: Damp location-listed (not-Raintite-in-use) cast copper-free, pad lockable, die-cast aluminum cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell/Rayco 502?/503? Series. Polycarbonate covers are unacceptable. Unit shall comply with CEC Article 406.9(A) and (B). Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.

- H. Motor Controllers/Starters: See drawings for motorized equipment schedules and specifications.

I. Circuit Breakers:

1. Service entrance circuit breakers smaller than 400A (Amp) frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers and main circuit breakers. 400A frame and larger shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification.
2. All non-service entrance circuit breakers 225A and larger shall be thermal magnetic type and have continuously adjustable instantaneous pick-ups of approximately 5 to 10 times trip rating. Breakers shall have either tamper-resistant rating dials or easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600A frame and larger, located in 480V, 3-phase, 3-wire or 277/480V, 3-phase, 4-wire switchgear, distribution boards, panel boards or busway plugs shall be solid state, 100% rated. Breaker shall have built-in test points for testing long delay, short delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above - at the Engineer's request.
3. All non-service entrance circuit breakers less than 225A shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.
4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a UL listed current limiting thermal magnetic circuit breaker(s) UON. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.
5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating, Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by



means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above, at the Engineer's request.

6. Circuit breakers, 1200A Frame or larger, or circuit breakers with sensors or adjustable trip settings, 1200A or larger, shall be equipped with an Energy Reducing Maintenance Switch that complies with CEC Article 240.87(B)(3) unless specified elsewhere with an alternate arc energy reduction method allowed by this same code section.
7. Ground Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with ground fault circuit interrupt capability, conforming to UL Class A, Group 1.
8. Arc Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with arc fault circuit interrupt capability, conforming to UL 1699. Provide on all dwelling-unit circuits supplying bedrooms, sleeping quarters etc. as required to comply with CEC Article 210.12.
9. Tandem or half-sized circuit breakers are not permitted.
10. Series-Rated Breakers: UL listed series-rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series-rated breakers are used, switchboards, distribution boards, and panel boards shall be appropriately labeled to indicate the use of series-rated breakers. Shop drawing submittal shall include chart of UL listed devices, which coordinate to provide series rating.
11. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 100A.
12. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.
13. Shunt-trip equipped circuit breakers shall be provided on all elevator feeders.
14. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to due nearby industrial processes, etc.
15. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.
16. All circuit breaker terminations shall be suitable for use with 75-degree Celsius ampacity conductors. Listed, dual-rated pin terminals, straight or offset, are acceptable for use to in accommodating oversized or parallel conductor installations.
17. Circuit breakers serving Fire Alarm or Central Monitoring panels and power supplies shall be red in color and lockable in the "ON" position.

**J. Disconnect Switches:**

1. Non-fusible or fusible, heavy-duty, externally operated horsepower-rated, 600V A.C: Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.
2. Fusible switches shall be Class "R" when 600A or less or Class "L" when greater than 600A.
3. Amperage, Horsepower, Voltage and number of poles per drawings: All shall be clearly marked on the switch nameplate.
4. Provide the Owner's project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

**K. Fuses:**

1. Provide fuses at all locations shown on the Drawings and as required for supplemental protection:
  - a. Fuses shall be manufactured by Bussman, Shawmut, or equal.
  - b. All fuses shall be the product of a single manufacturer.
2. Main and Feeder Protection:
  - a. Protective devices rated greater than 600A: Provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
  - b. Protective devices rated 600A or less: Provide Bussman Class R fuses, Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
3. Motor Protection:
  - a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
  - b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
  - c. Where fuses feeding motors are indicated, but not sized, it shall be the responsibility of the Contractor to coordinate the fuse size with the motor to provide proper motor running protection.
  - d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.

- L. Cable Tray, Flexible Cable Tray and/or Cable Runway:
  - 1. See drawings for Cable Tray, Flexible Cable Tray and/or Cable Runway specifications.
- M. Uninterruptible Power Systems (UPS):
  - 1. See drawings for UPS schedules and specifications.
- N. Power Distribution Units (PDU):
  - 1. See drawings for PDU schedules and specifications.
- O. Generator Systems:
  - 1. See drawings for Generator schedules and specifications.
- P. Transfer Switches:
  - 1. See drawings for Transfer Switch schedules and specifications.
- Q. Lighting Control/Dimming Systems:
  - 1. See drawings for Lighting Control and/or Dimming Systems schedules and specifications.
  - 2. Wall box dimmers shall be rocker-type as manufactured by Lutron (no known equal except as noted below). Dimmers and dimmer faceplates shall match the color of adjacent switches and faceplates. Dimmers and dimmer faceplates in wood finished areas shall generally be black unless otherwise indicated by the Architect. The Contractor shall obtain written approval of the Architect regarding final dimmer and dimmer faceplate color selection prior to ordering material. Multiple dimmers/switches shall be ganged together with a common cover plate. Provide dimmers as follows:
    - a. Incandescent: Lutron DIVA DV-10P or DV-103P (3-way) (1000-Watt max.).
    - b. Electronic Low Voltage: Lutron DIVA DVELV-300P or DVELV-303P- (3-way) (300 Watt).
    - c. Magnetic Low Voltage: Lutron DIVA DVLV-10P or DVLV103p (3-way) (800-Watt max.).
    - d. Fluorescent (3-Wire): Lutron DIVA DVF-103P (single/3way, 8A @ 120V) or DVF-103P-277 (single/3way, 6A @ 277V).
    - e. Fluorescent (0-10V): Lutron DIVA DVTV with PP-???H Power Pack.
    - f. Fluorescent (Lutron Tu-Wire): Lutron DIVA DVFTU-5A3P with Lutron H.P. module where required.

- g. LED (0 - 10V): Lutron DIVA DVTV with PP-???H Power Pack.
  - h. Screw Base CFL/LED: Lutron DIVA DVCL-153P.
  - i. Fan Control: Lutron DIVA DVFSQ-F (1.5A @ 120V max, 3 speed, single pole, 3-way).
3. Contractor shall verify if dimmer(s) requires derating when ganged. Contractor shall provide, and provide connections to, additional Lutron Power Modules, Lutron Power Packs, and / or Lutron Interface Modules where required to accommodate loads higher than dimmers standard or derated load-carrying capacity. Note - contractor may to provide a Lutron recommended dimmer type (typically a #DVF-103P unit) to control the necessary power modules or interface devices.
- R. Fire Alarm System/Central Monitoring System:
- 1. See drawings for Fire Alarm System or Central Monitoring System specifications.
- S. Surge Protective Device (SPD):
- 1. See drawings for SPD specifications.
- T. Conduit:
- 1. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metalizing, or sherardizing process.
  - 2. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242, and meet Federal Specification WWC-581 (latest revision).
  - 3. Electrical Metallic Tubing (EMT) shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces. EMT shall be dipped in a chromic acid bath to chemically form a corrosion-resistant protective coating of zinc chromate over galvanized surface.
  - 4. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Use only as directed in writing by the Engineer with the exception of 400 Hz feeders and 400 Hz branch circuits which shall be run in flexible aluminum conduit.
  - 5. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory-installed fittings. For outdoor installations and motor connections only unless otherwise noted on drawings.
  - 6. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc.) shall not be

used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.

7. When approved for use in the Allowed Specification Deviations Section, generally located on the symbols list drawing, MC cables shall be allowed for lighting branch circuits (homeruns shall be EMT), receptacle branch circuits (homeruns shall be EMT) and poke-thru fed systems furniture homeruns. MC shall not be used where exposed, except for a maximum 6' length for final connections to light fixtures or terminate in electrical panelboards or distribution boards. Equipment ground conductor shall be green. Isolated ground conductor shall be green with yellow stripe. Provide 600V rated aluminum or lightweight steel interlocking armor Metal Clad (MC) cable with copper conductors, THHN (90-degree C) insulation, and integral equipment grounding conductor and isolated grounding conductor as required. Type AC cable listed for use in patient care areas for non-essential electrical system branch circuits per CEC Article 517.13 shall be required in such areas in lieu of MC cable. Type AC and MC cable shall not be used for essential electrical system branch circuits. MC cable shall be manufactured to Underwriter Laboratory Standard 1569. See PART 3 - EXECUTION section of this specification for additional installation requirements.
8. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See PART 3 - EXECUTION section in this specification for additional installation requirements.
9. Non-Metallic Conduit:
  - a. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (UL) requirements, listed for exposed and direct burial application.
  - b. Conduit and fittings shall be produced by the same manufacturer.
10. Fire-rated MC Cable:
  - a. 2-hour fire-rated, polymer insulated 600V MC cable listed and conforming to Underwriters Laboratories, Inc. (UL) 2196 and UL 1569 requirements for installation as an Electrical Circuit Protective System for use in complying with CEC Articles 695 and 700. Cable sheath shall be suitable for use as a CEC equipment grounding conductor and shall be listed for use in wet locations to 90 degrees C (Raychem or equal).
  - b. Cable connectors shall be brass MC connectors.

U. Fittings:

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.
2. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.
3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.
4. UON all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2" and smaller. Insulated throat is not required for fittings, connectors and couplings 1" and smaller.
5. All interior and exterior EMT fittings, connectors and couplings, 2" and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be Raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If Raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.
6. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.
7. Conduit unions shall be "Erickson" couplings or approved equal. The use of running threads will not be permitted.

V. 600 Volt Conductors - Wire and Cable:

1. All conductors shall be copper. Provide stranded conductor for #10 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.
2. Type THHN/THWN-2 thermoplastic, 600 volt, UL approved, dry and wet locations rated at 90 degrees Celsius, for conductors of all sizes from #12 AWG up to and including 1000 kcmil. RHH/RHW insulation is allowed only to provide an Electrical Circuit Protective System to comply with CEC Articles 695 and 700.

3. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
4. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.
5. Systems Conductor Color Coding:
  - a. Power 208/120V, 3PH, 4W:
    - 1) Phase A = Black
    - 2) Phase B = Red
    - 3) Phase C = Blue
    - 4) Neutral = White or White with Phase Color Tracer
    - 5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
    - 6) Travelers = Purple with Black stripe or Pink.
  - b. Power 480/277V, 3PH, 4W:
    - 1) Phase A = Brown
    - 2) Phase B = Orange
    - 3) Phase C = Yellow
    - 4) Neutral = Grey or Grey with Phase Color Tracer
    - 5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
    - 6) Travelers = Purple with black stripe or Pink.
  - c. Ground Conductors: Green
  - d. Isolated Ground Conductors: Green with continuous yellow stripe.
  - e. Fire Alarm System: As recommended by the manufacturer.
6. All color-coding for #12 through #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.
7. No conductors carrying 120V or more shall be smaller than #12 AWG.

8. Aluminum conductors shall not be used.
9. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.

**W. Medium Voltage Conductors (greater than 600V):**

1. See drawings for Medium Voltage Cable Schedule and Specifications.

**X. Junction and Pullboxes:**

1. For interior dry locations, boxes shall be NEMA 1 galvanized one-piece drawn steel, knockout type, with removable, machine screw secured covers.
2. For outside, damp or surface locations, boxes shall be NEMA 3R heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.
3. For in-grade applications, junction and pull boxes shall be pre-cast concrete or molded fiberglass manufactured by Christy, Brooks-Jensen, or Utility Vault Co. Fiberglass boxes shall:
  - a. Be used only in landscape planter areas that are not subject to damage from lawnmowers, tractors and other machinery.
  - b. Not be used in lawn or turf areas.
  - c. Not exceed 11" W x 17" L in size unless required to be larger to meet code requirements.
4. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required.
5. All boxes located in traffic areas shall be traffic rated.

**Y. Outlet Boxes:**

1. For fixtures, boxes shall be galvanized, one-piece drawn steel, knockout type equipped with 3/8" fixture studs and plaster rings where required.
2. For convenience outlets, wall switches, or other devices, outlet boxes shall be galvanized one-piece drawn steel, knockout type 4" x 4" x 2-1/8" minimum size with plaster rings as required.
3. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements and submitted for approval.



4. For exposure to weather, damp locations, or surface mounting, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs; covers shall be watertight with gaskets and non-ferrous screws.
  5. Outlet boxes used for support of ceiling fans shall be galvanized, one-piece drawn steel, knockout type equipped with bracing bars and plaster rings where required and listed for ceiling fan support use. Such boxes shall be labeled and capable of supporting ceiling fan weights up to 70 pounds.
  6. See drawings for floor box installation notes and specifications.
- Z. Plywood Backboards: Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' all (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.

**AA. Terminal Cabinets:**

1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.
  2. Provide each terminal cabinet with a full-size mounting backplate.
  3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.
  4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.
  5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc.). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.
- BB. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surfaces. Refer to painting section of the specifications for additional requirements.

**CC. Seismic Design, Certification and Anchoring of Electrical Equipment:**

1. Contractor shall include all costs in the base bid for labor, materials, all special inspections and structural engineering design necessary to meet the Seismic

Design Requirements for Non-Structural Components (ASCE/SEI 7 Chapter 13 Minimum Design Loads for Buildings and Other Structures) as required by CBC Section 1704A and as related to the installation all electrical equipment furnished under this contract. See Specific Project Site Seismic Criteria on architectural and/or structural plans which include Building Occupancy Category, Seismic Design Category, Design Spectral Response Acceleration ( $S_{DS}$ ), Height factor ratio ( $z/h$ ) and Site Class. Non-structural Component Importance Factor ( $I_P$ ) for a particular component shall be determined based on the following criteria:

- a.  $z/h$  - Height factor ratio: See plans for respective equipment locations.
2. Provide a delegated-design submittal for each of the following seismic-restraint systems to be used as required:
  - a. Restraint Channel Bracings consisting of MFMA-4, shop-or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.
  - b. Restraint Cables consisting of ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service, with a minimum of two clamping bolts for cable engagement.
  - c. Seismic-Restraint Accessories consisting of hanger rod/hanger rod stiffener assemblies, multifunctional steel connectors for attaching hangers to rigid channel bracings and/or restraint cables, bushings for floor and wall-mounted equipment anchor bolts and resilient isolation washers and bushings.
  - d. Mechanical Anchor Bolts consisting of drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
  - e. Adhesive Anchor Bolts consisting of drilled-in and capsule anchor system containing resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide specific LEED-compatible environmentally friendly resins and adhesives on all LEED projects. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
3. Submittal shall include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the contractor's structural engineer responsible for their preparation. Calculations shall include, but not be limited to, static and dynamic loading caused by equipment weight, operation, and seismic and, if applicable, wind forces required to select seismic and, if applicable, wind

restraints and for designing vibration isolation bases. Provide seismic and wind-restraint detailing to support system selection, arrangement of restraints, attachment locations, methods, and spacings with all components identified to include their strengths, directions and values of forces transmitted to the structure during seismic events and association with vibration isolation devices. Sizes of components shall be selected so strength will be adequate to carry present static and seismic loads to accommodate 25% spare future capacity within specified loading limits.

4. Any pre-approval and evaluation documentation shall have a California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproval (OSP) demonstrating horizontal and vertical load testing and analysis showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
5. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified elsewhere in the project specifications.
6. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment. Flexible connection limitations of the CEC shall apply.
7. Install seismic-restraint devices using methods approved by OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component.
8. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by OSHPD or an agency acceptable to authorities having jurisdiction.
9. The contractor shall engage a qualified testing agency to perform tests and inspections as listed in other Project Specifications, but as a minimum shall include at least four of each type and size of installed anchors and fasteners selected by Architect. Schedule tests with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members as required. Test to 90 percent of rated proof load of device. Prepare and submit test and inspections reports.

DD. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for complete requirements.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION AND INSTALLATION**

##### **A. Installation of Conduit and Outlet Boxes:**

1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.
2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:
  - a. When noted on the drawings.
  - b. When considered exposed to damage by the local AHJ.
  - c. When installed in wet or damp locations and of a trade size where listed-Raintite fittings, connectors, couplings etc. are unavailable.
  - d. When required by CEC Article 517.13.
  - e. When installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.
3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or steel-tube EMT and in accordance with CEC Article 342.
4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. Except when concealed in walls or other structural elements, all flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per CEC in each conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.
5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the CEC in damp and wet location, where exposed to weather, in refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per CEC in each conduit. Other uses of

liquidtight flexible conduit shall be allowed as approved in writing by the Engineer on a case by case basis.

6. Rigid metallic conduit installed underground or embedded in concrete shall be 1" trade size minimum and shall be wrapped with 20 mil. Polyvinylchloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4" minimum trade size.
7. Where required for providing an electrical circuit protective system to comply with CEC Articles 695 and 700 utilize UL Listed 2-hour fire-rated, MC cable or UL Listed 2-hour fire-rated RHH/RHW conductors in conduit.
8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.
9. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.
10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.
11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.
12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.
13. PVC conduit shall not be run in walls except where approved by the Engineer prior to bid in limited instances that may include concrete or CMU walls used in site retaining, parking structures, or exterior equipment yard or enclosure walls, etc.
14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.
15. Where conduit extends through roof to equipment on roof area, the Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner's roof warranty. This flashing shall be delivered to the roofing Contractor for installation. The actual location of all such roof penetrations and outlets shall be verified by the Architect/Owner. Contractor to verify type of flashing prior to bid and include all costs.
16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.
17. Where conduit racks are used the rack shall consist of two-piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.

18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.
19. Seismic Conduit Support:
- a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

<u>CONDUIT SIZE</u>	<u>MAXIMUM BRACE SPACING</u>
1/2" to 3"	6'-0"
3-1/2" to 4"	8'-0"

20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.
21. Open knockouts in outlet boxes only where required for inserting conduit.
22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.
23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or screwed to studs; on wood studs attachment shall be with wood screws, nails are not acceptable.
24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.
25. Junction Boxes that do not contain any device(s) shall be located in storage rooms, electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner's Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner's Project manager.
26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on architectural and/or structural drawings. If architectural and/or structural drawings are not provided on the project, Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any additional requirements imposed by the local Authority-Having-Jurisdiction.
27. Sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24-gauge galvanized steel no more than 1/2" greater in diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool and waterproof below grade.

When located in fire rated structures, provide UL listed fire stopping system. See fire stopping section of this specification for additional requirements.

28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device/method to keep dirt/debris from entering box, conduit or panels. If dirt/debris does get in, it shall be removed prior to pulling wires.
29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover, and painted as directed by the Architect with weatherproof paint to match building.
30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.
31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.
32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures
33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.
34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers. Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.
35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.
36. Except as otherwise indicated on the Drawings or elsewhere in these specifications, bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times

the internal diameter of the conduit. Except where sweeping vertically into a building, and where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12'-6" radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.

37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16-gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.
38. The following additional requirements shall apply to underground conduits:
  - a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per CEC Article 517.13.
  - b. For all communications conduits 2" and larger and feeders 100A or greater, provide with a minimum 3" inch concrete envelope with 2-inch minimum separation between conduits, installed at depth of not less than 24" below grade. Concrete to be used for encasement shall be normal weight concrete with minimum 28-day compressive strength of 2,000 psi. (Provide concrete encasement and/or greater minimum conduit depth as required by the Utility Companies.) Conduit separation within a duct bank shall be maintained using plastic spacers located at 5'-0" intervals. Where power and communication conduits are run in a common trench, a 12-inch minimum separation shall be maintained between power and communication conduits or as required by Utility Companies. Where concrete encasement is not required by serving utilities for a utility-only duct bank, provide free draining sand bedding suitable to achieve 95% relative compaction based on ASTM D1557 using 6" lifts or directed by Utility Company Standards.
  - c. In all cases, where any conduit(s) pass under a building slab or footing, the electrical Contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation extending a minimum of 24" on either side of the foundation. In all cases, where conduit(s) pass through a sleeve in a footing or other foundation element, the electrical Contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or through the slab or footing via the trench or sleeve.
  - d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.
  - e. Underground conduits, which terminate inside building(s) below grade, such as in a basement level, or which slope so that water might flow into interior



building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain membrane/system manufacturer and installer warranty for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and such that water drains into the nearest manhole, pull box or vault – not into the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) preventing both water and gas from entering the facility via the conduits.

- f. Include a separate insulated green ground conductor sized per CEC in each underground electrical feeder/branch circuit.
- g. All underground conduits with circuits rated at 40As or greater and all underground communications conduits shall be provided with a metallic marker tape located 12 inches below the finished grade.
- h. Where underground conduits sweep into/through slabs, utilize PVC 90 degree sweeps that transition, via female PVC adapter to GRC coupling mounted flush in slab. GRC couplings shall be 1/2 lap taped with 20-mil tape. If the distance of the conduit run between a sweep and the next connecting sweep, pullbox, vault or manhole exceeds 150 ft then the sweep shall be concrete encased. Exceptions:
  - 1) Communications conduits shown terminating at a finished floor shall have an additional 4" high GRC nipple equipped with a bushing, removable conduit plug, labeling tag and pull rope. Tie off pull rope to conduit plug.
  - 2) Utility conduit sweeps shall be installed per the requirements of the respective utility company.
- i. All PVC conduit shall be glued for a water and gas tight installation. The Contractor shall use appropriate solvent on all joints prior to gluing conduit and fittings together.
- j. All underground conduit work shall conform to the Federal, State and Local Safety Orders or Rules regarding excavations, trenches and related earthwork. For projects in California, refer to the California Code of Regulations, Title 8, Construction Code Sections 1540 and 1541 for additional requirements.

39. Installation of Metal Clad (MC) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing).
- a. Provide J-box above accessible ceiling prior to running MC cable within partitions or walls. J-box shall be permanently labeled with panel identification and circuit numbers contained within.
  - b. Overhead MC cable runs shall generally follow building lines to provide a neat and workmanlike installation.
  - c. Provide code-sized J-boxes to accommodate MC cable splicing in general. For systems furniture poke-through feeds utilizing MC cable, transition from MC cables to conduit and wire near the panelboard in the TI accessible ceiling space on the floor below the panel board via code-sized gutter(s). Utilize UL listed, insulated barrier strips with recessed screw heads (Ideal #89-6?? Series or equal) fastened within the gutter(s), terminate MC conductors on one side of the strips(s) and individual conductors in conduit from the panelboard(s) on the other side of the strip(s). Label each terminal strip(s) with panel designation. Label each phase conductor with circuit number using wire markers (Ideal or equal). Wire nuts are not an acceptable alternative to the terminal strips in these underfloor transition locations. Provide (1) spare 3/4" conduit from each gutter to its respective panelboard.
  - d. MC cable shall not run directly into panelboards, distribution boards or electrical rooms.
  - e. MC cabling shall be provided with its own code-approved ceiling support wires, cable hangers, individual spring steel support clips, steel trapeze hangers, threaded rods or dedicated #10 AWG drop wire. Cable supports shall be fastened to concrete slabs, beams, joists or other structural members of the building. In no case shall MC cable rest on ceilings, suspended ceilings or structures. Do not support MC cable using ceiling support wires. The use of nylon cable ties to support MC cable is not allowed.
  - f. Use lock or spring nut MC cable fittings.
  - g. Cable runs shall be continuous from wiring device to wiring device – no intermediate splicing J-boxes allowed.
  - h. When terminating or splicing at a junction, outlet, or switch box, cut the cable with an armored cable rotary cutter such that 6-inches of free conductors remain for connections or splices. Use screw-in or spring lock connector and ensure a proper bonding by firmly tightening the connector to both the box and cable. Insert an anti-short bushing at cable ends to protect conductors from abrasion and use insulated connectors.
  - i. MC cable bend radius shall not be less than seven (7) times the external diameter of the cable.

- j. MC cables passing through fire-rated walls or floors shall be firestopped as required with a UL listed system. See firestopping requirements outlined elsewhere in this specification for additional requirements.
  - k. Installation shall not exceed code requirements for total current carrying conductors in multiple MC Cable runs bundled together into a single MC cable hanger or strap unless support device is specifically listed for such purpose. Neutrals shall be counted as current carrying conductors.
  - l. Maintain MC Cable clearance of at least 6 inches from hot water and any other high temperature pipes. Maintain at least 12-inches clearance between MC cable(s) and telecommunication conduits and cables. MC cable shall cross telecommunication cables and conduits at right angles.
  - m. MC cabling shall not be run through exposed ceilings, where open grid conditions exist, exposed on walls, or exposed to view. See Power Plan and Lighting Plan General Notes for additional requirements.
40. Installation of Electrical Nonmetallic Tubing (ENT) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing).
- a. When approved for use in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing, 1/2" and 3/4" trade size ENT shall be allowed for concealed lighting branch circuits, receptacle branch circuits and miscellaneous signal system circuits within concrete floors, walls and columns within parking structures.
  - b. ENT conduit shall meet the requirements of Underwriters Laboratories Standards 1479 and 1655, NEMA TC-13, and be UL-listed.
  - c. All ENT conduit, ENT fittings, ENT boxes and ENT accessories shall be UL listed and manufactured by the same manufacturer so as to form a complete ENT system. ENT systems shall only be used if they are listed for use in fire resistance rated concrete floors and ceilings with resistance ratings as indicated elsewhere in the project plans. ENT system shall comply with CEC Article 362.
  - d. All ENT fittings and ENT boxes shall be concrete-tight listed without the use of tape. Additionally, ENT fittings shall be constructed of high impact PVC and able to resist ENT conduit pull out forces of a minimum of 175 lbs. ENT fittings with fewer than 6 locking tabs for ENT connection shall utilize manufacturer approved glue as additional protection from fitting/conduit separation. ENT conduit to rigid conduit transition fittings shall be equipped with set screw fittings on the rigid conduit side of the fitting. ENT to metal box fittings shall be equipped with a threaded end and lock washer.

- e. Where tubing enters a box, fitting, or other enclosure provide a bushing or adapter to protect conductors from abrasion unless the box, fitting, or enclosure design provides equivalent protection.
- f. ENT junction boxes shall have brass screw inserts and shall be rated to support lighting fixtures weighing less than 50 lbs.
- g. Concrete tight metal boxes shall be used to support pendant hung fixtures or fixtures over 50 lbs.
- h. ENT shall be provided in continuous lengths between junction boxes without use of in-line splices or connectors and shall be clearly marked/labeled at least every 10 feet.
- i. All ENT conduit containing electrical branch circuits shall contain a code-sized equipment ground conductor.
- j. ENT shall transition to EMT, IMC, RMC, or rigid PVC, as appropriate or as called out elsewhere in this specification, for all exposed conduits within/on/under a parking structure.
- k. ENT shall transition to appropriately sized PVC expansion joint(s) at all structure expansion or seismic joints.
- l. ENT shall be securely fastened and supported every 2 – 3 ft. and within 1 ft. of every junction box and fitting to prevent movement and sag.
- m. ENT shall be routed straight without sags, or excessive bending. Where bends are required, comply with Table 362.24 of the CEC for minimum radius of bends. Number of bends shall not exceed quantity allowed by code where used for power and lighting branch circuit and/or feeder conductors. Where utilized for communications system conductors (phones, data cabling, etc.) number of bends shall not exceed the equivalent of (2) 90-degree bends with conduit length no more than 100 feet without installation of a TIA 569-compliant pull box.
- n. Separation of ENT from fittings, excessive sags, or deflections in ENT runs that prevent pulling of wire and other ENT system product or system installation failures/errors shall be corrected by saw cutting and patching as necessary at no additional cost to the Owner. Use of surface mounted conduits and junction boxes as a repair method is unacceptable.
- o. Empty ENT runs shall be provided with a nylon pull string.
- p. Coordinate installation of raceway with structural steel and other structural members. Do not cut, notch or otherwise alter structural members without obtaining approval in writing from the Structural Engineer of record.

- q. No more than (2) 3/4" ENT conduits may cross each other within a horizontal concrete slab without obtaining approval in writing from the Structural Engineer of record.

**B. Installation of 600-Volt Conductors:**

1. All electrical wire, including signal circuits, shall be installed in conduit.
2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
  - a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y or equal as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the spring connector. **THE USE OF PUSH-WIRE CONNECTORS (e.g. "WAGO" OR EQUIVALENT) IS STRICTLY PROHIBITED.**
  - b. Wires #4 AWG and larger AWG shall be joined together as follows:
    - 1) When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.
    - 2) When located in an interior environment, the splice shall be made with an IlSCO or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90-degree Celsius rated conductors.
  - c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.
3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.
4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.
5. For 20A branch circuit wiring, increase #12 conductors to #10 for 120-volt circuits longer than 100 feet and for 277V circuits longer than 150 feet.
6. Conductor Support: Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.

**C. Grounding/Bonding:**

1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein, and as required by applicable codes. Included, but not limited to, are items that require grounding/bonding:
  - a. Conduit, Raceways and Cable Trays.
  - b. Neutral or identified conductors of interior wiring system.
  - c. Panel boards, Distribution Boards, Switchgear and Switchboards.
  - d. Non-current carrying metal parts of fixed equipment.
  - e. Telephone distribution equipment.
  - f. Transformers, Inverters, UPS, PDU, RDC, Transfer Switch and Generator Systems.
  - g. Raised Flooring.
  - h. Exposed metal in maintenance holes, hand holes.
  - i. Lightning Protection Systems and Antennas.
  - j. Metal piping installed in or attached to a building/structure.
  - k. Metallically isolated structural steel.
  - l. Metallically isolated underground metal water piping.
  - m. Elevator hydraulic piston/lift case.
2. In multi-occupancy buildings, Contractor shall bond metal water piping systems instated in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallically isolated from each other. Per CEC Article 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panel board serving that suite/occupancy.
3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and CEC, unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.

4. Grounding System Connection:
  - a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.
  - b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.
  - c. Mechanical connectors shall not be used.
5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point and shall be distinguished from other ground wires by a continuous yellow stripe.
6. Provide separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through #10 AWG. Use CEC Table 250.122 for conductor size with phase conductors #8 and larger, if not shown on the Drawings.
7. Clean the contact surfaces of all ground connections prior to making connections.
8. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.
9. Motors: Connect the ground conductor to the conduit with an approved ground, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.
10. Building grounding system resistance to ground shall not exceed 25 ohms unless otherwise noted and should be confirmed by testing.
- D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units:
  1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by the Contractor for each item or mechanical equipment.
  2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the

Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.

3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.
  4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.
  5. Unless otherwise noted, the Contractor shall furnish and install all conduit, boxes, wires, etc., for line voltage wiring and low voltage wiring.
  6. It is the Contractor's responsibility to verify with the drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.
  7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.
- E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.
- F. Firestopping:
1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services in conjunction with the selection and installation of a complete, fully functioning, code compliant, UL-listed, fire stop assembly/system(s) as required by project conditions.
  2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current UL listing, as indicated in the latest edition of the UL Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each fire stop assembly/system in accordance with the manufacturer's printed instructions.
  3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.
- G. Housekeeping Pads



1. Provide a minimum 3" high housekeeping pad above finished floor/finished grade for all floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, etc., flush with the face of the equipment. Located in mechanical central plant(s), other mechanical spaces, and located outdoors, pads shall be flush with the face of the equipment. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
2. Unless otherwise noted above, provide a minimum 1-1/2" high housekeeping pad above finished floor/finished grade for all interior floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, transfer switches etc., flush with the face of the equipment. All housekeeping pad heights are as measured from finished floor or grade. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
3. Provide a 1-1/2" high housekeeping pad above finished floor/finished for service equipment. Prior to pad rough-in, Contractor shall verify serving utility company's maximum meter height requirements and, if necessary, adjust height of housekeeping pad to comply with those requirements. In indoor applications, the pad shall be flush with the face of the switchgear. In outdoor applications, the housekeeping pad shall extend a minimum of 4 feet from the front of switchgear/switchboard's weatherproof enclosure. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
4. All housekeeping pads located in, on or attached to a building shall be seismically braced/connected to the building structure.

