

**STANDARD
SPECIFICATIONS**

**FOR
THE CONSTRUCTION OF
DOMESTIC WATER
AND
RECYCLED WATER FACILITIES**

City Council

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**CITY OF SAN JUAN CAPISTRANO
UTILITY DEPARTMENT**

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PART 1

PROCEDURAL GUIDE AND GENERAL DESIGN REQUIREMENTS
FOR CONSTRUCTION OF
DOMESTIC WATER AND RECYCLED WATER FACILITIES

CITY OF SAN JUAN CAPISTRANO
PUBLIC WORKS DEPARTMENT

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SECTION 100

PROCURING DOMESTIC WATER SERVICE FROM CITY OF SAN JUAN CAPISTRANO PUBLIC WORKS DEPARTMENT

100.1 AVAILABILITY OF SERVICE

The Developer (or Applicant) or its agent shall check with the City of San Juan Capistrano Public Works Department (PWD) to determine the current boundaries of the Water PWD and the availability of service.

100.2 PLAN CHECKING PROPOSED DESIGN

The Applicant's Engineer shall submit an initial concept plan and design report, as required by the PWD, of the proposed domestic water and recycled water facilities, for any development, to the PWD Engineer for review and approval. The applicant shall pay the preliminary process fee detailed in Exhibit B, Section V, part e; at the time of the first plan check submittal. Plans shall also be submitted to the City Engineer of the City having jurisdiction for review and determination of the requirements for approval of work within City jurisdiction.

100.3 APPLICATION, AGREEMENT, AND FEE PAYMENT

Upon the Applicant's/Engineer's submission of the utility plans for second plan check, (see requirements of Sections 300.1 - 300.7) the PWD will prepare an "AGREEMENT FOR THE CONSTRUCTION OF WATER FACILITIES". (See Exhibit A) This agreement includes all required fees to be paid to the PWD. The PWD will sign its approval of the utility plans when the Applicant has satisfied those financial obligations and returned the original and two signed copies of the agreement properly notarized, and the Council has accepted and executed the agreement.

100.4 RESPONSIBILITY FOR FURNISHING MATERIAL AND INSTALLATION

Installation of a development's domestic water and recycled water facilities and any other required off site facilities will be the obligation of, and at, Developer's expense. The Applicant shall cause all installation work to meet the PWD's "Standard Specifications," and upon final acceptance convey the facilities to the PWD.

100.5 GUARANTEES

As set forth in the Agreement, the Applicant shall be responsible for any and all repairs and replacements for a period of one year from the date of acceptance by the PWD Council of Directors without expense whatsoever to the PWD; ordinary wear and tear and unusual abuse or neglect excepted. In the event of failure to comply with the aforementioned conditions, the PWD will use securities posted by the Developer to have

the defects repaired and made good. The cost and charges shall include attorney fees and other incidental costs involved thereof.

100.6 ORDER OF PRECEDENCE OF THE STANDARD SPECIFICATIONS AND DRAWINGS

In the case of conflict between the specifications, drawings, and permit requirements, with regard to water facilities, the order of precedence set in the Green book will apply.

The "Standard Specifications for Public Works Construction," (Green Book), are incorporated herein by this reference. Copies may be purchased from Building News, Inc., 3055 Overland Avenue, Los Angeles, California 90034.

100.7 AS-BUILT DRAWINGS

As-built drawings will be provided to the PWD as detailed in Section 500.13 for Domestic and Recycled off-site facilities, and Section 700.5 for Recycled on site irrigation systems.

END OF SECTION

SECTION 200

PWD CHARGES CONNECTION FEES AND OTHER COSTS

200.1 WATER RATES AND MONTHLY SERVICE CHARGES

These changes will be billed for water and meter use as listed in the schedule of rates and charges - Exhibit B, Sections I & II, & IV

200.2 DEVELOPMENT CHARGES

Development fees as listed in Exhibit B part V, will be assessed and collected as part of the agreement between the developer and the PWD except for part "e" (the preliminary processing fee) which will be collected after the concept plan review and with the 1st submission of the improvement plans.

The developer's water capacity fees will be based on the maximum day water demand the proposed development will generate, as outlined in Section 300.5, the "Maximum Day Demand"; and charged according to the rates set out on Exhibit B, Section V, Part a.

The Capital Improvement Charge as outlined on Exhibit B, Section V, Part b, is based on the type of construction and levied on a per meter, unit basis, or square footage basis for commercial/ industrial; whichever is greater.

The Storage Charge as outlined on Exhibit B, Section V, part c, is based on whether or not the development falls in a development zone. Contact the PWD to determine whether or not the subject project falls in a development zone.

The Plan Check and Inspection Fees as outlined on Exhibit B, Section V, part d, are based on estimated cost of the water facilities improvements, and subject to confirmation and adjustment when an agreement between the Developer and the PWD is signed.

200.3 METER CHARGES

Applicant of all residential or commercial/industrial properties will be required to furnish and dedicate to the PWD all water meters 3-inch and larger.

The Developer will pay for and the PWD will furnish and install all meters up to and including 2-inch in size. All meters must be applied for through the PWD's Public Works Department. The schedule and cost of these meters is as listed. Exhibit B Section IV.

END OF SECTION

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SECTION 300

DESIGN AND INSPECTION CONTROL PROCEDURES

300. SUBMISSION PROCESS

Submission shall occur in the procedure as listed below. Next to each title is the specification detailing the item and its components. Items will not be skipped unless so stated in a letter (Exhibit "C") by the PWD; which states which items, if any, are not required.

Failure to complete items in the order listed will result in the plans being returned, unchecked.

CONCEPT PLAN SUBMITTED	300.1.0	
CONCEPT PLAN RETURNED	300.1.1	
1ST PLAN CHECK SUBMITTED	300.2	
1ST PLAN CHECK RETURNED	-----	
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COST ESTIMATE SUBMITTED	300.4	
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FIRE DEPT APPROVAL.	300.6	
2ND PLAN CHECK SUBMITTED	300.7	
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AGREEMENT	300.8	COMPLETE ALL ITEMS IN SECTION 300.1 THROUGH 300.7 PRIOR TO CONTINUING WITH ITEMS 300.8 TO 300.12
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FEES PAID	300.11	
CITY COUNCIL APPROVAL OF AGREEMENT	300.12	
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300.1.0 Domestic Water Development Plan.

Two sets of concept water development plans are to be submitted to the PWD Engineer by the Applicant or the Applicant's Engineer at least 30 days before filing any development map.

It is the recommendation of the PWD, but not a requirement, that the fire department review a copy of the concept plan.

300.1.1 Water System Design Approval.

The PWD Engineer will review for approval the water system concept plans for the development, taking into consideration the following:

1. Existing transmission main locations and sizes.
2. City and/or County fire flow requirements. Whether or not general Fire Department criteria have been met. (It is the responsibility of the Developer to meet with the Fire Department separately, to determine specific Fire Department concerns.)
3. PWD's Domestic Water Master Plan.
4. PWD's design criteria, Section (500).

The PWD reserves the right to change proposed domestic water main sizes after considering the above criteria. The Developer will be required to improve the existing Distribution system, if necessary, to support the proposed project.

300.1.2 Recycled Water System Development Plan. (See Sections 600 and 700.)

300.2 INDIVIDUAL TRACT IMPROVEMENT PLANS SUBMITTED FOR REVIEW AND APPROVAL

300.2.1 First Plan Check Requirements.

1. The Applicant/Engineer shall submit the following items for first review of Residential/ Commercial/Industrial Subdivisions:
 - a. 2 sets of Utility Improvement Plans
 - b. 2 sets of Tract/Parcel Map showing gross acreage
 - c. 1 set of grading plans
 - d. Engineer's Quantities estimate for water and recycled water system
 - e. Transmittal from Applicant's Engineer
 - f. Improvement Plans - Maximum Size 24" X 36", no exceptions.
 - g. Payment of the preliminary review fee per Exhibit B, Part V, Section "e"
 - h. Developments larger than 20 lots require a Geotechnical report including corrosivity analysis of soils. The corrosivity analysis shall be prepared by a California registered Corrosion Engineer or NACE International Certified Corrosion Technologist and shall include the results of tests for soils resistivity and chemical analysis including pH, Chlorides, Sulfate Alkalinity.

After the first plan check, PWD will return one redlined set each of the utility improvement plan and the tract/parcel map. The returned sets will note any specific variations from the basic requirements. See Section 300.2.2 below.

300.2.2 Detailed Plan Requirements

All plans submitted to the City of San Juan Capistrano Public Works Department (PWD) Engineering staff for plan checking and approval of domestic water and recycled water facilities will be submitted on 24" X 36" overall size. These plans shall conform to the "Standard Procedure for Processing Maps and Improvement Plans", of the City having jurisdiction and the following requirements.

300.2.2.1 Required Details:

1. Title Sheet

- a. Standard Water and Recycled water Notes as provided by the PWD. (See Section 500.11)
- b. Index Map
 - 1) Scale: 1" = 100'
 - 2) Show: Water mains - size, fire hydrant, and valves and existing facilities
 - 3) North Arrow
 - 4) Street Names
 - 5) Legend of symbols and lines
 - 6) Show easements for Water and Irrigation Facilities
- c. Location Map showing general area with project noted
- d. Signature Block - the PWD's Approval of Water Facilities form as provided by the PWD
- e. Fire Marshall Signature Block
- f. Bench Mark Description and latest elevations
- g. City Engineer Signature Block
- h. Basis of Bearings
- i. Name, Address, and Phone Number of the Engineering Firm, including signature & seal of responsible Engineer.
- j. Quantity Estimates may appear on Title Sheet. Water and Recycled water Facilities to be called out separately; Labeled and not mixed together.
- k. Index of Sheets
- l. Revision block
- m. General Notes
- n. Utility addresses and phone numbers, including but not limited to - Gas, Telephone, Power, Cable TV., Water, Sewer, and Storm Drain.

- o. U.S.A. Dig Alert notice per Section 4212/5217 of the Government code.
- 2. Second Sheet (Normally Sheet 2 includes):
 - a. Quantity Estimates
 - b. PWD Standard Notes (See Section 500.11)
 - c. Construction Notes
 - d. Detail Drawings
- 3. Plan and Profile Sheets
 - a. Scale: - 1" = 20' or 1" = 40'
 - b. The plan and profile should be on same sheet and aligned
 - c. Existing domestic water and recycled water facilities adjacent to development must be shown
 - d. Easements for domestic water and recycled water facilities must appear on plans
 - e. Building/D.U. pad elevation
 - f. Water, sewer, irrigation system and storm drain crossing elevations.
 - g. Provide a key map on each sheet at an appropriate scale

300.2.3 Non-Residential Application Procedure Requirements.

- 1. Domestic Water Services
 - a. Services may be required to have back flow prevention devices (minimum double check valve), as determined by the PWD.
 - b. Items required to make an application for domestic service.
 - 1) A completed meter application.
 - 2) Proof that all fees, stipulated in the agreement must have been paid.
- 2. Fire Service Requirements
 - a. All fire services will require at a minimum a double check detector check per PWD Standard W-17, or a Reduced Pressure Principle Assembly per PWD standard W-19.
- 3. Recycled Water Service Requirements:
 - a. Landscape plans must be reviewed and approved by PWD.
 - b. MUST have an address for each service

- c. One approved landscape plan -- showing each service's point-of-connection to PWD main
- d. All fees, stipulated in the agreement must have been paid.
- e. If recycled water is available, it must be used.
- f. The irrigation plans for the use of Recycled water will be in compliance with the Rules and Regulation for Users of Recycled Water, adopted March 1994.

300.2.4 Additional Requirements, Standards, and Fees

1. Standards for Application

- a. The PWD will furnish and install all domestic and recycled meters -- 5/8-inch through 2-inch.
- b. Sizing water meters:

Size and maximum gpm demand.

5/8" X 3/4"	-	15	gpm - maximum
1"	-	37	gpm - maximum
1½"	-	75	gpm - maximum
2" Disc	-	120	gpm - maximum
2" Turbine	-	160	gpm - maximum
2" Compound	-	160	gpm - maximum
3" Turbine	-	350	gpm - maximum
3" Compound	-	320	gpm - maximum
4" Turbine	-	1000	gpm - maximum
4" Compound	-	500	gpm - maximum
6" Turbine	-	2000	gpm - maximum
6" Compound	-	1000	gpm - maximum
8" Turbine	-	3500	gpm - maximum
10" Turbine	-	5500	gpm - maximum

PWD reserves the right to specify the size of the meters.

- c. Type of meter:

A turbine meter and strainer shall be used on all irrigation services 2-inch and larger or as determined by the PWD.

A compound meter and strainer shall be used on all master metered domestic multi-unit developments or as determined by the PWD.

- 2. The Applicant's Contractor should have a Class A or C-34 license.

300.2.5 PWD's Regulation Regarding Cross Connections

All domestic water services shall be subject to the provisions of the section in the PWD's Ordinance Relations to back-flow Into Water System. The following summarizes these provisions:

Cross connections of any type that permit a back flow condition from any source or system other than that of the PWD's domestic water mains are prohibited. A connection constituting a potential or actual back flow hazard is not permissible unless a back flow device or air gap, which is approved by the California State Department of Health and local Health Agency and complies with Title 17 of the California State Administrative Code, is installed. Such an installation shall at all times be subject to inspection and regulation by the PWD for the purpose of avoiding possibility of back flow.

The PWD has a Production Supervisor who is available for consulting on any questions regarding cross-connections.

The PWD will not provide any water service to any premises unless the public domestic water supply is protected as required by State, County and PWD regulations. Services are now required to have back flow devices installed for:

- All Commercial domestic water services
- All Industrial domestic water services
- All Fire lines where the Commercial or Industrial buildings are over two stories in height
- All Domestic systems or fire line systems having two, or more, points of connection to PWD mains
- All irrigation services on the domestic water system
- All domestic services to sites with recycled irrigation service

Backflow prevention devices shall be approved by the U.S.C. Foundation for Cross Connection Control and shall be installed by and at the expense of the Customer.

The Customer shall have the device regularly tested (at least once a year) by a tester certified by the Orange County Health Department and service such devices to maintain them in satisfactory operating condition and shall overhaul or replace such devices if they are found defective.

Records of such annual tests, repairs, and overhauling shall be kept by the Customer and copies forwarded to the PWD Production Supervisor and local Health Agency.

Service of water to any premises may be discontinued by the PWD if a back flow prevention device required by the PWD Ordinance is not installed, tested, and maintained; or if any defect is found in an installed back flow prevention device; or if it is found that a back flow prevention device has been removed or bypassed; or if

unprotected cross-connections exist on the premises. Services will be restored only when such conditions or defects are corrected to the satisfaction of the PWD.

The PWD will further define how water lines must be marked where multiple water systems are in use and outline the duties and responsibilities of a property's Water Supervisor.

Additional reference for guidelines to when, why, and what types of back flow and cross-connection control devices are approved may be found in:

- a. Regulations Relating to Cross Connections, California Administrative Code - Title 17 - Public Health.
- b. Manual of Procedures and Practices for Public Water Suppliers (California Department of Health Services - Public Water Supply Brand).
- c. Manual of Cross-Connection Control, published by Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, University Park, Los Angeles, California 90007.

300.2.6 On-Site Irrigation Systems

See Section 400 for detailed specifications regarding the construction and or conversion of on-site domestic irrigation systems to on-site recycled water systems.

300.2.7 Domestic Water Facilities

See Section 500 for detailed specifications regarding the construction of domestic off-site water facilities.

300.2.8 Off-Site Recycled Water Facilities

See Section 600 for detailed specifications regarding the construction of off-site recycled water facilities.

300.2.9 On-Site Recycled Water Facilities

See Section 700 for detailed specifications regarding the construction of on-site recycled water facilities.

300.3 PROVIDING REQUIRED EASEMENTS

If an easement outside of the Public Right-of-Way is required for construction and/or maintenance of water facilities, including but not limited to, water mains, hydrants, meter

vaults, and detector check assemblies. Its minimum width shall be 20 feet for water mains with the line placed per the direction of the PWD Engineer. For all other appurtenances its minimum width shall be 10' and a minimum of 5 feet on all sides will be maintained, unless the need for a greater easement is determined by the PWD. An easement running parallel with a lot line shall not be split so as to occur on two lots. The Easement, the title report, and the legal descriptions with accompanying sketch and plans shall be prepared by the Applicant's Engineer, two copies of which shall be sent to the PWD Engineer. Alternately, easements shall be shown on a tract or parcel map. Easement descriptions shall be in a form acceptable to the PWD and will be checked by the PWD Engineer. Easements shall also be shown on the construction plans. The PWD will approve the plans only after all required easements have been deeded to the PWD together with any necessary partial reconveyance or subordination agreements. Exhibits will be 8-1/2" X 11", no exceptions.

Along public streets a three or five foot utility parallel easement on private property for PWD may be required depending upon Public Right-of-Way widths and sidewalk locations.

300.4 COST ESTIMATE

The developer's engineer shall provide a cost estimate that shows the quantities, unit cost, and cost extension of the water distribution facilities to be dedicated to the PWD. The items listed will include, but will not be limited to pipes, valves, meters & appurtenances, connections, hot taps, and facilities construction. The estimate will also include a reasonable design fee, survey and layout costs, and the contractor's construction overhead and profit.

300.5 MAXIMUM DAY DEMAND

The developer's engineer shall submit a calculation of the maximum day demand. The maximum day demand being defined as 1.90 times the average day demand for Domestic Water, and 2.55 times the average day demand for Recycled Water.

The calculation of the maximum day demand shall be based on the use factors listed below; provided the proposed development is similar enough to the developments used to develop this schedule. If the PWD Engineer determines that the project is unique enough to require a special use study, the PWD will perform one; and the maximum day demand calculated will be used as the basis for the design.

Alternatively the developer's engineer may provide a calculation of the maximum day demand; provided sufficient evidence is provided, with the calculations, to substantiate the validity of the calculations. The PWD reserves the right to reject these calculations if it feels that the evidence for an alternate basis of calculation is unacceptable.

The PWD has developed the following average day demand factors listed below, based on detailed use studies. Domestic water use factors are based on detailed consumption studies and the gross area of the development. For recycled water, the use factors are based on detailed consumption studies and the actual irrigated area within the development.

Schedule of Use Factors, Average Day Demands

<u>Land Use - Model</u>	<u>City Zoning Designation</u>	<u>Water Duty</u>
Agricultural	AG - General Agricultural	586 GPD/Ac
Estate	RA - Small Farm	1650 GPD/Ac
	EL - Large Estate	" "
	ES - Small Estate	" "
Residential	RS - Single Family	2229 GPD/Ac
	RD - Garden Home	" "
	PRD -Planned Residential Development	" "
	RD - Multiple Family	" "
Mobile home Park	MHP - Mobile home Park	790 GPD/Ac
Commercial/Industrial	CG - General Commercial	1785 GPD/Ac
	CM - Commercial Manufacturing	" "
	MG - General Industrial	" "
	MP - Industrial Park	" "
Public/Institutional	IP - Public & Institutional	935 GPD/Ac
Recreational	OR - Open Space Recreation	598 GPD/Ac
Open Space	OS - Open Space	" "
Equestrian Use	Equestrian (or 39 GPD/Stall, which ever is greater.)	693 GPD/Ac
Recycled Irrigation	Park	3190 GPD/Ac

300.6 FIRE DEPARTMENT APPROVAL

After the first utility plan check by the PWD, it will become the responsibility of the Applicant's Engineer to have the governing fire department sign the plans before submitting them for a second plan check. Fire flow requirements for the development

shall be submitted with the second plan check submitted. The PWD reserves the right to require additional fire protection or modify water facility sizes as deemed necessary.