**END OF SECTION**

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**SECTION 31 11 00**

**CLEARING AND GRUBBING**

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**PART 1 - GENERAL**

1.01 SUMMARY

- A. Clearing vegetation, debris, trash and other materials within limits indicated.
- B. Grubbing of vegetation within limits indicated.

1.02 RELATED DOCUMENTS

- A. Caltrans Standard Specifications: Clearing and Grubbing.
- B. California Building Code: Site Work, Demolition and Construction.

**PART 2 - PRODUCTS**

2.01 NOT USED

**PART 3 - EXECUTION**

3.01 PREPARATION

- A. Locate and clearly flag vegetation to remain or to be relocated.

3.02 RESTORATION

- A. Repair or replace vegetation indicated to remain that is damaged by construction operations, as directed by the Owner.
- B. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to shrubs.

3.03 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
- B. Remove trash, debris, logs, concrete, masonry and other waste materials.
- C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
- D. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18-inches below subgrade.
- E. Use only hand methods for grubbing within drip line of remaining trees.

**END OF SECTION**



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SECTION 31 20 00

EARTHWORK

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**PART 1 – GENERAL**

1.01 WORK SPECIFIED IN THIS SECTION

- A. Work of this section includes all required excavation, grading, preparation of subgrade for fills, proper placement of fills, including backfilling and compaction, the watering, rolling and compacting of fill material in place and the finish grading all as required by the drawings and as specified herein.
- B. All grading work shall be performed in accordance with:
  - 1. Title 24, Part 2, C.C.R., 2016 C.B.C., 2015 I.B.C. with California Amendments & Supplements
  - 2. The grading code of the County and any special requirements of the permit.
  - 3. The Geotechnical Investigation report for the project site
  - 4. Provide special inspection for engineered fill and compaction, Title 24, Part 2, C.C.R., 2016 C.B.C., 2015 I.B.C. with California Amendments & Supplements
  - 5. Applicable General and Special Conditions of these specifications herein after set forth in full or by reference.
  - 6. A final grading report shall be submitted by the Geotechnical Consultant in accordance with Title 24, Part 2, C.C.R., 2016 C.B.C. Appendix J

1.02 PRINCIPAL ITEMS OR WORK INCLUDED HEREIN.

- A. Excavation
- B. Filling
- C. Backfilling
- D. Geotechnical Consultant and Tests
- E. Grading
- F. Miscellaneous related work necessary for a complete job.
- G. Special Requirements.

1.03 SCHEDULING

- A. PAD GRADING: It is imperative that Building construction commence as quickly as possible, therefore, contractor shall submit a schedule of grading that clearly establishes the construction of the Building Pad area as a priority of grading construction along with providing appropriate or required reports and certifications from the Geotechnical Consultant, Civil Engineer, and governmental authority necessary to commence foundation excavation and building construction.

1.04 RELATED WORK SPECIFIED IN OTHER SECTIONS.

- A. Clearing and Grubbing: Section 31 11 00
- B. Final subgrade preparation for asphalt paving: Section 32 12 00. Flexible Paving.
- C. Aggregate base beneath asphalt paving is specified under Flexible Paving, Section 32 12 00.
- D. Excavation and backfill for utility lines specified under Mechanical and Electrical Sections, shall be performed as specified in this Section.

## **PART 2 - PROTECTION**

- 2.01 Contractor shall protect adjacent properties, roads, right-of-ways, easements and existing improvements from damage during the life of the grading operation and prevent caving, sloughing or the placing of materials or stock piles on adjacent properties.
- 2.02 Provide cribbing, sheathing, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavating, together with suitable forms of protection against bodily injury to personnel employed on the work and the general public. The responsibility for the design, installation, and maintenance of required cribbing and shoring shall be entirely that of the Contractor and shall meet the approval of the State Division of Industrial Safety and local governing agencies' requirements.
- 2.03 Utility lines and structures shown shall be protected and treated as indicated. Where work not shown is encountered, report it to the Architect before proceeding with excavation. The Contractor shall bear the costs for all repairs to damaged or broken utilities and any damages related thereto.
- 2.04 It shall be the Contractor's full responsibility to take all measures necessary during grading to protect slope areas, both cut and fill, existing improvements and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. It shall be the Contractor's responsibility to maintain completed slopes until all slopes are in satisfactory compliance with the job specifications, all berms have been properly constructed, and all associated drainage devices have met the requirements of the Architect. It shall also be the Contractor's responsibility to prevent silt run-off from the limits of work.

## **PART 3 - GEOTECHNICAL CONSULTANT, TESTS, AND REPORTS**

- 3.01 A Geotechnical Consultant designated by the Owner will be engaged to perform continuous inspection of the placing and compacting of all fills and backfills within the limits of grading of this project. All work shall be done in accordance with these specifications and as recommended and approved by the Geotechnical Consultant. Costs for all such inspections and tests shall be paid by the Owner. The Contractor shall be responsible for notifying the Geotechnical Consultant in advance so that he may be present to perform his

services as needed. The Geotechnical Consultant shall approve all subgrades prior to placement of fill or placement of forms and reinforcing.

- 3.02 The Geotechnical Consultant shall also make an investigation of the fill material to establish the ability of the soil to sustain the vertical loads to be imposed on the fill by the proposed structure.
- 3.03 The Geotechnical Consultant shall submit compaction reports to the Architect and the Civil Engineer at the completion of the work, including test results and plot plans indicating the locations from which the tested samples of fill were taken. The Geotechnical Consultant shall keep the Architect informed on the progress of the grading work.
- 3.04 No clearing, demolitions, filling and backfilling, or grading operations shall be performed without the presence of a representative of the Geotechnical Consulting firm. Operations undertaken at the site without the Geotechnical Consultant present may result in exclusions of affected areas from the final compaction report for the project. The presence of the Geotechnical Consultant will be for the purpose of providing observation and field testing, and will not include any supervising or directing of the actual work of the Contractor, directing his/her employees or agents. Neither the presence of the field representative nor the observations and testing by the Geotechnical Consulting firm shall excuse the Contractor in any way for defects discovered in the Contractor's work. The Geotechnical Consulting firm shall not be responsible for job or site safety on this project, which shall be the sole responsibility of the Contractor.
- 3.05 The existing soil conditions at this site have been investigated, and a report of findings is on file at the Owners office for review by the Contractors during the bidding period. This information is offered as supplemental information only, and no guarantee of existing soil or other conditions is intended.

#### **PART 4 - MATERIALS**

- 4.01 All imported material and sources for import material shall be approved by the Geotechnical Consultant prior to hauling on site. Contractor shall be responsible for communicating the necessary information to the Geotechnical Consultant in a timely manner so the Geotechnical Consultant may perform appropriate testing and reporting.
- 4.02 The Contractor shall import any and all additional fill material required to complete the grading on this project. Imported fill soils shall be non-expansive, granular soils meeting the USCS classifications of SM, SP-SM or SW-SM with a maximum rock size of 3 inches and 5 to 35% passing the No. 200 sieve. The Geotechnical Consultant shall evaluate the import fill soils before hauling to the site. The imported fill shall be placed in lifts no greater than 8 inches in loose thickness and compacted to at least 90% relative compaction (ASTM D1557) near optimum moisture content.
- 4.03 Fill material within new building and paved areas shall be clean, well-pulverized soil free of vegetation matter, rocks larger than 3 inches in any dimension, and other debris, and shall be subject to approval by the Geotechnical Consultant.
- 4.04 Backfill material for storm drain and utility lines shall be non-expansive granular materials, such as clean sand, and shall be placed in a minimum thickness of 6 inches for bedding

and backfilled to 12 inches above top of pipe. Bedding sand shall have a sand equivalent value of 30 or greater determined in accordance with Cal-Trans Test Method # 217.

## **PART 5 - SURPLUS EARTH MATERIAL**

- 5.01 All surplus earth material not needed for the completion of the grading shall be removed from the site by the Contractor and disposed of in a legal manner.

## **PART 6 - INADEQUATE SOIL CONDITIONS**

- 6.01 Should soil of inadequate density and bearing capability be encountered at the elevations indicated on the drawings, or where new fill is to be placed upon existing loose fill material exposed by excavation, the excavation shall be carried to the depth required to attain soil of bearing quality as determined by the Geotechnical Consultant. The adequacy of all soil bearing value shall be determined by the Geotechnical Consultant.

## **PART 7 - EXECUTION**

### **7.01 PRE JOB CONFERENCE**

An onsite pre job meeting with Architect, the Construction Manager, the Geotechnical Consultant, Civil Engineer, Inspector, and the Utility Line and Earthwork Subcontractor(s) is required prior to all grading related operations. ATTENDANCE IS MANDATORY.

### **7.02 PREPARATION**

- A. Protect adjacent property and existing improvements and structures as necessary to prevent undermining, caving of cuts, and miscellaneous damage, or sloughing of material onto adjacent property.
- B. Provide cribbing, sheathing, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavation together with suitable forms of protection against bodily injury to personnel employed on the work and the general public. Be responsible for the design, installation, and maintenance of required cribbing and shoring and same shall meet the approval of the State Division of Industrial Safety and local governing agencies' requirements.
- C. Protect existing improvements and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. Prevent silt runoff from the limits of work in accordance with governmental requirements, and the S.W.P.P.P.
- D. Borrow pits, if any, shall meet all requirements of these Specifications for over-excavation and backfill.

### **7.03 DUST CONTROL**

During all grading operations, water shall be applied to the surfaces in the working area at frequent intervals and in sufficient quantities to allay the dust and for proper compaction. No other method will be permitted.

### **7.04 CLEAN-UP**

Upon completion of work in this Section, remove rubbish, trash, and debris resulting from operations. Remove disused equipment and implements of service, and leave entire area involved in a neat, clean, and acceptable condition.

### **7.05 EXCAVATION**

- A. Prior to any excavation or filling operation, the entire area within the limits of work containing vegetation shall be excavated to a minimum depth to ensure removal of all vegetation. This material shall be disposed of off the site in a legal manner.
- B. Excavate to the depths, lines, and grades indicated. Excavate sufficiently over-size to permit installation and removal of concrete forms and all other required work.
- C. Footing pads, if poured neatly, may be excavated to the net pad widths plus two inches if approved by the Architect. Approval will not be given until the completed excavation has been inspected.
- D. Should footing excavations exceed reburied dimensions or should sloughing occur, fill such extra space with concrete at no additional cost to the contract. If unsuitable material is found at the indicated depths, immediately notify the Architect.
- E. Sequencing of the work to ensure that one part of the excavating does not interfere with another part rests with the Contractor.
- F. Notify the Structural Engineer 48 hours before foundation excavations are ready for inspection.
- G. The bottoms of footings shall be free of loose material, debris, and water before concrete is placed.
- H. Cut banks shall be neatly trimmed to the required finish surface as the cut progresses, or the Contractor shall have the option of leaving the cuts full and finish grading by mechanical equipment which will produce the finish surfaces as shown on the drawings.
- I. All cut or "at grade" building, concrete and asphalt pavement areas shall be scarified to a minimum depth of 8 inches below subgrade brought to an optimum moisture content, and compacted to a density of not less than 90% of maximum dry density.

### **7.06 FILLING**



- A. Prior to placing new fill in all other areas, the exposed cleared surface should be plowed, scarified, or otherwise processed to a depth of at least 24 inches, watered and/or aerated, as required, thoroughly mixed to a uniform, near optimum moisture condition, and recompact to at least 90 percent of the ASTM D1557 test standard.
- B. All recompact and new fill required to secure final subgrade elevations should be spread, water and/or aerated as required, thoroughly mixed to a uniform near optimum moisture condition, and compacted in approximated 8-inch thick lifts to at least 90 percent. Backfilling of excavations made for removal of any existing buried elements during site clearing should also be performed in this manner.
- C. Imported fill materials should consist of clean soils, free from vegetation, debris, or rocks larger than 3 inches. The Expansion Index value should not exceed a maximum of 50 ("Low" expansive per UBC Table 18-1-B.)
- D. Where fills are placed on existing slopes exceeding a slope of five horizontal to one vertical, the slopes shall be benched in accordance with the Geotechnical Consultant's requirements and local governing public agencies' requirements, and compacted as herein specified before placing fill material on same, so that all fills shall be placed in horizontal layers as specified. Widths of benches shall be as directed by the Geotechnical Consultant.
- E. Rock encountered in the excavation on this site may, at the option of the Contractor, be broken up into pieces not larger than three inches in maximum dimension, and be incorporated in the fill material if spread as directed by the Geotechnical Consultant. Otherwise, all rocks larger than three inches in maximum dimensions shall be removed from the site. Rocks and stones larger than one inch in maximum dimension will not be permitted within the top 12 inches of finished grade in non-paved areas.
- F. Fill banks shall be graded full and compacted beyond the grade of the finish bank. After the banks have been filled, they shall be trimmed to the finish grades and limits shown on the drawings.

#### **7.07 BACKFILLING**

- A. Place no backfill until work in excavations has been approved. Remove cave-ins and loose soil to permit inspection.
- B. Place backfill in layers which will compact to six inches maximum, concurrently on both sides of footings and walls. Thoroughly compact each layer with mechanical tampers, adding water as required to obtain optimum moisture content, and compact as set forth in paragraph 7.9 herein.
- C. Backfill placed in narrow, restricted areas, such as along utility trenches, may possibly be placed in up to 12-inch thick lifts, depending on the materials, procedures and equipment being employed. Backfill consolidation by flooding or jetting is prohibited unless approved by the Geotechnical Consultant. In any case,

all backfill should be mechanically compacted to at least 90 percent of the aforementioned test standard.

#### **7.08 FINISH GRADING**

- A. The entire area within the limits of grading as indicated on the Drawings shall be constructed to the lines, grades, elevations, slopes, and cross sections indicated on the Drawings. When the grading has been completed, the areas shall be rolled smooth with a steel tandem roller or equal.
- B. Fine grade to bring areas to required lines and grades. The subgrade elevation within the building area for slabs on grade (without a base course) shall be within 0.50 inch along a 10-foot straight edge.
- C. Slope finish grades to drain surface water away from buildings, walks, paving, and other structures. Generally, grade with uniform slope between points where elevations are given, or between such points and existing grades. Excavate and grade swales to provide drainage away from and around buildings.
- D. Areas to Receive Paving or Surfacing: Review plans and details for each area. See plans for paving and base course thickness. Review Drawings for site work details.
- E. Areas to Receive Interior Building Slab-on-Grade: Review plans and details for thickness of slabs and granular fill under slabs.
- F. Areas to receive Topsoil and/or Planting: Where not otherwise indicated, areas outside of buildings shall be given uniform slopes between points for which finish grades are shown, or between such points and existing established grade, except that vertical curves or roundings shall be provided at abrupt changes in slope.
- G. Rocks or cobbles larger than 1-inch in diameter shall not be placed in the upper 12-inches of planting area fill, rocks, or cobbles larger than 3/4 inch shall not appear on the finish graded surface.
- H. It shall be the Contractor's full responsibility to take all measures necessary during grading to protect slope areas, both cut and fill, and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. It shall be the Contractor's responsibility to maintain completed slopes until all slopes are in satisfactory compliance with the job specifications.

#### **7.09 COMPACTION**

- A. All fills shall be compacted to at least 90 percent of maximum density obtainable using the ASTM test procedure D1557. All areas, which are scarified, shall be recompacted to these same requirements.
- B. All earthwork operations should be subject to compaction monitoring field observation and testing by the Geotechnical Consultant. The Geotechnical Consultant should be notified at least two days in advance of the start of grading. A

joint meeting between a representative of the Client, the Contractor and the Geotechnical Consultant is recommended prior to grading to discuss specific procedures and scheduling.

- C. Compaction by flooding or jetting is prohibited unless approved by the Geotechnical Consultant.

## **7.10 SPECIAL REQUIREMENTS**

### **A. REMEDIAL GRADING**

- 1. **Building slabs and Footings**  
Overexcavate to a depth of 2 feet below existing grade or the bottom of building footings, whichever is greater, to extend a minimum of 5 feet beyond the outer edge of the building slabs or footings (including column supports).
- 2. **Garden and Retaining walls**  
Overexcavate to a depth of 2 feet below existing grade or the bottom of footings, whichever is greater, to extend a minimum of 2 feet beyond the face of the footing.
- 3. **Areas to receive fill, pavements or hardscape**  
The top 18 inches of the native subgrade shall be overexcavated. The bottom of overexcavation shall be scarified an additional 6 inches, moisture conditioned and compacted to 90% relative compaction per ASTM D1557.

- B. A representative of the Geotechnical Consultant's firm shall observe the bottom of all excavations. Artificial fill, soft soils, organic soils, or other unsuitable material remaining in the bottom of the excavations shall be overexcavated until competent natural material is encountered. Competent natural soil is defined as undisturbed material exhibiting a relative compaction of at least 85 percent.

- C. Prior to replacing compacted fill in over-cut building, concrete flatwork and A.C. paved areas, the exposed over-cut surface should be plowed, scarified, or otherwise processed to an additional depth of at least 12 inches, water and/or aerated as required, thoroughly mixed to an uniform, near optimum moisture condition, and recompact to at least 90 percent of maximum dry density obtainable using the ASTM D1557 test standard.

- D. All recompact and new fill should be spread, watered, mixed and compacted by mechanical means in approximate 8 inch thick lifts to at least 90 percent of the aforementioned standard.

- E. Completed building, exterior concrete pavement, and A.C. pavement subgrades should be trimmed and rolled to a firm smooth surface. Final watering and rolling should be performed immediately prior to placing concrete or paving.

- F. Prior to placing backfill within the remaining excavation behind new retaining walls, these areas should first be cleared of all significant vegetation, construction debris, loose and/or disturbed soils, etc. All new backfill should be spread, watered or aerated as required, thoroughly mixed to a uniform near optimum moisture condition and compacted by mechanical means in approximate 6 to 8 inch thick lifts. The degree of compaction obtained should be at least 90 percent of maximum dry density per the ASTM D1557 laboratory test standard.
- G. The top 12 inches of soil within all designated planted areas shall be imported topsoil or stockpiled existing site soil capable of supporting plant growth. The 12-inch layer shall be measured down from the finish grade shown on the project drawings.
- H. At the completion of grading operations and prior to building, A.C. pavement and concrete paving construction, Contractor shall provide an as-built grading plan at his own expense. As-built grading plan shall be prepared, signed and dated by a licensed land surveyor or Registered Civil Engineer licensed to practice land surveying.
- I. The upper 6 inches of subgrade soils shall be compacted to 95% of maximum dry density when no aggregate base material is specified for asphalt paving.

**END OF SECTION**

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SECTION 31 23 00

EXCAVATION AND FILL

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, walks, paths, or trails and any other site improvements called for on the Plans.

1.02 SECTION EXCLUDES

- A. Earthwork related to underground utility installation, see Section 31 23 33 – Trenching and Backfilling.

1.03 RELATED DOCUMENTS

A. ASTM:

- 1. D 1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- 2. D 1586, Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.
- 3. D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- 4. D 3740, Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- 5. D 4318. Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- 6. E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing or special Inspection.

B. California Code of Regulation Title 24, Part 2, California Building Code:

- 1. Accessibility to Public Buildings.
- 2. Safeguards During Construction.

C. Caltrans Standard Specifications:

- 1. Watering.
- 2. Earthwork.

- D. CAL/OSHA, Title 8.

#### **1.04 DEFINITIONS**

- A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.
- B. Excavation: Removal of material encountered above subgrade elevations.
  - 1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans.
  - 2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions. Unauthorized excavation shall be without additional compensation.
- C. Structural Backfill: Soil materials used to fill excavations resulting from removal of existing below grade facilities, including trees. Any fill soil or aggregate base or crush rock under the building shall not contain recycled asphalt, asphalt grindings, or soil with petroleum products. See Section 31 23 33 – Trenching and Backfilling.
- D. Structural Fill: Soil materials used to raise existing grades.
- E. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material  $\frac{3}{4}$ -cubic yards or more in volume that, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.
- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.
- H. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project.
- I. Utilities: onsite underground pipes, conduits, ducts and cables.

#### **1.05 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

#### **1.06 QUALITY ASSURANCE**

- A. Conform all work to the appropriate portion(s) of the California Code of Regulations, Title 24 and Caltrans Standard Specifications.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

- C. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces.
- D. Finish soil grade tolerance at completion of grading:
  - 1. Building and paved areas: +0.05
  - 2. Other areas:  $\pm 0.10$  feet.
- E. The project geotechnical engineer shall be notified of the construction schedule at least one week prior to the beginning of major site construction, and notified at least 48 hours (working days) before being required to perform field observation and testing.

#### **1.07 PROJECT CONDITIONS**

- A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless the Contractor has notified the Owner in writing of differing conditions prior to the Contractor starting work on affected items.
- B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.
- D. Temporarily stockpile fill material in an orderly and safe manner and in a location approved by the Owner.
- E. Provide dust and noise control in conformance with Division 1 General Requirements for Cleaning and Waste Management.
- F. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

**PART 2 - PRODUCTS**

**2.01 SOIL MATERIALS**

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from on-site excavations.
- B. On-Site Structural Fill and Structural Backfill: Soil or soil-rock mixture from on site excavations, free from organic matter or other deleterious substances. On-site structural fill and backfill shall not contain rocks or rock fragments over 4 inches in greatest dimension and not more than 15 percent shall be over 2-1/2 inches in greatest dimension and with an organic content less than 3.0 percent by weight.
- C. Imported Structural Fill and Structural Backfill: Conform to the requirements of on-site structural fill. Material shall also be a non-expansive and predominantly granular soil or soil-rock mixture with plasticity index of 15 or less in accordance with ASTM D 4318 and an R-Value of 25 or greater.

**PART 3 - EXECUTION**

**3.01 GENERAL**

- A. Earthwork: conform to Caltrans Standard Specifications as modified by the Contract Documents.
- B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- C. The use of explosives will not be permitted.

**3.02 CONTROL OF WATER AND DEWATERING**

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.
- B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- C. Obtain the Owner's approval for proposed control of water and dewatering methods.
- D. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- E. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.
- F. Maintain dewatering system in place until dewatering is no longer required.



**3.03 WET WEATHER CONDITIONS**

- A. Do not prepare subgrade, place or compact soil materials if above optimum moisture content.

**3.04 BRACING AND SHORING**

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

**3.05 EXCAVATION**

- A. Excavate earth and rock to lines and grades shown on drawings and to the neat dimensions indicated on the Plans, required herein or as required to satisfactorily compact backfill.
- B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- C. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- D. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

**3.06 REMOVAL OF EXISTING FILLS AND UNSUITABLE MATERIAL**

- A. Over-excavate areas of existing fills and other unsuitable material encountered during mass grading.

- B. Compensation for increased removal widths and depths that are not required will not be considered, except when such increase is necessary for protection of life and property as determined by and approved by the Owner.

**3.07 GRADING**

- A. Uniformly grade the Project to the elevations shown on plans.
- B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.
- C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

**3.08 SUBGRADE PREPARATION**

- A. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.
- B. Prepare subgrades under paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.
- C. Prepare subgrades for paved areas, curbs and gutters by plowing or scarifying surface at least 6 inches below final subgrade elevations and 5-feet beyond edge of pavement. Uniformly moisture condition to obtain optimum moisture contents. Break clods and condition surface by harrowing or dry rolling. Remove boulders, hard ribs and solid rock. Prepare earth uniform for full depth and width of subgrade.
- D. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.

**3.09 PLACEMENT OF STRUCTURAL FILL**

- A. Place structural fill on prepared subgrade.
- B. Spread structural fill material in uniform lifts not more than 8-inches in un-compacted thickness and compact.
- C. Place structural fill material to suitable elevations above grade to provide for anticipated settlement and shrinkage.
- D. Overbuild fill slopes to obtain required compaction. Remove excess material to lines and grades indicated.
- E. Do not drop fill on structures. Do not backfill around, against, upon concrete, or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.
- F. Backfill in uniform lifts not exceeding 8 inches in uncompacted thickness. Each lift should be brought to a uniform moisture content of at least 1 percent above optimum prior to

compacting by either spraying the soil with water if it is too dry or aerating the material if it is too wet.

### **3.10 KEYWAYS AND BENCHES**

- A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway 3-feet minimum into competent, undisturbed soil or 3-feet minimum into competent, undisturbed rock.
- B. Place subsurface drains in bottom of keyway in conformance with Section 33 46 00 – Subdrainage.
- C. Bench subgrade as indicated above toe of fill.
- D. Place subsurface drains at benches every 20 vertical feet.

### **3.11 LOT FINISH GRADING**

- A. Blade finish lots to lines and grades indicated.

### **3.12 COMPACTION AND TESTING**

- A. Do not compact by ponding, flooding or jetting.
- B. Compact soils at optimum water content. Aerate material if it is too wet. Add water to material if it is too dry. Thoroughly mix lifts before compaction to ensure uniform moisture distribution.
- C. Perform compaction using rollers, pneumatic or vibratory compactors.
- D. Compaction requirements:
  - 1. Compact structural fills less than 5-feet thick to 90 percent compaction.
  - 2. Compact structural fill 5-feet thick or greater to 95 percent compaction.
  - 3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5-feet beyond pavement.
  - 4. Compact the upper 6-inches of subgrade soils to the following percentage of compaction: 95 percent under walks and pavements; 93 percent for foundations; and 90 percent for areas to receive structural fill.”

### **3.13 DISPOSAL**

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

**END OF SECTION**

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**SECTION 31 23 33**

**TRENCHING AND BACKFILLING**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping and associated structures.

**1.02 SECTION EXCLUDES**

- A. Drainage fill material and placement around subdrains.
- B. Trenching and backfill for other utilities such as underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc.

**1.03 RELATED DOCUMENTS**

**A. ASTM:**

- 1. C 33, Standard Specification for Concrete Aggregates.
- 2. C 150, Standard Specification for Portland Cement.
- 3. C 260, Standard Specification for Air-Entraining Admixtures for Concrete.
- 4. C 618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- 5. D 1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- 6. D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- 7. D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- 8. D 3740, Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- 9. E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

**B. California Code of Regulation Title 24, Part 2, California Building Code:**

- 1. Accessibility to Public Buildings.

- 2. Safeguards During Construction.
  - C. Caltrans Standard Specifications:
    - 1. Earthwork.
    - 2. Aggregate Bases.
    - 3. Subsurface Drains.
    - 4. Geosynthetics.
  - D. CAL/OSHA, Title 8.
- 1.04 DEFINITIONS
- A. AC: Asphalt Concrete.
  - B. ASTM: American Society for Testing and Materials.
  - C. Bedding: Material from bottom of trench to bottom of pipe.
  - D. CDF: Controlled Density Fill.
  - E. DIP: Ductile Iron Pipe.
  - F. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.
  - G. PCC: Portland Cement Concrete.
  - H. RCP: Reinforced Concrete Pipe.
  - I. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of  $\frac{1}{2}$  the outside diameter measured from the top or bottom of the pipe.
  - J. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.
  - K. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
    - 1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans.
    - 2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions. Unauthorized excavation shall be without additional compensation.
  - L. Utility Structures:
    - 1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
    - 2. Sanitary sewer manholes, vaults, etc.

3. Water vaults, etc.

#### 1.05 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product Data:
  1. Grading and quality characteristics showing compliance with requirements for the Work.
  2. Certify that material meets requirements of the Project.
- C. Samples:
  1. If required, provide 40-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material.
  2. Provide materials from same source throughout work. Change of source requires approval of the Owner.

#### 1.06 QUALITY ASSURANCE

- A. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- C. Conform work to the requirements of the California Building Code: Pipe and Trenches.

#### 1.07 PROJECT CONDITIONS

- A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.
- B. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.
- D. Provide dust and noise control in conformance with Division 1 General Requirements for Cleaning and Waste Management.

**PART 2 - PRODUCTS**

**2.01 PIPE BEDDING AND INITIAL BACKFILL**

- A. ASTM D 2321, Class IA, IB or II.
  - 1. Clean and free of clay, silt or organic matter.
- B. Permeable Material: Conform to Caltrans Standard Specifications, Class 2 permeable.
- C. Class 2 Aggregate Base: Conform to Caltrans Standard Specifications, ¾-inch maximum. Material shall also be non-expansive and predominantly granular soil or soil-rock mixture "(percent of passing #200: 50 maximum, 5 minimum)" with plasticity index of 15 or less.
- D. Sand: Conform to Caltrans Standard Specifications.

**2.02 WARNING TAPE**

- A. See Section 33 10 00 – Water Utilities.

**2.03 SUBSEQUENT BACKFILL**

- A. Conform to on-site or imported structural backfill in Section 31 23 00 – Excavation and Fill.

**2.04 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)**

- A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8-inch top size. The 3/8-inch aggregate shall not comprise more than 30% of the total aggregate content.
- B. Cement: Conform to the standards as set forth in ASTM C-150, Type II Cement.
- C. Fly Ash: Conform to the standards as set forth in ASTM C-618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.
- D. Air Entraining Agent: Conform to the standards as set forth in ASTM C-260.
- E. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
- F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.
- G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained

air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

**2.05 CONCRETE STRUCTURE BEDDING AND BACKFILL**

- A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill.
- B. Poured-in-Place Structures:
  - 1. Bedding: In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
  - 2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 23 00 – Excavation and Fill.

**2.06 FILTER FABRIC**

- A. Filter Fabric:
  - 1. Filter Fabric: per Caltrans Standard Specifications.

**PART 3 - EXECUTION**

**3.01 TRENCHING AND EXCAVATION**

- A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12-inches beyond the edge of the trench.
- B. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
- C. Excavation Depth for Bedding: Minimum of 4-inches below bottom, except that bedding is not required for nominal pipe diameters of 2-inches or less.
- D. Excavation Width at Springline of Pipe:
  - 1. Up to a nominal pipe diameter of 24-inches: Minimum of twice the outside pipe diameter.
  - 2. Nominal pipe diameter of 30-inches through 36-inches: Minimum of the outside pipe diameter plus 2-feet.
  - 3. Nominal pipe diameter of 42-inches through 60-inches: Minimum of the outside pipe diameter plus 3-feet.



- E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
- F. Comply with the Owner's limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of the Owner.
- G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
- H. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

### **3.02 CONTROL OF WATER AND DEWATERING**

- A. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water.
- B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- C. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.
- D. Maintain dewatering system in place until dewatering is no longer required.

### **3.03 BRACING AND SHORING**

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

**3.04 PIPE BEDDING**

- A. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 95% relative compaction unless specified otherwise on the. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of bedding material will not be permitted.

**3.05 WARNING TAPE**

- A. Install in accordance with Section 33 10 00 – Water Utilities.

**3.06 BACKFILLING**

- A. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12-inches above the top of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of initial backfill material will not be permitted.
- B. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, unless specified otherwise on the Plans. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of subsequent backfill material will not be permitted.
- C. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe.

**3.07 CLEANUP**

- A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.
- B. See Section 01 74 00 – Refer to Division 1 General Requirements for Cleaning and Waste Management for further cleanup requirements.

**END OF SECTION**

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SECTION 31 31 19

VEGETATION CONTROL

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Application of soil sterilant on subgrades for roadways, driveways, parking areas, walks, paths, trails and any other site improvements called for on the plans.

1.02 RELATED SECTIONS

- A. Section 31 23 00 – Excavation and Fill.

1.03 RELATED DOCUMENTS

- A. CAL/OSHA, Title 8.

1.04 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

**PART 2 - PRODUCTS**

2.01 SOIL STERILANT

- A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wet-able powder form.

**PART 3 - EXECUTION**

3.01 SOIL STERILIZATION

- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.
- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

**3.02 DISPOSAL**

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

**END OF SECTION**

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SECTION 32 05 23

CONCRETE FOR EXTERIOR IMPROVEMENTS

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Materials for portland cement concrete.
- B. Aggregate and aggregate grading for portland cement concrete.
- C. Water for portland cement concrete.
- D. Admixtures for portland cement concrete.
- E. Proportioning for portland cement concrete.
- F. Mixing and transporting portland cement concrete.
- G. Formwork for cast in place portland cement concrete.
- H. Embedded materials for portland cement concrete.
- I. Steel reinforcement for portland cement concrete.
- J. Placing and finishing portland cement concrete.
- K. Curing portland cement concrete.
- L. Protecting portland cement concrete.

**1.02 RELATED DOCUMENTS**

- A. ASTM Standards
  - 1. A 1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
  - 2. A 615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  - 3. C 94, Standard Specification for Ready-Mixed Concrete.
  - 4. C 114, Standard Test Methods for Chemical Analysis of Hydraulic Cement.
  - 5. C 150, Standard Specification for Portland Cement.
  - 6. C 618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
  - 7. D 1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruded and Resilient Bituminous Types).
- B. Caltrans Standard Specifications:
  - 1. Concrete Structures.
  - 2. Concrete Curbs and Sidewalks.
  - 3. General section of Concrete section.
- C. California Building Code:
  - 1. Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
  - 2. Concrete.
  - 3. Safeguards During Construction.

**1.03 DEFINITIONS**

- A. ASTM: American Society for Testing and Materials.

**1.04 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

- B. Design Mixes: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.
- C. Reinforcing Steel Shop-Drawings

#### **1.05 QUALITY ASSURANCE**

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Standard Specifications.
  - 1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.
- B. Certifications:
  - 1. Provide Owner's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
  - 2. Materials contained comply with the requirements of the Contract Documents in all respects.
  - 3. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
  - 4. Statement of type and amount of any admixtures.
  - 5. Provide Owner's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.
- C. Conform to the applicable provisions of the Caltrans Standard Specification and these Technical Specifications.
  - 1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
  - 2. Construct "V" ditches in accordance with Section 72-5.03 of the Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73 instead of 53, or as otherwise required in these Technical Specifications or shown on the Plans.
  - 3. Conform other construction of portland cement concrete items to the requirements of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
- D. Conform to the requirements of the California Building Code for testing of reinforcing bars.

#### **1.06 DESIGNATION**

- A. General: Whenever the 28-day compressive strength is designated herein or on the plans is greater than 3,600 psi, the concrete shall be considered to be designated by

compressive strength. The 28-day compressive strength shown herein or on the plans which are 3,600 psi or less are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the plans, the concrete shall contain the cement per cubic meter shown in section 90-1.01 of the Caltrans Standard Specifications.

- B. Unless specified otherwise herein or on the Plans, Portland Cement Concrete for this Project shall be Class "2" as specified in the Caltrans Standard Specifications.

## **PART 2 - PRODUCTS**

### **2.01 PORTLAND CEMENT**

- A. General: Type V or type II (modified) cement conforming to the requirements of ASTM C 150, with the following modifications:
  - 1. Cement shall not contain more than 0.60% by weight of alkalis, calculated as the percentage of  $\text{Na}_2\text{O}$  plus 0.658 times the percentage of  $\text{K}_2\text{O}$  when determined by either 4 intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in accordance with the requirements of ASTM C 114.
  - 2. The autoclave expansion shall not exceed 0.50%.
  - 3. Mortar containing the Portland Cement to be used and the sand, when tested in accordance with Test Method No. Calif. 527, shall not expand in water more than 0.010% and shall have an air content less than .048%.
  - 4. Allowable tri-calcium Aluminate ( $\text{C}_3\text{A}$ ) by weight shall not exceed 5%. Allowable tetracalcium aluminoferrite plus twice the tricalcium aluminate ( $\text{C}_4\text{AF}+2\text{C}_3\text{A}$ ) by weight shall not exceed 25%. The sulfate expansion test (ASTM C 452) may be used in lieu of the above chemical requirements, provided the sulfate expansion does not exceed 0.040% at 14 days (max.).
  - 5. Contractor may substitute pozzolan for Portland Cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C 618.
- B. Cement for Surface Improvements: Provide a coloring equivalent to ¼ pound of lampblack per cubic yard. Add to the concrete at the central mixing plant.
- C. Liquiblack, as supplied by Concrete Corporation of Redwood City, California, may be used in lieu of lampblack. One pint of liquiblack shall be considered equal to one pound of lampblack.

### **2.02 AGGREGATE AND AGGREGATE GRADING**

- A. General: Conform to the requirements of the Caltrans Standard Specifications.
- B. Aggregate Size and Gradation: Conform to the requirements of the Caltrans Standard Specifications for 25-mm (1-inch) maximum combined aggregate.

### **2.03 WATER**

- A. General: Conform to the requirements of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

### **2.04 CLASSIFICATION OF PORTLAND CEMENT CONCRETE**

- A. Concrete for the following items shall be designated by the following classes per of the Caltrans Standard Specifications:
  - 1. Vehicular Pavement: Class 2.
  - 2. Curbs, Gutters, and Sidewalks: Minor Concrete.
  - 3. Cast in place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of Portland cement per cubic yard of concrete.
  - 4. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
  - 5. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of Portland cement per cubic yard of concrete.
  - 6. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of Portland cement per cubic yard of concrete.

## **2.05 EXPANSION JOINT MATERIAL**

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
  - 1. Curbs, Curb Ramps, Island Paving, Sidewalks, Driveways and Gutter Depressions: ¼-inch.
  - 2. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½-inch.
  - 3. Structures: As indicated.

## **2.06 REINFORCEMENT AND DOWELS**

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.
- B. Slip dowels, where noted or called for on the plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM Designation A 1064 for the material and mesh. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM Designation A 1064.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

## **2.07 COLOR AND PATTERN FOR DECORATIVE SURFACES**

- A. Colors for decorative surfacing shall be CHROMIX admixtures as manufactured by



the L. M. Scofield Company, Schedule A-312.05 or approved equal. The specific color shall be as designated or called for on the Plans.

- B. Patterns for decorative surfacing shall be standard "Bomanite" patterns as copyrighted by the Bomanite Corporation of Palo Alto, California or equal. The specific pattern shall be as designated or called for on the Plans.

## **2.08 ACCESSORY MATERIALS**

- A. Conform water stops and other items required to be embedded in of Portland Cement Concrete structures to the applicable requirements of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans or detail drawings.
- B. Curing Compounds:
  - 1. Regular Portland Cement Concrete: "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" conforming to the requirements contained in the Caltrans Standard Specifications.
  - 2. Color Conditioned Decorative Portland Cement Concrete: LITHOCHROME colorwax as manufactured by the L. M. Scofield Company or approved equal.

## **2.09 FORMS**

- A. Conform to the requirements of the Caltrans Standard Specifications.

## **2.10 PRECAST CONCRETE STRUCTURES**

- A. Conform to the following Sections of Caltrans Standard Specifications:
  - 1. Minor Structures.
  - 2. Flared End Sections.
  - 3. Precast Concrete Structures.

## **2.11 PORTLAND CEMENT CONCRETE VEHICULAR PAVEMENT**

- A. General: See Section 32 13 00 – Rigid Paving.

## **PART 3 - EXECUTION**

### **3.01 STRUCTURAL EXCAVATION**

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density.
- C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

### **3.02 SOIL STERILANT**

- A. Furnish and apply to areas indicated in accordance with Section 31 31 19 – Vegetation Control.

### **3.03 BRACING AND SHORING**

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

#### **3.04 PLACING CONCRETE FORMS**

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

#### **3.05 PLACING STEEL REINFORCEMENT**

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
  - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
  - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports

and ties of such strength and density to permit walking on reinforcing without undue displacement.

- C. Place reinforcing to provide the following minimum concrete cover:
  - 1. Surfaces exposed to water: 4-inches.
  - 2. Surfaces poured against earth: 3-inches.
  - 3. Formed surfaces exposed to earth or weather: 2-inches.
  - 4. Slabs, walls, not exposed to weather or earth: 1-inch.
- D. Minimum spacing, center of parallel bars shall be two and one half (2-1/2) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

### **3.06 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE**

- A. Transit mix concrete in accordance with the requirements of ASTM Designation C 94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner's Representative.
- B. Do not hand mix concrete for use in concrete structures.

### **3.07 PLACING PORTLAND CEMENT CONCRETE**

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

### **3.08 PLACING ACCESSORY MATERIALS**

- A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.
- B. Curing Compounds:
  - 1. Regular Portland Cement Concrete: Apply "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" in accordance with Caltrans Standard Specifications.
  - 2. Color Conditioned Decorative Portland Cement Concrete: Apply LITHOCHROME colorwax in accordance with the manufactures instructions.

**3.09 EXPANSION JOINTS**

- A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, sidewalks, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch (1/2" x 12") smooth slip dowels in the positions shown or noted on the detail drawings.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

**3.10 WEAKENED PLANE JOINTS**

- A. Construct weakened plane joints in concrete curbs, gutters, sidewalks, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.
  - 1. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8-inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

**3.11 FINISHING CONCRETE**

- A. Finish curb and gutter in conformance with the applicable requirements of the Caltrans Standard Specifications as modified herein.
- B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.
- C. Provide a medium broom finish to all horizontal surfaces unless otherwise shown.

**3.12 FORM REMOVAL**

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.
- D. Leave edge forms in place at least 24 hours after pouring.

**3.13 CONSTRUCTION**

- A. Form, place and finish concrete walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of the Caltrans Standard Specifications as modified herein.
- B. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12-inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6-inch deep lift of asphalt concrete after gutter form is removed.

**3.14 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS**

- A. New curb, gutter, or sidewalk is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert 1/2-inch diameter by 12-inch long dowels at 24-inches on center

into existing improvements. Install pre-molded expansion joint filler at the matching joint.

- B. A cold joint to the existing curb is not acceptable.

**3.15 DECORATIVE SURFACING CONSTRUCTION**

- A. Decorative surfacing concrete walks, concrete median islands or other installations shall be formed and placed as a concrete slab conforming to the details shown or noted on the Plans.

**3.16 FIELD QUALITY CONTROL**

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.
- B. No concrete shall be placed prior to approval of forms.
- C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established the Caltrans Standard Specifications.

**3.17 RESTORATION OF EXISTING IMPROVEMENTS**

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

**END OF SECTION**

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**SECTION 32 11 00**

**BASE COURSES**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Aggregate subbase.
- B. Aggregate base.
- C. Cement treated base.
- D. Lime stabilization.

**1.02 RELATED DOCUMENTS**

- A. ASTM:
  - 1. D 3740, Standard Practice for Minimum Requirement for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
  - 2. E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
  - 3. E 548, Standard Guide for General Criteria Used for Evaluating Laboratory Competence.
- B. Caltrans Standard Specifications:
  - 1. Lime Stabilized Soil.
  - 2. Aggregate Subbases.
  - 3. Aggregate Bases.
  - 4. Cement Treated Bases.

**1.03 DEFINITIONS**

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material  $\frac{3}{4}$ -cubic yards or more in volume that when tested, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.
- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

**1.04 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

**1.05 QUALITY ASSURANCE**

- A. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- B. Do not mix or place cement treated base when the temperature is below 36 degrees F or when the ground is frozen.

- C. Finish surface of material to be stabilized prior to lime treatment shall be as specified in the Caltrans Standard Specifications.
- D. Finish surface of the stabilized material after lime treatment shall be as specified in the Caltrans Standard Specifications.
- E. Finish surface of cement treated base shall be as specified in the Caltrans Standard Specifications.
- F. Do not project the finish surface of aggregate subbase above the design subgrade.
- G. Finish grade tolerance at completion of base installation: +0.05'

**1.06 PROJECT CONDITIONS**

- A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Owner.
- C. Provide dust and noise control in conformance with Division 1 General Requirements.

**PART 2 - PRODUCTS**

**2.01 AGGREGATE SUBBASE**

- A. Material: Caltrans Standard Specification.
  - 1. Class 1, 2, or 3: Section 25-1.02B.
  - 2. Class 4: Section 25-1.02C.
  - 3. Class 5: Section 25-1.02D.

**2.02 AGGREGATE BASE**

- A. Material: Caltrans Standard Specification.
  - 1. Class 2, 1-1/2-inch Maximum:.
  - 2. Class 2, 3/4-inch Maximum:.
  - 3. Class 3: .

**2.03 CEMENT TREATED BASE**

- A. Materials: Caltrans Standard Specification.

**2.04 LIME STABILIZATION**

- A. Lime Treatment Material: Conform to the Caltrans Standard Specifications.

**PART 3 - EXECUTION**

**3.01 GENERAL**

- A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

**3.02 WET WEATHER CONDITIONS**

- A. Do not place or compact subgrade if above optimum moisture content.

**3.03 AGGREGATE SUBBASE**

- A. Spreading and Compacting: Conform to Caltrans Standard Specifications.

**3.04 AGGREGATE BASE**

- A. Spreading and Compacting: Conform to Caltrans Standard Specifications.

**3.05 CEMENT TREATED BASE**

- A. Cement treated base shall be as follows: Proportioning and Mixing Plant-Mixed: per Caltrans Standard Specifications.

**3.06 LIME STABILIZATION**

- A. Performing the stabilization shall conform to Caltrans Standard Specifications and the following:
  - 1. Add lime in the amount specified by a Geotechnical Consultant.
  - 2. Lime treat subgrade soils from back of curb to back of curb to a depth specified by a Geotechnical Consultant.

3. Mix in two mixing periods, both with the tines lowered to the same depth. Both mixing periods shall be monitored and verified by a Geotechnical Consultant. The second mixing shall occur at about 36 hours after the initial mixing.
4. Compact and grade the lime mixed subgrade immediately after the second mixing.
5. Compact the lime treated subgrade to 95 percent as determined by ASTM D1557.
6. After application of the curing seal, do not allow traffic on the lime treated material for a period of 7 days in lieu of the 3 days specified in the Caltrans Standard Specifications.
7. Proof-roll the stabilized subgrade after compacting to confirm that a non-yielding surface has been achieved. Yielding areas, if any, shall be mitigated. Mitigation could consist of over-excavation, utilization of stabilization fabric, or chemical treatment. Each case shall be addressed individually in the field by a Geotechnical Consultant.

**3.07 DISPOSAL**

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

**END OF SECTION**



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**SECTION 32 12 00**

**FLEXIBLE PAVING**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Prime coat.
- B. Tack coat.
- C. Asphaltic concrete paving.
- D. Asphaltic concrete overlay and slurry seals.
- E. Speed bumps.
- F. Asphalt curbs.
- G. Pavement grinding.

**1.02 RELATED DOCUMENTS**

- A. ASTM:
  - 1. D 979: Standard Practice for Sampling Bituminous Paving Mixtures.
  - 2. D 1073: Standard Specification for Fine Aggregate for Asphalt Paving Mixtures.
  - 3. D 1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
  - 4. D 2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
  - 5. D 2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures.
  - 6. D 2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
  - 7. D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
  - 8. D 3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Mixtures.
- B. Caltrans Standard Specifications.
  - 1. Bituminous Seals.
  - 2. Asphalt Concrete.
  - 3. Geosynthetics.
  - 4. Asphalt Binders.
  - 5. Asphaltic Emulsions.
- C. California Building Code:
  - 1. Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
  - 2. Exterior Routes of Travel.

**1.03 DEFINITIONS**

- A. ASTM: American Society for Testing Materials.

**1.04 QUALITY ASSURANCE**

- A. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
  - 1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
- B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- C. Thickness of Asphaltic Concrete: In-place compacted thickness of asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.
  - 1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement may be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    - (a) One core sample may be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.
    - (b) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

**1.05 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Job-Mix Designs: Certificates signed by manufacturers certifying that each asphaltic concrete mix complies with requirements.
- C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

**1.06 PROJECT CONDITIONS**

- A. Environmental Limitations:
  - 1. Prime Coat: Minimum surface temperature of 60 deg F at application.
  - 2. Tack Coat: Minimum surface temperature of 60 deg F at application.
  - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at application.
  - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at application.

5. Reinforcing Fabric: Air temperature is 50 deg F and rising and pavement temperature is 40 deg F and rising.

## **PART 2 - PRODUCTS**

### **2.01 ASPHALTIC CONCRETE**

- A. Caltrans Standard Specifications
- B. Asphalt Materials:
  1. Asphalt: Caltrans Standard Specification, steam refined paving asphalt.
    - (a) Asphalt Curbs: use grade PG 70-10
    - (b) All other asphalt products: use grade PG 64-10.
  2. Prime Coat: per Caltrans Standard Specification
  3. Tack Coat: per Caltrans Standard Specification.
  4. Asphaltic Emulsion: per Caltrans Standard Specification, for quick-setting type, Grade QS1h anionic or CQS1h cationic.
- C. Aggregates: Conform to Caltrans Standard Specification as applicable.
- D. Storing, Proportioning and Mixing Materials: per Caltrans Standard Specification
- E. Pavement Reinforcing Fabric: per Caltrans Standard Specification.
- F. Sand: ASTM D 1073, Grade No. 2 or 3.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Notify Owner in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

### **3.02 PAVEMENT GRINDING**

- A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.
- B. Grind conforms as indicated.

### **3.03 SOIL STERILANT**

- A. Furnish and apply to areas indicated in accordance with Section 31 31 19 – Vegetation Control.

### **3.04 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS**

- A. General: Immediately before placing asphalt materials remove loose and deleterious material from substrate surfaces and ensure that prepared subgrade is ready to receive paving according to the Caltrans Standard Specification Section

- B. Prime Coat: Apply uniformly over surface of compacted-aggregate base according to the Caltrans Standard Specification Section. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.
  - 1. If prime coat is not entirely absorbed within 8 hours after application, spread excess prime coat with hand tools and broadcast sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.
- C. Tack Coat: Apply uniformly to all vertical surfaces against which asphaltic concrete is to be placed, including existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new asphalt pavement, according to the Caltrans Standard Specification.
  - 1. Allow tack coat to cure undisturbed before paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### **3.05 SURFACE PREPARATION FOR PAVEMENT AT ASPHALTIC CONCRETE OVERLAYS AND SLURRY SEALS**

- A. Pavement Irregularities: Level with asphaltic concrete, Type B, No. 4 maximum.
- B. Pavement Cracks:
  - 1. Less than 1/8-inch wide: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion.
  - 2. Wider than 1/8-inch: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion and skin patch.
- C. Clean surface of all material, such as leaves, dirt, sand, gravel, water and vegetation including roots prior to applying binder of paving asphalt to existing surface.
- D. Oil spots shall be removed with brush and detergents and covered with Oil Spot Sealer by OverKote or an equal product.
- E. Prior to first application in exceptionally hot weather, dampen surface with water. Remove excess water and leave surface slightly damp.

### **3.06 APPLYING ASPHALT PAVEMENT OVERLAYS AND SLURRY SEALS**

- A. Use OverKote Asphalt Pavement Coating or equal product.
- B. Apply at a rate of 25 gallons per 1,000 sf of surface area.
- C. Follow all manufacturers' recommendations for preparation and applications procedure of the products used.
- D. Apply second coat as soon as first coat is dry.

### **3.07 PAVEMENT REINFORCING FABRIC**

- A. Protect from exposure to ultraviolet rays until placed.

- B. Reject rolls with broken or damaged cores, or factory wrinkled fabric that prevents wrinkle free placement.
- C. Place with binder of paving asphalt in accordance with Caltrans Standard Specifications.

### **3.08 ASPHALTIC CONCRETE SPREADING AND COMPACTING EQUIPMENT**

- A. Spreading Equipment: per Caltrans Standard Specification.
- B. Compaction Equipment: per Caltrans Standard Specification

### **3.09 ASPHALTIC CONCRETE PLACEMENT**

- A. Place, spread and compact asphaltic concrete to required grade, cross section, and thickness according to the Caltrans Standard Specification Sections
- B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### **3.10 JOINTS**

- A. Construct joints to ensure continuous bond between adjoining paving sections according to the Caltrans Standard Specification.
  - 1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
  - 2. Clean contact surfaces and apply tack coat.
  - 3. Offset longitudinal joints in successive courses a minimum of 6 inches.
  - 4. Offset transverse joints in successive courses a minimum of 24 inches.
  - 5. Compact joints as soon as asphaltic concrete will bear roller weight without excessive displacement.

### **3.11 COMPACTION**

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact according to the Caltrans Standard Specification
- B. Compaction Requirements: Average Density to be 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- C. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.
- D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.
- E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.

- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### **3.12 ASPHALT CURBS**

- A. Construction: Place over compacted surfaces according to Caltrans Standard Specification Section 39-7.01 as specified for dikes. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- B. Shape: Place asphaltic concrete to curb cross section indicated.

### **3.13 SPEED BUMPS**

- A. Construct speed bumps over compacted pavement surfaces according to Caltrans Standard Specification. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- B. Place asphaltic concrete by hand using a template/screed designed to result in speed bump cross-section indicated after compaction.
- C. Compact speed bumps with 8-ton static roller.

### **3.14 INSTALLATION TOLERANCES**

- A. Asphalt Pavement:
  - 1. Course thickness and surface smoothness within the tolerances in the Caltrans Standard Specification
  - 2. Total Thickness: Not less than indicated.
- B. Trench Patch:
  - 1. Compacted surface: Within 0.01 foot of adjacent pavement.
  - 2. Do not create ponding.

**END OF SECTION**

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SECTION 32 13 00

RIGID PAVING

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.
- B. Form construction and use in placing portland cement concrete pavement.
- C. Joints for portland cement concrete pavement.
- D. Finishing portland cement concrete pavement.
- E. Curing and protecting portland cement concrete pavement.

1.02 RELATED DOCUMENTS

- A. AASHTO Standard Specifications
  - 1. T 53: Standard Method of Test for Softening Point of Bitumen (Ring-and-Ball Apparatus).
- B. ASTM Standards
  - 1. A 615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  - 2. A 775: Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
  - 3. A 934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
  - 4. C 881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
  - 5. D 2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
  - 6. D 2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
  - 7. D 6690: Standard Specification for Joint and Crack Sealants, Hot-Applied , for Concrete and Asphalt Pavements.
  - 8. D 3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
- C. Caltrans Standard Specifications:

1. Concrete Pavement.
2. Reinforcement.
3. Concrete.
4. Epoxy.

**D. Caltrans Standard Plans:**

1. Portland Cement Concrete Pavement (Undoweled Transverse Joints).
2. Portland Cement Concrete Pavement Joint and End Anchor Details.

**1.03 DEFINITIONS**

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ASTM: American Society for Testing and Materials.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
  1. Manufacturer must be certified according to the National Ready Mix Concrete Plant Certification Program.
- B. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

**1.05 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
  1. Cementitious materials and aggregates.
  2. Steel reinforcement and reinforcement accessories.
  3. Admixtures.



4. Curing compound.
5. Applied finish material.
6. Bonding agent of adhesive.
7. Joint filler.
8. Joint Sealant.
9. Tie Bars.
10. Epoxy.
11. Backer Rods.

## **PART 2 - PRODUCTS**

### **2.01 PORTLAND CEMENT CONCRETE**

- A. General: Conform to Caltrans Standard Specifications. Use Class 2 Concrete.

### **2.02 TIE BARS**

- A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A 615/A (615M), Grade 40 or 60 (Grade 300 or 420).
- B. Epoxy-coat in conformance with the provisions in Caltrans Standard Specifications, except that references made to ASTM Designation D 3963/D 3963M shall be deemed to mean ASTM Designation A 934/A 934M or A 775/775M.
- C. Do not bend tie bars.

### **2.03 EPOXY**

- A. Bond tie bars to existing concrete with epoxy resin conforming to "Epoxy Resin Adhesive for Bonding Freshly Mixed Concrete to Hardened Concrete," of the Caltrans Standard Specifications.

### **2.04 SILICONE JOINT SEALANT**

- A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 412 (Die C)	310 kPa max.
Flow at 25° ± 1°C	ASTM C 639 <sup>a</sup>	Shall not flow from channel
Extrusion Rate at 25° ± 1°C	ASTM C 603 <sup>b</sup>	75-250 g/min.
Specific Gravity	ASTM D 792 Method A	1.01 to 1.51
Durometer Hardness, at -18°C, Shore A, cured 7 days at 25° ± 1°C	ASTM C 661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C 793	No chalking, cracking or bond loss
Tack free at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM C 679	Less than 75 minutes
Elongation, 7 day cure at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 412 (Die C)	500 percent min.
Set to Touch, at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 25° ± 1°C	AASHTO T 132 <sup>c</sup>	345 kPa min.
Movement Capability and Adhesion, 100% extension at -18°C after, air cured 7 days at 25° ± 1°C, and followed by 7 days in water at 25° ± 1°C	ASTM C 719 <sup>d</sup>	No adhesive or cohesive failure after 5 cycles

Notes:

ASTM Designation: C 639 Modified (15 percent slope channel A).

ASTM Designation: C 603, through 3-mm opening at 345 kPa.

Mold briquets in conformance with the requirements in AASHTO Designation: T 132, sawed in half and bonded with a 1.5 mm maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T 132. Briquets shall be dried to constant mass at 100 ± 5° C.

Movement Capability and Adhesion: Prepare 305 mm x 25 mm x 75 mm concrete blocks in conformance with the requirements in ASTM Designation: C 719. A sawed face shall be used for bond surface. Seal 50 mm of block leaving 12.5 mm on each end of specimen unsealed. The depth of sealant shall be 9.5 mm and the width 12.5 mm.

a. R.H. equals relative humidity.

B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.

- C. Furnish to the Owner a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

**2.05 ASPHALT RUBBER JOINT SEALANT**

- A. Conform to the requirements of ASTM Designation: D 6690 as modified herein or to the following:
  - 1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a 2.36-mm sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
  - 2. The Ring and Ball softening point shall be 57°C minimum, when tested in conformance with the requirements in AASHTO Designation: T 53.
  - 3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 204°C.
- B. The penetration requirement of Section 4.2 of ASTM Designation: D 6690 do not apply. The required penetration at 25°C, 150g, 5s, shall not exceed 120.
- C. The resilience requirement of Section 4.5 of ASTM Designation: D 6690 do not apply. The required resilience, when tested at 25°C, shall have a minimum of 50 percent recovery.
- D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D 6690, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.
- E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the plans. Provide manufacturer's instructions to the Owner. Do not place when the pavement surface temperature is below 10°C.

**2.06 PREFORMED COMPRESSION JOINT SEALANT**

- A. Material: ASTM Designation: D 2628.
  - 1. Number of cells: 5 or 6.
  - 2. Lubricant Adhesive: ASTM Designation D 2835.
  - 3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacture's recommendations to the Owner's Representative`.
- B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the

manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the plans.

**2.07 BACKER RODS**

- A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

**PART 3 - EXECUTION**

**3.01 WATER SUPPLY**

- A. Conform to Caltrans Standard Specifications.

**3.02 SUBGRADE**

- A. Conform to Caltrans Standard Specifications.

**3.03 SOIL STERILANT**

- A. Furnish and apply to areas indicated in accordance with Section 31 31 19 – Vegetation Control.

**3.04 PLACING**

- A. Conform to Caltrans Standard Specifications.

**3.05 SPREADING COMPACTING AND SHAPING**

- A. Conform to Caltrans Standard Specifications.
  - 1. Stationary Side Form Construction: per Caltrans Standard Specifications.
  - 2. Slip Form Construction: per Caltrans Standard Specifications.

**3.06 INSTALLING TIE BARS**

- A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 15 meters. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.
- B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:

1. Drilling and bonding in conformance with the details shown on the plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

<u>Temperature of Concrete</u>	<u>Required Class of Epoxy Resin</u>
Lower than 40° F (4.5 °C)	A
40° F (4.5° C) through 60° F (15.5° C)	B
Above 60° F (15.5° C)	C

2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Owner, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

### 3.07 JOINTS

- A. Conform to Caltrans Standard Specifications, except that tie bars shall be as specified under Part 2, Products.
  1. Transverse Contact Joints: per Caltrans Standard Specifications.
    - (a) Construct a transverse contact (construction) joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
    - (b) If sufficient concrete has not been mixed to form a slab to match the next weakened plane joint, when an interruption occurs, the excess concrete shall be

removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall become the property of the Contractor and shall be properly disposed of.

(c) A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.

2. Weakened Plane Joints: Conform to Caltrans Standard Specifications, except that the insert method of forming joints in pavement shall not be used.

### 3.08 FINISHING

- A. Conform to the Caltrans Standard Specifications.

### 3.09 CURING

- A. Conform to the Caltrans Standard Specifications.

### 3.10 SEALING JOINTS

- A. Liquid Joint Sealant Installation.

1. The joint sealant detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of  $6 \pm 1$  mm and a minimum pressure of 0.62-MPa.
4. Install backer rod as shown on the plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 4°C or above. Install backer rod

when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.

5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the plans.
6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

**B. Preformed Compression Joint Seal Installation**

1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of  $6 \pm 1$  mm and a minimum pressure of 0.62-MPa.

**3.11 PROTECTING CONCRETE PAVEMENT**

- A. Conform to Caltrans Standard Specifications.**

END OF SECTION



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SECTION 32 31 00

CHAIN LINK FENCES AND GATES

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Provide chain link fence and gates with framing and fabric, gate hardware, and accessories as required for complete installation.
  - 1. Provide galvanized steel or aluminum coated steel chain link fence and gates.
  - 2. Provide plastic coated steel chain link fence and gates.
  - 3. Excavate for post bases and provide concrete anchorage for posts.
  - 4. Provide privacy slats in chain link fabric.
- B. Related Work:
  - 1. Section 01 50 00: Temporary construction fence.