300.7 SECOND PLAN CHECK

Upon satisfactory completion of items 300.1 through 300.6 the developer's engineer shall submit plans for the second plan check.

300.7.1 Return of Corrected Plans

Corrected Plans Returned to the Developer's Engineer upon review of the water systems for the total development, one red lined copy will be returned to the Developer's Engineer, showing any corrections and/or comments. The redlined copy will be returned to the PWD along with corrected copies in the next submission.

300.8 AGREEMENT FOR THE CONSTRUCTION OF WATER FACILITIES

Upon receiving the corrected utility plans for a second plan check, the PWD Engineer will compute the required development fees, based on the then governing PWD Rules and Regulations and will prepare the Developer's Agreement. (See Exhibit A.)

The PWD will send a draft copy of the Agreement to the Developer.

300.8.1 Security

The Developer will provide a Surety Bond, a letter of Credit, a certificate of Deposit, of other form of surety acceptable to the PWD, as shown on Exhibit E. This Surety shall be of a type that is automatically renewed every year, at the Developer's expense, until released by the PWD.

300.9 FINAL PLANS

Upon completion of any remaining items noted in the plan check, the Developer's engineer shall submit two blue line sets of improvement plans, along with the red line mark up, for final verification.

300.10 FINAL EASEMENTS

300.10.1 Submission of Easement Documents

The Developer shall submit easement documents, which incorporate all changes caused by the review process, in accordance with Section 300.3

300.10.2 Verification of Easements

The developer's engineer will verify that the easements as listed in the easement documents remain valid. The engineer will then submit the final easement documents and the final title report for recordation.

300.11 PAYMENT OF FEES

The Developer shall pay all fees as determined in the "AGREEMENT FOR CONSTRUCTION OF WATER FACILITIES" between the Developer and the PWD.

300.12 CITY COUNCIL APPROVAL OF AGREEMENT

Upon satisfactory completion of items 300.1 through 300.11 the PWD will, at the request of the Developer, submit to the City Council for acceptance the AGREEMENT FOR THE CONSTRUCTION OF WATER FACILITIES. (See Exhibit A)

300.13 SIGNED PLANS

Utility improvement plans must have the PWD Engineer's signature before any construction by the Applicant begins.

300.13.1 Prerequisites for Signing Plans

1. The AGREEMENT FOR THE CONSTRUCTION OF WATER FACILITIES must be signed by Developer, and approved by the City Council.
2. The required signed easement documents or the Tract/Parcel map must have been accepted for dedication by the PWD. The easement documents must have been recorded.
3. The Applicant must pay all fees and charges in full.
4. Water rights are to be dedicated to the PWD on the Tract/Parcel map, or if necessary by separate instrument.

300.13.2 PWD Signing Plans.

The Applicant must satisfy the requirements detailed in Sections 300.1 through 300.12 (out lined above) then:

1. Utility plan original mylars shall be delivered to the PWD Engineer with two revised blue line sets.

2. PWD will call Applicant's Engineer once the plans have been signed.

300.13.3 Validity of Signed Plans.

Plans will be valid for two years from the date of PWD approval. If construction has not started within two years from date of approval, the signed plans shall become "null and void". At this occurrence the PWD will require rechecking of the plans and it reserves the right to charge additional plan check fees.

300.13.3.1 Re-permit letter in the event that construction does not start, and the approval could become null and void, as described in Section 300.13.3; the letter shown in exhibit D will be submitted by the developer's engineer, by registered mail, to request a one year extension of the approval.

300.14 SIGNED UTILITY PLANS

Two sets of blue lines and one set of mylars shall be furnished to PWD at least two working days before the pre-construction conference and commencing work.

300.15 CONSTRUCTION INSPECTION

300.15.1 Pre-construction Conference

A pre-construction conference is to be held 24 hours before starting construction, at which will be present the Applicant's Contractor's working foremen and/or job Superintendent, the Applicant's Engineer, and the PWD Inspector. The purpose of this meeting will be to answer any questions on PWD specification requirements, to obtain the Contractor's construction schedule, and to discuss any known circumstances that might affect job installation.

300.15.2 Notice Prior to Construction

Notice shall be given to the PWD Inspector at least 48 hours before starting construction. Signed utility plans must be delivered to the Inspector at least two working days before the Contractor will be allowed to start construction. The City Inspector shall be notified prior to work within public right-of-way.

300.15.3 Pre-Construction Meeting Agenda

Without relieving the developer of responsibilities outlined elsewhere in the specifications; the PWD will present to the Developer a list of requirements that may contain, but will not be limited to, the following items:

- Order of Work

- Working hours
- Operations manuals
- Manufactures Specifications
- Pressure, and Bacterial test results
- As-Built Drawings

300.15.3.2 Curbs Installed Before Starting Water Facilities.

It is a basic requirement of the PWD that the curbs be installed in tracts prior to starting the installation of water facilities. They act as positive grade control for setting services and fire hydrants. The PWD may approve an exception if the Developer fills out an Application for Waiver stating that surveyor, paid for by the developer, will set line and grade stakes and that the Developer will accept full financial responsibility for any installation not in accordance with the approved plans made by installing the facilities before curbs.

300.15.3.3 Water for Construction Purposes

The Contractor will be furnished construction water at a connection point designated by the PWD after payment of fees per Exhibit B, Section III, Part b; Section I, part f, Section VI, Section IV, parts g & h plus any items in Section VI.

The water shall be taken through a metered delivery and the Developer shall pay all costs related thereto, including but not limited to the PWD's standard deposit for temporary meter and actual costs of water used, pumping costs, loading, hauling, and the use thereof. The Developer shall make all arrangements for transporting the water to the construction site. Water shall be used for construction purposed when possible.

300.15.4 Inspection of the Work

300.15.4.1 All work shall be subject to inspection by the PWD and shall be left open and uncovered until approved by appropriate PWD personnel.

300.15.4.2 Domestic water and/or Recycled Water System Inspections. The Contractor shall not proceed with any subsequent phase of work until the previous phase has been inspected and approved by the PWD. Inspection shall be made at the following intervals of work:

1. Delivery of materials to job site.
2. Trench excavation and bedding.
3. Placing of pipe, fittings, and structures, including warning tape on recycled irrigation water main and service lines.
4. Pouring all concrete anchors and thrust blocks.
5. Placing and compacting the pipe zone back fill.
6. Backfilling balance of trench to grade. (The compaction test is to be performed by governing agency road departments in public right-of-way, or

by private soils consultant retained by the Applicant and acceptable to the PWD in private streets and easements. Copies of test results shall be given to the PWD and the governing agency, by the Applicant for approval before final acceptance of the work.) Backfilling and repaving shall be in accordance with the requirements of the City.

7. Pressure testing all mains and services.
8. Disinfecting and flushing.
9. Repaving trench cuts.
10. Raising valve box covers to finish grade and paint to PWD standards.
11. Fire hydrants painted and pads poured.
12. Installation of service lines, appurtenances meter boxes, and customer service valves.
13. Connection to the existing system.

300.15.5 PWD Authority

300.15.5.1 The PWD shall at all times have access to the work during construction and shall be furnished with every reasonable facility for ascertaining full knowledge respecting the progress, quality of labor, and character of materials used and employed in the work. No pipe, fittings, or other materials shall be installed or backfilled until inspected and approved by the PWD or its representative. The Contractor shall give due notice in advance of backfilling to the PWD Inspector so that proper inspection may be provided.

Inspection of the work shall not relieve the Contractor of any obligations to complete the work as prescribed by the standard specifications. Any known defective work shall be corrected before testing or final inspection will be permitted. Unsuitable materials may be rejected, even though the inspector may have previously overlooked them.

The PWD shall have the authority to suspend the work wholly or in part for such time, as it may deem necessary if the Contractor fails to carry out orders given by the PWD's Inspector, or to perform any required provisions of the plans and specifications. The Contractor shall immediately comply with a written order of the PWD to suspend the work wholly or in part. The work shall be resumed when methods or defective work are corrected as ordered and approved in writing by the PWD.

300.16 PRESSURE TEST

300.16.1 Conduct of the pressure test.

A pressure test of the newly constructed line shall be conducted as detailed in Section 15042

300.16.2 Water for Flushing, Testing and Sterilization

Domestic water for flushing, testing and sterilization of the completed pipelines or sections thereof will be available from the PWD at the point, or points, of connection with the existing domestic water mains via the construction water connection.

The Developer shall make all arrangements for this water with the City of San Juan Capistrano Public Works Department, which shall designate the exact location of the outlet or outlets and the time periods these connections may be used.

If, due to construction problems or for any other reason, the Developer desires to use water from some other source for testing, flushing, or chlorination, it shall be the responsibility of the Developer to obtain the source of water, which water shall be tested and approved by the County Health Department prior to the use thereof. The Developer shall pay all expenses for obtaining and using another source of water.

Cannon flushing operations shall be conducted with a residual line pressure not less than 30 psi and a PWD representative will be present. Adequate connections to conduct the flushing, testing and sterilization operations shall be furnished by the Contractor and reviewed by the Engineer, at no added cost to the PWD, and the Developer shall pay for any and all costs for flushing, testing and sterilization.

300.17 CHLORINATION AND BACTERIOLOGICAL TESTING

300.17.1 Conduct of Bacterial Testing

After passing pressure test the line shall be chlorinated and tested for bacteria as detailed in Section 15041

300.18 FINAL DOMESTIC WATER AND RECYCLED WATER FACILITIES INSPECTION

300.18.1 Final Acceptance

Before final acceptance, the PWD's Inspector will make a final inspection of all work, accompanied by the Contractor's Superintendent or representative, to verify that:

1. All phases of the job are complete in accordance with plans and specifications.
2. All valve boxes are raised to finish grade and that all repairs are completed.
3. All valves are referenced and the inspector has been given all reference measurements. Valves shall be located by a 2" "V" chiseled in the adjacent curb face.
4. All right-angle meter stops, and the meters, are properly positioned and all meter boxes are positioned and raised to proper grade.
5. Fire hydrants are raised to proper grade, are in a vertical position, painted; and its concrete pad is poured.

6. Backfill has passed all compaction testing.
7. All system valves are turned and left open (except those specifically required to be normally closed), turns required for complete open/close cycle are recorded on the record drawings.
8. Domestic water lines have been chlorinated.
9. Water line pressure testing and flushing have been completed.
10. The job site is clean and cleared of all the Contractor's equipment and materials.
11. All service lateral locations have been marked on curbs.
12. A mylar and a blue line copy of the water facility plans LABELED "AS-BUILT PLANS" with the "As-Built" revisions have been delivered to the PWD.

300.19 AS - BUILT, RECORD MYLARS

As-built drawings shall be completed and submitted by the Developer's engineer, or a registered Land Surveyor, as detailed in Section 500.13

300.20 EASEMENT VERIFICATION

The developer's engineer will verify in writing that the facilities to be accepted by the PWD were constructed within the easements as listed in the easement documents. In the event the facilities were not constructed with-in the designated easement, the engineer will submit revised easement documents, quitclaim documents, and a the final title report for recordation.

300.21 METER USE AND FEE VERIFICATION

300.21.1 With the As-Built Drawing - the PWD will verify the quantities used in the calculation of the fees for the AGREEMENT FOR CONSTRUCTION OF WATER FACILITIES. Any adjustments to the fees will be made at this time.

300.22 CITY COUNCIL ACCEPTANCE

300.22.1 Completion of All Requirements

After satisfactory completion of the items in Section 300.1 through 300.21 and item 300.22.2 below the PWD will, upon the request of the Developer, petition the PWD's governing City Council for acceptance of the project, and the commencement of the one-year warranty period.

The PWD will also re-evaluate the plans for compliance with the "AGREEMENT FOR CONSTRUCTION OF WATER FACILITIES", and reserves the right to re-assess the development impact fees if deviations from the originally approved plans have been made. Changes include, but are not limited to: the number of service connections, meter

sizes, building square footage, the irrigated area, the number of dwelling units, and any other measure used to calculate the original impact fees.

300.22.2 Release Given to City and Or County

All final inspection requirements shall be fulfilled before the PWD will give its final acceptance notice to the City and/or County for release of the Applicant's bond to those agencies. The Applicant's bond with the PWD shall remain in effect in accordance with Section 300.8 and the Agreement.

300.22.3 Domestic and Recycled water Service shall be in service prior to Acceptance. PWD Engineer may approve putting newly installed water and irrigation system into service prior to City Council acceptance after compaction has been approved by the governing agency and the portions have been pressure tested, chlorinated, flushed, and have passed the bacteriological test and inspection for domestic water mains. The PWD Engineer shall grant this partial acceptance only upon written request from the Applicant and subsequent approval. Upon this written approval for partial acceptance of facilities, the Applicant shall be relieved of the duty to maintain the portions so used or placed into operation provided, however, that nothing in this section shall be construed as relieving the Applicant of full responsibility for completing the work in its entirety, for making good any defective work and materials, for protecting the work from damage, and for being responsible for damage and for work as set forth in the agreement and other contractual documents; nor shall such action by the PWD be deemed completion and acceptance, and such action shall not relieve the Applicant of the guarantee provision of the Agreement with the PWD.

300.23 SECURITY RELEASE

If in the time period of one year from the date of City Council acceptance no failure of the system has occurred, which has gone unprepared by the developer, to the satisfaction of the PWD: the Developer may petition the PWD to request final acceptance of the project by the City Council and release of the Surety.

END OF SECTION

SECTION 400

PROCEDURES AND REQUIREMENTS FOR CONSTRUCTION AND/OR CONVERSION OF ON-SITE IRRIGATION SYSTEMS

400.1 GENERAL

All potential uses of domestic or recycled water for irrigation purposes, including, but not limited to, uses for landscape irrigation systems, agricultural irrigation systems, systems used for industrial process or construction purposes, or recreational impoundment systems, shall be reviewed by the PWD.

If recycled water is to be used, the facilities shall be constructed as described in this section. If the PWD determines that the site will be served with domestic water the provisions of this section will be followed. If the PWD determines that the site will be served with recycled water the provisions of the "Rules and Regulations for Users of Recycled Water, March 1994," or as last revised, will be followed.

For the purposes of Sections 400, 600, and 700 the term "off site" will be understood to mean main distribution lines, up to and including the meter. The term "on site" will be understood to refer to irrigation system past the meter to the point of discharge.

400.1.1 PERMITTING

Recycled system permitting shall occur at the same time as, and be subjected to the same permitting requirements as the domestic water system plans; with the exception of the condition of this section. See Section 300 for permit process requirements.

400.2 DETERMINATION TO USE RECYCLED WATER OR DOMESTIC WATER

The PWD shall determine whether a given service will be furnished with recycled water or domestic water. This determination shall be in accordance with standards of treatment and water quality requirements set forth in Title 22, Chapter 4 of the California Administrative Code, with the intent of the PWD to protect the public health, and the availability and/or feasibility of making available recycled water facilities.

400.3 DESIGN INFORMATION

Before design, the Applicant should obtain the following from the PWD:

1. Approval to use domestic or recycled water for the proposed system, as stated in the previous section.
2. Verification of locations and size of proposed points of connection (meter facilities).

3. Design pressures for the proposed facilities.

400.4 DESIGN AND CONSTRUCTION CRITERIA

The design of the off-site Recycled Water facilities shall conform to Section 600 herein entitled "Design Criteria - Off-site Recycled Water Facilities."

The design of the on-site Recycled water facilities shall conform to Section 700 herein entitled "Design Criteria On-site Recycled Water Facilities."

400.5 PURPOSE OF THE PLAN CHECK

Submittal of the plan check is to ensure that the proposed use of domestic and recycled water conforms to the approved uses as set forth in Subsection 400.1 and 400.2 herein.

The Applicant is solely responsible for all provisions set forth herein. It is not the purpose of the plan check to assure that all requirements have been met. If, during field inspection, the installation and/or material does not meet these standards, the Applicant shall modify the system in order to bring the system into full compliance with these design and construction standards.

400.5.1 Plan Check

The plan check and inspection procedures will be identical to, and run concurrently with the domestic water plan check and inspection procedures outlined in Section 300.

400.6 RECORD DRAWINGS

Record drawings shall be completed and submitted per section 500.13, with the exception that the record drawings will also include the items listed below:

1. Point of connection.
2. Routing of sprinkler constant pressure lines and non-constant pressure lateral lines.
3. Gate valves.
4. Sprinkler controller and control valves.
5. Quick-coupling valves.
6. Routing of control wires.
7. Other related equipment as specified by the PWD or the Owner.

400.7 CONVERSION FROM A DOMESTIC TO RECYCLED WATER SUPPLY

All irrigation facilities converted from a domestic to a recycled water supply shall conform to the Rules and Regulations for Users of Recycled Water.

400.8 CONVERSION FROM RECYCLED WATER TO A DOMESTIC WATER SUPPLY

As set forth and in accordance with the PWD's Rules and Regulations, if due to any reason of system failure or use violations it becomes necessary to convert from a recycled water supply to a domestic water supply, it shall be the responsibility of the Applicant to pay all costs for such conversion including but not limited to, the following items:

1. Isolation of the recycled irrigation water supply. Service shall be removed and plugged at the PWD main or abandoned in a manner approved by the PWD Engineer.
2. The installation of approved backflow devices on any and all meter connections.
3. The removal of the special irrigation water quick-couplers including the replacement of these with approved quick-coupler valves for domestic water systems.
4. Notification to all personnel involved.
5. The removal of all warning labels.
6. The installation of all domestic water lines and to pay any capacity fees due, as provided for in Exhibit B "Schedule of Rates and Charges."
7. In the event of a conflict between these rules and compliance with the Rules and Regulations for Users of Recycled Water later will govern.

END OF SECTION

SECTION 500

DESIGN CRITERIA, OFF-SITE DOMESTIC WATER FACILITIES

500.1 MINIMUM SIZE MAINS

The normal minimum size distribution main shall be 8-inch looped line, or a single 12" line.

On dead-end streets, the minimum size main shall be 8 inches to at least the last fire hydrant.

The PWD Engineer may individually approve smaller mains on dead-end mains without fire hydrants. These mains shall be sized so that sufficient water is regularly drawn to prevent stagnation.

500.2 DESIGN FLOW AND PIPE VELOCITY CRITERIA

Design flow shall be determined using the demand criteria described in Section 300.5, "Maximum Day Demand."