1.2 REFERENCES

- A. Chain Link Fence Manufacturer's Institute (CLFMI): Chain Link Fence Installation Standard.
- B. ASTM F567: Installation of Chain Link Fence.

1.3 SUBMITTALS

- A. Product Data: Submit product literature, including standard details.
- B. Shop Drawings: Indicate plan layout, grid, spacing of components, accessories, and anchorage.

**PART 2 - PRODUCTS**

2.1 SYSTEMS MANUFACTURERS

- A. Anchor Fence, Inc.
- B. Master Halco, Inc.
- C. Iron World Manufacturing.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide chain link fence and gates with framing and fabric, gate hardware, and accessories.

1. Provide complete system from single manufacturer including framing, fabric, and accessories.
2. Automatic Gate Operators: Provide operators including accessories. Automatic gate operators may be from different company.
- B. Framework: Design fence framework to comply with strength requirements conforming to ASTM F1043; ASTM A1083, Schedule 40, butt weld, standard weight, hot dip galvanized to 1.8 oz/sf coating; Type I weight.
  1. Line Posts, Corner Posts, Terminal Posts, Caps, Brace Rails:
    - a. End, Corner and Pull Posts: Minimum 2.875" outside diameter, and 5.79 pounds per linear foot.
    - b. Rails and Braces: Minimum 1.66", 1.35 lbs/lin. ft.
    - c. Caps: Galvanized castings as approved by Architect and as appropriate for applications specified.
    - d. Gate Posts: Minimum 4" outside diameter; 9.1 lbs/lin. ft.
  2. Types and Sizes: As indicated, where not indicated, sizes as recommended by manufacturer.
    - a. Fence Height: 7'-0", unless otherwise indicated.
  3. Fittings: Provide sleeves, bands, clips, rail ends, tension bars, fasteners, fittings, tie wire, and accessories as required for complete installation.
- C. Fabric: 1" diamond mesh, no climb, interwoven, 9-gage top selvage twisted tight, bottom selvage knuckle end closed; one-piece fabric widths unless fence height exceeds maximum available width.
  1. Mesh: ASTM A392 Class 2, zinc-coated steel or ASTM A428 aluminum coated steel, minimum 0.40 oz/sf coating.
  2. Plastic Coating: ASTM F668, minimum Class 2a extruded and adhered or Class 2b fusion bonded PVC coating on minimum 0.3 oz/sf zinc coated steel wire or comparable aluminum coated steel wire.
    - a. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- D. Tension Wire: Minimum 7-gage galvanized steel single strand or comparable aluminum coated steel.
- E. Concrete: ASTM C94, normal Portland cement, 2,500 psi at 28 days, 2" to 3" slump, 2 to 4 percent entrained air.

## **2.3 FABRICATION**

- A. Gates: Assemble gate frames by welding with both horizontal and vertical members and with diagonal cross-bracing of minimum 3/8" diameter adjustable length truss rods to ensure rigidity.
  - 1. Swing Gates: Conform to ASTM F900; manufacturer's standard galvanized steel gates, 3'-0" wide unless otherwise indicated; complete with hardware including hasp for padlock.
    - a. Gate Frames: Minimum 1.9" outside diameter; 2.60 lbs/lin. ft.
    - b. Hinges: Non-lift-off type, offset to permit 180 degree opening, minimum 1-1/2 pair per gate leaf.
    - c. Locksets: Where gates are indicated to be locked provide mortise type locksets conforming to general requirements specified in Section 08 71 00 – Door Hardware.
      - 1) Panic Devices (Where Indicated): Provide panic devices conforming to general requirements specified in Section 08 71 00.
      - 2) Provide security casing for mortise locksets and panic devices and provide security screening for gates to prevent opening gates from secured side while allow egress from direction of travel for egress.
    - d. Accessories: Keepers, stops, and accessories as required for complete, secure fence gate installation.
  - 2. Sliding Gates: Comply with ASTM F1184, Type II, Cantilever; manufacturer's standard top rail incorporating track for top roller and guideposts to keep gate on rollers.
    - a. Accessories: Provide as required for complete and secure fence gate installation in configuration indicated.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install line posts, corner posts, gates, rails, post caps, and fabric to provide rigid structure for fence of heights indicated and in accordance with CLFMI Installation Standard and ASTM F567.
  - 1. Use manufacturer's standard fittings, fasteners and hardware.
- B. Maximum Spacing of Posts: Comply with ASTM F567 and CLFMI Installation Standard.
- C. Install line, corner, and terminal posts plumb in accordance with recommendations of ASTM F567 and CLFMI Standard for locations indicated on Drawings.

1. Coordinate embedded post sleeves with concrete work.
- D. Position bottom rail continuous between posts and centered nominal 4" above finished grade or surface with bottom of fabric nominal 2" above finished grade or surface.
- E. Pass top rail through line post tops to form continuous bracing; install 7" long couplings mid-span at pipe ends.
- F. Brace corner posts back to adjacent line post with horizontal center brace rail; install brace rail, one bay from end posts.
- G. Fasten fabric to rails, line posts, braces and tension wires with wire ties maximum 12" centers.
- H. Attach fabric to end, corner and gate posts with tension bars and tension bar clips.
- I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is least dimension.
- J. Install gates for free, easy operation, ready for Owner supplied Knox padlock.

**END OF SECTION**

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SECTION 32 8400  
IRRIGATION SYSTEM

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**PART 1 GENERAL**

**1.01 DESCRIPTION**

- A. The General Conditions and all other Contract Documents for this project are complementary and applicable to this Section of the Specifications.
- B. Work Included: Order and furnish all labor, materials, supplies, tools, and transportation and perform all operations for a complete installation of the water connection providing potable water and automatic irrigation system as shown on the Drawings. Items listed hereinafter are included as an aid to estimating quantities and are not necessarily a complete list of work items.
  - 1. Trenching, stockpiling excavation materials, and refilling trenches.
  - 2. Furnishing materials and installation for a complete irrigation system including point of water connection using potable water, controller, piping, valves, fittings, irrigation heads, and final adjustment of irrigation heads to ensure complete turf coverage and water to plants and trees.
  - 3. Rerouting of existing main line pipe with new main line pipe due to new construction.
  - 4. Rerouting and installation of new low voltage control wiring as required due to new construction and relocation of existing irrigation main line pipe.
  - 5. Replacement of unsatisfactory materials.
  - 6. Clean-up, inspection, and approval.
  - 7. All work of every description mentioned in the Specification and/or addenda thereto, and all other labor and materials reasonably incidental to the satisfactory completion of the work, including clean-up of the site, as directed by the District.
  - 8. Tests.
  - 9. Record Drawings.
- C. Related Work Described Elsewhere:
  - 1. 26 00 00: Electrical Specification
  - 2. 32 90 00: Landscape Planting

**1.02 GENERAL REQUIREMENTS**

- A. Purpose: It is the intention of these Specifications to accomplish the work of installing an irrigation system which shall operate in an efficient manner, provide 100% uniform coverage, and be water conserving. The Drawings indicate the general arrangement of piping and equipment, and do not necessarily indicate all offsets, fittings and accessories that may be required. Furnish incidental materials and labor not specifically called for but required to complete work as intended.
- B. OSHA Compliance: All articles and services covered by this Specification shall meet or exceed the safety standards established under the Federal Occupational Safety and Health Act of 1970, together with all amendments in effect as of the date of this Specification.
- C. Codes and Standards: Comply with all applicable codes and standards.
  - 1. Perform work in accordance with the District's (LUSD) standards.
  - 2. Work and materials shall be in full accordance with the latest rules and regulations of the California Electric Code, the Uniform Plumbing Code, published by the Western Plumbing Officials Association and other applicable State or local laws or regulations. Nothing in these Drawings or Specifications shall be construed to permit work not conforming to these codes.

3. When the Specifications call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, the provision of the Specifications shall take precedence over the requirements of the said rules and regulations.
4. Furnish, without any additional cost to the District, any additional material and labor required to comply with these rules and regulations. Provide the work even if it is not mentioned in this section or shown on the Drawings.
5. Erect and maintain barricades, guards, warning signs and lights as required by the District or required by OSHA regulations for the protection of the public or work crew.
6. Damage by leaks: The Contractor shall be responsible for damages to any property or work caused by leaks in the piping systems being installed. Repair, at no additional expense to the District, all damages so caused. All repair work shall be done as directed, and in a manner that is satisfactory to the District.
7. Protection: The Contractor shall be responsible for any damage to this work, which occurs before final acceptance. Securely cover all openings into the systems and protect all apparatus, equipment, and appliances, both before and after being set in place, to prevent obstructions in the pipes and breakage, misuse or disfigurement of the apparatus, equipment of appliance.

### **1.03 QUALITY ASSURANCE**

- A. Provide evidence to the District that skilled and an experienced supervisor and work crew will be employed on the job from beginning to end.
- B. Provide evidence to the District that your construction firm possesses the skill and experience in the construction of an irrigation system.
- C. Provide documentation with the bid documents, a list of at least five school-related irrigation projects awarded and constructed in the last five years including owner and construction cost.

### **1.04 INSTRUCTION**

- A. After the system has been installed and approved, instruct the District's personnel in the complete operation and maintenance of the irrigation system.

### **1.05 SUBMITTALS**

- A. Equipment List and Drawings: Within 14 days after date of Notice to Proceed, submit to the District for approval, a list of the proposed equipment and material to be furnished and installed. The list shall be complete as to name of manufacturer, size, and catalog number of unit, and be supplemented by such other data as may be required, including detailed scale Drawings, plumbing and wiring diagrams. Submit materials list using the following format:

<u>Item</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model No.</u>
1	Pressure Supply Line	Lasco	Sch. 40
2	Lawn Head	Rain Bird	1800

- B. Record Drawings:
  1. Record accurately on one set of blue or black line prints, changes in the work constituting departures from the original contract Drawings, including changes in pressure and non-pressure line locations, and a complete schematic diagram.
  2. Record the changes and dimensions in a legible manner and to the satisfaction of the District. Prior to final inspection of work, and prior to transferring the information to mylars, submit record prints to the District for approval.

3. Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavements, etc.). Record data to be shown on record prints, day-to-day, as the project is being installed.
4. Show locations and depths of the following items:
  - a. Point of connection.
  - b. Controller.
  - c. Routing of irrigation main line pipe. Provide dimensions a minimum of 100 feet along main line route.
  - d. Routing of drinking fountain and hose bib main line pipe. Provide dimensions a minimum of 100 feet along main line route.
  - e. Gate valves.
  - f. Remote control valves or valve groups.
  - g. Routing of control wires.
  - h. Routing of conduit.
  - i. Sleeves.
  - j. Related equipment including sprinkler heads (as may be directed by the District).
5. Keep and maintain record prints on-site at all times.
6. Upon completion of work, transfer all as-built information and dimensions to reproducible sepia mylars. Correct and record the changes and dimensions in a legible manner and to the satisfaction of the District.

## **PART 2 PRODUCTS**

### **2.01 PIPE: MAIN AND LATERAL LINE**

- A. Pipe manufacturer: PW Pipe, JM Pipe, or approved equal.
- B. Pipe Material: Polyvinylchloride (PVC) plastic in conformance with ASTM D1784 (cell class 12454-B).
- C. Schedule or Class:
  1. Main line pipe:
    - a. 4 and 6 -inch diameter pipe: Class 200 PVC plastic pipe with integral push-on gasketed joints and DI gasketed fittings at changes of direction.
    - b. 2.5-inch and smaller: Schedule 40 PVC plastic pipe with solvent cemented joints.
  2. Lateral line pipe (non-pressure):
    - a. Schedule 40 PVC plastic pipe with Schedule 40 Type I, Grade I, PVC with solvent weld or threaded fittings as shown on the Drawings.
- D. Identification marking: Pipe shall be clearly marked at regular intervals indicating the manufacturer's name, nominal pipe size, schedule or class, pressure rating in PSI, and date of extrusion.
- E. Connections between main lines and remote control valves: Schedule 80 PVC (threaded both ends) nipples and fittings.

### **2.02 SLEEVES**

- A. Sleeves: 1120-Schedule 40 or Class 200 PVC pipe, whichever has the thickest wall thickness, minimum of two times the diameter of pipe contained within.

### **2.03 DUCTILE IRON FITTINGS**

- A. 4 and 6-inch diameter fittings shall be ductile iron, slanted, deep bell, gasketed style made in accordance with ASTM A-536, Grade 65-45-12. Fittings shall have four lugs to accommodate joint restraints and other fittings. Bell section shall allow 5-degree freedom of pipe deflection

within the bell end. Gasket design shall be rib-enforced "U-Cup" configuration to seal and assist in restraining pipe at all pressures. Fittings shall be as manufactured by Leemco, Inc., U.S.A.

**2.04 PVC PIPE FITTINGS**

- A. 2.5-inch and smaller PVC fitting manufacturer: Lasco, Dura, Spears, or approved equal.

**2.05 JOINT RESTRAINTS**

- A. All 4 and 6-inch pipe restrained joints shall be as manufactured by Leemco, Inc., U.S.A. unless otherwise noted on the Drawings.

**2.06 SERVICE SADDLES**

- A. Manufacturer: Leemco, APAC 122E, Smith-Blair 317, or approved equal to District standard with epoxy coated saddle, stainless steel double straps and nuts for use with PVC pipe.
- B. Components: Composed of ductile iron (ASTM-A536) and stainless steel (Type 304) with stainless steel bolts, studs, washers, and nuts (Type 304). Teflon coated nuts. Ductile iron surfaces are coated with fusion-bonded nylon (12 mils. minimum) or epoxy coated.
- C. Saddle provides full support by directing the mechanical forces toward and around the pipe, uniformly distributing pressure around the pipe circumference, supporting the pipe, and reinforcing it without a crushing action.

**2.07 GATE OR BALL VALVES**

- A. Provide the valves as listed on the Drawings.
- B. Gate valves shall have a resilient wedge.
- C. Ball valves shall be the full port style.

**2.08 REMOTE CONTROL VALVE**

- A. Provide the solenoid remote control valves as listed on the Drawings.

**2.09 QUICK COUPLING VALVE**

- A. Provide the quick coupling valves as listed on the Drawings.

**2.10 HOSE BIB**

- B. Provide the hose bib as listed on the Drawings.

**2.11 BOXES FOR CONTROL VALVES, QCV, GATE VALVE, AND PULL BOX.**

- A. Remote control valves and pull boxes: Carson Model 1419, 12-inch x 17-inch x 12-inch deep (top dimensions) valve box with bolt-down T-type plastic lid or approved equal. Lid shall be marked: "Irrigation".
- B. Gate valve and quick coupling valve: Carson Model 910, 12-inch deep round plastic valve box with bolt-down T-type plastic lid or approved equal. Lid shall be marked: "Irrigation".
- C. Use plastic box extensions made by the same manufacturer and of equal size to the valve box as required to allow access to the valve.
- D. The valve box and lid shall be a green color, as manufactured by the vendor.

**2.12 CONTROLLER**



- A. Provide the specified controller as listed on the Drawings, a Rain Bird "ESP-LX" controller.
- B. Controller shall be preassembled in an enclosure constructed by Imperial Technical Services.
- C. Enclosure shall be a weatherproof, stainless steel metal locking enclosure. Provide two keys to the District. Install the enclosure and accessories in conformance with the manufacturer's instructions and recommendations.
- D. Provide a Rain Bird remote control unit compatible with the irrigation controller.
- E. Provide and install a 6-foot copper ground rod for controller enclosure.

### **2.13 LOW VOLTAGE WIRE AND SPLICES**

- A. Single conductor type:
  - 1. Manufacturer: Paige Electric, Regency, or equal.
  - 2. Attributes:
    - a. Soft-annealed, uncoated copper.
    - b. Single conductor, with PVC insulating jacket, 600 volt rated UL listed Type UF for direct burial in soil.
    - c. Common ground wire to have a white insulating jacket with a colored strip along the jacket which matches the controller's control wire color.
    - d. Control wire to have an insulating jacket color other than white and each set of control wires at a satellite to have an insulating jacket color different from adjacent satellite control wires.
    - e. Spare wire to have an insulating jacket color other than white or the color of the satellite control wires.
    - f. Control wires and spare wires: #14-1 AWG
    - g. Common wires: #12-1 AWG.
- B. Notes:
  - 1. All wire insulation shall be intact and free of nicks and cuts.
  - 2. Wiring Sizes: Standard wire lengths for straight line installation i.e. wire distance to the furthest device without any loop: (Wire size chart is provided for reference only, #14Ga wire or larger is always recommended as specified above.)

Wire size (gauge)	#14	#12
Total loop wire length (ft.)	10,000	14,800
Distance to furthest valve (ft.)	5,000	7,400

- C. Weatherproof splices: 3M model 3M-DBY, King model Dryconn #10999, Spears model #400 pre-filled seal packs or approved equal.

### **2.14 IRRIGATION HEADS**

- A. Provide and install the irrigation heads as listed on the Drawings.
- B. Irrigation head body and risers: Provide and install bodies and risers as shown in the construction details using Schedule 80 PVC threaded nipples, Schedule 40 or 80 PVC elbows, and/or PVC flexible hose.

### **2.15 PULL BOXES**

- A. Install pull boxes at the locations shown on the plans or at locations designated by the District at site of work. Contractor may, at no additional expense to the District, install additional pull boxes to facilitate work with good reason.

- B. Carson Model 1419, 12-inch x 17-inch x 12-inch deep green valve box with bolt-down plastic lid or approved equal. Lid shall be marked: "Irrigation".

## **2.16 PVC-CONDUIT**

- A. Polyvinylchloride conduit: heavy-wall, Schedule 40, with factory made solvent cemented socket sweep elbows, couplings, and fittings, as permitted by NEC.

## **2.17 VALVE IDENTIFICATION TAGS**

- A. Manufacturer: T. Christy Enterprises, or equal (no known equal.)
- B. Material: Polyurethane behrdesopan
- C. Attributes:
  - 1. 2.25-inch by 2.75-inch hot stamped with 1-1/8-inch black letters on a yellow background.
  - 2. Indicates controller letter or number and valve station number.

## **2.18 MARKING TAPE**

- A. Marking tape shall be a detectable underground utility marking tape as follows:
  - 1. It shall consist of a minimum 4.0 mil (0.004) thickness, inert 100% linear low-density polyethylene plastic film formulated for extended use underground.
  - 2. The tape tensile strength shall be in accordance with ASTM D882 and not be less than 4100 MD and 3650 TD.
  - 3. Elongation properties shall be in accordance with ASTM D882 and be greater than 550%+ at break point.
  - 4. Tape flexibility shall be in accordance with ASTM D671 and shall remain pliable.\
  - 5. The materials shall be acid and alkali resistant.
  - 6. Width of warning tape shall be 6-inch.
- B. Color Coding: The tape shall conform to the American Public Works Association color code as follows:
  - 1. Potable Water Pipeline: Tape color shall be blue.
- C. Message Inscription: The tape shall include an inscription in black letters to identify the type of utility pipeline on or over which it is installed. The inscription shall be impregnated with colorfast, lead-free, organic pigments suitable for direct burial and prolonged exposure to the elements normally encountered in moderately corrosive type soils. The height of the message letters shall be 1.5 inches minimum, and the message inscription shall be repeated at approximately 3-foot intervals. The message inscription for the different types of pipelines shall be as follows:
- D. Irrigation main line:
  - 1. Warning tape shall be manufactured by T. Christy Enterprises, Inc., or approved equal. Model for potable irrigation water: TA-DT-6-BIRR.
  - 2. The message on the tape shall be:  
**"CAUTION IRRIGATION LINE BURIED BELOW"**
- E. Potable water line to drinking fountain and hose bibs:
  - 3. Warning tape shall be manufactured by T. Christy Enterprises, Inc., or approved equal. Model for potable water: TA-DT-6-BW.
  - 4. The message on the tape shall be:  
**"CAUTION WATER LINE BURIED BELOW"**

## **2.19 POLYETHYLENE ENCASEMENT**

- A. Install ductile iron pipe fittings, valves and other buried pipeline accessories with polyethylene encasement conforming to AWWA C105. Color of the polyethylene encasement shall be green for potable water piping.

## **2.20 MISCELLANEOUS INSTALLATION MATERIALS**

- A. Solvent cement and primer for solvent weld joints: make and type approved by manufacturer(s) of pipe and fittings. Maintain cement at proper consistency throughout use. IPS Weld-On, Oatey, or approved equal.
- B. Pipe joint compound: non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Rectorseal T+2 pipe thread sealant or approved equal.

## **2.21 MISCELLANEOUS EQUIPMENT**

- A. Provide all equipment called for by the Drawings.

# **PART 3 INSTALLATION**

## **3.01 PREPARATION**

- A. General: Prior to all work of this section, carefully inspect the installed work of all other trades and verify that their work is complete or to the point where this installation may properly commence. Verify that irrigation system can be installed in strict accordance with pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

In the event any equipment or methods indicated on the Drawings or in Specifications conflicts with local codes, immediately notify the inspector prior to installing. If this notification is not provided, assume full responsibility for the cost of all revisions necessary to comply with code.

Grades: Before starting work, carefully check grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.

Coordination with work of other trades: Provide all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Coordinate the installation of irrigation materials with all other work. Give special attention to coordination of piping locations with new and existing signage, light standards, hydrants, and other utility locations to avoid conflicts.

- B. Irrigation Water Supply: Connect to the existing irrigation main line at locations as shown on the Drawings. Make minor changes caused by actual site conditions at no additional cost to the District. All required testing shall be successfully completed prior to connection.
- C. Potable Water Supply:
  - 1. Connect to the existing potable line stub-out at locations as shown on the Drawings. Make minor changes caused by actual site conditions at no additional cost to the District.
  - 2. All required testing and cleaning shall be successfully completed prior to connection.
  - 3. Potable water lines must be cleaned, disinfected, flushed,, and must pass testing for chlorine concentration and coliform absence before being put into use. Follow procedure as set forth by the Civil plans and/or the District's guidelines.
- D. Electrical service: Connect controller to 120 VAC high voltage electrical connections provided under the electrical contract work to the new designated controller location.

## **3.02 HANDLING AND STORAGE**

- A. Protect work and existing or new materials from damage during construction.

- B. Store material in staging location as directed by the District.
- C. Handle plastic pipe carefully; especially protect it from prolonged exposure to sunlight.

### **3.03 LAYOUT**

- A. Lay out work in accordance with diagrammatic construction Drawings.
- B. Stake out the irrigation system as shown on the Drawings. Obtain approval from the District before starting work.
- C. Where site conditions do not permit location of piping, valves and heads where shown, notify the District immediately and determine relocation in joint conference.
- D. Run pipelines and automatic control wiring in common trenches wherever practical.
- E. Irrigation heads, valves, and boxes shall not be placed in the path of gates or vehicular/pedestrian traffic.
- F. Piping shall be routed away from trees, light poles, fence posts, hydrants, and other utilities.
- G. Determine the proper locations for all irrigation items at the time of staking the irrigation system.

### **3.04 EXCAVATING AND TRENCHING**

- A. Excavate trenches ample in size to permit the pipes to be laid at the elevations intended and to permit ample space for joining. When two or more pipes are placed in the same trench, maintain a 3-inch minimum separation between pipes.
- B. Make trenches for pipelines deep enough to provide minimum cover from finish grade as follows:
  - 4. 4 -inch diameter main line pipe: 24-inch minimum cover over main line.
  - 1. 2.5-inch and smaller main line pipe: 18-inch minimum cover over main line.
  - 2. Lateral line pipe: 12-inch minimum cover.
  - 3. Low voltage wire: 18-inch minimum cover.
- C. Restore surfaces, existing underground installations, utilities, plant materials, etc., damaged or cut as a result of excavations, to original conditions in manner approved by the District.
- D. Where other utilities interfere with irrigation trenching and pipe work, adjust the trench depth as instructed by the District.

### **3.05 ASSEMBLING PIPELINES**

- A. Assemble pipe free from dirt and pipe scale. Ream field cut ends to full pipe diameter with rough edges and burrs removed.
- B. 4 -inch main line: All change of directions and reductions shall be mechanically restrained. Additional adjacent joints shall also be restrained as per manufacturer's recommendations. Gate valves shall be treated as a dead end and shall be mechanically restrained for serviceability. Concrete thrust blocks shall not be allowed.
- C. Solvent-Weld Main Line: At changes in direction or branch mains, use appropriate Schedule 40 PVC fittings as approved by the Uniform Plumbing Code.
- D. Ductile iron pipe with push-on joints:
  - 1. General: Pipe installation shall be in conformance with Sections 1 through 3 of AWWA C600, except as otherwise required by the Contract Documents.
  - 2. Pipe Jointing: Jointing shall be in conformance with the pipe manufacturer's installation instructions using the proper lubricant.

3. Maximum Joint Deflection for Push-On Joint Pipe: Special care shall be taken so as not to exceed the manufacturer's recommendations for joint deflection. For push-on joint pipe, the maximum deflection per 18-foot-long section of pipe is 19 inches. For bends exceeding the maximum deflection, a fitting shall be installed.
  4. Wrap below grade ductile iron pipe and fittings in polyethylene encasement.
- E. Solvent Weld Joint:
1. Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe and fittings of dirt, dust, and moisture.
  2. Dry-insert pipe into fitting. Pipe should enter fitting 1/3 to 2/3 depth of socket.
  3. Coat the inside of socket surface of the fitting and the external surface of the male end of the pipe with solvent cement primer (P-70 as manufactured by Weld-On or approved equal). Then without delay, apply solvent cement (Weld-On 711 as manufactured by Weld-On or approved equal) liberally to the male end of the pipe and apply solvent cement lightly to the inside of the socket. Now, apply a second coat of solvent cement to the pipe end. (Solvent cement with primer incorporated into the solvent cement may be used.)
  4. Insert pipe immediately into fitting and turn ¼ turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Align the pipe and fitting properly to prove no strain to either.
  5. Hold joint still for approximately thirty (30) seconds and then wipe excess cement from the pipe and fitting.
  6. Cure joints a minimum of thirty (30) minutes before handling and at least six (6) hours before allowing water in the pipe.
- F. Threaded Joint:
1. Field threading of plastic pipe or fittings is not permitted. Provide factory-formed threads only.
  2. Field-cut threads in metallic pipe will be permitted only where necessary. When field threading, cut threads accurately an axis with sharp dies.
  3. Provide threaded joints with pipe joint compound. Apply compound to male threads and first two female threads only.
  4. Where assembling metallic pipe to metallic fitting or valve, no more than one full turn beyond hand tight.
  5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.
  6. Where assembling soft metal (brass or copper) or plastic pipe, use strap type friction wrench only; do not use metal-jawed wrench.
- G. Cap or unplug openings as pipeline is assembled to prevent entrance of dirt or obstruction. Remove caps or plugs only when necessary to continue assembly.
- H. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.

### **3.06 SLEEVES AND ELECTRICAL CONDUIT**

- A. Install sleeves to carry main line pipe, lateral line pipe, and wire under concrete and asphalt surfaces. Provide a sleeve even if the Drawings do not indicate a sleeve under the concrete and asphalt surfaces.
- B. Install pvc electrical conduit to carry control wires under concrete and asphalt surfaces where a sleeve does not exist for main and/or lateral line pipe.

- C. Install pvc electrical conduit to carry control wires under soil, concrete, and asphalt surfaces for master control valve and flow sensor cable where applicable. Provide a separate conduit for each item.
- D. Sleeves and/or conduit under existing paving: Bore for sleeves and/or conduit under existing paving and extend 12 inches beyond paving edge. Provide a separate sleeve for each water line and conduit for electrical control wires.

### **3.07 REMOTE CONTROL VALVES**

- A. Install where shown and on Drawings and group together where practical. Provide only remote control valve per box without exceptions
- B. Locate valve boxes 12 inches from and perpendicular to hardscape edges and walls.
- C. Provide a 12-inch separation between valve boxes where valves are grouped together.
- D. Thoroughly flush main line before installing valve.
- E. Install in shrub or ground cover areas and out of pedestrian paths.
- F. Label control line wire at each valve with a 2-1/4-inch x 2-3/4-inch polyurethane I.D. tag, indicating identification number of valve (controller and station number). Attach label to control wire.

### **3.08 QUICK COUPLING VALVES**

- A. Install where shown and on Drawings.
- B. Locate valve boxes 12 inches from hardscape edges and walls.
- C. Thoroughly flush main line before installing valve.
- D. Install in planted shrub or ground cover areas.

### **3.09 VALVE BOXES**

- A. Provide and install remote control valves, gate valves, or other valves in a valve box as shown in details, complete with cover bolted to valve box at the finish of work.
- B. Set valve boxes to finish grade in turf areas and 2 inches above finish grade in groundcover areas.
- C. Install one remote control valve in one valve box - no exceptions.
- D. Do not allow valve boxes to rest on pipes.
- E. Provide a 2-inch minimum clear distance between valve and the box wall.
- F. Install valve boxes located near walks, curbs, headerboards and paving in such a way as to allow for valve boxes to abut those items with top lid surface matching plane of items listed above.

### **3.10 AUTOMATIC CONTROL WIRING**

- A. Run wires along mains wherever practical. Tie wires in bundles with pipe wrapping tape at 10 foot intervals and allow slack for contraction between strappings. Do not tape wire together where contained within sleeving of conduit.
- B. Loop a minimum of three (3) feet of extra wire in each valve box, control wire, spare wire, and common ground wire.

- C. Provide an expansion curl within three (3) feet of each wire connection and at least every 100 feet of wire length on runs more than 100 feet in length. Form expansion curls by wrapping at least 5 turns of wire around a 1 -inch diameter pipe, then withdraw the pipe.
- D. Make connections by crimping bare wires with brass connectors and sealing with splice kits as detailed.
- E. Field splicing will be permitted only upon inspection and written approval from the District. Locate splices at valve locations within valve boxes.
- F. Where control lines pass under paving, install wire in Schedule 40 electrical PVC conduit or inside a sleeve for irrigation pipes.
- G. All wire connections shall be watertight.

### **3.11 CONTROLLER**

- A. Provide and install irrigation controller in location shown on Drawings. The exact location will be determined on-site by the District. Provide conduit and wire and connect to 120-volt switch accessible to controller for ease of maintenance.
- B. Connect control lines to controller in sequential arrangement per assigned identification number of valve. Label each control line wire at controller with a permanent, non-fading label indicating station number of valve controlled. Attach label to control wire.
- C. Arrange for the entire controller and installation to be approved and certified by the vendor (ITS) in writing. Provide written certification to the District.

### **3.12 BACKFILLING**

- A. Obtain Architect's approval for valve manifolds, gate valves, main line pipe, wire, and lateral line pipe prior to backfill at these items.
- B. Backfill only after piping has been tested, inspected, and approved by the District.
- C. Backfill material: earth excavated from the trenches, free from rocks, concrete chunks and other foreign or coarse materials.
- D. Place backfill materials in 4 -inch layers and compact to between 85 and 90% relative compaction.
- E. Dress areas to finish grades and remove excess oil, rocks or debris remaining after backfill is completed.
- F. If settlement occurs along trenches, and adjustments in pipes, valves and sprinkler heads, soil, sod, or paving are necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, as part of the work under this Contract, make all adjustments without additional cost to the District.