The criteria for velocity shall be as described herein. The maximum velocity in a line shall not exceed 5 fps (feet per second) during the peak hour condition. The peak hour is defined as 2 times the maximum day demand. The maximum velocity in a line shall not exceed 7 fps during the maximum day plus fire demand condition.

500.3 TYPE OF MAIN PIPE

Residential Areas (Distribution Mains) Polyvinyl Chloride pipe (PVC) pressure class 200, concrete mortar lined and coated pressure class as needed, or Asbestos Concrete pipe (ACP) pressure class 150 is to be used for distribution lines. A higher pressure class may be required for special installations. Fully welded concrete mortar lined and coated pipe shall be used within easements with restricted access and slopes exceeding 10%. Fittings for PVC pipe shall be ductile iron. All fittings shall be ductile iron coated with a polyurethane coating for corrosion protection.

500.4 MINIMUM DEPTH TO TOP OF WATER MAIN PIPE

500.4.1 Distribution Mains

The depth to top of distribution mains shall be as specified in the standard water notes, section 500.11.

500.4.2 Transmission Mains

The depth to top of transmission mains shall be as specified in the standard water notes, section 500.11.

500.5 STANDARD LOCATION

Domestic water main centerlines shall normally be located 6 feet from the curb face. Recycled water lines, shall in no case be placed in this location.

500.6 WATER VALVE SPACING

As a general rule, there should be three control valves where one main ties into another. Where two mains cross, there should be four valves, and there shall be four valves at a major distribution point. On long blocks, intermediate valves should be installed so that only a maximum of 28 lots or 600 feet, whichever is less, would have to be shut off at any one time.

Valves should also be spaced so that not more than two fire hydrants should be cut out of service at any one time.

In all cases where water mains pass through easements outside traveled streets, a valve shall be located at each end of the easement.

500.7 SEPARATION OF DOMESTIC, SEWER, AND RECYCLED LINES

500.7.1 Horizontal Separation.

State Health Department regulations require a 10-foot-minimum separation between domestic water, recycled water, and sewer water mains. However, in special situations where there is no alternative but to install the mains with less than the required separation, special construction will be considered on an individual basis by PWD for approval. (See Standard Drawing W-12.)

500.7.2 Vertical Separation.

Normally, domestic water, recycled water, sewer, and recycled water shall be located vertically from the street surface in order of the higher quality, i.e., domestic water shall be above recycled water and recycled water shall be above sewer.

Whenever a crossing must occur where a sewer main passes within 1 foot of a domestic water main or where a sewer main passes within 1 foot of a recycled water main, special construction will be required as shown on Drawing W-12.

Encasement may be required if Drawing W-12, conditions cannot be met and then one of the following types of alternates may be required:

1. Reinforced concrete encasement, a minimum thickness of 6 inches.
2. Piping within a continuous steel casing, per Standard Drawing W-10, which shall have a thickness of not less than 1/4 inch.

If a sewer line is above a recycled or domestic water main, or a recycled line is above a domestic water main, the special construction shall extend a sufficient distance on both sides of the crossing to provide a minimum of 10 feet of horizontal clearance. If a sewer, or recycled is located below a water main, or if a sewer is located below a recycled water main, and within a vertical distance of a 1-foot clearance distance, the special construction shall extend a sufficient distance on both sides of the crossing to provide 4 feet of horizontal clearance. These construction requirements shall not apply to house laterals that cross perpendicular less than 1 foot below a pressure water main.

500.8 FIRE FLOW DEMAND

The design criteria to be used for determining fire flow requirements shall be the actual fire flow requirements as determined by the Orange County Fire Marshall.

500.8.1 Residential Dwelling Units.

A minimum of 2000 gpm, combined flow, for a 4 hour duration from any two adjacent hydrants at a minimum 20 pounds of residual pressure at the main.

500.8.2 Schools and Commercial Areas

A minimum of 3,000 gpm for 3 hours duration (or as required by the Orange County Fire Marshal) out of any two adjacent hydrants at a minimum 20 pounds of residual pressure at the main.

500.8.3 Industrial Areas.

In industrial developments requiring a high fire flow, the Applicant shall consult with the Fire Department to discuss options for upgrading the domestic water system to deliver the fire flow or provide built-in sprinkler protection for the structures.

500.9 FIRE HYDRANT SPACING

The location of fire hydrants shall be as determined by the Orange County Fire Marshal, and per the guidelines set out in Section 500.9.1, 2, & 3. The exact location with respect to the curb and sidewalk shall be as shown in PWD standard W-6, & W-7.

500.9.1 Fire Hydrant spacing.

The maximum fire hydrant separation is at the discretion of the Fire Marshal.

Fire hydrants shall be located near the beginning of curb return (BCR) or lot lines.

No fire hydrant shall be located within 3 feet of a driveway, or closer than 40 feet to any structure (unless approved by the fire marshal.)

In situations where the fire hydrant run is over 20 feet, the size of the hydrant lateral shall be 8".

500.9.2 Types of Hydrants.

Wet barrel all bronze type hydrants as specified by the PWD are to be used except in hill areas or special "high-risk" situations where the PWD may specify "dry-barrel" type, or a wet barrel with check valve.

500.9.3 Plan requirements.

Fire Hydrants shall be shown on the plans where the hydrant is to be located with respect to the property line, and what easements will be provided. The building foot prints or building pad areas are also to be shown.

500.10 SERVICE MATERIALS AND MINIMUM SERVICE SIZE

500.10.1 General.

Approved materials and manufacturers for various service material tubing and connections are as listed in PWD's Standard Specifications, herein.

500.10.2 Minimum Domestic Service Size.

Minimum domestic service line size shall be 1-inch. Commercial irrigation or industrial are to be as shown on plans or as directed by the PWD Engineer.

500.10.3 Type of Service Line.

Acceptable service line is as described below:

1. 1-inch and 2-inch copper. (1-1/2" service lines are not allowed)

2. 4 inches and larger, use PVC per section 15064, or CML&C per section 15062. As determined by the PWD Engineer. (3" size not PWD Standard).

500.10.4 Meters. All residential meters 5/8" through 2" will be furnished and installed by the PWD, subsequent to payment of all applicable charges. All industrial, commercial, individual service meters 3" and larger will be supplied and installed by the Applicant and dedicated to the PWD subsequent to payment of applicable charges.

500.11 STANDARD WATER NOTES

1. The water system is to be installed by the applicant. All water system work shall conform to the City's "Standard Specifications for the construction of domestic water and non-domestic water irrigation facilities," as last revised.
2. The City's water engineering inspector shall be called for inspection two working days before start of work at (949) 487-4311.
3. A preconstruction conference of representatives from affected agencies and the contractor shall be held on the job site 24 hours prior to start of work.
4. The water system is to be installed after curb and gutter is placed, or staked by the applicant's surveyor at a minimum 50-foot stationing, if not within a roadway.
5. Any water service found to be within a driveway or sidewalk shall be removed completely and reinstalled at the proper location, at no cost to the City.
6. All main line valves shall be maintained so as to be accessible during tract development, and all valve stem tops having over 48 inches of cover will require an extension as per drawing W-9.
7. The clearances from the top of the pipe and the finished street surface shall have a minimum as follows – unless otherwise noted on the approved plans:

Water main size	surface streets	state highway
6 inches & smaller	36 inches	48 inches
8 inches	42 inches	48 inches
12 inches	48 inches	54 inches
16 inches	54 inches	60 inches

All water mains greater than 16 inches shall be decided on a case by case basis. pipe shall be bedded and backfilled per City standard W-8.

8. All fire hydrants shall be set with the bottom flange 4 inches above the concrete pad or sidewalk.

9. All water mains 4" through 12" shall be pressure class 200, PVC (C-900) and for 14" and larger shall be class 235, PVC (C-905) unless otherwise noted.
10. No taps or other connections shall be made to existing City water mains prior to conducting an approved pressure test on the new water distribution system. Tapping sleeves shall be pressure tested in an approved manner, in the field, in the presence of the City inspector, prior to tapping the main line. Tapping of the main line shall not proceed unless a City inspector is present.
11. Where meters and water boxes are located within slopes, the angle meter stops shall be located that the meters and boxes will be parallel and flush, respectively, with the finished street surface. A retaining wall may be required around the meter box.
12. The applicant shall furnish and install the service connections between water mains and meter and furnish / install meter boxes.
13. Curbs shall be inscribed with a "W" indicating locations of all domestic water services.
14. Individual pressure regulators will be required by the plumbing codes of the City having jurisdiction if static pressure reached 80 PSI or more.
15. All 1" through 2" meters and customer service valves will be furnished and installed by the City following receipt of application and deposit. The contractor shall expose all angle meter stops and properly locate the meter boxes to grade prior to requesting installation of the meters and customer service valves by the City.
16. Any City water used shall be metered with a construction meter obtained from the City, the use of jumpers is allowed by permit only. Meters must be installed prior to occupancy of a dwelling.
17. An encroachment permit from the City having jurisdiction is required prior to any work within public right-of-way or easement.
18. The existence and location of any underground utilities or structures shown on these plans were obtained by a search of the available records. Approval of these plans by the City of San Juan Capistrano does not guarantee the accuracy, completeness, location, or the existence or non-existence of any utility pipe or structure within the limits of this project. The contractor is required to take all due precautionary means necessary to protect those utility lines shown and not shown on these plans.
19. All below grade bolts and nuts shall be stainless steel 316 with fluoropolymer (tripac 2000 or equal coated nuts).

500.12 MISCELLANEOUS STANDARD GUIDELINES

1. Separated quantity estimates, for the domestic and recycled water systems, are to be included on the plans indicating quantity of pipe valves, fire hydrants, domestic and irrigation water services, etc.
2. The drawing shall show on plan and profile the position of all other known underground utilities or proposed underground utilities. Top and bottom of pipe elevations will be required.
3. Blow-off assemblies shall be installed at end and at low points of all mains. Temporary blow-offs shall be installed as service stub-outs for testing and flushing purposes.
4. Air and vacuum valves to be installed at all high points in the line for 12-inch size pipe and larger, or as directed by the PWD.
5. Generally the PWD requires all fittings and valves to have "bell and spigot" type ends, except at tees and crosses where valves are required. Valve and fitting are to be joined by a flange.
6. The Contractor shall restore or replace all removed or damaged or otherwise disturbed existing surfaces or structures not otherwise noted on the plans or specified herein to a condition equal to that before the work began and to the satisfaction of PWD's Engineer, and the City Engineer. All excess earth and all other debris shall be removed and disposed of by the Contractor and the entire site of the work shall be left in a condition acceptable to the Engineer prior to final acceptance of the work. All restoration and cleanup shall be performed in accordance with the PWD's Standard Specifications.

500.13 RECORD DRAWINGS / AS-BUILT DRAWINGS

500.13.1 Record Drawings

Record drawings shall be prepared and shall show all changes in the work constituting departures from the original contract drawings including those involving both constant-pressure and intermittent-pressure lines and appurtenances. The PWD shall approve all conceptual or major design changes, including any changes that may be affected by the requirements of these Standard Specifications, before implementing the change in the construction contract. Failure to receive prior approval may result in termination of service.

Prior to submission of the As-Built mylars, the Applicant will submit two sets of blue lines for review. One set will be returned with comments if necessary. Final Mylar as-built plans are to be submitted only upon incorporation of the PWD's comments. The final as-built submission will include a copy of the plans in electronic format in accordance with City of San Juan Capistrano's "Digital Submission Standards"

Upon completion of each increment of work, all required information and dimensions shall be transferred to the record drawings. Facilities and items to be located and verified on the record drawings shall include the following:

1. Point of connection
2. Location and elevation of all valves, bends and tees
3. Location of all services
4. Type, mfg., and model of valves & fire hydrant.
5. Location of buried conduit and sensor line assemblies
6. Items located and constructed as called out in the plans need not be noted as such, with the labeled AS-BUILT (A.B.).
7. Final settings of instrumentation and control equipment.

As-built mylars are to be delivered to the PWD prior to acceptance of the project; along with a digital submission in compliance with the City's Digital Submission Ordinance (available on the City of San Juan Capistrano's web site.)

500.13.2 As-Built Review

An "as-built" survey of the completed water line and appurtenances shall be made by the developer's engineer prior to placement of final paving. Markers or monuments shall be set during the placement of backfill so that all connection points, horizontal and vertical angle points, utility crossings, service connections and any other features and/or appurtenances designated by the Engineer may be located. The Contractor shall submit to the Engineer for review, prior to the start of construction of the Project, a program for installing the markers or monuments and shall comply with any recommendations of the Engineer to modify such a program. It shall be the responsibility of the contractor to re-establish any lost markers or monuments.

500.13.3 Record Drawings

A. General Requirements

Keep accurate and legible records on a single set of full size project blue line prints of the Drawings.

1. Make the record drawings available for review by PWD's Representative in Contractor's field office
2. Maintain record drawings on an up-to-date basis with all entries reviewed by PWD's Representative.
3. Protect the record set from damage or loss.

B. Detailed Requirements

1. Mark on the drawings all changes in the work that occurs during construction, including adding approved changes.
2. Show locations by key dimensions, depths, elevations of all underground lines, conduit runs, sensor lines, valves, capped ends, branch fittings, pull boxes, etc.
3. Record information on maintenance access and/or concealed work.
4. Make a record of finalized hydraulic and electrical equipment control settings in the tables and spaces provided on the Drawings.

Deliver the marked record set of drawings to the PWD prior to acceptance of the work

END OF SECTION

SECTION 600

DESIGN CRITERIA Off-site RECYCLED WATER FACILITIES

600.1 GENERAL

Design of all off-site recycled water facilities shall be as set forth under the Rules and Regulations for Users of Recycled Water, and Section 500. "Design Criteria, Domestic Water Facilities", herein, except as modified or expanded upon in the following sections.

600.2 STANDARD LOCATION

The recycled water mains shall normally be between the domestic water and sewer lines and shall be in accordance with the requirements of separation from water and sewer lines. They shall not be located 6 feet from curb face as that is the standard location for domestic water mains

600.3 SEPARATION BETWEEN DOMESTIC, SEWER, AND RECYCLED LINES

Recycled water lines should be installed at least ten feet horizontally from domestic water lines and sewer lines and one foot lower than the domestic water lines, but one foot above sewer lines. Where separations cannot be maintained special construction should be used as detailed in PWD standards W-12.

600.4 RECYCLED SYSTEM IDENTIFICATION

600.4.1 General

All new buried transmission/distribution piping in the recycled water system, including service lines, valves, and other appurtenances are to be colored purple, Pantone 522C, and embossed or be integrally stamped/marked CAUTION: RECYCLED WATER - DO NOT DRINK, or be installed with a purple identification tape, or a purple polyethylene vinyl wrap, color to be pantone 512C.

600.4.2 Detailed Specifications

Detailed provisions for Recycled system markings can be found in Section 15151 "Domestic and Recycled water Facilities Identification".

600.5 SPECIAL OFF-SITE RECYCLED WATER NOTES

In addition to the standard Water Notes Shown in Section 500.11, the following special off-site recycled water notes are to be shown on all on-site recycled water system construction plans:

1. The installation of the recycled water system shall conform to the regulations for the construction of recycled water system within the PWD.
2. All constant pressure recycled and domestic water main line piping installed on this project shall be identified in accordance with the PWD's specifications.
 - a. Warning tapes shall be used on all constant pressure main line piping carrying recycled or domestic water.
 - b. Warning tapes shall be a minimum of 3 inches wide and shall run continuously for the entire length of all constant pressure main line piping. The tape shall be 12" to 18" above the top of the pipe.
 - c. Warning tape for the constant pressure recycled water piping shall be purple in color with the words "CAUTION: RECYCLED WATER" imprinted in minimum 1-inch-high letters black in color. Imprinting shall be continuous and permanent
 - d. Alternately transmission/distribution piping in the recycled water system, including service lines, valves, and other appurtenances can be colored purple, Pantone 522C, and embossed or be integrally stamped/marked CAUTION: RECYCLED WATER - DO NOT DRINK, or be installed with or a purple polyethylene vinyl wrap, color to be pantone 512C.
3. The recycled water system shall be installed to maintain a separation from the domestic water system as shown on detail W-12.
4. All "Valve cans" on off-site recycled water facilities shall be triangular in shape with the word "RECYCLED" cast thereon, constructed and marked per the PWDs' Standard Detail W-13.
5. All main line valves shall be accessible during tract development. All valve stem tops having over 48-inch cover to have an extension installed and pinned to the valve-operating nut per W-9.
6. Recycled pipe shall have a cover depth equivalent to that of the domestic lines, deeper if separation requirements necessitate additional depth.
7. An Encroachment Permit from the City having jurisdiction is required prior to any work within public right-of-way or easement.
8. See Subsection 500.7 herein, and Standard Drawing No. W-12.

END OF SECTION

SECTION 700

DESIGN CRITERIA ON-SITE RECYCLED WATER FACILITIES

700.1 GENERAL

Design of all on-site recycled water facilities shall be as set forth under in the Rules and Regulations for Users of Recycled Water, except as modified or expanded upon in the following sections.

On-site facilities include, but are not limited to, landscape irrigation systems, agricultural irrigation systems, systems used for industrial process or construction purposes, or recreational impoundment systems shall conform to the provisions set forth herein and to any conditions, standards, and requirements set forth by the PWD in addition to these standard specifications.

700.2 DESIGN OF RECYCLED WATER FACILITIES WITH TEMPORARY DOMESTIC WATER SERVICE

Where recycled water is not immediately available for use when the design area is ready for construction, and if the PWD has determined that recycled water will be supplied in the future, the on-site facilities shall be designated to use recycled water. The on-site system shall be designed and constructed to the Rules and Regulations for Users of Recycled Water and the PWD's construction specifications as set forth herein. Provisions shall be made as directed by the PWD and these specifications to allow for connection to the recycled water facilities when they become available. In the interim, domestic water will be supplied to the recycled water facilities through a temporary domestic meter connection with a reduced pressure backflow device. Until recycled water is available, domestic water rates will be charged as set forth in the Schedule of Rates and Charges, Exhibit "B".

A backflow prevention device, on all domestic and recycled water services to the site, acceptable to the local Health Department and the PWD will be required as long as the on-site facilities are or are planning to use recycled water for any purpose. The backflow prevention device shall be downstream of the meter and a part of the on-site facilities.

700.3 BACKFLOW PREVENTION DEVICES

Backflow prevention devices will not normally be required on the on-site recycled water facilities using recycled water. However, backflow protection devices will be required of the Applicant's, Owner's or Customer's domestic water service.

700.4 DATA REQUIRED ON PLANS

700.4.1 Meter Data.

The following information shall be supplied for each irrigation water meter desired; information is to be provided and shown at each meter location.

1. The meter location and size (inches).
2. The peak flow through the meter (gpm).
3. The design pressure at the meter (psi).
4. The total area served through the irrigation meter in square feet or acres.

700.4.2 Drinking Fountains.

Exterior drinking fountains must be shown and called out on the recycled water irrigation plans. If no exterior drinking fountains are present in the design area, it must be specifically stated on the plans that none exist. The domestic water line supplying the drinking fountain must have a warning blue colored tape identifying it as a domestic water line and stating "CAUTION: DOMESTIC WATER LINE BURIED BELOW" installed over it and shall be so stated on the plans.

700.4.3 Irrigation Equipment Legend.

For irrigation system, a legend showing the pertinent data for the materials used in the system shall be recorded on the plans. The legend shall include a pipe schedule listing pipe sizes and materials of construction, a listing of valve types including quick-coupling valves, and the following information for each type of sprinkler head:

1. Manufacturer and model number.
2. Sprinkler radius (feet).
3. Operating pressure (psi).
4. Flow (gpm).
5. Sprinkler pattern.

700.5 RECORD DRAWINGS /AS-BUILT DRAWINGS

700.5.1 General.

Record drawings shall be completed per section 500.13 unless noted otherwise.

700.5.2 Detailed Requirements

1. Show locations by key dimensions, depths, elevations of all underground lines, conduit runs, sensor lines, valves, capped ends, branch fittings, pull boxes, etc.
2. Record information on maintenance and/or service concealed work.

END OF SECTION

EXHIBIT A

EXHIBIT B

The standard rates and charges are updated on a separate document. A reference copy is available at on the City of San Juan Capistrano's web site at: www.sanjuancapistrano.org

EXHIBIT C

EXHIBIT D

EXHIBIT E

EXHIBIT "A"
THE AGREEMENT IS LOCATED AT:
P:\ENG\MSTRFRM\MAGMT\CTY_WTR.doc

EXHIBIT "B"
THE SCHEDULE OF RATES AND CHARGES IS LOCATED AT:
P:\ENG\MSTRFRM\FEESCHDL.MST???

EXHIBIT "C"
THE PROJECT PERMIT PROCESS LETTER IS LOCATED BELOW:

EXHIBIT "D"
THE PERMIT EXTENSION LETTER IS LOCATED BELOW:

EXHIBIT "E1"
THE BOND LETTER IS LOCATED AT:
P:\ENG\MSTRFRM\BONDS\BND.BLK ?? Which one, there are several??

EXHIBIT "E2"
THE LETTER OF CREDIT IS LOCATED AT:
P:\ENG\MSTRFRM\BONDS\LTRCRD.BLK

Date

Name
Address
City, State and Zip

Re: Project
Permit Process

Dear _____:

Upon review of the concept plan submitted for your project, the PWD has determined that you need to submit the items shown on the attached progress status sheet.

Please feel free to contact the Public Works Department (at 949-493-1171) regarding any questions about the status of the project approval, or with questions about the requested submissions.

Sincerely,
CITY OF SAN JUAN CAPISTRANO
PUBLIC WORKS DEPARTMENT

Eric P. Bauman, PE.
PWD Water Engineering Manager

DEVELOPMENT PROJECT PROCESSING LOG

PROJECT

PROCEDURES GUIDE	SECTION	DATE	COMMENTS
CONCEPT PLAN SUBMITTED	300.1.0		
CONCEPT PLAN RETURNED	300.1.1		
1ST PLAN CHECK SUBMITTED	300.2		
1ST PLAN CHECK RETURNED	-----		
1ST SUB EASEMENT DOCUMENTS	300.3		
PRELIMINARY TITLE REPORT SUBMITTED	300.3		
1ST EASEMENT RETURNED	-----		
COST ESTIMATE SUBMITTED	300.4		
MAXIMUM DAY DEMAND SUBMITTED	300.5		
FIRE DEPT APPROVAL.	300.6		
2ND PLAN CHECK SUBMITTED	300.7		
2ND PLAN CHECK RETURNED	300.7.1		
AGREEMENT	300.8		COMPLETE ALL ITEMS IN SECTION 300.1 THROUGH 300.7 PRIOR TO CONTINUING
BOND/LETTER OF CREDIT WITH AUTOMATIC RENEWAL	300.8.1		
FINAL PLANS SUBMITTED	300.8		
FINAL EASEMENTS RECORDED	300.9		
FEES PAID	300.10		
COUNCIL APPROVAL OF AGREEMENT	300.11		
PLANS SIGNED	300.12		COMPLETE ALL ITEMS IN SECTION 300.1 THROUGH 300.12 PRIOR TO CONTINUING
PLANS RECEIVED	300.13		
PRECONSTRUCTION MEETING	300.14		
PRESSURE TEST	300.15		
BACTERIAL TEST	300.16		
FINAL INSPECTION.	300.17		
PUNCH LIST COMPLETE	300.18		
AS-BUILT PLANS - MYLARS	-----		
EASEMENT VERIFIED	300.19		
METER & USER FEE VERIFIED	300.20		
COUNCIL ACCEPTANCE	300.21		
SURETY RELEASE	300.22		COMPLETE ALL ITEMS IN SECTIONS 300.1 THROUGH 300.21 PRIOR TO CONTINUING
	300.23		

Date

CITY OF SAN JUAN CAPISTRANO PUBLIC WORKS DEPARTMENT
32450 Paseo Adelanto
San Juan Capistrano, CA 92675

Re: Project:
Permit Extension

Dear Mr. Bauman:

By this letter we are informing you that construction of the subject project has not begun prior to the one-year anniversary of the agreement between and the PWD, in accordance with the articles of Section 300.13 of the STANDARD SPECIFICATIONS.

The project plans have not changed, and we provide a recent copy of the plans for your verification.

or

The plans have changed, as detailed below, and we provide for your review and approval a recent copy of the plans, with the changes delineated.

Sincerely,

Developer's engineer

PART 2

TECHNICAL SPECIFICATIONS
FOR CONSTRUCTION OF
DOMESTIC WATER AND RECYCLED WATER FACILITIES

CITY OF SAN JUAN CAPISTRANO PUBLIC WORKS DEPARTMENT
32450 Paseo Adelanto
San Juan Capistrano, CA 92675
(949) 443-6363

CITY OF SAN JUAN CAPISTRANO PUBLIC WORKS DEPARTMENT

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01045	Existing Facilities
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01610	Transportation of Materials
01720	Record Documents
02200	Structure Earthwork
02223	Trenching, Backfilling, and Compacting
02315	Jacked Casing
03300	Concrete
03462	Precast Concrete Vaults
09900	Painting and Coating
15041	Chlorination of Water Mains and Services for Disinfection
15042	Hydrostatic Testing of Pressure Pipelines
15052	Exposed Piping Installation
15056	Ductile-Iron Pipe and Fittings
15057	Copper, Brass, and Bronze Pipe, Fittings and Appurtenances
15062	Concrete Mortar Lined and Coated Pipe
15064	PVC Pressure Distribution Pipe
15072	Asbestos Cement Distribution Pipe (6-inch through 16-inch)
15089	Combination Air Release and Vacuum Relief Valve Assembly
15096	Wall Pipes, Floor Pipes, and Pipe Sleeves
15100	Manual Valves
15112	Backflow Preventers
15139	Fire Hydrants
15150	Meters
15151	Domestic & Recycled Water Identification
15162	Flexible Pipe Couplings
15300	Self Contained Automatic Control Valves
15950	Corrosion Control for Buried Piping

STANDARD SPECIFICATIONS

SECTION 01045

EXISTING FACILITIES

PART 1 - GENERAL

A. Description

This section includes requirements for connection to and abandonment of existing water facilities.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1. Trenching, Backfilling, and Compacting: 02223

C. Condition of Existing Facilities

The PWD does not warranty the condition, size, material, and location of existing facilities.

D. Location

The contractor shall be responsible for potholing and verifying in advance the location of all existing pipelines as shown on the plans. Discrepancies shall be reported to the project engineer, prior to the fabrication of, or purchase of material affected by the discrepancy.

E. Protection of Existing Utilities and Facilities

1. The contractor shall be responsible for the care and protection of all existing sewer pipe, water pipe, gas mains, culverts, power or communications lines, side walks, curbs, pavement, or other facilities and structures that may be encountered in or near the area of the work.
2. It shall be the duty of the contractor to notify Underground Service Alert and each agency of jurisdiction and make arrangements for locating their facilities prior to beginning construction.
3. In the event of damage to any existing facilities during the progress of the work and of the failure of the contractor to exercise the proper precautions, the contractor will pay for the cost of all repairs and protection to said facilities. The contractor's work may be stopped until repair operations are complete.

F. Protection of Landscaping

1. The contractor shall be responsible for the protection of all the trees, shrubs, fences, and other landscape items adjacent to or within the work area, unless directed to do otherwise on the plans.
2. In the event of damage to landscape items, the contractor shall replace the damaged items in a manner satisfactory to the PWD Representative and the property owner.
3. When the proposed pipeline is to be within planted or other improved areas in public or private easements, the contractor shall restore such areas to the original condition after completion of the work. This restoration shall include grading, a placement of 5 inches of good topsoil, new sod, and replacement of all landscape items indicated.

G. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, the Orange County PFRD, the city having jurisdiction, or the other affected agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

PART 2 - MATERIALS

A. Grout

Grout shall consist of Portland cement and water; or, of Portland cement, sand, and water. All grout mixtures shall contain 2% of bentonite by weight of the cement.

Portland cement, water and sand shall conform to the applicable requirements of the concrete section (Section 03300), except that sand used shall be of such fineness that 100% will pass a standard 8-mesh sieve and at least 45%, by weight, will pass a standard 40-mesh sieve.

B. Bentonite

Bentonite shall be a commercial-processed powdered bentonite, Wyoming type, such as Imacco-gel, Black Hills, or equal. All materials used in making the connection or removing the facility from service shall conform to the applicable sections of these specifications.

PART 3 - EXECUTION

A. Connection to Existing Water Lines

1. The contractor shall make all connections unless shown otherwise on the plans or specified herein.

2. The contractor shall furnish all pipe and materials including furnishing all labor and equipment necessary to make the connections, all required excavation, backfill, pavement replacement, lights, and barricades, and may be required to include a water truck, high line hose, and fittings as part of this equipment for making the connections. In addition, the contractor shall assist the PWD in alleviating any hardship incurred during the shutdown for connections. The PWD Representative may require standby equipment or materials.

3. The contractor will de-water existing mains, as required, in the presence of the PWD Representative.

4. Connections shall be made with as little change as possible in the grade of the new main. If the grade of the existing pipe is below that of the new pipeline, a sufficient length of the new line shall be deepened so as to prevent the creation of any high spot or abrupt changes in grade of the new line. Where the grade of the existing pipe is above that of the new pipeline, the new line shall be laid at specified depth, except for the first joint adjacent to the connection, which shall be deflected as necessary to meet the grade of the existing pipe. If sufficient change in direction cannot be obtained by the limited deflection of the first joint, a fitting of the proper angle shall be installed. Where the connection creates a high or low spot in the line, a standard air release or blow off assemble shall be installed as directed by the PWD Representative.

B. Removal from Service of Existing Mains and Appurtenances

1. Existing mains and appurtenances shall be removed from service at the locations shown on the plans or as directed by the PWD Representative.
2. Abandoned pipe shall be filled with grout or bentonite.
3. Existing pipe and appurtenances may be removed from the ground, in which case all backfill and repair of surface shall be in accordance with Sections 02200 and 02223.
4. Removed pipe and appurtenances may be temporarily stockpiled on the job in a location that will not disrupt traffic or be a safety hazard, disposed of in a proper manner (as determined by the PWD Representative), or it may be delivered to the PWD yard as directed by the PWD Representative.
5. Before excavating for installing mains that are to replace existing pipes and/or services, the contractor shall make proper provisions for the maintenance and continuation of service as directed by the PWD Representative unless otherwise specified.
6. If the meter box is to be removed from an abandoned water service, the service line is to be removed and the corporation stop closed and capped. If there is no corporation stop on the service, the adapter is to be removed and a brass plug is to be installed in the service saddle.

END OF SECTION

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SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Submittals of documents described in the Contract Documents, and hereinafter are required prior to, during and at the end of the construction period. The submittals shall conform to the requirements described in this Section and all referenced Sections or Articles.

1.2 PROCEDURE

- A. Submittals within 10 days after the effective date of the Agreement: Submit the following items within 10 days after the Effective Date of the Agreement:
 - 1. Preliminary Construction Schedule: Prepare and submit in accordance with Section 01310, Construction Schedule.
 - 2. Preliminary Submittal Schedule: Prepare and submit schedule for the submittal of all Shop Drawings, product data and samples in accordance with Section 01340, Shop Drawing Procedures. Form is included in this Section.
- B. Submittals within 30 days after the effective date of the Agreement: Submit the following items within 30 days after the Effective Date of the Agreement.
 - 1. Construction Schedule: Prepare and submit in accordance with Section 01310, Construction Schedule.
 - 2. Submittal Schedule: Prepare and submit schedule for the submittal of all Shop Drawings, product data and samples in accordance with Section 01340, Shop Drawing Procedures. Form is included in this Section.
 - 3. Monthly payment schedule.
- C. Submittals Prior to Beginning The Work: Reference the Standard Form of Construction Agreement in the Contract Documents.
- D. Submittals During Construction: During progress of the construction, make the following submittals in a timely manner to prevent any delay in the Work schedule:
 - 1. Updates to Construction Schedule: Provide an assessment of Work progress in relation to the Construction Schedule in accordance with Section 01310, Construction Schedule.

2. Shop Drawings, Product Data and Samples: Submit Shop Drawings, product data and samples in accordance with Section 01340, Shop Drawing Procedures, and as required in various Sections of the Specifications.
3. Progress Payments: Submit applications for partial payments as specified in the Construction Agreement.
4. Request for Information: The CONTRACTOR shall retain 1 copy and submit 3 copies to the PWD for response. Form is included in this Section. Submit a Request for Information when any of the following are required:
 - a. An interpretation of the Specifications.
 - b. Additional details.
 - c. Information not shown on the Drawings or in the Specifications.
 - d. Clarification of discrepancies.
5. Change Orders: Forms are included in this Section. Whenever the PWD determines the need for a Change Order, the CONTRACTOR will receive a Request for Change Order Proposal Form, included in this Section. Upon receipt of a Request for Change Order Proposal Form or when the CONTRACTOR determines the need for a Change Order, the CONTRACTOR shall prepare and submit 3 copies of a Change Order Proposal in accordance with the Construction Agreement. The Change Order Proposal, included in this Section, must be in writing and must include sufficient information to assess the need for a change in the Work, the Contract time or the Contract amount. The Change Order Proposal must be approved by the CONTRACTOR, and PWD. When a Change Order Proposal is acceptable to the PWD, a Change Order will be prepared and executed. The CONTRACTOR is not authorized to begin Work on a Change Order until it is fully executed. Any Work done by the CONTRACTOR prior to execution of a Change Order is entirely at his own risk.
6. CONTRACTOR'S Daily Report: Form is included in this Section. Submit 4 copies of the CONTRACTOR'S Daily Report. The CONTRACTOR and each Subcontractor shall prepare and submit a daily report on the form shown in this Section. The report shall contain, as a minimum, information on the location and description of the Work being performed, size, quantity and description of materials and equipment installed or delivered, coordination or scheduling concerns, requests for clarifications, and any discrepancies noted in the Contract Documents, or on the as-built conditions. The report shall also contain the CONTRACTOR'S daily workforce count by craft, general weather conditions, any Work performed other than during established working hours, and any other pertinent items relative to the Work and as required by the PWD. The report is due at the PWD's office by 9:00 a.m. on the following work day and shall be signed by a responsible member of the CONTRACTOR'S staff.
7. Updates to Submittal Schedule: Submit 3 updated Shop Drawings, Product Data and Samples Submittal Schedule with each month's Progress Payment Request.

8. Construction Photographs: Submit Construction Photographs with each month's Progress Payment Request, as specified in Section 01380, Construction Photographs.
 9. Operation and Maintenance Manuals and Lesson Plans: Submit Equipment Operation and Maintenance Manuals for approval by the PWD within 90 days after approval of Equipment Shop Drawing. Submit Equipment Training Lesson Plans for approval by the PWD 30 days prior to commencement of training. Submit Operation and Maintenance Data and Lesson Plans in accordance with Section 01730, Operation and Maintenance Data.
- E. Submittals at Interim Completion: Submit all Operations and Maintenance Data for each item of Work commissioned into operation at each interim completion date.
- F. Submittals At Project Closeout: With a written Notice of Completion, submit the following items in the proper form as a condition of Final Acceptance of the Work:
1. Guarantees, Warranties and Bonds: Submit as required in the Construction Agreement and listed in various Sections of the Specifications.
 2. Operations and Maintenance Data: Submit all remaining product data and manuals as specified in various Sections of the Specifications.
 3. Survey notes.
 4. Construction photographs of all completed Work.
- G. Attachments:
1. Shop Drawings, Product Data and Samples Submittal Schedule.
 2. Request for Information.
 3. Request for Change Order Proposal.
 4. Change Order Proposal.
 5. CONTRACTOR'S Daily Construction Report.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01340

SHOP DRAWING PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The submittal of Shop Drawings shall conform to requirements of Contract Documents and procedures described in this Section. A separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of Shop Drawings on various items using a single transmittal form shall be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. The item(s) to be supplied shall be highlighted clearly.
- B. The term "Shop Drawing" as used herein shall be understood to include detailed design calculations, fabrication and installation drawings, lists, graphs, test data, operating instructions, and other items which shall include, but not are necessarily limited to:
1. Drawings and/or catalog information and cuts.
 2. Specifications, parts list, suggested spare parts lists, and equipment drawings.
 3. Wiring diagrams of systems and equipment.
 4. Complete lubrication, maintenance and operation instructions, including initial startup instructions as described in Section 01731, Instruction of Operations and Maintenance Personnel.
 5. Applicable certifications.
 6. Anchor bolt templates, mounting instructions and mounting design calculations as required.
 7. Required maintenance operations to allow all installed equipment to remain idle for a period of time not to exceed 24 months.
 8. Other technical, installation, and maintenance data as applicable.
 9. Unloading and handling methods and storage requirements.
 10. Note, highlight, and explain proposed changes to the Contract Documents.
 11. Paint submittal showing type of paint and the mils thickness of coating system used. The coating system shall be the approved system as submitted under Division 9, Finishes.
 12. Drawings showing CONTRACTOR field verifications illustrating all field dimensions. CONTRACTOR shall field verify all dimensions and existing materials shown on the Drawings. Any modifications required shall be at the CONTRACTOR'S expense.