### **3.13 IRRIGATION HEADS**

- A. Thoroughly flush lines before installing heads.
- B. Locate heads as shown in the Drawings and details.
- C. Adjust emitter or bubbler heads to apply water directly to the nursery container rootball.

### **3.14 TESTS**

Perform tests as specified below. Remake any faulty joints with new materials. Use of cement or caulking to seal leaks is absolutely prohibited.

- A. Record Prints: No testing or system observation shall commence without "record" prints. In the event the Contractor calls for testing or system observation without up to date "record" prints, without completing previously noted corrections, or without preparing the system for testing or system observation, the testing or system observation will be canceled, and the Contractor will be charged for the direct costs of all District personnel's time and consultant's time lost. Testing or system observation will be required for:
1. Cross-connection control testing
  2. Pressure test of irrigation main line.
  3. Coverage test.
  4. Start of maintenance period.
  5. Final acceptance.
- B. Notify LUSD at least three (3) days in advance of testing.
- C. Perform testing at no additional expense to the District and in the presence of the District.
- D. Center load piping with small amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered.
- E. Pipe test for solvent welded main line: Apply the following tests after weld plastic pipe joints have cured at least 24 hours:
1. Prior to the installation of any valves to the main line, flush pipes with water and fully expel air from piping. Cap ends of pipe and test pressure lines with the line fully charged with water.
  2. Test live (constant pressure) piping hydrostatically at 125-psi minimum. Lines will be approved if test pressure is maintained for six (6) hours. Contractor shall make tests and repairs as necessary until test conditions are met.
  3. Test RCV controlled (lateral) lines prior to installation of sprinklers or bubblers with water at line pressure and risers capped, and visually inspect for leaks. Retest after correcting defects.
- F. Leakage testing of main lines with gasketed push-on ductile iron fittings:
1. Conform leakage testing with AWWA Standard C605-94, Section 7, except as otherwise required by the Contract Documents as follows: (1) add water slowly to pipe to avoid water or air hammer damage, (2) bleed air out of system through quick coupling valves to ensure air is exhausted, (3) pressurize system to 125 PSI for a minimum period of 6 hours. Test must not exceed the allowable leakage for 6" dia. PVC pipe of 0.50 gallons per hour per 1000 feet of pipeline.
  2. The pressure should be maintained as constant as possible through the period of test. Pump water into the main line during the test to maintain the pressure. Measure and note the amount of additional water pumped in during the test to determine the amount of leakage, if any.

ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE GPH (GALLONS PER HOUR)					
AVERAGE TEST PRESSURE	NOMINAL PIPE DIAMETER (INCHES)				
PSI	3	4	6	8	10
150	0.28	0.37	0.55	0.74	0.92
125	0.25	0.34	0.50	0.67	0.84
100	0.23	0.30	0.45	0.60	0.75



- G. Coverage Test: When the irrigation system is completed, perform a coverage test in the presence of the District to determine if the water coverage for planting areas is complete and adequate. Provide this test prior to planting. Overspray that causes runoff to non-landscaped areas such as storm drain system, streets, or waterway shall not be permitted. Overspray on drinking fountains, picnic areas, and non-turf play areas shall not be permitted.
- H. Testing of Electrical System:
- Prior to acceptance of the work, provide the following tests to wiring:
1. Continuity test of each circuit.
  2. Ground fault of each circuit.
  3. A functional test to demonstrate that each part of the system functions as specified or intended herein.

### **3.15 GUARANTEE**

- A. Unconditionally guarantee the entire sprinkler system for material and installation, including settling of backfilled areas below grade for a minimum period of one year following the date of final acceptance of the work.
- B. Submit a guarantee on Contractor letterhead as follows:

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the Drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted, and that the work, materials, and equipment as installed will fulfill the requirements of the guarantee included in the specifications. We agree to repair or replace any or all our work, together with any other adjacent work which may be displaced by doing so, that may prove to be defective in materials and installation within a period of one (1) year from date of acceptance of the below named project in the District, at no additional cost to the District. We shall make such repairs or replacement of the work within seven (7) calendar days of written notification by the District. When the immediate repair or replacement of the work is necessary to ensure the public safety and welfare, which would be endangered by continued usage of the facility, such circumstance will be deemed an operational emergency. In the event of such an emergency after the District contacts our firm and after authorizing 24 hours to initiate repairs, if we fail to initiate and diligently complete such repairs in a timely manner, the District may direct District forces to perform such functions as may be necessary to correct the work and immediately place the facility back in operations condition. If such procedure is implemented, we shall bear all expenses incurred by the District. In all cases, the judgment of the District shall be final in determining whether an operational emergency exists. In the event of our failure to make such repairs or replacements within the times specified after receipt of written notice from the District (other than an operational emergency), we authorize the District to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT: \_\_\_\_\_

LOCATION: \_\_\_\_\_

SIGNED: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

PHONE: \_\_\_\_\_

- C. If, within one year following acceptance of the work, settlement occurs and adjustments in pipes, valves and sprinkler heads, sod or paving is necessary to bring the system, sod or paving to the proper level of the permanent grades, as part of the work under this Contract, make all adjustments without extra cost to the District, including the complete restoration of all damaged planting, paving or other improvements of any kind.
- D. Should any operational difficulties in connection with the sprinkler system develop within the specified guarantee period which in the opinion of the District may be due to inferior material and/or workmanship, correct said difficulties immediately and to the satisfaction of the District and at no additional cost to the District, including all other damage caused by such defects.

### **3.16 CLEAN UP**

- A. Upon completion of the work, and at the end of each day, smooth all ground surfaces; remove excess materials, rubbish, debris, etc., sweep adjacent streets, curbs, gutters, and trails and remove construction equipment from the premises.

### **3.17 MAINTENANCE**

- A. Properly and completely maintain the irrigation system. Maintain a balanced water program to ensure proper germination and growth until acceptance of the work. Plants which cannot be watered sufficiently with the irrigation system shall be watered by means of a hose.
- B. Each controller shall have each station associated with this contract work individually adjusted on a weekly basis. Program controller considering the application rate each area can receive. Operate the system on short intervals, with the cycle repeating later to reduce runoff. Program the irrigation system to operate between dusk and dawn (nightly) only and during non-windy hours.

### **3.18 TURNOVER ITEMS**

- A. Controller Charts:
  - 1. The District must approve record prints before charts are prepared.
  - 2. Provide one controller chart (of the maximum size controller door will allow) for automatic controller. Chart shall show the new contract area covered by controller.
  - 3. The chart shall be a reduced copy of the actual "record" print. In the event the controller sequence is not legible when the print is reduced, enlarged to a readable size.
  - 4. Color code the chart with a different color to show the area of coverage for each station.
  - 5. When completed and approved, hermetically seal the chart between two pieces of plastic, each piece being minimum 20 mils in thickness. Install the chart in the controller enclosure using weatherproof Velcro fasteners.
  - 6. Controller charts are to be completed prior to final observation.
- B. Operation and Maintenance Manuals: Within 10 calendar days prior to acceptance of construction, prepare and deliver to the District all required descriptive materials, properly prepared in two individually bound copies of the operation and maintenance manual. The manual shall describe the material installed and be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Include spare parts lists and related manufacturer's information for each equipment item installed. Each complete, bound manual shall include the following information:
  - 1. Index sheet stating Contractor's address and telephone, including names and addresses of local manufacturer's representative.
  - 2. Complete operating and maintenance instructions on all major equipment.
- C. Materials to be furnished:
  - 1. Supply as part of the contract the following spare parts:

- a. 4 percent additional emitter or bubbler heads of each type shown.
  - b. Two (2) wrenches for disassembly and adjustment of each type of bubbler installed.
  - c. One (1) quick coupler with a  $\frac{3}{4}$  inch bronze hose bib, bent nose type with hand wheel and coupler key.
  - d. "As-built" mylars from "record" prints.
2. Turnover the above spare parts to the District at the final observation.

**END OF SECTION**

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SECTION 32 91 00

PLANTING SOIL

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**PART 1 GENERAL**

**1.01 SUMMARY**

- A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soil and /or the modification of existing site soil for use as Planting Soil, complete as shown on the drawings and as specified herein.
- B. The scope of work in this section includes, but is not limited to, the following:
  - 1. Locate, purchase, deliver and install Imported Planting Soil and soil amendments.
  - 2. Install Planting Soil Mixes
  - 3. Clean up and disposal of all excess and surplus material.

**1.02 CONTRACT DOCUMENTS**

- A. Shall consist of specifications, general conditions, and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

**1.03 REFERENCES**

- A. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the Specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specifications conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.
  - 1. ASTM: American Society of Testing Materials cited section numbers.
  - 2. U.S. Department of Agriculture, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI. Available Online.
  - 3. US Composting Council [www.compostingcouncil.org](http://www.compostingcouncil.org) and [http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/Landscape\\_Arch\\_Specs.pdf](http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/Landscape_Arch_Specs.pdf).
  - 4. *Methods of Soil Analysis*, as published by the Soil Science Society of America (<http://www.soils.org/>).
  - 5. Up by Roots: healthy soils and trees in the built environment. 2008. J. Urban. International Society of Arboriculture, Champaign, IL.
  - 6. *Soils in Urban Agriculture: Testing, Remediation and Best Management Practices for California Community Gardens and Urban Farms*, University of California Agriculture and Natural Resources, Cooperative Extension <https://ucanr.edu/sites/UrbanAg/files/197207.pdf>
  - 7. *Reusing Potentially Contaminated Landscapes: Growing Gardens in Urban Soils*, U.S. EPA, 2011 [https://clu-in.org/download/misc/urban\\_gardening\\_fact\\_sheet.pdf](https://clu-in.org/download/misc/urban_gardening_fact_sheet.pdf)

**1.04 VERIFICATION**

- A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner's Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner's Representative.

**1.05 PERMITS AND REGULATIONS**

- A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
- B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.
- C. In case of conflict among any referenced standards or codes or among any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.
- D. Comply with the requirements of the California code of regulation title 23 waters, division 2 department of water resources chapter 2.7 model water efficient landscape ordinance, 492.5 soil management report.
  - 1. Where requirements of specification section Planting Soil are more stringent than the California code, the more stringent requirements shall prevail.

**1.06 PROTECTION OF WORK, PROPERTY AND PERSON**

- A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions.

**1.07 CHANGES IN WORK**

- A. The Owner's Representative may order changes in the work, and the contract sum adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.
- B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

**1.08 CORRECTION OF WORK**

- A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest possible time that can be coordinated with other work and seasonal weather demands but not more than 180 (one hundred and eighty) days after notification.

**1.09 DEFINITIONS**

- A. Acceptable drainage: Drainage rate is sufficient for the plants to be grown. Not too fast and not too slow. Typical rates for installed Planting Soil are between 1 - 5 inches per hour. Turf soils are often higher, but drainage rates above 2 - 3 inches per hour will dry out very fast. In natural undisturbed soil a much lower drainage rate, as low as 1/8<sup>th</sup> inch per hour can still support good plant growth. Wetland plants can grow on top of perched water layers or even within seasonal perched water layers, but could become unstable in high wind events.
- B. Amendment: material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, biological, and pH amendments.
- C. Biological Amendment: Amendments such as Mycorrhizal additives, compost tea or other products intended to change the soil biology.
- D. Compacted soil: soil where the density of the soil is greater than the threshold for root limiting, and further defined in this specification.
- E. Compost: well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.
- F. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units

are inches per hour).

- G. End of Warranty Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation (if applicable) work run concurrent with each other, and further defined in this specification.
- H. Fertilizer: amendment used for the purpose of adjusting soil nutrient composition and balance.
- I. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification, and further defined in this specification.
- J. Finished grade: surface or elevation of Planting Soil after final grading and 12 months of settlement of the soil, and further defined in this specification.
- K. Installed soil: Planting soil and existing site soil that is spread and or graded to form a planting soil, and further defined in this specification.
- L. Owner's Representative: The person or entity, appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.
- M. On-Structure: Planted areas to be installed on top of concrete structure built under another Section.
- N. Ped: a clump or clod of soil held together by a combination of clay, organic matter, and fungal hyphae, retaining the original structure of the harvested soil.
- O. Planting Soil: Topsoil, or Planting Soil Mixes which are imported or existing at the site, or made from components that exist at the site, or are imported to the site; and further defined in this specification.
- P. Poor drainage: Soil drainage that is slower than that to which the plants can adapt. This is a wide range of metrics, but generally if the soil is turning grey in color it is reasonable preferable to either to plant moisture adaptive plants at smaller sizes that are young in age with shallow root balls or look at options to improve the drainage
- Q. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation (if applicable) where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project, and further defined in this specification.

#### **1.10 SUBMITTALS**

- A. See the contract General Conditions for policy and procedures related to submittals.
  - 1. Submit all product submittals eight weeks prior to the start of the soil work.
  - 2. Product data and certificates: For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with the following:
    - 3. Submit manufacturers or supplier's product data and literature certified analysis for standard products and bulk materials, complying with testing requirements and referenced standards and specific requested testing.
      - i. For each Compost product submit the following analysis by a recognized laboratory:
        - 1.) pH
        - 2.) Salt concentration (electrical conductivity)
        - 3.) Moisture content %, wet weight basis
        - 4.) Particle size % passing a selected mesh size, dry weight basis
        - 5.) Stability carbon dioxide evolution rate mg CO<sub>2</sub>-C per g OM per day
        - 6.) Solvita maturity test
        - 7.) Physical contaminants (inerts) %, dry weight basis
        - 8.) US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels Chemical Contaminants mg/kg (ppm)
      - ii. For Coarse Sand product submit the following analysis by a recognized

laboratory:

- 1.) pH
- 2.) Particle size distribution (percent passing the following sieve sizes):
  - 3/8 inch (9.5 mm)
  - No 4 (4.75 mm)
  - No 8 (2.36 mm)
  - No 16 (1.18 mm)
  - No 30 (.60 mm)
  - No 50 (.30 mm)
  - No 100 (.15 mm)
  - No 200 (.075 mm)

- B. Samples: Submit samples of each product and material, where required by Part 2 of the specification, to the Owner's Representative for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only.
1. Submit samples a minimum of 8 weeks prior to the anticipated date of the start of soil installation.
  2. Samples of all Compost and Planting Soil Mixes shall be submitted at the same time as the particle size and physical analysis of that material.
  3. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the Owner's Representative.
    - b. All soil testing will be at the expense of the Contractor.

Submit all testing required by California Code of regulation Title 23 Waters, Division 2 Department of Water resources Chapter 2.7 Model Water Efficient Landscape Ordinance, 492.5 Soil Management Report.

Provide a particle size analysis (% dry weight) and USDA soil texture analysis. Soil testing of Planting Soil Mixes shall also include USDA gradation (percentage) of gravel, coarse sand, medium sand, and fine sand in addition to silt and clay.

Provide the following other soil properties:

- c. pH and buffer pH.
- d. Percent organic content by oven dried weight.
- e. Nutrient levels by parts per million including: phosphorus, potassium, magnesium, manganese, iron, zinc and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.
- f. Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.
- g. Cation Exchange Capacity (CEC).

#### **1.12 PRE-CONSTRUCTION CONFERENCE**

- A. Schedule a pre-construction meeting with the Owner's Representative at least fourteen (14) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.

#### **1.13 QUALITY ASSURANCE**

- A. Installer Qualifications: The installer shall be a firm having at least 5 years of experience of a scope similar to that required for the work, including the preparation, mixing and installation of soil

mixes to support planting. The installer of the work in Section: Planting, shall be the same firm installing the work in this section.

- B. The bidders list for work under this section shall be approved by the Owner's Representative.
- C. Installer Field Supervision: When any Planting Soil work is in progress, installer shall maintain, on site, an experienced full-time supervisor who can communicate in English with the Owner's Representative.
- D. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades and can communicate in English with the Owner's Representative.
- E. The installer's crew shall be experienced in the installation of Planting Soil, plantings, and irrigation (where applicable) and interpretation of planting plans, soil installation plans, and irrigation plans (where applicable).
- F. Submit references of past projects and employee training certifications that support that the Contractors meet all of the above installer qualifications and applicable licensures.
- G. Soil testing laboratory qualifications: an independent laboratory, with the experience and capability to conduct the testing indicated and that specializes in USDA agricultural soil testing, Planting Soil Mixes, and the types of tests to be performed. Geotechnical engineering testing labs shall not be used.
- H. All delivered and installed Planting Soil shall conform to the approved submittals sample color, texture and approved test analysis.
  - a. The Owner's Representative may request samples of the delivered or installed soil be tested for analysis to confirm the Planting Soil conforms to the approved material.
  - b. All testing shall be performed by the same soil lab that performed the original Planting Soil testing.
  - c. Testing results shall be within 10% plus or minus of the values measured in the approved Planting Soil Mixes.
  - d. Any Planting Soil that fails to meet the above criteria, if requested by the Owner's Representative, shall be removed and new soil installed.
- I. Soil compaction testing: following installation or modification of soil, test soil compaction with a penetrometer.
  - a. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.
    - i. Penetrometer shall be AgraTronix Soil Compaction Meter distributed by Ben Meadows, [www.benmeadows.com](http://www.benmeadows.com) or approved equal.
    - ii. Moisture meter shall be "general digital soil moisture meter" distributed by Ben Meadows, [www.benmeadows.com](http://www.benmeadows.com) or approved equal.
    - iii. Prior to testing the soil with the penetrometer check the soil moisture and penetrometer readings in the mockup soils. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.
    - iv. The penetrometer readings shall be within 20% plus or minus of the readings in the approved mockup when at similar moisture levels.

#### **1.14 SITE CONDITIONS**

- A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
  - a. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner's Representative in writing, stating the conditions and submit a proposal covering the cost of corrections. If the Contractor fails to notify the Owner's Representative of such conditions, they shall remain responsible for plant material under the warranty clause of the specifications.
  - b. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.



**1.15 SOIL COMPACTION – GENERAL REQUIREMENTS**

- A. Except where more stringent requirements are defined in this specification. The following parameters shall define the general description of the threshold points of soil compaction in existing, modified or installed soil and subsoil.

a. The following are threshold levels of compaction as determined by each method.

Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.

1. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
2. Standard Proctor Method – 75-85%; soil below 75% is unstable and will settle excessively.
3. Penetration Resistance Method – about 75-250 psi, below 75 psi soil becomes increasingly unstable and will settle excessively.

Root limiting Compaction: Root growth is limited with fewer, shorter and slower growing roots.

Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.

- a. Standard Proctor Method – above approximately 85%.
- b. Penetration Resistance Method – about 300 psi.

Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.

- c. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
- d. Standard Proctor Method – Above 90%.
- e. Penetration Resistance Method – Approximately above 400 psi

**1.16 DELIVERY, STORAGE, AND HANDLING**

- A. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity.
- B. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.
- C. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.
- D. Deliver all chemical amendments in original, unopened containers with original labels intact and legible, which state the guaranteed chemical analysis. Store all chemicals in a weather protected enclosure.
- E. Bulk material: Coordinate delivery and storage with Owner's Representative and confine materials to neat piles in areas acceptable to Owner's Representative.

**1.17 EXCAVATING AND GRADING AROUND UTILITIES**

- A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Determine location of underground utilities and perform work in a manner that will avoid damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Notification of Dig Alert dial '811', is required for all planting areas. The Contractor is responsible for knowing the location and avoiding utilities that are not covered by Dig Alert.

**PART 2 PRODUCTS**

**2.01 COMPOST**

- A. Compost: Blended and ground leaf, wood and other plant based material, composted for a minimum of 9 months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plant or manure based material designed to produce Compost high in fungal material.
- B. Compost shall be commercially prepared Compost and meet US Compost Council STA/TMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component".  
[http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/Landscape\\_Arch\\_Specs.pdf](http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/Landscape_Arch_Specs.pdf)
- C. 'Amendment Mix' by Lyngso Garden Materials, San Carlos, CA (650) 364-1730, or approved equal.
- D. Compost shall comply with the following parameters:
  - a. pH: 5.5 - 8.0.
  - b. Soil salt (electrical conductivity): maximum 5 dS/m (mmhos/cm).
  - c. Moisture content %, wet weight basis: 30 – 60.
  - d. Particle size, dry weight basis: 98% pass through 3/4 inch screen or smear.
  - e. Stability carbon dioxide evolution rate: mg CO<sub>2</sub>-C/ g OM/ day < 2.
  - f. Solvita maturity test: > 6.
  - g. Physical contaminants (inerts), %, dry weight basis: <1%.
  - h. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels.
  - i. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements.
  - j. OMRI Certified or equal
- B. Provide a two gallon sample with manufacturer's literature and material certification that the product meets the requirements.

**2.02 FERTILIZER, BIOLOGICAL and OTHER AMENDMENTS**

- A. Blood Meal (12-0-0)
  - a. Class: Class One
  - b. OMRI Certified
  - c. Provide manufacturer's literature and certification that the product meets the requirements
- B. Steamed Bone Meal (3-15-0)
  - a. Class: Class One
  - b. OMRI Certified
  - c. Provide manufacturer's literature and certification that the product meets the requirements
- C. Potassium Sulfate (0-0-50)
  - a. Class: Class One
  - b. OMRI Certified
  - c. Provide manufacturer's literature and certification that the product meets the requirements
- D. Mycorrhizal inoculant
  - a. Fine suspendable material with particle size less than #50 screen
  - b. 'Mycorrhizal Landscape Inoculant' by Bio Organics or approved equal
  - c. Provide manufacturer's literature and certification that the product meets the requirements

### 2.03 PLANTING SOIL MIXES

- A. General definition: Mixes of Existing Soil or Imported Topsoil, Coarse Sand, and or Compost to make a new soil that meets the project goals for the indicated planting area. These may be mixed off site or onsite, and will vary in Mix components and proportions as indicated.

B. Orchard trees - Soil Profile A

- a. A mix of Bagged Materials and native soil blended in place / cubic yard  
1. The approximate mix ratio shall be:

<u>Mix component</u>	<u>/ Cubic yard</u>
Blood Meal	1/3 pound
Steamed Bone Meal	3/4 pound
Potassium Sulfate	3 pounds
Mycorrhizal Inoculant	per mfg's recommendations

2. Final tested organic matter between 2.75 and 4% (by dry weight).  
3. Soil mix shall be pit amended  
4. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. Clumps of Soil, Compost and Coarse Sand will be permitted in the overall Mix.

At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.

Provide a two gallon sample with testing data that includes recommendations for chemical additives for the types of plants to be grown. Samples and testing data shall be submitted at the same time..

C. Vineyard - Soil Profile B - no soil amendments recommended

D. In Ground Crops - Soil Profile C

- a. A mix of Bagged Materials, bulk materials and native soil blended in place / 1000 SF  
1. The approximate mix ratio shall be:

<u>Mix component</u>	<u>/ 1000 SF</u>
Blood Meal	6 lbs
Steamed Bone Meal	15 lbs
Potassium Sulfate	3 lbs
Compost	3 cu yd

2. Final tested organic matter between 2.75 and 4% (by dry weight).  
3. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. Clumps of Soil, Compost and Coarse Sand will be permitted in the overall Mix.

At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.

Provide a two gallon sample with testing data that includes recommendations for chemical additives for the types of plants to be grown. Samples and testing data shall be submitted at the same time..

E. Floral Cutting Garden - Soil Profile E

- a. A mix of Bagged Materials and native soil blended in place / 1000 SF  
4. The approximate mix ratio shall be:

<u>Mix component</u>	<u>/ 1000 SF</u>
Blood Meal	6 lbs

Steamed Bone Meal	15 lbs
Potassium Sulfate	3 lbs

5. Final tested organic matter between 2.75 and 4% (by dry weight).
6. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. Clumps of Soil, Compost and Coarse Sand will be permitted in the overall Mix.

At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.

Provide a two gallon sample with testing data that includes recommendations for chemical additives for the types of plants to be grown. Samples and testing data shall be submitted at the same time..

F. Organic Raised Bed Soil Mix - Soil Profile D - Organic Raised Bed Soil Mix - highly nutrient dense, well draining, OMRI certified, organic soil blend

1. A mix of Bagged Materials from Kellogg Garden Products, 350 W. Sepulveda Blvd., Carson, CA (323) 449-1097
2. The approximate mix ratio shall be:

<u>Mix component</u>	<u>% by moist volume</u>
Blue Ribbon Blend, Gardner & Bloome	45-50%
Harvest Supreme, Gardner & Bloome	25%
Purley Compost, Gardner & Bloome	12.5%
Composted Chicken Manure, Gardner & Bloome	12.5%

3. Mix the four bagged products together directly in the raised beds. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil.
4. Provide a two gallon sample.

G. Acid Soil Mix - Soil Profile F - fertile

1. A mix of natives soil and pre-mixed bulk planting mix.
2. Bulk materials to be 'Rhododendron Mix' by Lyngso Garden Materials, San Carlos, CA (650) 364-1730, or approved equal.
3. The approximate ratio shall be:

<u>Mix component</u>	<u>/ 1000 SF</u>
Rhododendron	3 cu yds

4. Final tested organic matter between 2.75 and 4% (by dry weight).
5. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. Clumps of Soil, Compost and Coarse Sand will be permitted in the overall Mix.

At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.

Provide a two gallon sample with testing data that includes recommendations for chemical additives for the types of plants to be grown. Samples and testing data shall be submitted at the same time.

### PART 3 - EXECUTION

#### 3.01 SITE EXAMINATION

- A. Prior to installation of Planting Soil, examine the site to confirm that existing conditions are satisfactory for the work of this section to proceed.
  1. Confirm that the raised beds are intact.

2. Planter floors shall slope toward the under drain lines as shown on the drawings.
  3. Confirm that surface all areas to be filled with Planting Soil Mixes are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.
  4. Confirm that no adverse drainage conditions are present.
  5. Confirm that no conditions are present which are detrimental to plant growth.
  6. Confirm that utility work has been completed per the drawings.
  7. Confirm that irrigation work, which is shown to be installed below prepared soil levels, has been completed.
- B. If unsatisfactory conditions are encountered, notify the Owner's Representative immediately to determine corrective action before proceeding.

### **3.02 COORDINATION WITH PROJECT WORK**

- A. The Contractor shall coordinate with all other work that may impact the completion of the work.
- B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.
- C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

### **3.03 GRADE AND ELEVATION CONTROL**

- A. Provide grade and elevation control during installation of Planting Soil. Utilize grade stakes, surveying equipment, and other means and methods to assure that grades and contours conform to the grades indicated on the plans.

### **3.04 SITE PREPARATION**

- A. Excavate to the proposed subgrade. Maintain all required angles of repose of the adjacent materials as shown on the drawings or as required by this specification. Do not over excavate compacted subgrades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving and structures where the bottom of the paving or structure is above the bottom elevation of the excavated planting area.
- B. Remove all construction debris and material including any construction materials from the subgrade.
- C. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
- D. In areas where Planting Soil is to be spread, confirm subgrade has been scarified.
- E. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 1/2 inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.

At the end of each working day, clean up any soil or dirt spilled on any paved surface.

Any damage to the paving or site features or work shall be repaired at the Contractor's expense.

### **3.05 PLANTING SOIL MIX INSTALLATION**

- A. Prior to installing any Planting Soil from stockpiles or Planting Soil Mixes blended off site, the Owner's Representative shall approve the condition of the subgrade and the previously installed subgrade preparation and the installation of subsurface drainage.
- B. All equipment utilized to install or grade Planting Soils shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery

- equipment shall have buckets equipped with 6 inch long teeth to scarify any soil that becomes compacted.
- C. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Planting Soil.
    - 1. Scarify the subsoil of the subgrade to a depth of 3 – 6 inches with the teeth of the backhoe or loader bucket, tiller or other suitable device.
    - 2. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.
    - 3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.
  - D. Install the Planting Soil in 12 - 18 inch lifts to the required depths. Apply compacting forces to each lift as required to attain the required compaction.
  - E. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil.
  - F. Where possible place large trees first and fill Planting Soil around the root ball.
  - G. Installing soil with soil or mulch blowers or soil slingers shall not be permitted due to the over mixing and soil ped breakdown caused by this type of equipment.
  - H. The depths and grades shown on the drawings are the final grades after settlement and shrinkage of the compost material. The Contractor shall install the Planting Soil at a higher level to anticipate this reduction of Planting Soil volume. A minimum settlement of approximately 10 - 15% of the soil depth is expected. All grade increases are assumed to be as measured prior to the addition of surface Compost till layer, mulch, or sod.

### **3.06 FINE GRADING**

- A. The Owner's Representative shall approve all rough grading prior to the installation of Compost, fine grading, planting, and mulching.
- B. Grade the finish surface of all planted areas to meet the grades shown on the drawings, allowing the finished grades to remain higher (10 – 15% of depth of soil modification) than the grades on the grading plan, as defined in paragraph Planting Soil Installation, to anticipate settlement over the first year.
- C. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.
- D. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Owner's Representative in the event that conditions make it impossible to achieve positive drainage.
- E. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the drawings.
- F. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in shrub and groundcover planting areas shall be a 2 inch deviation from the plane in 10 feet. The tolerance for dips and bumps in lawn areas shall be a 1 inch deviation from the plane in 10 feet.

### **3.07 CLEAN-UP**

- A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
  - 1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
- B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative seals are to remain on the trees and removed at the end of

the warranty period.

1. Make all repairs to grades, ruts, and damage to the work or other work at the site.
2. Remove and dispose of all excess Planting Soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

**3.08 PROTECTION DURING CONSTRUCTION**

- A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers.
  1. Maintain protection during installation until the date of plant acceptance (see specifications section – Planting). Treat, repair or replace damaged work immediately.
  2. Provide temporary erosion control as needed to stop soil erosion until the site is stabilized with mulch, plantings or turf.
- B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory. Damage to existing trees shall be assessed by a certified arborist.

**3.09 SUBSTANTIAL COMPLETION ACCEPTANCE**

- A. Upon written notice from the Contractor, the Owner's Representative shall review the work and make a determination if the work is substantially complete.
- B. The date of substantial completion of the planting soil shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

**3.10 FINAL ACCEPTANCE / SOIL SETTLEMENT**

- A. At the end of the plant warranty and maintenance period, (see Specification section - Planting) the Owner's Representative shall observe the soil installation work and establish that all provisions of the contract are complete and the work is satisfactory.
  1. Restore any soil settlement and or erosion areas to the grades shown on the drawings. When restoring soil grades remove plants and mulch and add soil before restoring the planting. Do not add soil over the root balls of plants or on top of mulch.
- B. Failure to pass acceptance: If the work fails to pass final acceptance, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owner's Representative.