- C. Submittal Schedule: The CONTRACTOR, within ten (10) days after the Notice of Award Date, shall prepare and submit to the PWD a comprehensive Submittal Schedule. The CONTRACTOR shall identify on his Submittal Schedule all of the submittal items required by the Contract Documents governing his Work. The CONTRACTOR shall indicate, for each submittal item on his Submittal Schedule the following:
1. Description and Transmittal Number;
 2. Reference to the applicable paragraph in the Contract Documents in chronological order that requires the submittal;
 3. The dates the CONTRACTOR proposes to furnish the submittals;
 4. The dates the materials, equipment, etc. are needed at the job site; and
 5. The date confirmation of compliance is needed by the CONTRACTOR (a minimum of 30 days from the date the PWD receives the shop drawing unless otherwise noted in the Contract Documents).
 6. Whether the submittal is for a deviation or an "equal" item. Complete submittals for all deviations or "equal" items shall be made to the PWD within 7 calendar days after the Notice of Award. Identification by the CONTRACTOR of deviations or "equal" items does not relieve the CONTRACTOR of his responsibility to furnish equipment and materials that meet all the requirements of the Contract Documents.
- D. In preparing his Submittal Schedule, the CONTRACTOR shall consider the nature and complexity of each submittal item and shall allow ample time for review, revision or correction. Submittals will normally be returned to the CONTRACTOR within 30 calendar days following receipt of the submittal.
- E. The PWD will review the CONTRACTOR'S Submittal Schedule to determine its completeness and compatibility with the Progress Schedule. A Submittal Schedule which is incompatible with the Progress Schedule or a review schedule which places extraordinary manpower demands on the PWD will be sufficient reason(s) to reject the Submittal Schedule. It shall be understood that certain submittals will take longer than 30 days to review and that these particular submittals will be identified during the submittal, by the PWD to allow for very complex submittal reviews. The CONTRACTOR shall also identify submittals for which he anticipates long review periods.
- F. The CONTRACTOR'S Submittal Schedule shall be consistent with the Progress Schedule.
- G. PWD's acceptance of the Submittal Schedule will be a precondition of the receipt of the first progress payment.

1.2 PROCEDURES

- A. All Shop Drawing submittals shall be accompanied by the PWD's standard shop drawing transmittal form. This form may be obtained from the PWD. Any Shop Drawing submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal. Ultimate responsibility for the accuracy and completeness of the information contained in the submittal shall remain with the CONTRACTOR. If data for more than one Section of the Specifications is submitted, a separate transmittal letter shall accompany the data submitted for each Section. A copy of all transmittal letters shall be sent to the PWD.
- B. All letters of transmittal shall be submitted in duplicate.
- C. At the beginning of each letter of transmittal, provide a reference heading indicating the following:
1. PWD=s Name _____
 2. Project Name _____
 3. Contract No. _____
 4. Transmittal No. _____
 5. Section No. _____
- D. If a Shop Drawing deviates from the requirements of the Contract Documents, CONTRACTOR shall specifically note each variation in his letter of transmittal.
- E. All Shop Drawings submitted for acceptance shall have a title block with complete identifying information satisfactory to PWD.
- F. All Shop Drawings submitted shall bear the stamp of approval and signature of CONTRACTOR as evidence that they have been reviewed by CONTRACTOR. Submittals without this stamp of approval will not be reviewed by PWD and will be returned to CONTRACTOR. CONTRACTOR'S stamp shall contain the following minimum information:

Project Name: _____

 CONTRACTOR'S _____

 Date: _____

 -----Reference-----
 Item: _____

 Specifications:
 Section:
 Page No.:
 Para. No.:
 Drawing No.: _____ of _____
 Location:
 Submittal No.:
 Approved By: _____

- G. A number shall be assigned to each submittal by CONTRACTOR starting with No. 1 and thence numbered consecutively. Resubmittals shall be identified by the original submittal number followed by the suffix "A" for the first resubmittal, the suffix "B" for the second resubmittal, etc.

- H. The CONTRACTOR shall initially submit to PWD a minimum of seven (7) copies of all submittals that are on 8-1/2-inch by 11-inch or smaller sheets, and one unfolded sepia and 6 prints made from that sepia for all submittals on sheets larger than 8-1/2-inch by 11-inch.

- I. After PWD completes his review, Shop Drawings will be affixed with a stamp and marked with one of the following notations:
 - 1. No Objection.
 - 2. No Objection; Make Corrections Noted.
 - 3. Make Corrections Noted, Resubmit.
 - 4. Non-Conforming.
 - 5. Non-Conforming; Submit Conforming Submittal.
 - 6. Not Reviewed.
 - 7. For Information Only.

- J. If a submittal is acceptable, it will be marked "No Objection" or "No Objection; Make Corrections Noted." Four (4) prints or copies of the submittal will be returned to CONTRACTOR.

- K. Upon return of a submittal marked "No Objection" or "No Objection; Make Corrections Noted," CONTRACTOR may order, ship or fabricate the materials included on the submittal, provided it is in accordance with the corrections indicated.
- L. If a Shop Drawing marked "No Objection; Make Corrections Noted" has extensive corrections or corrections affecting other Drawings or Work, PWD may require that CONTRACTOR make the corrections indicated thereon and resubmit the Shop Drawings for record purposes. Such Drawings will have the notation, "Make Corrections Noted, Resubmit." The corrected Shop Drawing shall be a pre-condition for payment for the work item of the Shop Drawing.
- M. If a submittal is unacceptable, two (2) copies will be returned to CONTRACTOR with one of the following notations:
 - 1. "Non-Conforming, Submit Conforming Submittal"
 - 2. "Non-Conforming"
- N. Upon return of a submittal marked "Non-Conforming; Submit Conforming Submittal," CONTRACTOR shall make the corrections indicated and repeat the initial approval procedure. The "Non-Conforming" notation is used to indicate material and/or equipment that is not acceptable. Upon return of a submittal so marked, CONTRACTOR shall repeat the initial approval procedure utilizing acceptable material and/or equipment.
- O. Any related Work performed or equipment installed without a "No Objection" or "No Objection; Make Corrections Noted" Shop Drawing will be at the sole responsibility of the CONTRACTOR.
- P. Shop Drawings shall be submitted well in advance of the need for the material or equipment for construction and with ample allowance for the time required to make delivery of material or equipment after data covering such is approved. CONTRACTOR shall assume the risk for all materials or equipment which are fabricated or delivered prior to the approval of Shop Drawings. Materials or equipment will not be included in periodic progress payments until approval thereof has been obtained in the specified manner.
- Q. PWD will review and process submittals within 30 calendar days following submittal receipt.
- R. It is CONTRACTOR'S responsibility to review submittals made by his suppliers and subcontractors before transmitting them to PWD to assure proper coordination of the Work and to determine that each submittal is in accordance with his desires and that there is sufficient information about materials and equipment for PWD to determine compliance with the Contract Documents. Incomplete or inadequate submittals will be returned for revision without review. Each Shop Drawing shall clearly identify what is to be supplied.

S. CONTRACTOR shall furnish required submittals with complete information and accuracy in order to achieve required approval of an item within three submittals. All costs to PWD involved with subsequent submittals of Shop Drawings, Samples or other items requiring approval will be back charged to CONTRACTOR. Costs shall be determined as follows:

$$C = (D.L.C. \times 3.15) + (O.D.C. \times 1.10)$$

where:

C = Cost for additional reviews
D.L.C. = Direct Labor Cost (Hours spent on review x hourly rate of reviewer)
O.D.C. = Other Direct Costs (travel, subsistence, etc.)

In the event that CONTRACTOR requests a substitution for a previously approved item, all of PWD's costs in the reviewing of the substitution will be back charged to CONTRACTOR, unless the need for such substitution is beyond the control of CONTRACTOR.

- T. The PWD reserves the right to withhold monies, up to the limit identified in the Contract Documents, for Shop Drawing reviews beyond those described herein.
- U. The PWD will implement, if requested by the CONTRACTOR, one (1) special Shop Drawing Review Meeting. The purpose of the meeting is to expedite Shop Drawing reviews for the equipment and materials required for the first document of the Work. Requirements of this Section will not be waived but could be expedited.
- V. Extension of contract time will not be granted because of CONTRACTOR=S substitutions, or because of the CONTRACTOR=S failure to make timely and correctly prepared and presented submittals with allowance for the checking and review periods.
- W. The acceptance of submittals shall not relieve the CONTRACTOR of responsibility for any deviation from the requirements of the Contract Documents or for any revision in resubmittals unless the CONTRACTOR has given notice in writing of the deviation or revision at the time of submission or resubmission and written approval has been given to the specific deviation or revision. Acceptance of submittals shall not relieve the CONTRACTOR of responsibility for error or omissions in the submittal or for the accuracy of dimensions and quantities, the adequacy of connections and the proper and acceptable fitting, execution and completion of the Work.

- X. No Work represented by required submittals shall be purchased or commenced until the applicable submittal has been accepted. Work shall conform to the approved submittals and all other requirements of the Contract Documents unless subsequently revised by an appropriate modification, in which case the CONTRACTOR shall prepare and submit revised submittals as may be required.
- Y. Within thirty (30) days of receiving a ANo Objection@ or ANo Objection; Make Corrections Noted@ equipment submittal, the CONTRACTOR shall submit Operation and Maintenance manuals for that item of equipment.

1.3 SCHEDULE OF SUBMITTALS

- A. A schedule of submittals shall be submitted to the ENGINEER via the CONSTRUCTION MANAGER within 7 calendar days after the date of receipt of the Notice To Proceed from the OWNER. Seven (7) copies of this schedule shall be submitted indicating the CONTRACTOR'S proposed schedule for submitting all submittals. Additionally, the schedule shall reflect the following information for each item.
 - 1. Description of Transmittal Number;
 - 2. Reference to the applicable paragraph in the Contract Documents in chronological order that requires the submittal;
 - 3. The dates the COTNTRACTOR proposes to furnish the submittals;
 - 4. The dates the materials, equipment, etc. are needed at the job site; and
 - 5. The date confirmation of compliance is needed by the CONTRACTOR (a minimum of 14 days from the date the ENGINEER receives the shop drawing unless otherwise noted in the Contract Documents).
 - 6. Whether the submittal is for a deviation or an "equal" item, complete submittals for all deviations or "equal" items shall be made to the ENGINEER within 30 calendar days after the CONTRACTOR'S Submittal Schedule is approved by the ENGINEER. Identification by the CONTRACTOR of deviations or "equal" items does not relieve the CONTRACTOR of his responsibility to furnish equipment and materials that meet all the requirements of the plans and specifications.
- B. In preparing the schedule, the CONTRACTOR shall coordinate it with the Progress Schedule and shall allow a minimum of 14 days for its processing and review by the CONSTRUCTION MANAGER/ENGINEER. Furnishing of the schedule shall not be interpreted as relieving the CONTRACTOR of his obligation to comply with all of the contract requirements for the items listed on the schedule. The CONTRACTOR shall review the listing at least every 30 days and take appropriate action to maintain an effective and updated system and a copy of the schedule shall be maintained at the job site. Seven (7) copies of the revised and/or updated submittal schedule shall be submitted to the ENGINEER at least every 30 days. The CONTRACTOR shall indicate on the schedule those submittals/re-submittals that were added or updated. Payment will not be made for any material or equipment which does not comply with contract requirements.

Failure to submit revised and/or updated Submittal Schedule as described will result in suspension of the processing of monthly Progress Payments by the PWD until the revised and/or updated Submittal Schedule is received.

- C. Updated shop drawing schedule submittals shall be numbered consecutively as 01341-101, 01341-102, and so on. Resubmittals shall be identified with alpha subscripts as specified in this Section.
- D. Submittals shall not be accepted by the ENGINEER until the submittal schedule has been approved by the ENGINEER.

1.4 SUBMITTAL LIST

The following general list of submittals is provided for the convenience of the CONTRACTOR in preparing his Submittal Schedule. The CONTRACTOR shall be required to furnish all submittals required by the Contract Documents.

Pipe material
Pipe fabrication
Pipe support details
Vaults
Meters

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01610

TRANSPORTATION AND HANDLING OF MATERIALS AND EQUIPMENT

F. PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall make all arrangements for transportation, delivery, receiving and handling of products required for prosecution and completion of the Work.
- B. Shipments of products to CONTRACTOR or Subcontractors shall be delivered to the Site only during regular working hours. Shipments shall be addressed and consigned to the proper party giving name of Project, street number and city. Shipments shall not be delivered to PWD except where otherwise directed.
- C. If necessary to move stored products during construction, CONTRACTOR shall move them without any additional compensation.

1.2 PREPARATION FOR SHIPMENT

- A. When practical, factory assemble products. Match mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with a strippable protective coating.
- B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, PWD's contract name and number, CONTRACTOR, equipment number, and approximate weight. Include complete packing lists and bills of materials with each shipment.
- C. Protect products from exposure to the elements and keep thoroughly dry and dust free at all times. Protect painted surfaces against impact, abrasion, discoloration, or other damage. Grease or oil all bearings and similar items.
- D. Do not have products shipped until related Shop Drawings have been approved by PWD.

1.3 DELIVERY

- A. Arrange deliveries of products in accordance with progress schedules and in ample time to facilitate inspection prior to installation.

- B. Coordinate deliveries to avoid conflict with Work and conditions at Site and to accommodate the following:
 - 1. Work of other contractors or PWD.
 - 2. Limitations of storage space.
 - 3. Availability of equipment and personnel for handling products.
 - 4. PWD's use of premises.
- C. Have products delivered to Site in manufacturer's original, unopened, labeled containers. Keep PWD informed of delivery of all equipment to be incorporated in the Work.
- D. Clearly mark partial deliveries of component parts of equipment to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.
- E. Immediately on delivery, inspect shipment to ensure:
 - 1. Product complies with requirements of Contract Documents and reviewed submittals.
 - 2. Quantities are correct.
 - 3. Containers and packages are intact and labels are legible.
 - 4. Products are properly protected and undamaged.
- F. Promptly remove damaged products from the Site and expedite delivery of new, undamaged products. Remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.4 PRODUCT HANDLING

- A. Provide equipment and personnel necessary to handle products, including those provided by PWD, by methods to prevent soiling or damage to products or packaging.
- B. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
- C. Handle products by methods to prevent bending or overstressing.
- D. Lift heavy components only at designated lifting points.
- E. Handle products in a safe manner and as recommended by manufacturer to prevent damage. Do not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 02200

STRUCTURAL EARTHWORK

PART 1 - GENERAL

A. Description

This section includes excavation, backfilling, materials, testing, and shoring for structures.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- | | | |
|----|---|-------|
| 1. | Trenching, Backfilling, and Compacting: | 02223 |
| 2. | Concrete: | 03300 |

C. Testing for Compaction

Testing for compaction shall conform to Section 02223.

D. Definition of Zones

1. Pavement and street zones shall be as specified in Section 02223.
2. Backfill zone is the backfill from the bottom of the structure excavation to the bottom of the street zone in paved areas or to the existing surface in unpaved areas.

E. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, the Orange County PFRD, the city having

jurisdiction, or any other affected agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

PART 2 - MATERIALS

Native earth backfill, imported backfill material, granular material, imported sand, and crushed rock shall conform to the requirements of Section 02223.

PART 3 - EXECUTION

A. Compaction Requirements

- | | | |
|----|----------------------------------|-------------------------|
| 1. | Backfill in Street Zone: | 90% relative compaction |
| 2. | Structural Backfill: | 90% relative compaction |
| 3. | Gravel Base: | 90% relative compaction |
| 4. | Adjacent to existing structures: | 95% relative compaction |

B. Sidewalk, Pavement, and Curb Removal

1. Saw cut bituminous or concrete pavements regardless of their thickness, and curbs and sidewalks prior to excavation for the structure in accordance with the requirements of the City, or agency having jurisdiction. Curbs and sidewalks that are damaged in the course of construction are to be cut and removed and replaced from joint to joint
2. Haul removed pavement and concrete materials from the site to a proper disposal facility. These materials are not permitted for use as backfill. If the material to be removed exceeds 50 cubic yards, the contractor shall obtain a haul route permit from the City(s) having jurisdiction.

C. De-watering

1. Provide and maintain means and devices to continuously remove and dispose of all water entering the excavation during construction of the structure and all backfill operations.
2. Dispose of the water in a manner to prevent damage to adjacent property and pipe trenches.
3. Do not allow water to rise in the excavation until backfilling around and above the structure is completed.

4. Reporting shall conform to the requirements of the City of San Juan Capistrano's NPDES permit requirements.
5. In no event shall the sewer system be used as a drain for de-watering.

D. Structure Excavation

1. Structure excavation shall include the removal of all material of whatever nature necessary for the construction of structures and foundations in accordance with the plans and these specifications.
2. The sides of excavations for structures shall be sufficient to leave at least a 2-foot clearance, as measured from the extreme outside of formwork or the structure, as the case may be.
3. The contractor shall dispose of surplus material in accordance with Section 02223.

E. Correction of Over Excavation

1. Where excavation is inadvertently carried below design depths, suitable provision shall be made by the contractor to adjust construction, as directed by the PWD Representative to meet requirements incurred by the deeper excavation.
2. No earth backfill will be permitted to correct over excavation beneath structures.
3. Over excavation shall be corrected by backfilling with crushed rock or concrete, as directed by the PWD Representative.

F. Bracing

1. The contractor's design and installation of bracing and sheeting shall take the necessary precautions to be consistent with the rules, orders, and regulations of the State of California Construction Safety Orders.
2. Excavations shall be so braced, sheeted, and supported that they will be safe, such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.
3. The sheeting, shoring, and bracing shall be arranged so as not to place any stress on portions of the completed work.

4. Carefully remove sheeting, shoring, bracing, and timbering to prevent the caving or collapse of the excavation faces being supported.

G. Backfill

1. After structures and foundations are in place, backfill shall be placed to the original ground line or to the limits designated on the plans.
2. No material shall be deposited against concrete structures until the concrete has reached a compressive strength of at least 3,000 pounds per square inch as tested per Section 03300.
3. Imported sand or granular material shall be placed in horizontal layers not exceeding 8 inches in depth.
4. Each layer of backfill material shall be moistened and thoroughly tamped, rolled, or otherwise compacted to the specified relative density.
5. Carefully operate compaction equipment near structures to prevent their displacement or damage. Structural fill is to be placed and compacted in uniform layers around all sides of the structure.

H. Pavement Replacement

Pavement replacement shall be in accordance with the requirements of the City or the agency having jurisdiction.

I. Permits

An Encroachment Permit from the City having jurisdiction is required prior to any work within City right-of-way. All traffic control and pavement replacement work shall be in accordance with the requirements of the permit and the City Inspector.

A permit from OSHA is required of any excavation exceeding 5 feet.

Follow all restrictions of the required permits from other agencies.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 02223

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation for trench excavation, backfilling, and compacting.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

C. Testing for Compaction

1. Determine the density of soil in place by the use of a sand cone, drive tube, or nuclear tester.
2. Determine laboratory moisture-density relations of existing soils by ASTM D 1557.
3. Determine the relative density of cohesionless soils by ASTM D 2049.
4. Sample backfill materials by ASTM D 75.
5. Express "relative compaction" as the ratio, expressed as a percentage, of the in place dry density to the laboratory maximum dry density.
6. Compaction shall be deemed to comply with the specifications when no test falls below the specified relative compaction.
7. The Contractor shall secure the services of a qualified testing laboratory, acceptable to the PWD, and pay the costs of all testing work. Test results shall be furnished to the PWD Representative.

D. Pavement Zone

The pavement zone includes the asphalt concrete and aggregate base pavement section placed over the trench backfill.

E. Street Zone

The street zone is the top 18 inches of the trench in paved areas, or the depth determined by the jurisdictional agency.

F. Trench Zone

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the street zone in paved areas or to the existing surface in unpaved areas.

G. Pipe Zone

The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level 12 inches above the top of the pipe. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipes to a horizontal level 12 inches above the top of the highest or topmost pipe.

H. Pipe Base

The pipe base shall be defined as a layer of material immediately below the bottom of the pipe or conduit and extending over the full trench width in which the pipe is bedded. Thickness of pipe base shall be a minimum of 4 inches, or as shown on the drawings or as described in these specifications for the particular type of pipe installed.

I. Excess Excavated Material

1. The contractor shall make the necessary arrangements for and shall remove and dispose of all excess excavated material unless indicated differently in the special provisions for any job.

2. It is the intent of these specifications that all surplus material not required for backfill or the contractor at a proper disposal site shall properly dispose of fill.
3. No excavated material shall be deposited on private property unless written the contractor thereof secures written permission from the owner. Before the PWD will accept the work, the contractor shall file a written release signed by all property owners with whom he has entered into agreements for disposing excess excavated material, absolving the PWD from any liability connected therewith.
4. The contractor shall obtain a haul route permit from the city having jurisdiction.

J. Safety

1. All excavations shall be performed, protected, and supported as required for safety and in the manner set forth in the operation rules, orders, and regulations prescribed by the Division of Industrial Safety of the State of California.
2. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrians and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.
3. No trench or excavation shall remain open during non-working hours. The trench or excavation shall be covered with steel plates, spiked in place, or secured with temporary A.C. pavement around the edges, or backfilled.

K. Access

Unobstructed access must be provided to all driveways, water valves, hydrants, or other property or facilities that require routine use.

L. Blasting

1. Blasting for excavation will be permitted only after securing approval of the City having jurisdiction, and PWD Engineer, and only when proper precautions are taken for the protection of persons and property.

2. The contractor shall also obtain permission from the Orange County Fire Department before commencing blasting operations.
3. All aspects concerning safety, transportation and the use of explosives shall be in accordance with Article 8 of the CAL-OSHA State of California Occupational Safety and Health Standards.
4. The contractor's methods of blasting and procedure shall conform to all state laws and local ordinances.
5. A permit shall be obtained from all state and local authorities, having jurisdiction, prior to blasting.

M. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, the Orange County PFRD, the city having jurisdiction, or and other agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

PART 2 - MATERIALS

A. Native Earth Backfill

1. The use of native earth as backfill material will require the approval of the PWD Representative in all cases.
2. Native earth backfill, acceptable for use, shall be fine-grained material free from roots, debris, and rocks with a maximum dimension not larger than 4 inches.
3. Native backfill shall not be used in the pipe zone.

B. Imported Backfill Material

1. Whenever the excavated material is not suitable for backfill, the contractor shall arrange for and furnish suitable imported backfill material that is capable of attaining the required relative density.
2. The contractor shall dispose of the excess trench excavation as specified in the preceding section. Backfilling with imported material shall be done in accordance with the methods described herein.

C. Granular Material

Granular material shall be defined as soil having a minimum sand equivalent of 30 as determined in accordance with State of California, CALTRANS, Test "California 217," with not more than 20% passing a 200-mesh sieve.

D. Imported Sand

Imported sand shall have a minimum sand equivalent of 30 per State of California, CALTRANS, Test "California 217" with 100% passing a 3/8-inch sieve and not more than 20% passing a 200-mesh sieve. Certification that the sand meets this requirement shall be provided.

E. Crushed Rock and Gravel

1. Crushed rock shall be the product of crushing rock or gravel. Fifty percent of the particles retained on a 3/8-inch sieve shall have their entire surface area composed of faces resulting from fracture due to mechanical crushing. Not over 5% shall be particles that show no faces resulting from crushing. Less than 10% of the particles that pass the 3/8-inch sieve and are retained on the No. 4 sieve shall be weatherworn particles. Gravel shall not be added to crushed rock.
2. Gravel shall be defined as particles that show no evidence of mechanical crushing, are fully weatherworn, and are rounded. For pipe bedding, where gravel is specified, crushed rock may be substituted or added.
3. Where crushed rock or gravel is specified in the bedding details on the plans, the material shall have the following gradations:

<u>Sieve Size</u>	<u>1½-Inch Max Gravel % Passing</u>	<u>1-Inch Max Gravel % Passing</u>	<u>¾-Inch Max Crushed Rock % Passing</u>
2"	100		
1½"	90 - 100	100	
1"	20 - 55	90 - 100	100
¾"	0 - 15	60 - 80	90 - 100
½"	-	-	30 - 60
3/8"	0 - 5	0 - 15	0 - 20
No. 4	-	0 - 5	0 - 5
No. 8	-	-	-

4. Unless otherwise specified, 3/4-inch-maximum crushed rock shall be used for pipes with inside diameters of 30 inches and less.

F. Sand-Cement Slurry

Sand-cement slurry shall consist of two sacks (188 pounds) of Portland cement per cubic yard of sand and sufficient moisture for workability.

PART 3 - EXECUTION

A. Compaction Requirements

1. The developer shall engage the services of a qualified soils engineering firm to determine the relative compaction of the trench backfill.
2. If the backfill fails to meet the specified relative compaction requirements, the contractor shall rework the backfill until the requirements are met. The contractor shall make all necessary excavations for density tests as directed by the PWD Representative. Orange County PFRD, city having jurisdiction, or CALTRANS compaction requirements shall prevail in all public roads.
3. Compaction tests shall be performed at random depths and at 200-foot intervals and as directed by the PWD Representative.
4. Unless otherwise shown on the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as described below:
 - a. Pipe zone and pipe base: 90% relative compaction
 - b. Trench zone not beneath paving: 90% relative compaction.
 - c. Trench zone to street zone in paved areas: 90% relative compaction.
 - d. Street zone in paved areas: per agency requirements. The most stringent agency requirements shall prevail.
 - e. Rock refill material for foundation stabilization: 90% relative density.
 - f. Rock refill for over excavation: 90% relative density.

B. Material Replacement

Removal and replacement of any trench and backfill material that does not meet the specifications shall be the contractor's responsibility.

C. Clearing and Grubbing

1. Areas where work is to be performed shall be cleared of all trees, shrubs, rubbish, and other objectionable material of any kind which, if left in place, would interfere with the proper performance or completion of the contemplated work, would impair its subsequent use, or would form obstructions therein.
2. Organic material from clearing and grubbing operations will not be incorporated in the trench backfill.
3. Organic material from clearing and grubbing operations will be disposed of at a proper waste disposal facility.

D. Sidewalk, Pavement, and Curb Removal

1. Saw cut bituminous or concrete pavements regardless of their thickness, and curbs and sidewalks prior to excavation for the structure in accordance with the requirements of the City, or the agency having jurisdiction. Saw cut, remove and replace from joint to joint all curbs and sidewalks damaged in the course of construction.
2. Haul removed pavement and concrete materials from the site, to a proper disposal facility. These materials are not permitted for use as trench backfill. If the material to be removed exceeds 50 cubic yards, the contractor shall obtain a haul route permit from the City(s) having jurisdiction.

E. Trenching and Tunneling

1. Excavation for pipe, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the facilities as shown on the plans.
2. Trench banks shall be kept as near to vertical as possible and shall be properly braced and sheeted.
3. Tunneling will not be permitted.
4. The use of a jack and bore or hydraulic ram may be employed.

F. Bracing

1. The contractor's design and installation of bracing and shoring shall be consistent with the rules, orders, and regulations of the State of California Construction Safety Orders.
2. Excavations shall be so braced, sheeted, and supported that they will be safe such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.
3. The sheeting, shoring, and bracing shall be arranged so as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.
4. Care shall be exercised in the drawing or removal of sheeting, shoring, bracing, and timbering to prevent the caving or collapse of the excavation faces being supported.

G. Trench Widths

1. Excavation and trenching shall be true to line so that a clear space of not more than 8 inches or less than 6 inches in width is provided on each side of the largest outside diameter of the pipe in place measured at a point 12 inches above the top of the pipe. For the purpose of this article, the largest outside diameter shall be the outside diameter of the bell on bell and spigot pipe or the pipe collar.
2. Where the trench width, measured at a point 12 inches above the top of the bell of the pipe, is wider than the maximum set forth above, the trench area around the pipe shall be backfilled with crushed rock, Class B concrete, or slurry to form a cradle for the pipe as shown on the Drawing W-8 at the discretion of the PWD Representative. Concrete or slurry shall not be poured directly against the pipe.

H. Length of Open Trench

Within developed areas, the length of open trench may be restricted as determined by the encroachment permit from the city or the agency having jurisdiction.

I. Grade

1. Excavate the trench to the lines and grades shown on the drawings with allowance for pipe thickness and for pipe base or special bedding.

2. The trench bottom shall be graded to provide a smooth firm, and stable foundation that is free from rocks and other obstructions and shall be at a reasonably uniform grade.

J. Correction of Over Excavation

1. Where excavation is inadvertently carried below the design trench depth, suitable provision shall be made by the contractor to adjust the excavation, as directed by the PWD Representative, to meet requirements incurred by the deeper excavation.
2. Over excavations shall be corrected by backfilling with approved graded crushed rock or gravel and shall be compacted to provide a firm and unyielding subgrade or foundation, as directed by the PWD Representative.

K. De-watering

1. The contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. De-watering shall be done by methods that will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. De-watering methods may include well points, sump points, suitable rock or gravel placed below the required bedding for drainage and pumping, temporary pipelines, and other means, all subject to the approval of the PWD Representative.
2. In no event shall the sewer, or storm drain system be used as drains for de-watering the construction trenches.
3. De-watering shall commence when groundwater is first encountered and shall be continuous until such times as water can be allowed to rise. No concrete shall be poured in water, nor shall water be allowed to rise around the concrete or mortar until it has set at least eight hours.

L. Foundation Stabilization

1. Whenever the trench bottom does not afford a sufficiently solid and stable base to support the pipe or appurtenances, the contractor shall excavate to a depth below the design trench bottom, as directed by the PWD Representative, and the trench bottom shall be backfilled with 3/4-inch rock and compacted to provide uniform support and a firm foundation.

2. Where rock is encountered, it shall be removed below grade and the trench shall be backfilled with graded gravel or crushed rock to provide a compacted foundation cushion with a minimum allowable thickness of 4 inches under the pipe foundation plane.
3. If excessively wet, soft, spongy, unstable, or similarly unsuitable material is encountered at the surface upon which the bedding material is to be placed, the unsuitable material shall be removed to a depth as determined in the field by the PWD Representative and replaced by crushed rock.

M. Excavated Material

1. All excavated material shall not be stockpiled in a manner that will create an unsafe work area or obstruct sidewalks or driveways. Gutters shall be kept clear or other satisfactory measures shall be taken to maintain street or other drainage.
2. In confined work areas, the contractor may be required to stockpile the excavated material off-site, as determined by the project permits.

N. Placing Pipe Base

1. Place the specified thickness of pipe base material over the full width of trench and compact the material to the specified relative density. Grade the top of the pipe base ahead of the pipe to provide firm, uniform support along the full length of pipe.
2. Excavate bell holes at each joint to permit assembly and inspection of the entire joint.

O. Placing Mounds to Support Pipe

1. As an alternate to placing imported sand pipe base material, the pipe may be supported on mounds of imported sand.
2. The mounds shall be of imported sand and extend the full trench width. The mounds shall provide a minimum of 6 inches of contact with the pipe.
3. The pipe shall be supported to maintain its design line and grade.
4. The mounds shall be located 2½ feet from the coupling of the pipe.

P. Backfilling within Pipe Zone

1. Backfill the pipe zone per the detailed piping specification for the particular type of pipe and per the following:
2. After pipe has been bedded, place pipe zone material simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or un-compacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.
3. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.

Q. Backfill within Trench Zone

1. Compact the trench zone per the detailed piping specification for the particular type of pipe and per the following:
2. Push the backfill material carefully onto the backfill previously placed in the pipe zone. Do not permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.
3. The remaining portion of the trench to the street zone or ground surface, as the case may be, shall be backfilled, compacted and/or consolidated by approved methods to obtain the specified relative compaction.
 - a. Where densities are required which cannot be attained by water densified backfill the Engineer may authorize the use of impact, free fall or "Stomping" type equipment to supplement the densification of the backfill. The backfill shall be placed in horizontal layers of such depths as are considered proper for the type of compacting equipment being used in relation to the backfill material being placed. Each layer shall be evenly spread, properly moistened, and compacted to the specified relative density. The contractor shall repair or replace any pipe, fittings, manholes, or structures as directed by the PWD Representative damaged by the contractor's operations.
 - b. Consolidation of backfill performed by flooding, or jetting shall not be allowed.

R. Backfill within Street Zone

1. The street zone within roadbed areas shall be compacted using approved hand, pneumatic, or mechanical type tampers to obtain the required relative compaction.
2. All work shall be done in accordance with the requirements and to the satisfaction of the city or the agency having jurisdiction.
3. Flooding and jetting will not be permitted in this Zone.

S. Sidewalk, Pavement, and Curb Replacement

Replace bituminous and concrete pavement, curbs, and sidewalks damaged or removed during construction in accordance with the requirements of the city or the agency having jurisdiction.

END OF SECTION

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STANDARD SPECIFICATIONS

SECTION 02315

JACKED CASING

PART 1 - GENERAL

A. Description

Tunneling by jacked casing, directional drilling, or a tunnel boring machine, method for highway, railroad, creek, and culvert crossings and other shallow depth tunnels, and carrier pipe installation.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- | | | |
|----|---|-------|
| 1. | Trenching, Backfilling, and Compacting: | 02223 |
| 2. | Concrete: | 03300 |
| 3. | Hydrostatic Testing of Pressure Pipeline: | 15042 |

C. Permits

All work shall conform to the specifications and requirements of the State of California Division of Occupational Safety, Mining and Tunneling Unit, State of California Department of Transportation, the Orange County PFRD, the city having jurisdiction, or and other agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

D. Alternative Methods

The contractor may present an alternative detailed proposal in lieu of the methods and materials specified herein to jack or bore casing pipe at the locations shown on the plans. Any such proposal shall be presented to the PWD Representative a minimum of 14 calendar days in advance of the work to allow adequate time for

checking, and must be in accordance with all the conditions set forth in the permits.

E. Safety

The Contractor shall obtain from the Division of Industrial Safety a classification for each bore exceeding 30-inches in diameter. It shall be the Contractor's responsibility to see that the work is done in conformance with the state requirements. It shall also be the Contractor's responsibility to call the required safety meeting with representatives from the State Division of Industrial Safety prior to beginning the construction of each bore.

F. Scheduling

If the pipeline is not installed within the casing as a continuous operation following completion of jacking, then bulkhead the portals and backfill the approach trenches and later reopen them for pipe installation.

G. Line and Grade

1. The contractor's attention is called to the fact that the casing pipe must be installed to the tolerances listed on the plans so as to permit the construction of the carrier pipe to the lines and grades shown on the plans.
2. It is the contractor's responsibility to choose a size of casing at or above the minimum specified, to insure that the jacking is done with a high degree of accuracy to permit installation of the carrier pipe to the grades shown on the plans.

H. Design

1. It is the contractor's responsibility to retain an engineer to design a casing that meets or exceeds the minimum specified, and to insure that the casing is compatible with the jacking machine, and the boring head used.

PART 2 - MATERIALS

A. Steel Casing

1. New steel casing pipe, unless otherwise approved by the PWD Representative, shall be butt-welded sheets conforming to ASTM A 245, commercial grade or of plate conforming to ASTM A 283, Grade C.
2. The minimum size and thickness of casing pipes for insertion of various sizes of carrier pipes shall be as described below, unless a larger or heavier wall casing pipe is required by the agency having jurisdiction over the road or railroad crossing:

<u>Pipe Size (Inches)</u>	<u>Min. O.D. Casing Size (Inches)</u>	<u>Min. Wall Thickness (Inches)</u>
4	10-3/4	1/4
6	12-3/4	1/4
8	16	1/4
12	20	5/16

3. It is the contractor's responsibility to retain a design engineer to choose a size of casing at or above the minimum specified, in order that the jacking may be done with a sufficient degree of accuracy to permit installation of the carrier pipe to the grades shown on the plans. The Contractor may select a greater thickness and diameter as convenient for method of work and loadings involved, as suitable for the site and as limited by possible interferences, but at no additional cost to PWD. If specified on the plans, provide 2-inch grout connections spaced at the top and bottom for casing 30-inches and larger in diameter per detail Drawing W-10.

Casing sections shall be joined by full-circumference butt-welded in the field. Prepare ends of casings for welding by providing ¼-inch X 45 degree chamfer on outside edges. Casings shall be protected from corrosion. The contractor or Design Engineer shall employ the services of a California licensed Corrosion Engineer or a NACE International Certified Corrosion specialist for the design of the casing corrosion protection system.

B. Grout

1. Grout shall consist of Portland cement and water or of Portland cement, sand, and water; and all grout mixtures shall contain 2% of bentonite by weight of the cement.
2. Portland cement, water and sand shall conform to the applicable requirements of the concrete section (Section 03300), except that sand to be used shall be of

such fineness that 100% will pass a standard 8-mesh sieve and at least 45%, by weight, will pass a standard 40-mesh sieve.

3. Bentonite shall be a commercial-processed powdered bentonite, Wyoming type, such as Imacco-gel, Black Hills, or equal.
4. The grout shall have a minimum penetration resistance of 100 psi in 24 hours when tested in accordance with ASTM C403 and a minimum compressive strength of 300 psi in 28 days when tested in accordance with ASTM C495 of C109

C. Stainless Steel Spacers

Casing spaces shall be bolt on style with a two-piece shell made of 316 stainless steel of a minimum 14-gauge thickness. Each shell section shall have bolt flanges formed with fins for added strength. Each connection flange shall have a minimum of three 5/16 inch 316 stainless bolts. The shell shall be lined with a ribbed PVC extrusion with a retaining section that overlaps the edge of the shell and prevents slippage. Bearing surfaces (runners) made from UHMW polymer with a static coefficient of friction of 0.11 - 0.13 shall be attached to support structures (risers). 316 stainless fasteners that are inserted through the punched riser section and welded for strength shall attach the runners mechanically. Risers shall be made of 316 stainless of a minimum 14 gauge. All risers over 2 inches in height shall be reinforced. Risers shall be welded to the shell. All metal surfaces shall be fully passivated. Casing spacers shall be as specified on the plans.

D. End Seal

End seals shall be virgin Buna-s or Virgin SBR with 316 stainless steel bands.

E. Sacrificial Anodes for Cathodic Protection

1. Anodes for cathodic protection of steel casing shall be 2-inch by 2-inch by 60-inch high purity zinc anodes, bagged in calcium sulfate and bentonite backfill.
2. The anodes shall be cad welded to the casing with No. 6 High Molecular Weight Polyethylene (HMWPE) covered, stranded copper lead wire.