END OF SECTION 32 91 00

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SECTION 32 93 00

PLANTING

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**PART 1 – GENERAL**

1.1 SUMMARY

- A. The scope of work includes all labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of plant (also known as "landscaping") complete as shown on the drawings and as specified herein.
- A. The scope of work in this section includes, but is not limited to, the following:
  - 1. Locate, purchase, deliver and install all specified plants.
  - 2. Water all specified plants.
  - 3. Mulch, fertilize, stake, and prune all specified plants.
  - 4. Maintenance of all specified plants until the beginning of the warranty period.
  - 5. Plant warranty.
  - 6. Clean up and disposal of all excess and surplus material.
  - 7. Maintenance of all specified plants during the warranty period.

1.2 CONTRACT DOCUMENTS

- A. Shall consist of specifications and general conditions and the construction drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 RELATED DOCUMENTS AND REFERENCES

- B. Related Documents:
  - 8. Drawings and general provisions of contract including general and supplementary conditions and Division I specifications apply to work of this section
  - 9. Related Specification Sections
    - a. Section - Planting Soil
    - b. Section - Irrigation
- C. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail or as determined by the Owner's Representative.
  - 1. State of California, Department of Food and Agriculture, Regulations for Nursery Inspections, Rules and Grading.
  - 2. ANSI Z60.1 American Standard for Nursery Stock, most current edition.
  - 3. ANSI A 300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current edition and parts.
  - 4. Florida Grades and Standards for Nursery Stock, current edition (Florida Department of



Agriculture, Tallahassee FL).

5. Interpretation of plant names and descriptions shall reference the following documents. Where the names or plant descriptions disagree between the several documents, the most current document shall prevail.
  - c. USDA - The Germplasm Resources Information Network ([GRIN](http://www.ars-grin.gov/npgs/searchgrin.html))  
<http://www.ars-grin.gov/npgs/searchgrin.html>
  - d. The New Sunset Western Garden Book, Oxmoor House, most current edition.
  - e. Landscape Plants for California Gardens; Land Design Publishing, Claremont, California, most current edition.
6. Pruning practices shall conform to recommendations "Structural Pruning: A Guide For The Green Industry" most current edition; published by Urban Tree Foundation, Visalia, California.
2. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign IL, most current edition.

#### 1.4 VERIFICATION

- A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner's Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner's Representative.
- B. In the case of a discrepancy in the plant quantities between the plan drawings and the plant callouts, list or plant schedule, the number of plants or square footage of the planting bed actually drawn on the plan drawings shall be deemed correct and prevail.

#### 1.5 PERMITS AND REGULATIONS

- A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
- B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.
- C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.

#### 1.6 PROTECTION OF WORK, PROPERTY AND PERSON

- A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

#### 1.7 CHANGES IN THE WORK

- A. The Owner's Representative may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.
- B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

#### 1.8 CORRECTION OF WORK

- A. The Contractor, at their own cost, shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest as possible time that can be coordinated with other work and seasonal weather demands.

**1.9 DEFINITIONS**

All terms in this specification shall be as defined in the "Glossary of Arboricultural Terms" or as modified below.

- A. Container plant: Plants that are grown in and/or are currently in a container including boxed trees.
- B. Defective plant: Any plant that fails to meet the plant quality requirement of this specification.
- C. End of Warranty Final Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation work run concurrent with each other.
- D. Healthy: Plants that are growing in a condition that expresses leaf size, crown density, color; and with annual growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site soil, drainage and weather conditions.
- E. Kinked root: A root within the root package that bends more than 90 degrees.
- F. Maintenance: Actions that preserve the health of plants after installation and as defined in this specification.
- G. Maintenance period: The time period, as defined in this specification, which the Contractor is to provide maintenance.
- H. Normal: the prevailing protocol of industry standard(s).
- I. Owner's Representative: The person appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.
- J. Reasonable and reasonably: When used in this specification relative to plant quality, it is intended to mean that the conditions cited will not affect the establishment or long term stability, health or growth of the plant. This specification recognizes that it is not possible to produce plants free of all defects, but that some accepted industry protocols and standards result in plants unacceptable to this project.

When reasonable or reasonably is used in relation to other issues such as weeds, diseased, insects, it shall mean at levels low enough that no treatment would be required when applying recognized Integrated Plant Management practices.

This specification recognizes that some decisions cannot be totally based on measured findings and that professional judgment is required. In cases of differing opinion, the Owner's Representative's expert shall determine when conditions are judged as reasonable.

- K. Root ball: The mass of roots including any soil or substrate that is shipped with the tree within the root ball package.
- L. Root ball package. The material that surrounds the root ball during shipping. The root package may include the material in which the plant was grown, or new packaging placed around the root ball for shipping.
- M. Root collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where

the majority of the structural roots join the plant stem, usually at or near ground level.

- N. Shrub: Woody plants with mature height approximately less than 15 feet.
- O. Spade harvested and transplanted: Field grown trees that are mechanically harvested and immediately transplanted to the final growing site without being removed from the digging machine.
- P. Stem: The trunk of the tree.
- Q. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project.
- R. Stem girdling root: Any root more than ¼ inch diameter currently touching the trunk, or with the potential to touch the trunk, above the root collar approximately tangent to the trunk circumference or circling the trunk. Roots shall be considered as Stem Girdling that have, or are likely to have in the future, root to trunk bark contact.
- S. Structural root: One of the largest roots emerging from the root collar.
- T. Tree: Single and multi-stemmed plants with mature height approximately greater than 15 feet.

#### 1.10 SUBMITTALS

- D. See contract general conditions for policy and procedure related to submittals.
  - E. Submit all product submittals 8 weeks prior to installation of plantings.
  - F. Product data: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal eight weeks before the installation of plants.
  - G. Plant growers' certificates: Submit plant growers' certificates for all plants indicating that each meets the requirements of the specification, including the requirements of tree quality, to the Owner's Representative for approval. Provide submittal eight weeks before the installation of plants.
  - H. Samples: Submit samples of each product and material where required by the specification to the Owner's Representative for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
  - I. Plant sources: Submit sources of all plants as required by Article – "Selection of Plants" to the Owner's Representative for approval.
  - J. Close out submittals: Submit to the Owner's Representative for approval.
7. Plant maintenance data and requirements.
- K. Warranty period site visit record: If there is no maintenance during the warranty period, after each site visit during the warranty period, by the Contractor, as required by this specification, submit a written record of the visit, including any problems, potential problems, and any recommended corrective action to the Owner's Representative for approval.
  - L. Installation plan submitted a minimum of 14 days prior to the scheduled installation. Plan should describe the methods, activities, materials and schedule to achieve installation of plants.

#### 1.11 OBSERVATION OF THE WORK

- A. The Owner's Representative may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed

- from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.
- B. The Owner's Representative shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Owner's Representative shall be afforded sufficient time to schedule visit to the site. Failure of the Owner's Representative to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.
1. SITE CONDITIONS PRIOR TO THE START OF PLANTING: review the soil and drainage conditions.
  2. COMPLETION OF THE PLANT LAYOUT STAKING: Review of the plant layout.
  3. PLANT QUALITY: Review of plant quality at the time of delivery and prior to installation. Review tree quality prior to unloading where possible, but in all cases prior to planting.
  4. COMPLETION OF THE PLANTING: Review the completed planting.
- 1.12 PRE-CONSTRUCTION CONFERENCE
- A. Schedule a pre-construction meeting with the Owner's Representative at least fourteen (14) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.
- 1.13 QUALITY ASSURANCE
- M. Substantial Completion Acceptance - Acceptance of the work prior to the start of the warranty period:
8. Once the Contractor completes the installation of all items in this section, the Owner's Representative will observe all work for Substantial Completion Acceptance upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of the observation.
  9. Substantial Completion Acceptance by the Owner's Representative shall be for general conformance to specified size, character and quality and not relieve the Contractor of responsibility for full conformance to the contract documents, including correct species.
  1. Any plants that are deemed defective as defined under the provisions below shall not be accepted.
- N. The Owner's Representative will provide the Contractor with written acknowledgment of the date of Substantial Completion Acceptance and the beginning of the warranty period and plant maintenance period (if plant maintenance is included).
- O. Contractor's Quality Assurance Responsibilities: The Contractor is solely responsible for quality control of the work.
- P. Installer Qualifications: The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the work, including the handling and planting of large specimen trees in urban areas. The same firm shall install planting soil (where applicable) and plant material.
2. The bidder's list for work under this section shall be approved by the Owner's Representative.
  3. Installer Field Supervision: When any planting work is in progress, installer shall maintain, on site, a full-time supervisor who can communicate in English with the Owner's Representative.
  4. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing plants and trees of the quality and scale of the proposed project, and can communicate in English with the Owner's Representative.

5. The installer's crew shall have a minimum of 3 years experienced in the installation of Planting Soil, Plantings, and Irrigation (where applicable) and interpretation of soil plans, planting plans and irrigation plans.
6. Submit references of past projects, employee training certifications that support that the Contractors meets all of the above installer qualifications and applicable licensures.

**1.14 PLANT WARRANTY**

**Q. Plant Warranty:**

1. The Contractor agrees to replace defective work and defective plants. The Owner's Representative shall make the final determination if plants meet these specifications or that plants are defective.

Plants warranty shall begin on the date of Substantial Completion Acceptance and continue for the following periods, classed by plant type:

- a. Trees – 1 Year(s).
  - b. Shrubs – 1 Year(s).
  - c. Ground cover and perennial flower plants – 1 Year(s).
  - d. Bulbs, annual flower and seasonal color plants – for the period of expected bloom or primary display.
2. When the work is accepted in parts, the warranty periods shall extend from each of the partial Substantial Completion Acceptances to the terminal date of the last warranty period. Thus, all warranty periods for each class of plant warranty, shall terminate at one time.
  2. All plants shall be warrantied to meet all the requirements for plant quality at installation in this specification. Defective plants shall be defined as plants not meeting these requirements. The Owner's representative shall make the final determination that plants are defective.
  3. Plants determined to be defective shall be removed immediately upon notification by the Owner's Representative and replaced without cost to the Owner, as soon as weather conditions permit and within the specified planting period.
  3. Any work required by this specification or the Owner's Representative during the progress of the work, to correct plant defects including the removal of roots or branches, or planting plants that have been bare rooted during installation to observe for or correct root defects shall not be considered as grounds to void any conditions of the warranty. In the event that the Contractor decides that such remediation work may compromise the future health of the plant, the plant or plants in question shall be rejected and replaced with plants that do not contain defects that require remediation or correction.
  4. The Contractor is exempt from replacing plants, after Substantial Completion Acceptance and during the warranty period, that are removed by others, lost or damaged due to occupancy of project, lost or damaged by a third party, vandalism, or any natural disaster.
  5. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.
  6. The warranty of all replacement plants shall extend for an additional one-year period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended warranty period, the Owner's Representative may elect one more replacement items or credit for each item. These tertiary replacement items are not protected under a warranty period.
  7. During and by the end of the warranty period, remove all tree wrap, ties, and guying unless agreed to by the Owner's Representative to remain in place. All trees that do not

have sufficient caliper to remain upright, or those requiring additional anchorage in windy locations, shall be staked or remain staked, if required by the Owner's Representative.

- R. End of Warranty Final Acceptance - Acceptance of plants at the end of the warranty period.
  - 8. At the end of the warranty period, the Owner's Representative shall observe all warranted work, upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date for final observation.
  - 9. End of Warranty Final Acceptance will be given only when all the requirements of the work under this specification and in specification sections Planting Soil and Irrigation have been met.

#### 1.15 SELECTION AND OBSERVATION OF PLANTS

- A. The Owner's Representative may review all plants subject to approval of size, health, quality, character, etc. Review or approval of any plant during the process of selection, delivery, installation and establishment period shall not prevent that plant from later rejection in the event that the plant quality changes or previously existing defects become apparent that were not observed.
- S. Plant Selection: The Owner's Representative reserves the right to select and observe all plants at the nursery prior to delivery and to reject plants that do not meet specifications as set forth in this specification. If a particular defect or substandard element can be corrected at the nursery, as determined by the Owner's Representative, the agreed upon remedy may be applied by the nursery or the Contractor provided that the correction allows the plant to meet the requirements set forth in this specification. Any work to correct plant defects shall be at the contractor's expense.
  - 1. The Owner's Representative may make invasive observation of the plant's root system in the area of the root collar and the top of the root ball in general in order to determine that the plant meets the quality requirements for depth of the root collar and presence of roots above the root collar. Such observations will not harm the plant.
  - 2. Corrections are to be undertaken at the nursery prior to shipping.
- T. The Contractor shall bear all cost related to plant corrections.
- B. All plants that are rejected shall be immediately removed from the site and acceptable replacement plants provided at no cost to the Owner.
- U. Submit to the Owner's Representative, for approval, plant sources including the names and locations of nurseries proposed as sources of acceptable plants, and a list of the plants they will provide. The plant list shall include the botanical and common name and the size at the time of selection. Observe all nursery materials to determine that the materials meet the requirements of this section.
- V. Each tree shall have a numbered seal applied by the Contractor. The seal shall be placed on a lateral branch on the north side of the tree. The seal shall be a tamper proof plastic seal bearing the Contractors name and a unique seven-digit number embossed on the seal.
  - 1. Do not place seals on branches that are so large that there is not sufficient room for the branch growth over the period of the warranty.
- W. The Owner's Representative may choose to attach their seal to each plant, or a representative sample. Viewing and/or sealing of plants by the Owner's Representative at the nursery does not preclude the Owner's Representative's right to reject material while on site. The Contractor is responsible for paying any up charge for the Owner's Representative to attach their seal to specific plants.
- X. Where requested by the Owner's Representative, submit photographs of plants or representative samples of plants. Photographs shall be legible and clearly depict the plant specimen. Each submitted image shall contain a height reference, such as a measuring stick. The approval of plants by the Owner's Representative via photograph does not preclude the Owner's Representative's right to reject material while on site.

**1.16 PLANT SUBSTITUTIONS FOR PLANTS NOT AVAILABLE**

- Y. Submit all requests for substitutions of plant species, or size to the Owner's Representative, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

**1.17 SITE CONDITIONS**

- A. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
  - 1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner's Representative in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Owner's Representative of such conditions, he/she shall remain responsible for plant material under the warranty clause of the specifications.
- B. It is the responsibility of the Contractor to be familiar with the local growing conditions, and if any specified plants will be in conflict with these conditions. Report any potential conflicts, in writing, to the Owner's Representative.
- B. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.
  - 1. Planting operations shall not begin until such time that the irrigation system is completely operational for the area(s) to be planted, and the irrigation system for that area has been preliminarily observed and approved by the Owner's Representative.
- C. Actual planting shall be performed during those periods when weather and soil conditions are suitable in accordance with locally accepted horticultural practices.
  - 2. Do not install plants into saturated or frozen soils. Do not install plants during inclement weather, such as rain or snow or during extremely hot, cold or windy conditions.

**1.18 PLANTING AROUND UTILITIES**

- D. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- E. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- F. Notification of *Local Utility Locator Service, 811*, is required for all planting areas: The Contractor is responsible for knowing the location and avoiding utilities that are not covered by the *Local Utility Locator Service*.

**PART 2 – PRODUCTS**

**1.19 PLANTS: GENERAL**

- G. Standards and measurement: Provide plants of quantity, size, genus, species, and variety or cultivars as shown and scheduled in contract documents.

1. All plants including the root ball dimensions or container size to trunk caliper ratio shall conform to ANSI Z60.1 "American Standard for Nursery Stock" latest edition, unless modified by provisions in this specification. When there is a conflict between this specification and ANSI Z60.1, this specification section shall be considered correct.
  10. Plants larger than specified may be used if acceptable to the Owner's Representative. Use of such plants shall not increase the contract price. If larger plants are accepted the root ball size shall be in accordance with ANSI Z-60.1. Larger plants may not be acceptable if the resulting root ball cannot be fit into the required planting space.
  11. If a range of size is given, no plant shall be less than the minimum size and not less than 50 percent of the plants shall be as large as the maximum size specified. The measurements specified are the minimum and maximum size acceptable and are the measurements after pruning, where pruning is required.
- H. Proper Identification: All trees shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by genus, species, variety and cultivar.
- I. Compliance: All trees shall comply with federal and state laws and regulations requiring observation for plant disease, pests, and weeds. Observation certificates required by law shall accompany each shipment of plants.
- J. Plant Quality:
2. **General:** Provide healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability and health for the expected life of the plant
  3. **Plant quality above the soil line:** Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified. Tree quality above the soil line shall comply with the project Crown Acceptance details (or Florida Grades and Standards, tree grade Florida Fancy or Florida #1) and the following:
    - 1.) Crown: The form and density of the crown shall be typical for a young specimen of the species or cultivar pruned to a central and dominant leader.
      - a.) Crown specifications do not apply to plants that have been specifically trained in the nursery as topiary, espalier, multi-stem, clump, or unique selections such as contorted or weeping cultivars.
    - 2.) Leaves: The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress or over watering as indicated by wilted, shriveled, or dead leaves.
    - 3.) Branches: Shoot growth (length and diameter) throughout the crown should be appropriate for the age and size of the species or cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.
      - a.) Main branches shall be distributed along the central leader not clustered together. They shall form a balanced crown appropriate for the cultivar/species.
      - b.) Branch diameter shall be no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 1 inch above the branch union.
      - c.) The attachment of the largest branches (scaffold branches) shall be free of included bark.
    - 4.) Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds that penetrate to the wood (properly made pruning cuts, closed or not, are acceptable and are not considered wounds), sunburned areas, conks (fungal fruiting bodies), wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties, or lesions (mechanical injury).



- b. Trees shall have one central leader. If the leader was headed, a new leader (with a live terminal bud) at least one-half the diameter of the pruning cut shall be present.
  - 1.) All trees are assumed to have one central leader trees unless a different form is specified in the plant list or drawings.
- c. All graft unions, where applicable, shall be completely closed without visible sign of graft rejection. All grafts shall be visible above the soil line.
- d. Trunk caliper and taper shall be sufficient so that the lower five feet of the trunk remains vertical without a stake. Auxiliary stake may be used to maintain a straight leader in the upper half of the tree.

**4. Plant quality at or below the soil line:**

- a. Plant roots shall be normal to the plant type specified. Root observations shall take place without impacting tree health. Root quality at or below the soil line shall comply with the project Root Acceptance details and the following:
  - 1.) The roots shall be reasonably free of scrapes, broken or split wood.
  - 2.) The root system shall be reasonably free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Wounds resulting from root pruning used to produce a high quality root system are not considered injuries.
  - 3.) A minimum of three structural roots reasonably distributed around the trunk (not clustered on one side) shall be found in each plant. Root distribution shall be uniform throughout the root ball, and growth shall be appropriate for the species.
    - a.) Plants with structural roots on only one side of the trunk (J roots) shall be rejected.
  - 4.) The root collar shall be within the upper 2 inches of the substrate/soil. Two structural roots shall reach the side of the root ball near the top surface of the root ball. The grower may request a modification to this requirement for species with roots that rapidly descend, provided that the grower removes all stem girdling roots above the structural roots across the top of the root ball.
  - 5.) The root system shall be reasonably free of stem girdling roots over the root collar or kinked roots from nursery production practices.
  - 6.) At time of observations and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

- B. Submittals: Submit for approval the required plant quality certifications from the grower where plants are to be purchased, for each plant type. The certification must state that each plant meets all the above plant quality requirements.
  - 1. The grower's certification of plant quality does not prohibit the Owner's Representative from observing any plant or rejecting the plant if it is found to not meet the specification requirements.

1.20 ROOT BALL PACKAGE OPTIONS: The following root ball packages are permitted. Specific root ball packages shall be required where indicated on the plant list or in this specification. Any type of root ball packages that is not specifically defined in this specification shall not be permitted.

**A. CONTAINER (INCLUDING ABOVE-GROUND FABRIC CONTAINERS AND BOXES) PLANTS**

- 1. Container plants may be permitted only when indicated on the drawing, in this specification, or approved by the Owner's Representative.

2. Provide plants shall be established and well rooted in removable containers.
3. Container class size shall conform to ANSI Z60.1 for container plants for each size and type of plant.

**B. BARE ROOT PLANTS**

1. Harvest bare root plants while the plant is dormant and a minimum of 4 weeks prior to leaf out (bud break).
2. The root spread dimensions of the harvested plants shall conform to ANSI Z60.1 for nursery grown bare root plants for each size and type of plant. Just prior to shipping to the job site, dip the root system into a slurry of hydrogel (cross linked polyacrylamide) and water mixed at a rate of 15 oz. of hydrogel in 25 gallons of water. Do not shake off the excess hydrogel. Place the root system in a pleated black plastic bag and tie the bag snugly around the trunk. Bundle and tie the upper branches together.
3. Keep the trees in a cool dark space for storage and delivery. If daytime outside temperatures exceeds 70 degrees F, utilize a refrigerated storage area with temperature between 35 and 50 degrees.
4. Where possible, plan time of planting to be before bud break. For trees to be planted after bud break, place the trees before bud break in an irrigated bed of pea gravel.
  - a. The pea gravel bed shall be 18 inches deep over a sheet of plastic.
  - b. Space trees to allow the unbundled branches to grow without shading each other.
  - c. Once stored in pea gravel, allow the trees sufficient time for the new root system to flush and spring growth of leaves to fully develop before planting.
  - d. Pea gravel stored trees may be kept for up to one growing season.
  - e. Pea gravel stored trees shall be dipped, packaged and shipped similar to the requirements for freshly dug bare root trees above.

**1.21 ANNUAL FLOWERING AND SEASONAL COLOR PLANTS**

- A. Container or flat-grown plants should be sized as noted in the planting plan. Plants shall be well-rooted and healthy.

**1.22 PLANTING SOIL**

- A. Planting Soil as used in this specification means the soil at the planting site, or imported as modified and defined in specification Section Planting Soil. If there is no Planting Soil specification, the term Planting Soil shall mean the soil at the planting site within the planting hole.

**1.23 MULCH**

- A. Mulch shall be natural wood and or tree clippings used to suppress weeds in planting beds, beneath trees and cover soil for access paths. The size range shall be a minimum (less than 25% or less of volume) fine particles 3/8 inch or less in size, and a maximum size of individual pieces (largest 20% or less of volume) shall be approximately 1 to 1-1/2 inch in diameter and maximum length approximately 4 to 6". Pieces larger than 6 inch long that are visible on the surface of the mulch after installation shall be removed. Mulch shall not contain clippings from *Eucalyptus* or palm trees.
- B. Product to be "Premium Arbor Mulch" by Lyngso Garden Materials, San Carlos, CA (650) 364-1730, or approved equal.
- C. Submit supplier's product specification data sheet and a one gallon sample for approval.

**1.24 TREE STAKING AND GUYING MATERIAL**

- A. Tree guying to be flat woven polypropylene material, 3/4 inch wide, and 900 lb. break strength. Color to be Green. Product to be ArborTie manufactured by Deep Root Partners, L.P. or approved equal.
- B. Stakes shall be lodge pole stakes free of knots and of diameters and lengths appropriate to the size of plant as required to adequately support the plant.
- C. Submit manufacturer's product data for approval.

**PART 3 – EXECUTION**

**1.25 SITE EXAMINATION**

- D. Examine the surface grades and soil conditions to confirm that the requirements of the Specification Section – Planting Soil - and the soil and drainage modifications indicated on the Planting Soil Plan and Details (if applicable) have been completed. Notify the Owner's Representative in writing of any unsatisfactory conditions.

**1.26 DELIVERY, STORAGE AND HANDLING**

- E. Protect materials from deterioration during delivery and storage. Adequately protect plants from drying out, exposure of roots to sun, wind or extremes of heat and cold temperatures. If planting is delayed more than 24 hours after delivery, set plants in a location protected from sun and wind. Provide adequate water to the root ball package during the shipping and storage period.
  - 1. All plant materials must be available for observation prior to planting.
  - 2. Using a soil moisture meter, periodically check the soil moisture in the root balls of all plants to assure that the plants are being adequately watered. Volumetric soil moisture shall be maintained above wilting point and below field capacity for the root ball substrate or soil.
- A. Do not deliver more plants to the site than there is space with adequate storage conditions. Provide a suitable remote staging area for plants and other supplies.
  - 1. The Owner's Representative or Contractor shall approve the duration, method and location of storage of plants.
- F. Provide protective covering over all plants during transporting.

**1.27 PLANTING SEASON**

- G. Planting shall only be performed when weather and soil conditions are suitable for planting the materials specified in accordance with locally accepted practice. Install plants during the planting time as described below unless otherwise approved in writing by the Owner's Representative. In the event that the Contractor request planting outside the dates of the planting season, approval of the request does not change the requirements of the warranty.
  - 1. Deciduous trees and shrubs October to May
  - 2. Evergreen trees and shrubs October to May

**1.28 ADVERSE WEATHER CONDITIONS**

- A. No planting shall take place during extremely hot, dry, windy or freezing weather.

**1.29 COORDINATION WITH PROJECT WORK**

- H. The Contractor shall coordinate with all other work that may impact the completion of the work.
- I. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.

- J. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

### 1.30 LAYOUT AND PLANTING SEQUENCE

- K. Relative positions of all plants and trees are subject to approval of the Owner's Representative.
- L. Notify the Owner's Representative, one (1) week prior to layout. Layout all individual tree and shrub locations. Place plants above surface at planting location or place a labeled stake at planting location. Layout bed lines with paint for the Owner's Representative's approval. Secure the Owner's Representative's acceptance before digging and start of planting work.
- M. When applicable, plant trees before other plants are installed.
- N. It is understood that plants are not precise objects and that minor adjustments in the layout will be required as the planting plan is constructed. These adjustments may not be apparent until some or all of the plants are installed. Make adjustments as required by the Owner's Representative including relocating previously installed plants.

### 1.31 SOIL PROTECTION DURING PLANT DELIVERY AND INSTALLATION

- A. Protect soil from compaction during the delivery of plants to the planting locations, digging of planting holes and installing plants.
  - 1. Where possible deliver and plant trees that require the use of heavy mechanized equipment prior to final soil preparation and tilling. Where possible, restrict the driving lanes to one area instead of driving over and compacting a large area of soil.
  - 2. Till to a depth of 6 inches, all soil that has been driven over during the installation of plants.

### 1.32 Soil MOISTURE

- A. Volumetric soil moisture level, in both the planting soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilting point and below field capacity for each type of soil texture within the following ranges.

Soil type	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

- 1. Volumetric soil moisture shall be measured with a digital moisture meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent.
- B. The Contractor shall confirm the soil moisture levels with a moisture meter. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

### 1.33 INSTALLATION OF PLANTS: GENERAL

- O. Installation plan shall be submitted a minimum of 14 days prior to the scheduled installation. Plan should describe the methods, activities, materials and schedule to achieve installation of plants.
- P. Observe each plant after delivery and prior to installation for damage of other characteristics that may cause rejection of the plant. Notify the Owner's Representative of any condition observed.

- A. No more plants shall be distributed about the planting bed area than can be planted and watered on the same day.
- B. The root system of each plant, regardless of root ball package type, shall be observed by the Contractor, at the time of planting to confirm that the roots meet the requirements for plant root quality in Part 2 Products: Plants General: Plant Quality. The Contractor shall undertake at the time of planting, all modifications to the root system required by the Owner's Representative to meet these quality standards.
  - 1. Modifications, at the time of planting, to meet the specifications for the depth of the root collar and removal of stem girdling roots and circling roots may make the plant unstable or stress the plant to the point that the Owner's Representative may choose to reject the plant rather than permitting the modification.
  - 2. Any modifications required by the Owner's Representative to make the root system conform to the plant quality standards outlined in Part 2 Products: Plants General: Quality, or other requirements related to the permitted root ball package, shall not be considered as grounds to modify or void the plant warranty.
  - 3. The resulting root ball may need additional staking and water after planting. The Owner's Representative may reject the plant if the root modification process makes the tree unstable or if the tree is not healthy at the end of the warranty period. Such plants shall still be covered under the warranty
  - 4. The Contractor remains responsible to confirm that the grower has made all required root modifications noted during any nursery observations.
- Q. Container and Boxed Root Ball Shaving: The outer surfaces of ALL plants in containers and boxes, including the top, sides and bottom of the root ball shall be shaved to remove all circling, descending, and matted roots. Shaving shall be performed using saws, knives, sharp shovels or other suitable equipment that is capable of making clean cuts on the roots. Shaving shall remove a minimum of one inch of root mat or up to 2 inches as required to remove all root segments that are not growing reasonably radial to the trunk.
- R. Exposed Stem Tissue after Modification: The required root ball modifications may result in stem tissue that has not formed trunk bark being exposed above the soil line. If such a condition occurs, wrap the exposed portion of the stem in a protective wrapping with a white filter fabric. Secure the fabric with biodegradable masking tape. DO NOT USE string, twine, green nursery ties or any other material that may girdle the trunk if not removed.
- S. Excavation of the Planting Space: Using hand tools or tracked mini-excavator, excavate the planting hole into the Planting Soil to the depth of the root ball measured after any root ball modification to correct root problems, and wide enough for working room around the root ball or to the size indicated on the drawing or as noted below.
  - 5. For trees and shrubs planted in soil areas that are NOT tilled or otherwise modified to a depth of at least 12 inches over a distance of more than 10 feet radius from each tree, or 5 feet radius from each shrub, the soil around the root ball shall be loosened as defined below or as indicated on the drawings.
    - a. The area of loosening shall be a minimum of 3 times the diameter of the root ball at the surface sloping to 2 times the diameter of the root ball at the depth of the root ball.
    - b. Loosening is defined as digging into the soil and turning the soil to reduce the compaction. The soil does not have to be removed from the hole, just dug, lifted and turned. Lifting and turning may be accomplished with a tracked mini excavator, or hand shovels.
  - 6. If an auger is used to dig the initial planting hole, the soil around the auger hole shall be loosened as defined above for trees and shrubs planted in soil areas that are NOT tilled or otherwise modified.
  - 7. The measuring point for root ball depth shall be the average height of the outer edge of

the root ball after any required root ball modification.