PART 3 - EXECUTION

A. Sectional Shield or Jacking Head

1. Fit a sectional shield or steel jacking head to the leading section of the casing. The shield or head shall extend around the outer surface of the upper two-thirds of the casing and project at least 18 inches beyond the driving end of the casing. It shall not protrude more than ½ inch beyond the outer casing surface.
2. Anchor the head to prevent any wobble or alignment variation during the jacking operation.
3. To avoid loss of ground outside the casing, carry out excavation entirely within the jacking head and not in advance of the head. In general, excavated material shall be removed from the casing as jacking progresses and no accumulation of excavated material within the casing will be permitted.
4. A jacking band to reinforce the end of the pipe receiving the jacking thrust will be required.

B. Jacking Pit

1. The approach trench for jacking or boring operations shall be adequately shored to safeguard existing substructures and surface improvements and to ensure against ground movement in the vicinity of the casing portal.
2. Place in the approach trench of jacking pit and firmly bed on the required line and grade heavy guide timbers, structural steel, or concrete cradle of sufficient length to provide accurate control of jacking alignment. Provide adequate space to insert the casing lengths to be jacked. Anchor the timbers and structural steel sections to ensure action of the jacks in line with the axis of the casing. Place a timber or structural steel bearing block between the jacks and the end of the casing to provide uniform bearing upon the casing end evenly distribute the jacking pressure.

C. Control of Alignment and Grade

Control the application of jacking pressure and excavation of material ahead of the advancing casing to prevent it from becoming friction bound or deviating from required line and grade, as detailed in the plans. Do not encroach upon the minimum annular space detailed. Restrict the excavation of material to the least clearance necessary to prevent binding in order to avoid settlement or possible damage to overlying structures or utilities.

D. Grouting

Immediately after completion of the jacking or boring operation, lean grout shall be injected through the grout connections of casings 30-inches and larger in a manner that will completely fill all voids outside the casing pipe resulting from the jacking or boring operation. The lean grout shall consist of one part Portland cement, four parts sand, and sufficient water to produce a workable mixture. Grout pressure is to be controlled so as to avoid deformation of the casing and/or avoid movement of the surrounding ground. Sand for grout to be placed outside the casing shall be of such fineness that 100% will pass a No. 8 sieve and not less than 35% will pass a No. 50 sieve. After completion of grouting, the grout connections shall be closed with cast-iron threaded plugs.

E. Installation of Carrier Pipe

1. The carrier pipe shall be pushed into the casing pipe using stainless steel casing spacers, which shall be sized to restrain the pipe from moving within the casing. If the casing has deviated from the design line and grade; specifically fabricated casing spacers may be used to correct the problem.
2. The casing pipe spacers shall be placed so as to support all of the carrier pipes within two feet or less of the end of the casing pipe. Unless noted otherwise in the plans, casing pipe spacers shall be placed at a minimum of one at the bell end and one at the center of each length of pipe. If alternate pipe material is used the spacing shall be as detailed in the plans.
3. Before sealing the carrier pipe ends, the carrier pipe shall pass an initial pressure test per Section 15042.

F. Sealing Ends of the Casing

The ends of the casing pipe shall be sealed with a rubber shroud, held in place with stainless steel straps, as shown on Standard detail W-10. The diameters and lengths of the end seals shall be sized to fit each casing pipe and carrier pipe to assure a positive barrier to backfill debris and seepage.

G. Installing Sacrificial Anodes for Cathodic Protection

1. One sacrificial anode shall be buried at each end of the casing as shown in Standard Detail W-10.
2. Lead wire shall be cad welded to the casing in accordance with Erico Engineering Specification No. A160-A05.

3. Cover each weld with Royston "Handy Cap."
4. Each anode shall be saturated with 20 gallons of water, prior to backfill of the trench.

H. Closing the Jacking Pit

After jacking equipment and muck from the tunnel have been removed from the approach trench of jacking pit, prepare the bottom of the jacking pit as a pipe foundation. Remove all loose and disturbed material below pipe grade to undisturbed earth and recompact the material in accordance with Section 02223.

END OF SECTION

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STANDARD SPECIFICATIONS

SECTION 03300

CONCRETE

PART 1 - GENERAL

A. Description

This section describes concrete materials, mixing, placement, form work, reinforcement and curing.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1. Structure Excavation: 02200

PART 2 - MATERIALS

A. Concrete

1. All Portland cement concrete shall conform to the provisions of Section 90 of the "State Specifications" except as herein modified.
2. Portland cement concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, and water proportioned and mixed to produce a smooth dense workable mixture. It can be of the ready-mix variety as produced by any reliable ready-mix concrete firm.
3. Portland cement, including Portland cement used in precast products, shall be Type II conforming to ASTM C 150.
4. Concrete mix design shall conform with ASTM C 94. Use classes of concrete as described in the following table.

Minimum 28-Day Compressive	Cement Content
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<u>Class</u>	<u>Type of Work</u>	<u>Strength (in psi)</u>
A	Concrete for all reinforced structures, piers, vaults	3,000
B	Concrete for anchors, thrust blocks, encasements, slope protection cutoff walls, cradles and miscellaneous unreinforced concrete	2,000

B. Reinforcing Steel

1. Reinforcement shall conform to ASTM A 615, Grade 40.
2. Fabricate reinforcing steel in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Bend reinforcing steel cold.
3. Deliver reinforcing steel to the site bundled and tagged with identifying tags.

C. Welded Wire Fabric

Welded wire fabric shall conform to ASTM 185.

D. Tie Wire

Tie wire shall be 16-gage minimum, black, soft annealed.

E. Bar Supports

Bar supports in beams and slabs exposed to view after form stripping shall be galvanized or plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

F. Forms

1. Forms shall be accurately constructed of clean lumber and shall be of sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure and tamping without deflection from the prescribed lines.
2. The surface of forms against which concrete is placed shall be smooth and free from irregularities, dents, sags, or holes. The surface shall leave uniform form marks conforming to the general lines of the structure.

PART 3 - EXECUTION

A. Excavation

Excavation for structures shall be in accordance with Section 02200.

B. Form Work

1. The contractor shall notify the PWD Representative a minimum of one working day before the placement of concrete to enable the PWD Representative to check the form lines, grades, and other required items for approval before placement of concrete.
2. Unless otherwise indicated on the plans, all exposed sharp edges shall be chamfered with at least 3/4 - by 3/4-inch triangular fillets.
3. Before placing concrete; the form surface shall be clean and coated with form oil of high penetrating qualities.

C. Reinforcement

1. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.
2. All reinforcing steel shall be of the required sizes and shapes and placed where shown on the drawings or prescribed by the PWD Representative.
3. Do not straighten or rebend reinforcing steel in a manner that will injure the material. Do not use bars with bends not shown on the drawings.
4. All bars shall be free from rust, scale, oil, or any other coating which would reduce or destroy the bond between concrete and steel.

5. Position reinforcement steel in accordance with the drawings and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms in order to provide the specified concrete coverage. Bars additional to those shown on the drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position, shall be provided and paid for by the Contractor.
6. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.
7. The reinforcement shall be so secured in position that it will not be displaced during the placement of concrete.
8. All reinforcing steel and wire mesh shall be completely encased in concrete.
9. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.
10. Minimum lap for all reinforcement shall be 20 bar diameters.
11. Place additional reinforcement around the pipe or opening as indicated in the drawings.
12. Wire mesh reinforcement is to be rolled flat before being placed in the form. Support and tie wire mesh to prevent movement during concrete placement.
13. Extend welded wire fabric to within 2 inches of the edges of the slab. Lap splices at least 1-1/2 courses of the fabric and a minimum of 6 inches. Tie laps and splices securely at ends and at least every 24 inches with 16-gage black annealed steel wire. Pull the fabric into position as the concrete is placed by means of hooks, and work concrete under the steel to ensure that it is at the proper distance above the bottom of the slab.

D. Embedded Items

All embedded bolts, dowels, anchors, and other embedded items shall be held correctly in place in the forms before concrete is placed.

E. Mixing and Placing Concrete

1. Concrete, either commercial or on-site ready mix or batch mixed, shall be placed in the forms before taking its initial set.

2. No concrete shall be placed in water except with permission of the PWD Representative.
3. As the concrete is placed in the forms, or in excavations to be filled with concrete, it shall be thoroughly settled and compacted throughout the entire layer by internal vibration and tamping bars.
4. All concrete surfaces upon which or against which the concrete is to be placed, and to which new concrete is to adhere, shall be roughened, thoroughly cleaned, wet, and grouted before the concrete is deposited.

F. Concrete Finishing

1. Immediately upon the removal of forms, all voids shall be neatly filled with cement mortar.
2. The surfaces of concrete to be permanently exposed to view must be smooth, free from projections, and thoroughly filled with mortar.
3. Exposed surfaces of concrete not finished against forms, such as horizontal or sloping surfaces, shall be screened to a uniform surface and worked with suitable tools to a smooth mortar finish.

G. Protection and Curing of Concrete

The contractor shall protect all concrete against damage. Exposed surfaces of new concrete shall be protected from the direct rays of the sun and from frost by being kept damp for at least two weeks after the concrete has been placed, or by using the "Hunt White Coverage" process or approved equal.

H. Backfill

Backfill around structures shall be in accordance with Section 02200.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 03462

PRECAST CONCRETE VAULTS, AND METER BOXES

PART 1 - GENERAL

A. Description

This section includes the materials, manufacture, and installation of precast concrete vaults.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- | | |
|-------------------------|-------|
| 1) Structure Earthwork: | 02200 |
| 2) Concrete: | 03300 |

C. Approved Manufacturers

1. Precast Vaults

Brooks Products, Inc.
Best Concrete Products
Associated Concrete Products

2. Meter Boxes

Eisel Enterprises, Inc.
Brooks Products, Inc.

3. Joint Sealing Compound

Quikseal manufactured by Associated Concrete Products

4. Waterproofing

Grace Dehydratine 4

D. Frames and Covers

All precast sections shall be provided with fabricated aluminum or steel frames and covers as specified or shown on the drawings and shall be built up so that the cover is flush with the surrounding surface unless otherwise specified on the drawings or by the PWD Representative in the field.

E. Meter Boxes

1. Precast concrete meter boxes shall be furnished and installed by the contractor unless noted otherwise.
2. Sizes shall be as specified on the standard drawings for the various sizes and types of services.
3. Any meter boxes to be requested for review as an equal must have identical lid and inside box dimensions.

PART 2 - MATERIALS

A. Precast Concrete Vault

1. Precast concrete vaults and covers shall be manufactured in a plant especially designed for that purpose and shall conform to the shapes and dimensions indicated on the plans.
2. Design loads shall consist of dead load, live load, impact, and in addition, loads due to water table and any other loads that may be imposed upon the structure. Live loads shall be for HS 20 per AASHTO standard specifications for highway bridges. Design wheel load shall be 16 kips. The live load shall be that which produces the maximum shears and bending moments in the structure.
3. The manufacture shall certify that the precast vault is fabricated to withstand the soil and loading conditions.

B. Meter Box Covers

1. All meter box covers shall be furnished with rectangular reading lids.
2. Concrete meter box covers shall be installed only in non-traffic locations.
3. Meter box covers within roadways or driveways shall be steel diamond plate designed to withstand highway loading.

C. Vault Frames and Covers

1. Vault frames and covers shall be fabricated stainless steel or aluminum.
2. Covers shall be fabricated with supports to resist deflection.
3. All covers shall be hinged. Covers shall have hydraulic assists.
4. All covers shall be equipped with a hold-open mechanism.
5. All covers shall be equipped with a flush locking devices.
7. All vaults located within roadways or driveways shall have traffic covers. Vaults in all other locations shall have parkway covers unless specified otherwise by the PWD Representative.
8. A 6" by 12" hinged reading lid shall be positioned over a meter in a vault.

D. Joint Sealing Compound

The joint sealing compound shall be a permanently flexible plastic material complying in every detail to Federal Specification SS S-00210 (GSA-FSS) dated July 26, 1965. "Quickseal", or equal.

E. Waterproofing

Waterproofing shall be formulated to comply with Federal Specification SS-A-701.

PART 3 - EXECUTION

A. Earthwork

1. Excavation and backfill for precast concrete vaults shall be in accordance with Section 02200 and the requirements herein.
2. The Contractor shall prepare an excavation large enough to accommodate the structure and permit grouting of openings and backfilling operations.
3. The bottom of the structure shall be placed on 12 inches of compacted, crushed rock sub-base, graded level and to the proper elevation as shown on the plans.

B. Installation

1. Openings or "knockouts" in precast concrete vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or coupling flange. Upon completion of

installation, all voids or openings in the vault walls around pipes shall be filled with 3,000-psi concrete or mortar, using an approved epoxy for bonding concrete surfaces.

2. After the structure and all appurtenances are in place and approved, backfill shall be placed to the original ground line or to the limits designated on the plans.
3. All joints between precast concrete vault sections shall be made watertight. The sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint that remains impermeable throughout the design life of the structure.
4. Frames and covers shall be built up so that the cover is flush with the surrounding surface unless otherwise specified on the drawings or by the PWD Representative in the field. The contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.
5. Waterproofing shall be applied to the exterior walls of all buried vaults in accordance with the manufacturer's instructions. Protection shall be placed over the waterproofing to prevent damage.

C. Meter Boxes

1. Boxes shall be set true to line and to the grade of the top of the curb, sidewalk, or surrounding graded area.
2. Meter boxes are not to be set until the developer has completed fine grading for landscape grading.
3. Retaining walls may be required around meter boxes installed on slopes as determined by the PWD Representative.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 09900

PAINTING AND COATING

PART 1 - GENERAL

A. Description

This section includes the materials and application of painting and coating systems for buried and exposed surfaces.

All articles to be painted or coated will be painted or coated in the place of manufacture, unless field painting and coating is absolutely necessary. The PWD Representative will make the determination. In the event that the paint or coating is damaged in the field, it will be touched up in the same manner as the original paint or coating applied in the place of manufacture.

B. Related Work Described Elsewhere

All related work, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Ductile-Iron Pipe and Fittings:	15056
2.	Manual Valves:	15100
3.	Fire Hydrants:	15139
4.	Domestic and Recycled water Facilities Identification:	15151

C. Approved Manufacturers and Materials

1. Inorganic Zinc Primer
Carboline 621
Tnemec – Zinc 90-97
Devoe Catha-Coat 302H
2. Alkyd Enamel
Carboline Subsil 30 HS
Tnemec Hi-Build Tnemec-Gloss 2H
Ameron Amercoat 5401 HSA

Devoe Devguard 4308

3. Epoxy Paint

Carboline Glamorglaze 202
Tnemec Hi-Build 66 Epoxoline
Devoe Bar – Rust 233H
Ameron Amercoat 351

4. Bituminous Mastic

Minnesota Mining and Manufacturing EC 244
Carboline Kop-Coat Bitumastic 300M

5. Polyurethanes

Carboline 133HB
Tnemec Hi-Build Epoxoline 69
Devoe Devthane 389
Ameron Amercoat 450HS

D. Paint Schedule

Aboveground or exposed facilities shall be color coded to differentiate recycled water facilities from domestic water facilities.

1. Domestic water System

a. Piping and Structures: Safety Blue

Carboline S150
Tnemec SC06
Devoe 9800
Ameron BL-6

b. Valve Box Lids and PWD Fire Hydrants: OSHA Safety Yellow

Carboline 6666
Tnemec SC01
Devoe 9400
Ameron YE-3

c. Private Fire System: Safety Red

Carboline 5555
Tnemec SC09
Devoe 9000
Ameron RD-2

2. Recycled Irrigation Water Facilities: Safety Purple

Devoe 9600

Tnemec SC08

E. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, the Orange County PFRD, the city having jurisdiction, or and other agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

PART 2 - MATERIALS

A. Primer

1. All primer shall contain not less that 63% solids by volume.

B. Alkyd Enamel

1. All enamels shall be silicone-alkyd based.
2. All enamels shall be lead-free.
3. All enamels shall be high gloss industrial type intended for use on exterior metal surfaces.
4. All enamels shall contain not less than 60% solids.

C. Bituminous Mastic

1. Bituminous mastic shall be coal-tar pitch based.
2. Bituminous mastic shall have a minimum of 70% solids by volume.

D. Epoxy Paint

1. Epoxy shall be a colored polyamide cured epoxy with not less than 70% solids by volume.
2. All coatings and pigments to be used in the water passages of domestic water service components and appurtenances shall have National Sanitation foundation (NSF) or Underwriters Laboratory (UL) approval for

use with domestic water. NSF and / or UL approved coatings acceptable for use in contact with domestic water are:

- a. Devoe Bar-Rust 233H
- b. Tnemec Pota-Pox Series 20
- c. Carboline Super Hi-Guard 891

PART 3 - EXECUTION

A. Surface Preparation

1. Do not sandblast or prepare more surface area than can be coated in one day. Remove all sharp edges, burrs, and weld spatter. Do not sandblast epoxy-coated pipe that has already been factory coated.
2. Surface preparation shall conform to the SSPC specifications as described below:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Near-White Blast Cleaning	SP-10

3. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning" or similar words are used in these specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Steel Structure Painting Council, Surface Preparation Specifications, ANSI A159.1) specifications listed above.

B. Painting Systems

1. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.
2. Deliver all paints to the job site in the original, unopened containers.

C. Surfaces Not To Be Coated

The following surfaces shall not be painted and shall be protected during the painting of adjacent areas:

1. Mortar-coated pipe and fittings.
2. Stainless steel.
3. Metal letters.
4. Nameplates.
5. Grease fittings.
6. Brass and copper, submerged.
7. Buried pipe, unless specifically required in the piping specifications.
8. Bronze meters and strainers.

D. Protection of Surfaces Not To Be Painted

Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

E. Field Touch Up of Manufacturer-Applied Prime Coats

Surfaces that are primed at the place of manufacture shall receive a field touch-up of inorganic zinc primer to cover all scratches or abraded areas.

F. Alkyd Enamel

1. The following items shall be painted using an alkyd enamel system:
 - a. All aboveground or exposed piping and all piping in vaults.
 - b. Fire hydrants.
 - c. Valve box lids.
 - d. Air release valves.
 - e. Meter box reading lids for all recycled water services.
 - f. Steel meter vault covers for all services 3 inches and larger.
 - g. All exposed metalwork as directed by the PWD Representative.
2. Surface Preparation:
 - a. All rust, mill scale, or weld splatter shall be removed by sandblasting or power tool cleaning.

- b. All unpainted surfaces shall be solvent cleaned in accordance with SP-1.
 - c. All abraded or scratched enamel coatings shall be sanded smooth or receive power tool cleaning per SP-3.
 - d. All failures in the existing coating shall be sandblasted in accordance with SP-6.
 - e. All existing surfaces to be repainted shall be Solvent cleaned in accordance with SP-1.
3. All unpainted or damaged surfaces shall be coated with primer to a dry-film thickness of not less than 2 mils.
 4. The finish coats shall be two or more coats of alkyd enamel applied to a dry-film thickness of 3 mils each, providing a total painted dry film thickness of not less than 5 mils.