8. If motorized equipment is used to deliver plants to the planting area over exposed planting beds, or used to loosen the soil or dig the planting holes, all soil that has been driven over shall be tilled to a depth of 6 inches.
- C. For trees to be planted in prepared Planting Soil that is deeper than the root ball depth, compact the soil under the root ball using a mechanical tamper to assure a firm bedding for the root ball. If there is more than 12 inches of planting soil under the root ball excavate and tamp the planting soil in lifts not to exceed 12 inches.
- D. Set top outer edge of the root ball at the average elevation of the proposed finish. Set the plant plumb and upright in the center of the planting hole. The tree graft, if applicable, shall be visible above the grade. Do not place soil on top of the root ball.
- E. The Owner's Representative may request that plants orientation be rotated when planted based on the form of the plant.
- F. Backfill the space around the root ball with the same planting soil or existing soil that was excavated for the planting space. See Specification Section Planting Soil, for requirements to modify the soil within the planting bed.
- G. Brace root ball by tamping Planting Soil around the lower portion of the root ball. Place additional Planting Soil around base and sides of ball in six-inch (6") lifts. Lightly tamp each lift using foot pressure or hand tools to settle backfill, support the tree and eliminate voids. DO NOT over compact the backfill or use mechanical or pneumatic tamping equipment. Over compaction shall be defined as greater than 85% of maximum dry density, standard proctor or greater than 250 psi as measured by a cone penetrometer when the volumetric soil moisture is lower than field capacity.
  1. When the planting hole has been backfilled to three quarters of its depth, water shall be poured around the root ball and allowed to soak into the soil to settle the soil. Do not flood the planting space. If the soil is above field capacity, allow the soil to drain to below field capacity before finishing the planting. Air pockets shall be eliminated and backfill continued until the planting soil is brought to grade level.
- H. Where indicated on the drawings, build a 4 inch high, level berm of Planting Soil around the outside of the root ball to retain water. Tamp the berm to reduce leaking and erosion of the saucer.
- T. Thoroughly water the Planting Soil and root ball immediately after planting.
- U. Remove all nursery plant identification tags and ribbons as per Owner's Representative instructions. The Owner's Representative's seals are to remain on plants until the end of the warranty period.
- V. Remove corrugated cardboard trunk protection after planting.
- I. Follow additional requirements for the permitted root ball packages.

**1.34 PERMITTED ROOT BALL PACKAGES AND SPECIAL PLANTING REQUIREMENTS**

- A. The following are permitted root ball packages and special planting requirements that shall be followed during the planting process in addition to the above General planting requirements.
- B. **BALLED AND BURLAPPED PLANTS**
  1. After the root ball has been backfilled, remove all twine and burlap from the top of the root ball. Cut the burlap away; do not fold down onto the Planting Soil.
  2. If the plant is shipped with a wire basket that does not meet the requirements of a "Low Rise" basket, remove the top 6 - 8 inches of the basket wires just before the final backfilling of the tree.

3. Earth root balls shall be kept intact except for any modifications required by the Owner's Representative to make the root package comply with the requirement in Part 2 Products.

**C. CONTAINER (INCLUDES BOXED AND ABOVE-GROUND FABRIC CONTAINERS) PLANTS**

1. This specification assumes that most container plants have significant stem girdling and circling roots, and that the root collar is too low in the root ball.
2. Remove the container.
3. Perform root ball shaving as defined in Installation of Plants: General above.
4. Remove all roots and substrate above the root collar and the main structural roots according to root correction details so root system conforms to root observations detail.
5. Remove all substrate at the bottom of the root ball that does not contain roots.
6. Using a hose, power washer or air excavation device, wash out the substrate from around the trunk and top of the remaining root ball and find and remove all stem girdling roots within the root ball above the top of the structural roots.

**D. BARE ROOT PLANTS**

1. Dig the planting hole to the diameter of the spread of the roots to a depth in the center that maintains the root collar at the elevation of the surrounding finished grade and slightly deeper along the edges of the hole.
2. Spread all roots out radial to the trunk in the prepared hole making the hole wider where needed to accommodate long roots. Root tips shall be directed away from the trunk. Prune any broken roots removing the least amount of tissue possible.
3. Maintain the trunk plumb while backfilling soil around the roots.
4. Lightly tamp the soil around the roots to eliminate voids and reduce settlement.

**1.35 GROUND COVER, PERENNIAL AND ANNUAL PLANTS**

- A. Assure that soil moisture is within the required levels prior to planting. Irrigation, if required, shall be applied at least 12 hours prior to planting to avoid planting in muddy soils.
- B. Assure that soil grades in the beds are smooth and as shown on the plans.
- C. Plants shall be planted in even, triangularly spaced rows, at the intervals called out for on the drawings, unless otherwise noted. The first row of Annual flower plants shall be 6 inches from the bed edge unless otherwise directed.
- D. Dig planting holes sufficiently large enough to insert the root system without deforming the roots. Set the top of the root system at the grade of the soil.
- E. Schedule the planting to occur prior to application of the mulch. If the bed is already mulched, pull the mulch from around the hole and plant into the soil. Do not plant the root system in the mulch. Pull mulch back so it is not on the root ball surface.
- F. Press soil to bring the root system in contact with the soil.
- G. Spread any excess soil around in the spaces between plants.
- H. Apply mulch to the bed being sure not to cover the tops of the plants with or the tops of the root ball with mulch.
- I. Water each planting area as soon as the planting is completed. Apply additional water to keep the soil moisture at the required levels. Do not over water.

**1.36 STAKING AND GUYING**

- A. Do not stake or guy trees unless specifically required by the Contract Documents, or in the event that the Contractor feels that staking is the only alternative way to keep particular trees plumb.
  - 1. The Owner's Representative shall have the authority to require that trees are staked or to reject staking as an alternative way to stabilize the tree.
  - 2. Trees that required heavily modified root balls to meet the root quality standards may become unstable. The Owner's Representative may choose to reject these trees rather than utilize staking to temporarily support the tree.
- B. Trees that are guyed shall have their guys and stakes removed after one full growing season or at other times as required by the Owner's Representative.
- C. Tree guying shall utilize the tree staking and guying materials specified. Guying to be tied in such a manner as to create a minimum 12-inch loop to prevent girdling. Refer to manufacturer's recommendations and the planting detail for installation.
  - 3. Plants shall stand plumb after staking or guying.
  - 4. Stakes shall be driven to sufficient depth to hold the tree rigid.
- D. For trees planted in planting mix over waterproofed membrane, use dead men buried 24 inches to the top of the dead man, in the soil. Tie the guy to the dead man with a double wrap of line around the dead man followed by a double half hitch. When guys are removed, leave the dead men in place and cut the guy tape 12 inches above the ground, leaving the tape end covered in mulch.

**1.37 STRAIGHTENING PLANTS**

- E. Maintain all plants in a plumb position throughout the warranty period. Straighten all trees that move out of plumb including those not staked. Plants to be straightened shall be excavated and the root ball moved to a plumb position, and then re-backfilled.
- F. Do not straighten plants by pulling the trunk with guys.

**1.38 INSTALLATION OF FERTILIZER AND OTHER CHEMICAL ADDITIVES**

- G. Do not apply any soluble fertilizer to plantings during the first year after transplanting unless soil test determines that fertilizer or other chemical additives is required. Apply chemical additives only upon the approval of the Owner's Representative.
- H. Controlled release fertilizers shall be applied according to the manufacturer's instructions and standard horticultural practices.

**1.39 PRUNING OF TREES AND SHRUBS**

- I. Prune plants as directed by the Owner's Representative. Pruning trees shall be limited to addressing structural defects as shown in details; follow recommendations in "Structural Pruning: A Guide For The Green Industry" published by Urban Tree Foundation, Visalia CA.
- J. All pruning shall be performed by a person experienced in structural tree pruning.
- K. Except for plants specified as multi-stemmed or as otherwise instructed by the Owner's Representative, preserve or create a central leader.
- L. Pruning of large trees shall be done using pole pruners or if needed, from a ladder or hydraulic lift to gain access to the top of the tree. Do not climb in newly planted trees. Small trees can be structurally pruned by laying them over before planting. Pruning may also be performed at the nursery prior to shipping.
- M. Remove and replace excessively pruned or malformed stock resulting from improper pruning that occurred in the nursery or after.
- N. Pruning shall be done with clean, sharp tools.
- O. No tree paint or sealants shall be used.



**1.40 MULCHING OF PLANTS**

- P. Apply 4 inches of mulch before settlement, covering the entire planting bed area. Install no more than 1 inch of mulch over the top of the root balls of all plants. Taper to 2 inches when abutting pavement.
- A. For trees planted in lawn areas the mulch shall extend to a 5 foot radius around the tree or to the extent indicated on the plans.
- Q. Lift all leaves, low hanging stems and other green portions of small plants out of the mulch if covered.

**1.41 PLANTING BED FINISHING**

- A. After planting, smooth out all grades between plants before mulching.

**1.42 WATERING**

- R. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants from the point of installation until the date of Substantial Completion Acceptance. The Contractor shall adjust the automatic irrigation system, if available, and apply additional or adjust for less water using hoses as required.
- S. Hand water root balls of all plants to assure that the root balls have moisture above wilt point and below field capacity. Test the moisture content in each root ball and the soil outside the root ball to determine the water content.

**1.43 CLEAN-UP**

- A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
  - 1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
- B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative's seals are to remain on the trees and removed at the end of the warranty period.
- B. Make all repairs to grades, ruts, and damage by the plant installer to the work or other work at the site.
- C. Remove and dispose of all excess planting soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

**1.44 PROTECTION DURING CONSTRUCTION**

- A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers. Maintain protection during installation until Substantial Completion Acceptance. Treat, repair or replace damaged work immediately.
- B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including roots, trunk or branches of large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory.

**1.45 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION ACCEPTANCE**

- A. During the project work period and prior to Substantial Completion Acceptance, the Contractor shall maintain all plants.
- B. Maintenance during the period prior to Substantial Completion Acceptance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, repairing and replacing of damaged tree wrap material, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings reasonably free of damaging insects and disease, and in healthy condition. The threshold for applying insecticides and herbicide shall follow established Integrated Pest Management (IPM) procedures. Mulch areas shall be kept reasonably free of weeds, grass.

**1.46 SUBSTANTIAL COMPLETION ACCEPTANCE**

- A. Upon written notice from the Contractor, the Owner's Representative shall review the work and make a determination if the work is substantially complete.
  - 1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.
- B. The date of substantial completion of the planting shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.
- C. The Plant Warranty period begins at date of written notification of substantial completion from the Owner's Representative. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

**1.47 MAINTENANCE DURING THE WARRANTY PERIOD BY THE PLANT INSTALLER**

- A. During the warranty period, provide all maintenance for all plantings to keep the plants in a healthy state and the planting areas clean and neat.
- B. General requirements:
  - 1. All work shall be undertaken by trained planting crews under the supervision of a foreman with a minimum of 5 years experience supervising commercial plant maintenance crews.
  - 2. All chemical and fertilizer applications shall be made by licensed applicators for the type of chemicals to be used. All work and chemical use shall comply with all applicable local, provincial and federal requirements.
  - 3. Assure that hoses and watering equipment and other maintenance equipment does not block paths or be placed in a manner that may create tripping hazards. Use standard safety warning barriers and other procedures to maintain the site in a safe manner for visitors at all times.
  - 4. All workers shall wear required safety equipment and apparel appropriate for the tasks being undertaken.
  - 5. The Contractor shall not store maintenance equipment at the site at times when they are not in use unless authorized in writing by the Owner's Representative.
  - 6. Maintenance vehicles shall not park on the site including walks and lawn areas at any time without the Owner's Representative's written permission.
  - 7. Maintain a detailed log of all maintenance activities including types of tasks, date of task, types and quantities of materials and products used, watering times and amounts, and number of each crew. Periodically review the logs with the Owner's Representative, and submit a copy of the logs at the end of each year of the maintenance agreement.
  - 8. Meet with the Owner's Representative a minimum of three times a year to review the progress and discuss any changes that are needed in the maintenance program. At the end of the warranty period attend a hand over meeting to formally transfer the responsibilities of maintenance to the Owner's Representative. Provide all information on past maintenance activities and provide a list of critical tasks that will be needed over the

next 12 months. Provide all maintenance logs and soil test data. Make the Contractor's supervisor available for a minimum of one year after the end of the warranty period to answer questions about past maintenance.

**C. Provide the following maintenance tasks:**

1. Watering; Provide all water required to keep soil within and around the root balls at optimum moisture content for plant growth.
  - a. Maintain all watering systems and equipment and keep them operational.
  - b. Monitor soil moisture to provide sufficient water. Check soil moisture and root ball moisture with a soil moisture meter on a regular basis and record moisture readings. Do not over water.
2. Soil nutrient levels: Take a minimum of 4 soil samples from around the site in the spring and fall and have them tested by an accredited agricultural soil testing lab for chemical composition of plant required nutrients, pH, salt and % organic matter. Test results shall include laboratory recommendations for nutrient applications. Apply fertilizers at rates recommended by the soil test.
  - a. Make any other soil test and/or plant tissue test that may be indicated by plant conditions that may not be related to soil nutrient levels such as soil contaminated by other chemicals or lack of chemical uptake by the plant.
3. Plant pruning: Remove cross over branching, shorten or remove developing co dominant leaders, dead wood and winter-damaged branches. Unless directed by the Owner's Representative, do not shear plants or make heading cuts.
4. Restore plants: Reset any plants that have settled or are leaning as soon as the condition is noticed.
5. Guying and staking: Maintain plant guys in a taught position. Remove tree guys and staking after the first full growing season unless directed by Owner's Representative.
6. Weed control: Keep all beds free of weeds. Hand-remove all weeds and any plants that do not appear on the planting plan. Chemical weed control is permitted only with the approval of the Owner's Representative. Schedule weeding as needed but not less *12 times per year*.
7. Trash removal: Remove all trash and debris from all planting beds and maintain the beds in a neat and tidy appearance. The number of trash and debris removal visits shall be no less than 12 times per year and may coincide with other maintenance visits.
8. Plant pest control: Maintain disease, insects and other pests at manageable levels. Manageable levels shall be defined as damage to plants that may be noticeable to a professional but not to the average person. Use least invasive methods to control plant disease and insect outbreaks.
  - a. The Owner's Representative must approve in advance the use of all chemical pesticide applications.
9. Plant replacement: Replace all plants that are defective as defined in the warranty provisions, as soon as the plant decline is obvious and in suitable weather and season for planting as outlined in above sections. Plants that become defective during the maintenance period shall be covered and replaced under the warranty provisions.
10. Mulch: Refresh mulch once a year to maintain complete coverage but do not over mulch. At no time shall the overall mulch thickness be greater than 4 inches. Do not apply mulch within 6 inches of the trunks or stems of any plants. Replacement mulch shall meet the requirements of the original approved material. Mulch shall be no more than one inch on top of the root ball surface.
11. Bed edging: Check and maintain edges between mulch and planting areas in smooth neat lines as originally shown on the drawings.
12. Leaf, fruit and other plant debris removal: Remove fall leaf, spent flowers, fruit and plant part accumulations from beds and paved surfaces. Maintain all surface water drains free of debris. Debris removal shall be undertaken at each visit to weed or pick up trash in beds.
13. Damage from site use: Repair of damage by site visitors and events, beyond normal wear, are not part of this maintenance. The Owner's Representative may request that the

Contractor repair damage beds or plantings for an additional cost. All additional work shall be approved in advance by the Owner's Representative.

**1.48 END OF WARRANTY FINAL ACCEPTANCE / MAINTENANCE OBSERVATION**

- A. At the end of the Warranty and Maintenance period the Owner's Representative shall observe the work and establish that all provisions of the contract are complete and the work is satisfactory.
  - 1. If the work is satisfactory, the maintenance period will end on the date of the final observation.
  - 2. If the work is deemed unsatisfactory, the maintenance period will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Owner's Representative.
- B. FAILURE TO PASS OBSERVATION: If the work fails to pass final observation, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owner's Representative.

**END OF SECTION 32 93 00**

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SECTION 33 05 16

UTILITY STRUCTURES

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Manhole structures for gravity storm drain and sanitary sewer utilities.

1.02 RELATED DOCUMENTS

A. AASHTO:

- 1. M 199: Standard Specification for Precast Reinforced Concrete Manhole Sections.

B. ASTM:

- 1. A 615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 2. C 478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
- 3. C 1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

C. Caltrans Standard Specifications.

- 1. Concrete Structures.
- 2. Miscellaneous Metal.

D. California Building Code.

- 1. Exterior Routes of Travel.

1.03 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.

- B. ASTM: American Society for Testing Materials.

1.04 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

- B. Product data for the following:

- 1. Cleanout plugs or caps.

- C. Shop drawings: Include plans, elevations, details and attachments for the following:

1. Precast concrete manholes, frames and covers.
2. Precast concrete clean out boxes and box covers.
- D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance.

#### **1.05 DELIVERY, STORAGE AND HANDLING**

- A. Handle precast concrete manholes according to manufacturer's written instructions.
- B. Protect imported bedding and backfill material from contamination by other materials.

### **PART 2 - PRODUCTS**

#### **2.01 CLEANOUTS**

- A. Piping: Same as sanitary sewer line if possible.
- B. Top Cap: Threaded and of same material as piping if possible.
- C. Box Size: As required to provide access and allow easy removal and reinstallation of cap.
- D. Box Types:
  1. Landscape Areas: Portland cement concrete box and box cover (bolt-down), light duty.
  2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover (bolt down) to be rated for AASHTO H20 loading.
- E. Box Cover Markings: "S.D." for storm drain cleanouts, "S.S." for sanitary sewer cleanouts, unless otherwise specified.
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
  1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
  2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
  3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486 7070).

#### **2.02 MANHOLES**

- A. General: Size, shape, configuration, depth, etc. of manhole and frame and cover shall be as indicated.
- B. Portland Cement Concrete and Reinforcing:
  - 1. Cast-In-Place Portion: Use Class A Concrete per Caltrans Standard Specification, and ASTM A615 Grade 60 reinforcing steel bars.
  - 2. Precast Portion: ASTM C 478. Rate for AASHTO H20 loading in traffic areas.
- C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification.
- D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step.
- E. Force Main Piping Access Openings:
  - 1. General: As indicated.

#### **2.03 JOINT SEALANT FOR STRUCTURES AND MANHOLES**

- A. Mortar: per Caltrans Standard Specification.
  - 1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.
- B. Gaskets: Preformed flexible rubber or plastic gasket.
  - 1. Rubber Gaskets: ASTM C443.
  - 2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist.

### **PART 3 - EXECUTION**

#### **3.01 CLEANOUT INSTALLATION**

- A. General: Install as indicated.

#### **3.02 MANHOLE INSTALLATION**

- A. General: Install as indicated.

#### **3.03 TESTING OF MANHOLES ON GRAVITY LINES**

- A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.
- B. Hydrostatic Test:

1. Insert inflatable plugs in all sewer inlets and outlets.
2. Fill the manhole with water to a point six inches below the base of the manhole frame.
3. Maintain the water at this point for one hour to allow time for absorption.
4. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
5. Determine the allowable leakage by the following formula.
6.  $L = 0.0002 \times D \times H^{1/2}$
7. L = Allowable leakage, gallons per minute.
8. D = Depth of manhole from top to bottom, feet.
9. H = Head of water in feet as measured from the surface of the water in the manhole to the sewer line invert or to the prevailing ground water surface outside the manhole. The lesser height governs.
10. If the leakage exceeds the allowable, determine the cause, take remedial action and re-test the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.

**C. Vacuum Test:**

1. General: Test in accordance with ASTM C 1244.
2. Test prior to backfilling around the manhole.
3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
4. Place test head inside the top section of the manhole's cone section and inflate in accordance with the manufacturers instructions.
5. Draw a vacuum of 10-inches of mercury and shut the pump off.
6. With the valve closed, the time for the vacuum to drop 9-inches shall be measured.
7. The manhole shall pass the test if the time is greater than 60 seconds for a 48-inch diameter manhole, 75 seconds for a 60-inch diameter manhole and 90 seconds for a 72-inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout while the vacuum is still being drawn. Retest until a satisfactory test is obtained.

**END OF SECTION**



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**SECTION 33 10 00**

**WATER UTILITIES**

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Site water distribution system for domestic and fire protection services up to 5 feet of any on-site building being served.
- B. Domestic water and fire protection water transmission or distribution system within a roadway or street right-of-way.

1.02 RELATED SECTIONS

- A. Section 31 23 33 – Trenching and Backfilling.
- B. Section 32 05 23 – Concrete for Exterior Improvements.

1.03 RELATED DOCUMENTS

A. ASTM:

- 1. A 536: Standard Specification for Ductile Iron Castings.
- 2. B 88: Standard Specifications for Seamless Copper Water Tube.
- 3. D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- 4. D 2564: Standard Specifications for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

B. AWWA:

- 1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
- 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
- 3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.
- 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- 5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
- 6. C150: Thickness Design of Ductile Iron Pipe.
- 7. C151: Ductile-Iron Pipe, Centrifugally Cast.
- 8. C153: Ductile- Iron Compact Fittings.

9. C200: Steel Water Pipe-6 In. (150 mm) and larger.
10. C203: Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot Applied.
11. C205: Cement-Mortar Protective Lining and Coating for Steel Water Pipe- 4 In. and Larger-Shop Applied.
12. C207: Steel Pipe Flanges for Waterworks Service-Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
13. C208: Dimensions for Fabricated Steel Water Pipe Fittings.
14. C209: Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections and Fittings.
15. C210: Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
16. C213: Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
17. C214: Tape Coatings for Steel Water Pipe.
18. C218: Liquid Coatings for Aboveground Steel Water Pipelines and Fittings.
19. C219: Bolted Sleeve-Type Couplings for Plain-End Pipe.
20. C500: Metal-Seated Gate Valves for Water Supply Service.
21. C502: Dry-Barrel Fire Hydrants.
22. C503: Wet-Barrel Fire Hydrants.
23. C504: Rubber-Seated Butterfly Valves, 3 In. (75 mm) through 72 In. (1,800 mm).
24. C507: Ball Valves 6 In. through 60 In. (150 mm Through 1,500 mm).
25. C508: Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1200-mm) NPS.
26. C509: Resilient-Seated Gate Valves for Water Supply Service.
27. C510: Double Check Valve Backflow Prevention Assembly.
28. C511: Reduced-Pressure Principle Backflow Prevention Assembly.
29. C512: Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
30. C550: Protective Interior Coatings for Valves and Hydrants.
31. C600: Installation of Ductile-Iron Mains and Their Appurtenances.
32. C605: Underground Installation of Polyvinyl Chloride (PVC) and Molecularly

Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

- 33. C606: Grooved and Shouldered Joints.
- 34. C651: Disinfecting Water Mains.
- 35. C800: Underground Service Line Valves and Fittings.
- 36. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100mm Through 1,500 mm).
- 37. C901: Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13mm) Through 3 In. (76mm) for Water Service.
- 38. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm) for Water Transmission and Distribution.
- 39. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks.
- 40. C907: Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water, Wastewater, and Reclaimed Water Service.
- 41. M11: Steel Pipe - A Guide for Design and Installation.
- 42. M23: PVC Pipe – Design and Installation.
- 43. M41: Ductile-Iron Pipe and Fittings.

#### 1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ASTM: American Society for Testing Materials.
- C. AWWA: American Waterworks Association
- D. DI: Ductile iron.
- E. DIP: Ductile iron pipe.
- F. FM: Factory Mutual.
- G. NFPA: National Fire Protection Association.
- H. NSF: National Sanitation Foundation.
- I. PCC: Portland cement concrete.
- J. PE: Polyethylene.

- K. PVC: Polyvinyl Chloride.
- L. UL: Underwriters Laboratory.

**1.05 SYSTEM PERFORMANCE REQUIREMENTS**

- A. Minimum Internal Pressures: As indicated on plans.
- B. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless indicated otherwise.

**1.06 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product Data: For the following:
  - 1. Piping materials and fittings.
  - 2. Pipe couplings.
  - 3. Flexible pipe fittings.
  - 4. Restrained pipe fittings.
  - 5. High deflection fittings/ball joints.
  - 6. Expansion joints.
  - 7. Flexible expansion joints.
  - 8. Gate valves.
  - 9. Butterfly valves.
  - 10. Check valves.
  - 11. Air and vacuum relief valves.
  - 12. Blow-off valves.
  - 13. Pressure reducing valves.
  - 14. Pressure sustaining valves.
  - 15. Ball valves.
  - 16. Fire hydrants.
  - 17. Post indicator valves.
  - 18. Fire department connections.
  - 19. Backflow preventers.

20. Precast valve boxes and box covers.

C. Shop drawings: Include plans, elevations, details and attachments.

1. Precast and cast in-place vaults and covers.

2. Wiring diagrams for alarm devices.

D. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

#### **1.07 QUALITY ASSURANCE**

A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.

B. Comply with the following requirements and standards:

1. NSF 61: "Drinking Water System Components-Health Effects" for materials for potable water.

2. NFPA 24: "Standard for the Installation of Private Fire Service Mains and Their Appurtenances" for materials, installations, tests, flushing, and valve and hydrant supervision.

3. NFPA 70: "National Electric Code" for electrical connections between wiring and electrically operated devices.

C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

#### **1.08 MATERIAL DELIVERY, STORAGE AND HANDLING**

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set Valves in best position for handling. Set valves closed to prevent rattling.

B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.

C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. During Storage: Use precautions for valves, including fire hydrants according to the

following.

1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
  2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- E. Do not store plastic pipe and fittings in direct sunlight.
- F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.
- G. Protect linings and coatings from damage.
- H. Handle precast boxes, vaults and other precast structures according to manufacturer's written instructions.
- I. Protect imported bedding and backfill material from contamination by other materials.

#### **1.09 COORDINATION**

- A. Coordinate connection to existing water mains with water utility supplying water.
- B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

### **PART 2 - PRODUCTS**

#### **2.01 SMALL-SIZE SERVICE PIPES**

- A. Copper Pipe: Sizes ¾-inch through 2-inch.
1. Pipe and Fittings: ASTM B 88, Type K, seamless water tube, annealed.
  2. Joints: Restrain by couplings.
- B. PE Plastic Pipe: Sizes ½-inch through 3-inch.
1. Pipe and Fittings: AWWA C901.
  2. Joints: Restrain with clamps or heat-fusion.
- C. PVC Pipe: Sizes 1/8-inch through 3 inch.
1. Pipe and Fittings: ASTM D 1785, Schedule 40
  2. Joints: Restrain with solvent cement. Do not use threaded pipe.
  3. Solvent Cement: ASTM D2564.

**2.02 LARGE-SIZE SERVICE AND DISTRIBUTION PIPES**

- A. DIP: Sizes 4-inch through 48-inch.
  - 1. Pipe: AWWA C150 and C151.
  - 2. Fittings
    - (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
    - (b) Compact: AWWA C153, sizes 4-inch through 24-inch.
  - 3. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
  - 4. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
  - 5. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
  - 6. Unrestrained Joints:
    - (a) Push-On Bell and Spigot Joint: AWWA C111.
    - (b) Mechanical Joint: AWWA C111.
  - 7. Restrained Joints:
    - (a) Flanged Joint: AWWA C115.
    - (b) Push-On Bell and Spigot Joint: AWWA C111 with "Field Lok Gasket," sizes 4-inch through 24-inch; "TR Flex," sizes 4-inch through 64-inch or approved equal.
    - (c) Mechanical Joint: AWWA C111 with "Mega Lug," sizes 3-inch through 48-inch or approved equal.
    - (d) Grooved and Shouldered Joints: AWWA C150, AWWA C151 and AWWA C606. 24-inch maximum size.
  - 8. Couplings:
    - (a) Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. or approved equal.
    - (b) Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219
- B. PE Pipe: Sizes 4-inch through 64-inch.
  - 1. Pipe and Fittings: AWWA C906.
  - 2. Joints:

- (a) Thermal Butt Fusion: AWWA C906 and pipe manufacturer's recommendations.
  - (b) Flanged joining: AWWA C906 and pipe manufacturer's recommendations.
  - (c) Other: Check with pipe manufacturer.
- C. PVC Pipe: Sizes 4-inch through 48-inch.
  - 1. Pipe:
    - (a) 4-inch through 12-inch: AWWA C900.
    - (b) 14-inch through 48-inch: AWWA C905.
  - 2. Fittings: DI conforming to 2.2A above.
  - 3. Unrestrained Joints:
    - (a) Push-On Bell and Spigot Joint: AWWA C900.
  - 4. Restrained Joints:
    - (a) Push-On Bell and Spigot Joint: or approved equal.
    - (b) Plain End PVC to DI Mechanical Joint: or approved equal.
  - 5. Steel or Ductile Iron Couplings:
    - (a) Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. or approved equal.
    - (b) Plain End Pipe to DI or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. or approved equal.
  - 6. PVC Couplings
    - (a) Unrestrained Plain End to Plain End Pipe: AWWA C900, or approved equal.
    - (b) Restrained Plain End to Plain End Pipe: AWWA C900, or approved equal.
- D. Cement Mortar Lined and Coated Steel Pipe: 6-inch and larger.
  - 1. Pipe: AWWA C200 and AWWA M11.
  - 2. Special Sections and Fittings: AWWA C200, C207, C208 and AWWA M11 for all bends, tees, nozzles, closures, etc.
  - 3. Flanges: AWWA C207. Includes blind flanges.



4. Linings and Coatings for Pipe, Special Sections and Fittings: Cement Mortar Lining and Coating: AWWA C205.
  - (a) Liquid Epoxy Lining and Coating: AWWA C210.
  - (b) Fusion Bonded Epoxy Lining and Coating: AWWA C213.
  - (c) Coal-Tar Lining and Coating: AWWA C203.
  - (d) Cold-Applied Tape Coatings, Piping: AWWA C214.
  - (e) Cold-Applied Tape Coatings, Specials, Connection and Fittings: AWWA C209.
  - (f) Cold Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Buried or Submerged Steel Water Pipelines.
  - (g) Aboveground Pipe Coatings: AWWA C218.]
5. Non-Restrained Joints: AWWA M11.
  - (a) Rubber Gasket: Carnegie-shape rubber gasket as indicated.
6. Restrained Joints: AWWA M11. Where a flanged joint, butt strap or coupling are not indicated, either restrained joint a, or b, as follows, is acceptable, but the selected joint shall be used throughout the project.
  - (a) Rubber Gasket: Carnegie-shape rubber gasket with field welded restraint bar as indicated.
  - (b) Field Lap Welded Slip Joint: As indicated.
  - (c) Field Welded Butt Strap: As indicated.
  - (d) Flanged Joint: AWWA C207 with Type 316L stainless steel bolts and nuts as indicated.
7. Joint Coating for Cement Mortar Lined and Coated Steel Pipe:
  - (a) Field Joint Encasement: Cement mortar contained in fabric lined with closed cell polyethylene foam as indicated. Attach fabric to pipe with Type 316L stainless steel straps as indicated.
8. Non-Restrained Flexible Couplings: Conforming to AWWA C219, with factory applied fusion-bond epoxy coating and Type 316L stainless steel bolts and nuts.
9. Restrained Flexible Couplings: Non-restrained flexible coupling supplemented with a restraining harness as indicated and as follows:
  - (a) Restraining harness design by Contractor's pipe manufacturer using criteria presented in Section 13.10 of AWWA M11.

- (b) Space harness-lugs and tie bolts equally around the pipe.
  - (c) Type 316L stainless steel harness tie bolts and nuts.
  - (d) Design and dimensions of harness lugs to be modified from that shown in AWWA M11, as necessary, to provide additional height to clear the coupling.
10. Field Coating of Coupling Assemblies: Apply either of the following, flexible tape and mastic or putty coating systems to the all non-restrained or restrained flexible steel couplings.

#### **2.03 HIGH DEFLECTION FITTINGS/BALL JOINTS**

- A. Plain End Pipe: Xtra Flex Restrained Joint High Deflection Fittings, 4-inch through 24-inch, or approved equal.
- B. Mechanical or Flanged Joint: Flex 900, 4-inch through 12-inch, or approved equal.

#### **2.04 EXPANSION JOINTS**

- A. TR Flex Joints: TR Flex Telescoping Sleeve, 4-inch through 64 inch, or approved equal.
- B. Mechanical or Flanged Joint: Ex-Tend 200, 4-inch through 36-inch, or approved equal.

#### **2.05 FLEXIBLE EXPANSION JOINTS**

- A. Plain End to Plain End Pipe: "Xtra Flex," sizes 4-inch through 24-inch, or equal.
- B. Flanged or mechanical Joint: "Flex-Tend," sizes 3-inch through 48-inch, or equal.
- C. Flanged Joint: Starflex, Series 500 or equal.

#### **2.06 GATE VALVES**

- A. Provide on lines 10-inch and smaller.
- B. Valves, 3-Inch through 20-Inch: AWWA C509, resilient-seated, non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise. All bolts, nuts and washers, except operating nut, shall be stainless steel. Stem operating nut to be 2-inches square and open counter-clockwise. Stem extensions shall be installed to bring the stem operating nut to within 2-feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4-feet. Equip valves in pump stations and other interior or vault installations with hand-wheels. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- C. Service Line Valves and Fittings, 2-Inch and Smaller: AWWA C800
- D. Valve Box and Cover: 9-inch minimum diameter PCC box with extensions of length required for depth of bury of valve, and cast iron or ductile iron cover with lettering "WATER". Both the box and the cover shall be rated for AASHTO H20 loading.

**2.07 BUTTERFLY VALVES**

- A. Provide on lines larger than 10-inch.
- B. Valves, 3-Inch through 72-Inch: AWWA C 504, rubber seated, Class 150B cast iron body, cast or ductile iron discs, stainless steel shafts, adjustable field replaceable rubber seats mating against stainless steel seat rings and field-replaceable seals. Flanged or mechanical joint end connections. No wafer type valves allowed. Traveling nut type valve actuators designed for buried service unless noted otherwise. All bolts, nuts and washers, except wrench nut, shall be stainless steel. Wrench nut to be 2-inches square and open counter-clockwise. Stem extensions shall be installed to bring the wrench nut to within 2-feet of finish grade where the depth from finish grade to the wrench nut exceeds 4-feet. Equip valves in pump stations and other interior or vault installations with hand-wheels. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- C. Valve Box and Cover: 9-inch minimum diameter PCC box with extensions of length required for depth of bury of valve, and cast iron or ductile iron cover with lettering "WATER". Both the box and the cover shall be rated for AASHTO H20 loading.

**2.08 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES**

- A. AWWA C512, specific type of valve, size, details and valve box as indicated.

**2.09 BLOW-OFF VALVES**

- A. Blow-off valve assemblies, details and boxes as indicated.

**2.10 SWING CHECK VALVES**

- A. Valves 2-Inch through 24-Inch: AWWA C508, details as indicated.

**2.11 BALL VALVES**

- A. Valves 6-Inch through 48-Inch: AWWA C507, details as indicated.

**2.12 PRESSURE-REGULATING VALVES**

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250-psi Working-pressure, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment. Details as indicated.

**2.13 FLOW-REGULATING VALVES**

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250-psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment. Details as indicated.

**2.14 SERVICE CONNECTIONS AND WATER METERS**

- A. Service connections and water meter details and boxes as indicated.

**2.15 FIRE HYDRANTS**

- A. Wet Barrel: AWWA C503, details as indicated.
- B. Dry Barrel: AWWA C502, details as indicated.

**2.16 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER**

- A. Provide as indicated and as required by State or local agency.
- B. General: AWWA C511, with OS gate valve on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application.
- C. Body:
  - 1. 2-Inch and Smaller: Bronze with threaded ends.
  - 2. 2-1/2-Inch and Larger: Bronze, cast iron steel, or stainless steel with flanged ends.
- D. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies.
- E. Interior Components: Corrosion-resistant materials.

**2.17 DOUBLE CHECK DETECTOR ASSEMBLY**

- A. FM approved or UL listed, with OS&Y gate valve on inlet and outlet, and strainer on inlet. Include two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application.

**2.18 POST INDICATOR VALVE**

- A. General: UL 789, FM approved, vertical-type, cast-iron body with operating wrench extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve. Review fire department connection with agency having jurisdiction. Check hose threads and all sizes with fire department.

**2.19 FIRE DEPARTMENT CONNECTION**

- A. Exposed, Freestanding Fire Department Connection: UL 405, cast brass body with threaded inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets and chains; lugged swivel connections and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate. Four 2-1/2-inch NPS inlets and 4-inch NPS outlet.

**2.20 UNDERGROUND VAULTS/PITS**

- A. General: Portland cement concrete, precast or cast-in-place as indicated.
- B. Portland Cement Concrete and Reinforcing Steel: Section 32 05 23 – Cement and

Concrete for Exterior Improvements.

- C. Access Openings: As indicated.
- D. External Load: Earth load plus AASHTO H20 live load if located in paved areas.
- E. Lids: Bolt down type.

#### **2.21 TRACER WIRE**

- A. General: Minimum #12 AWG stranded copper wire with blue THW, THWN, or THHN rated insulation.

#### **2.22 WARNING TAPE**

- A. General: Non-detectable 3-inch warning tape made of solid blue film with continuously printed black-letter message reading "CAUTION—WATER LINE BURIED BELOW."

#### **2.23 PCC THRUST BLOCKS**

- A. Portland Cement Concrete and Reinforcing Steel: Section 32 05 23 – Cement and Concrete for Exterior Improvements.

### **PART 3 - EXECUTION**

#### **3.01 PIPE INSTALLATION**

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with the following:
  - 1. DIP: AWWA M41 and AWWA C600.
  - 2. PVC pipe: AWWA M23 and AWWA C605.
  - 3. Steel Pipe: AWWA M11.
- B. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Lay pipe on a bed of bedding material specified and prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout it's entire length

with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

### **3.02 CONNECTING TO EXISTING MAINS**

- A. Pressure Tap Connections: Perform in accordance with the requirements of the owner of the system being tapped. Maintain a positive pressure flow from the main being tapped to the tapping device to flush plastic chips, metal ribbons, etc. into the tapping devise and not into the pipe being tapped.
- B. Other Connections: As indicated and in accordance with the requirements of the owner of the line being connected to.

### **3.03 ANCHORAGE INSTALLATION**

- A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.
- B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24-hours curing time before introducing water into the pipeline and allow a minimum of 7-days curing time before pressure testing.

### **3.04 HIGH DEFLECTION FITTINGS/BALL JOINTS, EXPANSION JOINTS, AND FLEXIBLE EXPANSION JOINTS**

- A. Install as indicated and in accordance with the manufacturers recommendations.

### **3.05 VALVE INSTALLATION**

- A. Install all valves in accordance with the manufacturer's instructions and the following:
  - 1. General:
    - (a) Gate Valves: Appendix A of AWWA C509.
    - (b) Butterfly Valves: Appendix A of AWWA C504.

2. Joints:

(a) Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.

(b) Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

**3.06 SERVICE CONNECTIONS INSTALLATION**

A. Install as indicated and in accordance with the requirements of the owner of the system.

**3.07 WATER METER INSTALLATION**

A. Install as indicated and in accordance with the requirements of the owner of the system.

**3.08 FIRE HYDRANT INSTALLATION**

A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

**3.09 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER INSTALLATION**

A. Install as indicated and in accordance with the requirements of the owner of the system and the local health department requirements.

**3.10 DOUBLE CHECK DETECTOR ASSEMBLY INSTALLATION**

A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

**3.11 POST INDICATOR VALVE INSTALLATION**

A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

**3.12 FIRE DEPARTMENT CONNECTION INSTALLATION**

A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

**3.13 UNDERGROUND VAULT/PIT INSTALLATION**

A. Install as indicated.

B. Excavation and Backfill: Section 31 23 33 – Trenching and Backfilling.

**3.14 TRACER WIRE INSTALLATION**

A. Install on trench bottom under the vertical projection of the pipe to protect it in all installations.

B. Form a mechanically and electrically continuous line throughout the pipeline, extending

to the nearest valve or other pipeline appurtenance designated by the owner of the system or the Owner. Extend the wire up the outside of the valve box/riser and cut a hole that is 8-inches from the top, extend a 12-inch wire lead to the inside of the box. At other pipeline appurtenances, designated by the owner of the system or the Owner, terminate the 12-inch wire lead inside the enclosure.

- C. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

### 3.15 WARNING TAPE INSTALLATION

- A. Install tape approximately 1-foot above and along the centerline of the pipe.
- B. Where tape is not continuous, lap tape ends a minimum of 2-feet.

### 3.16 HYDROSTATIC PRESSURE AND LEAKAGE TEST

#### A. General:

1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Test pressure: See Subsection titled "System Performance Requirements."
7. Apply test pressure by means of a pump connected to the pipe.
8. Base test pressure on the elevation of the lowest point in the line.
9. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
10. Allow water to stand in the pipe for 24 hours before test pressure is applied.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure



test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.

15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.

B. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (S \times D \times P^{1/2}) / 133,200$$

L = Allowable leakage, gallons per hour.

S = Length of pipe tested, feet.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

C. PE Pipe Leakage Test:

1. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
2. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for one to three hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.
3. Nominal Allowance for Expansion

(U.S. Gals./100 Feet of Pipe)			
Pipe Size (in.)	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
<u>11</u>	<u>1.0</u>	<u>2.0</u>	<u>3.0</u>

12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
<u>22</u>	<u>3.5</u>	<u>7.0</u>	<u>10.5</u>
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
<u>48</u>	<u>15.0</u>	<u>27.0</u>	<u>43.0</u>

D. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P^{1/2}) / 7,400$$

L = Allowable leakage, gallons per hour.

N = Number of joints in the length of the pipeline tested.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

E. Cement Mortar Lined and Coated Steel Pipe Leakage Test: Perform in accordance with AWWA M11. Selected requirements of AWWA M11 are repeated as follows:

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. There shall be no significant leakage for pipe with welded joints or mechanical couplings.
3. For pipe joined with O-ring rubber gaskets, a leakage of 25 gallons per inch of diameter per mile per 24-hours is allowed.

### 3.17 DISINFECTION

A. All New Pipelines shall be disinfected in accordance with one of the three methods specified in AWWA C651 and the following:

1. Disinfect after pressure and leakage test have been performed and accepted.
2. The method used shall be at the Contractor's option, unless specified by the owner

of the water system.

3. Engage the services of a commercial testing laboratory, approved by the owner of the water system, to perform the bacteriological tests specified in Section 5.1 of AWWA C651. Direct the testing laboratory to send the original report of the bacteriological testing to the owner of the water system. Should the laboratory report show that any sample taken was not acceptable, repeat the sterilization process shall until a satisfactory sterilization is accomplished.
4. Lawfully dispose of the chlorinated water.

**END OF SECTION**

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**SECTION 33 30 00**

**SANITARY SEWERAGE UTILITIES**

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Roadway and/or site sanitary gravity sewers and force mains up to 5 feet of any on-site building.

1.02 RELATED SECTIONS

- A. Section 31 23 33 – Trenching and Backfilling.
- B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.
- C. Section 33 05 16 – Utility Structures.

1.03 RELATED DOCUMENTS

A. AASHTO:

- 1. M 252: Standard Specification for Corrugated Polyethylene Drainage Pipe.
- 2. M 294: Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-inch.) Diameter.

B. ASTM:

- 1. A 615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 2. A 674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids.
- 3. C 443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- 4. C 1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
- 5. D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- 6. D 2235: Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- 7. D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

8. D 2564: Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
9. D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
10. D 3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
11. D 4101: Standard Specification for Propylene Injection and Extrusion Materials.
12. F 477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
13. F 656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
14. F 679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
15. F-1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings.

C. AWWA:

1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. C110: Ductile-Iron and Gray-Iron Fittings.
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. C150: Thickness design of Ductile-Iron Pipe.
6. C151: Ductile-Iron Pipe, Centrifugally Cast.
7. C153: Ductile-Iron Compact Fittings.
8. M41: Ductile Iron Pipe and Fittings.

D. Caltrans Standard Specifications.

1. Section 65, Concrete Pipe.

E. California Building Code.

F. Section 1806A.11 – Pipes and Trenches.

G. California Plumbing Code.

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.

- B. ABS: Acrylonitrile-butadiene-styrene.
- C. ASTM: American Society for Testing Materials.
- D. AWWA: American Water Works Association.
- E. HDPE: High-density polyethylene.
- F. PE: Polyethylene.
- G. DIP: Ductile iron pipe.
- H. PVC: Polyvinyl Chloride.
- I. RCP: Reinforced concrete pipe.
- J. NPS: Nominal pipe size.

**1.05 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product data for the following:
  - 1. Piping materials and fittings.
  - 2. Special pipe couplings.
  - 3. Joint sealants.
  - 4. Sewage air relief valves.
- C. Shop drawings: Include plans, elevations, details and attachments for the following:
  - 1. Force main piping access openings.
- D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance.

**1.06 DELIVERY, STORAGE AND HANDLING**

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, fittings, and seals from dirt and damage.
- C. Handle precast concrete pipe and other precast structures according to manufacturer's written instructions.
- D. Protect imported bedding and backfill material from contamination by other materials.

**PART 2 - PRODUCTS**

**2.01 PIPING MATERIALS FOR GRAVITY FLOW**

- A. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 26. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
- B. DIP: Sizes 4-inch through 48-inch.
  - 1. Pipe: AWWA C150 and C151.
  - 2. Pressure Class: Minimum pressure class for size indicated.
  - 3. Fittings
    - (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
    - (b) Compact: AWWA C153, sizes 4-inch through 24-inch.
  - 4. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
  - 5. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
  - 6. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
  - 7. Joints:
    - (a) Push-On Bell and Spigot Joint: AWWA C111.
    - (b) Mechanical Joint: AWWA C111.
    - (c) Flanged joint. AWWA C115.
- C. PE Pipe and Fittings (HDPE): 4-inch through 10-inch, AASHTO M252 Type S, smooth interior and corrugated exterior. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  - 2. Couplings: AASHTO M 252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- D. PE Pipe and Fittings (HDPE): 12-inch through 48-inch, AASHTO M 294. Type S, smooth interior and corrugated exterior. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  - 2. Couplings: AASHTO M 252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- E. PVC Pipe:
  - 1. Pipe:

- (a) 4-inch through 15-inch: ASTM D 3034, SDR 26. Bell and spigot joints.
  - (b) 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.
- 2. Fittings:
  - (a) 4-inch through 27-inch: ASTM F 1336.
  - (b) 30-inch through 36-inch: ASTM D 3034, SDR 26
- 3. Joint Gasket: Elastomeric seal, ASTM F 477.
- F. Reinforced Concrete Pipe: Designated by Class, rubber gasketed joints, Type II or V cement.
  - 1. Circular Reinforced Concrete Pipe, Described or Chosen by Class: Caltrans Standard Specification.
  - 2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification.
  - 3. Rubber Gasketed Joints: Caltrans Standard Specification Section 65-2.02F.
- 2.02 PIPING MATERIALS FOR FORCE MAINS
  - A. DIP: See Section 33 10 00 – Water Utilities.
  - B. PE Pipe: See Section 33 10 00 – Water Utilities.
  - C. PVC Pipe: See Section 33 10 00 – Water Utilities.
- 2.03 SPECIAL PIPE COUPLINGS
  - A. Gravity Piping: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.
  - B. Force Main piping: See Section 33 10 00 – Water Utilities.
- 2.04 MANHOLES AND CLEANOUTS
  - A. See Section 33 05 16 – Utility Structures.
- 2.05 SEWAGE AIR RELIEF VALVE ASSEMBLY FOR FORCE MAINS
  - A. General: As indicated.
- 2.06 THRUST BLOCKS FOR FORCE MAINS
  - A. General: Location, configuration bearing area, etc. as indicated.
  - B. Portland Cement Concrete: Section 32 05 23 – Concrete for Exterior Improvements.



**PART 3 - EXECUTION**

**3.01 GRAVITY PIPE INSTALLATION**

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03C for reinforced concrete pipe and chapter 11.3.3 of AWWA M41 for ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout it's entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance at the end of each days work or when work is not in progress.

**3.02 FORCE MAIN PIPE INSTALLATION**

- A. General: See Section 33 10 00 – Water Utilities.

**3.03 SPECIAL PIPE COUPLINGS**

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Per manufacturer's instructions.

**3.04 AIR RELIEF VALVE ASSEMBLY INSTALLATION**

- A. General: Install as indicated.

### 3.05 TESTING OF GRAVITY PIPING MAINS

- A. Obstructions: After backfilling and compacting, but before paving or other surface improvements, test sewer for obstructions either by rodding or by the sewer ball method. Provide for intercepting all grit, rocks and other flushed debris to keep debris from entering the existing system.
- B. At the option of the Contractor, either the following hydrostatic or air test shall be performed.
- C. Hydrostatic Test:
  - 1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
  - 2. Test sewer mains between successive manholes by closing the lower end of the sewer main to be tested and the inlet sewer main of the upper manhole with stoppers.
  - 3. Fill pipe and manholes with water to a point four feet below the ground surface of the upper manhole, but in no case less than four feet above the pipe invert. If ground water is present, the water surface at the upper manhole shall be at least four feet above the level of the ground water.
  - 4. Fill piping at least one hour prior to testing.
  - 5. Test piping at least two hours by maintaining the head specified above with measured additions of water. The sum of these additions of water, in the two-hour test period, shall be the leakage amount.
  - 6. The maximum allowable head of water above any portion of sewer being tested shall be 15-feet. Where the difference in elevation between successive manholes exceeds 15-feet, a test tee shall be installed between manholes, and the testing shall be carried on between the tee and the manhole.
  - 7. The allowable leakage shall not exceed 0.1-gallons per minute per inch diameter, per 1000-feet of sewer main being tested.
  - 8. If the leakage exceeds the above amount, determine the cause and remedy it prior to retesting.
  - 9. If the leakage is less than the allowable, but leaks are observed, repair the observed leaks.
- D. Air Test:
  - 1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.

2. Apply to each length between adjacent manholes.
3. Supply pressure gauge with minimum divisions of 0.10-psi and with an accuracy of +/- 0.04-psi. When requested by the Owner, provide certification that the gauge has been tested for accuracy within the last six months by a reliable testing firm.
4. Pressurize the test section to 3.5-psi, and then hold the pressure above 3.0-psi during a saturation period of at least 5 minutes. At the end of the saturation period, note the pressure, which must be a minimum of 3.0-psi, and begin the timed period. If the pressure drops 0.5-psi in less than the time given in the following table the section of pipe has not passed the test.

<u>PipeSize</u>	<u>Minimum Time Allowed</u> <u>for Pressure to Drop 0.5-PSI</u>
4"	125 seconds
6"	185 seconds
8"	245 seconds
10"	310 seconds
12"	370 seconds
15"	460 seconds
18"	555 seconds
21"	10 minutes
24"	12 minutes
27"	14 minutes
30"	16 minutes
36"	18 minutes
42"	20 minutes
48"	23 minutes
54"	26 minutes

6. If the time for the pressure to drop 0.5-psi is 125% or less of the time indicated, the line shall immediately be re-pressurized to 3.0-psi and the test repeated. If, during the 5-minute saturation period, the pressure drops less than 0.5-psi after the initial pressurization and air is not added, the section undergoing the test shall have passed.

7. If the test did not pass, find and repair the leak to the satisfaction of the Owner.
8. When the prevailing ground water is above the line being tested the air pressure shall be increased 0.43-psi for each foot the water table is above the invert of the pipe at the highest manhole.

**3.06 TESTING OF LATERALS**

- A. At the option of the Contractor, either the following hydrostatic or air test shall be performed.
- B. Hydrostatic Test:
  1. Test laterals before backfilling.
  2. Plug lateral at its ends and fill with water through the cleanouts.
  3. Maintain the water level in the cleanouts as high as possible throughout the test period.
  4. One hour after filling with water, examine the lateral for leakage.
  5. Repair all leaks to the satisfaction of the Owner.
  6. Do not backfill the trench until testing and repairs of the lateral are complete, and approved by the Owner.
  7. Following approval of the Owner, remove all plugs, dispose of the water and complete the connection to the main.
- C. Air Test
  1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
  2. Test in accordance with subsection above titled "Testing of Gravity Piping Mains," paragraph titled "Air Test."

**3.07 HYDROSTATIC AND LEAKAGE TESTING OF FORCE MAINS**

- A. General: Perform hydrostatic and leakage test in accordance with Section 33 10 00 – Water Utilities.

**END OF SECTION**

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SECTION 33 40 00

STORM DRAINAGE UTILITIES

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Roadway and/or site storm drainage up to 5-feet of any on-site building.

1.02 RELATED DOCUMENTS

A. AASHTO:

- 1. M 252: Standard Specification for Corrugated Polyethylene Drainage Pipe.
- 2. M 294: Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.

B. ASTM:

- 1. A 74: Standard Specification for Cast Iron Soil Pipe and Fittings.
- 2. A 615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 3. C 443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- 4. C 564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- 5. C 1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
- 6. D 1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- 7. D 2235: Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- 8. D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
- 9. D 2564: Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- 10. D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- 11. D 3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 12. D 4101: Standard Specification for Polypropylene Injection and Extrusion Materials.
- 13. F 477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

14. F 656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
15. F 679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
16. F-1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.

**C. AWWA:**

1. C104: Cement-Mortar Lining for Ductile Iron Pipe and Fittings.
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. C110: Ductile-Iron and Gray-Iron Fittings.
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. C150: Thickness design of Ductile-Iron Pipe.
6. C151: Ductile-Iron Pipe, Centrifugally Cast.
7. C153: Ductile-Iron Compact Fittings.
8. M41: Ductile Iron Pipe and Fittings.

**D. Caltrans Standard Specifications:**

1. Concrete Pipe.
2. Corrugated Metal Pipe.
3. Miscellaneous Drainage Facilities.
4. Slope Protection.

**E. Caltrans Standard Plans:**

1. Metal and Plastic Flared End Sections.
2. Concrete Flared End Sections.
3. Corrugated Metal Pipe Coupling Details No.1, Annular Coupling Band Bar and Strap and Angle Connections.
4. Corrugated Metal Pipe Coupling Details No. 2, Hat Band Coupler and Flange Details.
5. Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers.
6. Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands.
7. Corrugated Metal Pipe Coupling Details No. 5, Standard Joint.
8. Corrugated Metal Pipe Coupling Details No. 6, Positive Joint.
9. Corrugated Metal Pipe Coupling Details No. 7, Downdrain.

10. Slotted Corrugated Steel Pipe Drain Details.

11. Slotted Corrugated Steel Pipe Drain Details.

F. California Building Code:

G. Section for Pipes and Trenches.

H. Section for Gratings.

I. California Plumbing Code.

### 1.03 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. ABS: Acrylonitrile-butadiene-styrene.

C. ASTM: American Society for Testing Materials.

D. AWWA: American Water Works Association.

E. CMP: Corrugated metal pipe.

F. DIP: Ductile iron pipe.

G. HDPE: High-density polyethylene.

H. NPS: Nominal pipe size.

I. PE: Polyethylene.

J. PVC: Polyvinyl chloride.

K. RCP: Reinforced concrete pipe.

### 1.04 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Product Data Shop Drawings, Etc.: For the following:

1. Piping materials and fittings.

2. Special pipe couplings.

3. Polymer-concrete, channel drainage systems (trench drains).

4. Joint sealants.

5. Plastic area drains.

6. Precast concrete catch basins, inlets, curb inlets, and area drains, including frames and grates.

7. Concrete, metal and plastic flared end sections.

- C. Design Mix Reports and Calculations: For each class of cast in place concrete.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance.

**1.05 DELIVERY, STORAGE AND HANDLING**

- A. Do not store plastic structures, pipe and fittings in direct sunlight.
- B. Protect pipe, fittings, and seals from dirt and damage.
- C. Handle precast concrete pipe and other precast structures according to manufacturer's written instructions.
- D. Protect imported beddin
- E. g and backfill material from contamination by other materials.

**PART 2 - PRODUCTS**

**2.01 PIPING MATERIALS**

- A. ABS Pipe and Fittings: Smaller than 4-inch, ASTM D 2751, SDR 35. Solvent cement joints.
  - 1. Solvent Cement: ASTM D 2235.
- B. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 35. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
- C. Cast Iron Pipe and Fittings: Hub and spigot, 2-inch through 15-inch, ASTM A74, service class.
  - 1. Gaskets: ASTM 564, rubber, compression type, thickness to match class of pipe.
- D. Corrugated Metal Pipe: per Caltrans Standard Specification
  - 1. Bituminous Coating: per Caltrans Standard Specification.
  - 2. Bituminous Lining: per Caltrans Standard Specification.
  - 3. Bituminous Pavings: per Caltrans Standard Specification.
  - 4. Corrugated Aluminum Pipe: per Caltrans Standard Specification.
  - 5. Corrugated Steel Pipe: per Caltrans Standard Specification.
  - 6. Slotted Corrugated Steel Pipe: per Caltrans Standard Specification.
  - 7. Details: per Caltrans Standard Plans
- E. DIP: Sizes 4-inch through 48-inch.
  - 1. Pipe: AWWA C150 and C151.
  - 2. Pressure Class: Minimum pressure class for size indicated.



3. Fittings:
  - (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
  - (b) Compact: AWWA C153, sizes 4-inch through 24-inch.
4. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
5. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
6. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
7. Joints:
  - (a) Push-On Bell and Spigot Joint: AWWA C111.
  - (b) Mechanical Joint: AWWA C111.
  - (c) Flanged joint. AWWA C115.
- F. Reinforced Concrete Pipe: Designated by Class, rubber gasketed joints.
  1. Circular Reinforced Concrete Pipe: per Caltrans Standard Specification.
  2. Oval shaped (Elliptical) Reinforced Concrete Pipe: per Caltrans Standard Specification.
  3. Reinforced Concrete Pipe Arch: per Caltrans Standard Specification.
  4. Rubber Gasketed Joints: per Caltrans Standard Specification.
- G. PE Pipe and Fittings: 4-inch through 10-inch, AASHTO M 252 Type S, smooth interior and corrugated exterior. Bell and spigot joints.
  1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- H. PE Pipe and Fittings: 12-inch through 48-inch, AASHTO M 294. Type S, smooth interior and corrugated exterior. Bell and spigot joints.
  1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- I. PVC Pipe and Fittings-Smaller than 4-Inch: ASTM D1785, Schedule 40.
  1. Joints: Solvent Cement, ASTM D 2564. Include primer according to ASTM F656.
- J. PVC Pipe and Fittings, 4-Inch and Larger
  1. Pipe:
    - (a) 4-inch through 15-inch: ASTM D 3034, SDR 35. Bell and spigot joints.

(b) 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.

2. Fittings:

(a) 4-inch through 27-inch: ASTM F 1336.

(b) 30-inch through 36-inch: ASTM D 3034, SDR 35

3. Joint Gasket: Elastomeric seal, ASTM F 477.

**2.02 PIPE ANCHORS**

A. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

**2.03 SPECIAL PIPE COUPLINGS**

A. Plastic, Cast Iron and Ductile Iron Pipe: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

B. Reinforced Concrete Pipe: Portland cement concrete collar as indicated.

C. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

**2.04 CURB INLETS, CATCH BASINS, DROP INLETS, AREA DRAINS, ETC.**

A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.

B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

C. Precast Structure: Rate for AASHTO H20 loading in paved areas.

D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step.

E. Frames, Grates and Covers: per Caltrans Standard Specification.

1. Galvanize steel frames, grates and covers.

2. Grates and covers shall be non-rocking, bolt-down type.

3. Rate for AASHTO H20 loading in paved areas.

**2.05 MANHOLES AND CLEANOUTS**

A. See Section 33 05 16 – Utility Structures.

**2.06 POLYMER-CONCRETE TRENCH DRAINS**

A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.

B. Include the following components:

1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
  2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.
  - C. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- 2.07 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS
- A. General: Caltrans Standard Specification and Caltrans Standard Plans.
- 2.08 SLOPE PROTECTION
- A. Rock Slope Protection: Caltrans Standard Specification.
    1. Class: *[Select Class applicable to the Project.]*
    2. Fabric: Caltrans Standard Specification.
  - B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification.
    1. Bar Reinforcement: Caltrans Standard Specification, minimum Grade 40.
    2. Welded Wire Fabric: Caltrans Standard Specification. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated.
  - C. Concreted-Rock Slope Protection: Caltrans Standard Specification.
    1. Class: *[Select Class applicable to the Project.]*
  - D. Sacked Concrete Slope Protection.
    1. Concrete: Caltrans Standard Specification.
    2. Sacks: 10 ounce burlap measuring approximately 19.5-inches by 36 inches when empty and laid flat.
- 2.09 CONCRETE/SHOTCRETE DITCH LINING
- A. General: Caltrans Standard Specification.
    1. Bar Reinforcement: Caltrans Standard Specification, minimum Grade 40.
    2. Welded Wire Fabric: Caltrans Standard Specification. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated.

### **PART 3 - EXECUTION**

#### **3.01 PIPE INSTALLATION**

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans

Standard Specification Section 65-2.03C for reinforced concrete pipe, per Caltrans Standard Specification and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.

- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

### **3.02 INSTALLATION OF PIPE ANCHORS**

- A. Install at location, configuration and details shown on the Plans.

### **3.03 SPECIAL PIPE COUPLINGS**

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Per manufacturer's instructions.

### **3.04 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, AREA DRAINS, ETC.**

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
  - 1. Shape bottoms to convey flows as indicated.
- C. Precast Structures: Install as indicated.
  - 1. Seal all joints and pipe entrances and exits.
  - 2. Place concrete in bottom and shape to convey flows as indicated.

**3.05 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION**

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- B. Install: As indicated and in accordance with the manufacturer's instructions.

**3.06 CONCRETE OR PLASTIC FLARED END SECTION INSTALLATION**

- A. Install: As indicated.

**3.07 SLOPE PROTECTION PLACEMENT**

- A. Rock Slope Protection: Caltrans Standard Specification and as indicated.
  - 1. Use Method B Placement unless otherwise indicated. If Method A is used, then refer to Caltrans Standard Specification
- B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification.
- C. Concreted-Rock Slope Protection: Caltrans Standard Specification.
  - 1. Use Method B Placement unless otherwise indicated. If Method A is used, then refer to Caltrans Standard Specification.
- D. Sacked Concrete Slope Protection.
  - 1. Detailed configuration: As indicated.
  - 2. Use one cubic foot of concrete per sack.
  - 3. Locate headers and stretchers as indicated.
  - 4. Headers: Folded end to bank.
  - 5. Stretchers: Folded ends are not to be adjacent.
  - 6. Place no more than four vertical courses until initial set has taken place in first course.

**3.08 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT**

- A. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification.

**END OF SECTION**