G. Bituminous Mastic

1. Buried metal (flanges, Teflon coated nuts and bolts, flexible couplings, exposed reinforcing steel, etc.) shall be coated with a minimum of 20 mils of bituminous mastic.
2. All surfaces coated with bituminous mastic shall be covered with 8 mil polyethylene wrap per Section 15056.

H. Epoxy Coating

All items requiring epoxy coating to be coated with factory applied fusion bonded 100% pure powder epoxy. However, where, in the Engineer's opinion, because of the nature of the item being coated it would be impossible to use the fusion bonded powder method without causing damage to the item, the use of a liquid epoxy, factory applied by the manufacturer of the item being coated, will be permitted. The use of liquid epoxy other than those specified herein, including the equipment manufacturer's proprietary coating systems, must be reviewed and approved by the Engineer prior to use.

1. Only those metal surfaces specifically called out shall be epoxy coated.
2. Epoxy lining and coating of valves shall be per AWWA C550 and Section 15100 Manual Valves.
3. Surfaces to be epoxy coated shall be sandblasted to SP-10 requirements.
4. Sandblasted surfaces shall be coated with inorganic zinc primer to a dry film thickness of not less than 3 mils.

5. Apply two coats of epoxy paint (4 mils each) to the primed surface. The manufacturer's recommended drying time between coats shall be followed.
6. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

I. Dry-Film Thickness Testing

1. Measure coating thickness specified for metal surfaces with a magnetic-type dry-film thickness gage. Test the finish coat (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. The Contractor shall provide measuring equipment.

Provide detector as manufactured by Tinker and Razor or K-D Bird Dog. Provide dry-film thickness gage as manufactured by Mikrotest or Elcometer. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.

2. If the item has an improper finish color or insufficient film thickness, the surface shall be cleaned and top coated with the specified paint material to obtain the specified color and coverage. Visible areas of chipped, peeled, or abraded paint shall then be primed and finish coated in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.
3. The epoxy lining of all valves will be inspected and tested by a PWD representative prior to valve installation. The contractor shall notify the PWD seven days prior to valve installation to arrange for inspection.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15041

CHLORINATION OF DOMESTIC WATER MAINS AND SERVICES FOR DISINFECTION

PART 1 - GENERAL

A. Description

This section describes requirements for disinfection of domestic water mains, services, appurtenances and connections by chlorination and all requirements for bacterial testing of the facilities, and obtaining subsequent clearances for operations issued by the PWD and all state and local health agencies having jurisdiction.

B. Related Work Specified Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

Hydrostatic testing of Pressure Pipelines: 15042

C. Referenced Standard

All domestic water mains, water services, attached appurtenances, and connections, if any, shall be disinfected in accordance with AWWA C651 and as specified herein.

D. Application

Before being placed in service, all facilities shall be chlorinated. Either direct chlorine gas feed or calcium hypochlorite tablets may apply chlorine.

E. Retesting

Retesting of the system may be required if 90 days have passed between the date of testing and acceptance by the PWD.

PART 2 - MATERIALS

A. Chlorine Gas.

Chlorine gas shall be supplied and converted from its liquid form to a gas as detailed in AWWA C651 Sections 2.1 and 5.2

PART 3 - EXECUTION

A. Procedure

1. All required corporation stops and other plumbing materials necessary for chlorination or flushing of the main shall be installed by and at the expense of the contractor.
2. Every service connection served by a main being disinfected shall be tightly shutoff at the curb stop before water is turned into the main. Care shall be taken to expel all air from the main and services during the filling operation.
3. Water shall be fed slowly into the pipeline with chlorine applied in amounts to produce a dosage of not less than 50 ppm nor more than 100 ppm in all sections of the pipeline and appurtenances.
4. Treated water shall be retained in the system for a minimum of 24 hours and shall maintain a chlorine residual with a drop in residual level of not more than 25 ppm less than the beginning level at the end of the retention period in all sections being disinfected.

B. Concurrent Testing

Disinfecting the mains and appurtenances, hydrostatic testing, and preliminary retention may run concurrently for the required 24-hour period, but in the event there is leakage and repairs are necessary, additional disinfection shall be made by injection of chlorine solution into the line as provided hereinafter.

C. Additional Disinfection

If the tests are not satisfactory the contractor shall provide additional disinfection as required. If the requirement for additional disinfection is due to any omission,

negligence, or non-conformance with these specifications on the part of the contractor, or because of premature wetting of the hypochlorite or repairs made to the pipeline after its initial filling with water for disinfection, the contractor shall provide and pay for such additional chlorination.

D. Flushing

After chlorination, the water shall be flushed from the line, in accordance with AWWA C651, at its extremities until the replacement water tests are equal chemically and bacteriologically to those of the permanent source of supply. The chlorinated water may be used later for testing other lines, or if not so used, shall be disposed of by the contractor, as designated in AWWA C651, Section 6.2. The PWD will not be responsible for loss or damage resulting from such disposal.

E. Cutting Into Existing Mains

Following the opening of an existing domestic water main, the interior of all accessible pipes and fittings shall be swabbed with a hypochlorite solution. The drained portion of the existing line and any new section shall be flushed from two directions toward the cut-in, if possible.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15042

HYDROSTATIC TESTING OF PRESSURE PIPELINES

PART 1 - GENERAL

A. Description

This section describes the requirements and procedures for pressure and leakage testing of pressure distribution mains.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

Chlorination of Water Mains and Services for Disinfection: 15041

C. Connection to Existing Mains

The test shall be made before connecting the new line with the existing PWD pipes and mains, excepting hot taps. In the event that the new pipe is connected to existing pipe, a pressure test plate shall be used to separate the systems during the pressure test.

D. Tester

A PWD-approved testing company, who will be required to provide the PWD Representative with certified testing results, shall perform all testing. Tester will have a gage and meter, calibrated annually.

E. Requirements Prior to Testing

1. Before testing, the pipe trench shall be backfilled with a minimum of 2½ feet of material, or center loaded to hold the pipe in place while testing.

2. All concrete anchor blocks shall be allowed to cure a sufficient time to develop a minimum strength of 2,000 psi before testing unless otherwise directed by the PWD Representative.
3. Steel pipelines shall not be tested before the mortar lining and coating on the entire pipeline has attained an age of 14 days. Cement-mortar lined pipe shall not be filled with water until a minimum period of eight hours has elapsed after the last joint in any section has been made.
4. In place of a separation from existing water lines with a valve and thrust block assembly, an in line test plate may be used.

F. Final Pavement

All pipelines shall be satisfactorily pressure tested prior to the placement of final pavement.

PART 2 - MATERIALS

A. Water

1. The same water used for chlorination of the pipeline may be used to fill the line for pressure testing.
2. Make up water for testing shall be domestic water.

PART 3 - EXECUTION

A. General

1. All labor, materials, tools, and equipment for testing shall be furnished by the contractor.
2. The pipeline shall be subjected to a field hydrostatic pressure of 50 psi in excess of the class rating of the pipe being tested for a period of four hours.
3. The water necessary to maintain test pressure shall be measured through a meter. The leakage shall be considered as the amount of water entering the pipe during the test, less the measured leakage through valves and fittings. Leakage shall not exceed the rate specified. Any noticeable leaks shall be stopped, and any defective pipe shall be replaced with new sections.

4. The test shall further be conducted with valves open, and the open ends of pipes, valves, and fittings suitably closed. Valves shall be operated during the test period.
5. In hilly areas, it may be necessary to conduct the test in segments so that no pipe section is tested at less than the pipe pressure class plus 50 psi, nor more than 1½ times the pipe pressure class.

B. Field Test Procedure

1. The pipeline should be filled at a rate such that the average velocity of flow is less than 1 fps. At no time shall the maximum velocity of flow exceed 2 fps. The following table has been provided to relate this velocity-filling rate to an equivalent volume flow rate.

Filling Rate in gpm equivalent to filling velocities of 1 fps, for pipes flowing full:

<u>Nominal Size (inches)</u>	<u>Flow Rate Q (gpm)</u>
4	39
6	88
8	157
12	352

2. All air should be purged from the pipeline before checking for leaks or performing pressure or acceptance tests on the system. To accomplish this, if air valves or hydrants or other outlets are not available, taps shall be made at the high points to expel the air, and these taps shall be tightly plugged afterwards.
3. After the pipeline has been filled and allowed to sit a minimum of 24 hours (48 hours for mortar-lined pipelines), the pressure in the pipeline shall then be pumped up to the specified test pressure. If a large quantity of water is required to increase the pressure during testing, entrapped air, leakage at joints, or a broken pipe can be suspected. TESTS SHOULD BE DISCONTINUED until the source of trouble is identified and corrected.
4. When the test pressure has been reached, the pumping shall be discontinued until the pressure in the line has dropped 30 psi, at which time the pressure shall again be pumped up to the specified test pressure. This procedure shall be repeated until four hours have elapsed from the time the specified test pressure was first applied. At the end of the four-hour period, the pressure shall be pumped up to the test pressure for the last time.

5. The leakage shall be considered as the total amount of water pumped into the pipeline during the four-hour period, including the amount required in reaching the test pressure for the final time. Leakage shall not exceed the rates in the tables below. If the size, pipe material, or pressure fall outside of the table listed below, the PWD Engineer will determine the leakage amount.

<u>ACP LEAKAGE ALLOWANCE</u>				
Nominal Pipe size in (inches)	Test pressure		Allowable leakage, gallons per 4-hour period per 1,000 feet of pipe.	
	Class 150 (psi)	Class 250 (psi)	Class 150 (psi)	Class 250 (psi)
4	200	250	3.0	4.0
6	200	250	4.5	5.5
8	200	250	6.0	7.5
12	200	250	9.0	11.0

<u>Steel Pipe LEAKAGE ALLOWANCE</u>				
Nominal Pipe size in (inches)	Test pressure		Allowable leakage, gallons per 4-hour period per 1,000 feet of pipe.	
	Class 150 (psi)	Class 250 (psi)	Class 150 (psi)	Class 250 (psi)
4	200	250	1.7	1.9
6	200	250	2.6	2.8
8	200	250	3.4	3.8
12	200	250	5.1	5.7
16	200	250	6.8	7.6
20	200	250	8.5	9.5
24	200	250	10.2	11.4

<u>PVC LEAKAGE ALLOWANCE</u>				
Nominal Pipe size in (inches)	Test pressure		Allowable leakage, gallons per 4-hour period per 1,000 feet of pipe.	
	Class 150 (psi)	Class 250 (psi)	Class 150 (psi)	Class 250 (psi)
4	200	250	1.7	1.9
6	200	250	2.6	2.8
8	200	250	3.4	3.8
12	200	250	5.1	5.7
16	235	300	6.8	7.6
20	235	300	8.5	9.5
24	235	300	10.2	11.4

6. Any noticeable leak shall be stopped and all defective pipes, fittings, valves, and other accessories discovered in consequence of the test shall be removed and replaced by the contractor with sound material, and the test shall be repeated until the total leakage during a test of four hours duration does not exceed the rate specified above.

END OF SECTION

SECTION 15052

EXPOSED PIPING INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to install and test all exposed piping, fittings, and specials. The Work includes, but is not limited to, the following:
 - a. All types and sizes of exposed piping, except those specified under other Sections.
 - b. Piping embedded in concrete within a structure or foundation will be considered as exposed and included herein.
 - c. Supports, restraints, thrust blocks and other anchors.
 - d. Work on or affecting existing piping.
 - e. Testing.
 - f. Cleaning and disinfecting.
 - g. Installation of all jointing and gasketing materials, dielectric appurtenances, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all other Work required to complete the exposed piping installation.
 - h. Incorporation of valves, meters and special items shown or specified into the piping systems as required and as specified in the appropriate Division 15 Sections.
 - i. Unless otherwise specifically shown, specified, or included under other Sections, all exposed piping Work required, beginning at the outside face of structures or structure foundation and extending into the structure.

B. Coordination:

1. Review installation procedures under other Sections and coordinate with the Work that is related to this Section.
2. Comply with all regulations, standard details and approved materials lists issued by the Capistrano Valley Water PWD and the Fire Marshal.
3. Review installation procedures under other Sections and coordinate the Work that must be installed prior to the installation of insulation pipe Work.
4. Manufacturers and suppliers of the equipment and materials specified herein shall be required to review and satisfy all relevant requirements of other sections of the Contract Documents and the requirements of the Contract Drawings. The CONTRACTOR, manufacturer, supplier, fabricator and/or subcontractors furnishing and/or installing equipment, materials, services and specialties associated with this Section shall fully coordinate

their efforts to avoid potential claims that are based on failure to review relevant Contract Documents, including the Contract Drawings.

5. The CONTRACTOR shall furnish and install all equipment, labor, materials, appurtenances, specialty items and services not provided by the CONTRACTOR'S manufacturers, suppliers, fabricators and/or subcontractors but required for complete and operable systems.

C. Related Sections Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.
2. Section 09900, Painting.
3. Division 15, Sections on Piping, Valves and Appurtenances.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Comply with applicable requirements of NFPA Standard No. 14 for A Standpipe and Hose Systems used for fire protection.
2. Comply with requirements of UL, FM and other jurisdictional authorities, where applicable.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ANSI B13.1, Code for Pressure Piping.
2. ANSI B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.
3. ANSI B16.4, Cast Iron Threaded Fittings, Classes 125 and 250.
4. ANSI B16.5, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
5. ANSI B16.9, Factory-Made Wrought Steel Butt Welding Fittings.
6. ANSI B16.11, Forged Steel Fittings, Socket-Welding and Threaded.
7. ANSI B31.1, Power Piping.
8. ANSI D1.1, Structural Welding Code.
9. AWWA C206, Field Welding of Steel Water Pipe Joints.
10. AWWA C606, Grooved and Shouldered Type Joints.
11. AWWA C651, Disinfecting Water Mains.
12. AWWA M11, Steel Water Pipe Design and Installation.
13. AWS D10.9, Standard for Qualification of Welding Procedures and Welders for Piping and Tubing.
14. ASME Boiler and Pressure Vessel Code.
15. NFPA 14, Standpipe and Hose Systems.

1.3 SUBMITTALS

- A. Shop Drawings: Submit per section 01300 for approval the following:
 - 1. Detailed layout drawings and laying schedules for all piping 6 inches in diameter and greater, reflecting the CONTRACTOR'S construction schedule and installation methods.
 - 2. Details of piping, valves, supports, accessories, specials, joints, harnessing, and connections to existing pipes and structures.
 - 3. Welding procedures.
 - 4. Signed and fully executed welder qualifications which are current within six months of the date of the Notice to Proceed.
- B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of test report for each test.
- C. Certificates: Submit certificates of compliance with referenced standards.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site to insure uninterrupted progress of the Work.
- B. Handle all pipe, fittings and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks. Do not otherwise drop, roll or skid piping.
- C. Store pipes and fittings on heavy wood blocking or platforms so they are not in contact with the ground.
- D. Unload pipe, fittings and specials opposite to or as close to the place where they are to be installed as is practical to avoid unnecessary handling. Keep pipe interiors completely free from dirt and foreign matter.
- E. Inspect delivered pipe for cracked, gouged, chipped, dented or other damaged material and immediately remove from site.
- F. Thermoplastic pipe shall be stored so as to prevent sagging or bending.
- G. Thermoplastic pipe, fittings and specials shall not be stored in direct sunlight.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. General:
 - 1. Marking Piping:

- a. Clearly mark each piece of pipe or fitting with a designation conforming to that shown on the Shop Drawings.
- b. Cast or paint material, type and pressure designation on each piece of pipe or fitting 4 inches in diameter and larger.
- c. Pipe and fittings smaller than 4 inches in diameter shall be clearly marked by manufacturer as to material, type and rating.

B. Pipe Identification Markers and Arrows: Refer to Section 09900, Painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install piping as shown, specified and as recommended by the manufacturer.
2. If there is a conflict between manufacturer's recommendations and the Drawings or Specifications request instructions from PWD before proceeding.

B. Piping Installation:

1. Install straight runs true to line and elevation.
2. Install vertical pipe truly plumb in all directions.
3. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, and other obstructions.
4. Protect and keep clean water pipe interiors, fittings and valves.
5. Provide temporary caps or plugs over all pipe openings at the end of each days work, and when otherwise required or directed by PWD.
6. Cutting: Cut pipe from measurements taken at site, not from Drawings.
7. Install dielectric unions wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping.
8. Additional Requirements for Thermoplastic Piping:
 - a. Support all valves independently of the piping system.
 - b. Utilize wide band supports as recommended by manufacturer and approved by PWD to minimize localized stresses.
 - c. Provide piping passing through walls with a sleeve of wearing material to prevent abrasion damage to piping.
 - d. When anchors are required at locations other than equipment or tanks they shall be placed at elbows, valve locations and at bends in pipe line.
 - e. Spacing of supports shall be in accordance with the manufacturer's published recommendations at the maximum design operating temperature of the pipe.

- f. Use "U" clamps with wide band circumferential contact. Avoid all pressure contact with piping.

C. Joints:

1. General:

- a. Make joints in accordance with the pipe manufacturer's recommendations and the requirements below.
- b. Cut piping accurately and squarely and install without forcing or springing.
- c. Ream out all pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.
- d. Remove all cuttings and foreign matter from the inside of pipe and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.

2. Not Used.

3. Flanged Joints:

- a. Assemble flanged joints using 1/8-inch ring-type gaskets for raised face flanges. Use full face or ring-type gaskets for flat face flanges. Gaskets shall be suitable for the service intended in accordance with the manufacturer's ratings and instructions. Gaskets shall be properly centered.
- b. Bolts shall be tightened in a sequence which will insure equal distribution of bolt loads.
- c. The length of bolts shall be uniform, and they shall not project beyond the nut more than 1/4-inch or fall short of the nut when fully taken up. The ends of bolts shall be machine cut so as to be neatly rounded. No washers shall be used except as required on PVC pipe.
- d. Bolt threads and gasket faces for flanged joints shall be lubricated prior to assembly.
- e. Alternately tighten bolts 180 degrees apart to compress the gasket evenly.

4. Steel Pipe Joints:

- a. Joints in steel pipe shall be butt welded, lap welded slip joints, flanged, or threaded joints, except that flexible couplings, mechanical couplings, or flanged connections shall be provided where shown on the Drawings.
- b. Welding shall conform to the requirements of AWWA C206. Pipe 36-inches in diameter and larger shall be welded both inside and outside of the pipe.
- c. After welding, the joint and the surrounding damaged or uncoated area shall be coated with the same material and to the same thickness as the shop applied coating and lining.
- d. For threaded joints, use standard, right hand tapered full depth threads on steel piping and apply an approved joint compound to the male threads only, before installation. Remove all cuttings and foreign matter from the inside of the pipe. Thoroughly clean all pipe, fittings, valves,

- specials, and accessories before installing.
5. Not Used.
 6. Copper Tubing Joints:
 - a. Assemble copper tubing with soldered joints. Solder shall be 95-5 tin-antimony conforming to ASTM B32.
 - b. Ream or file pipe to remove burrs.
 - c. Clean and polish contact surfaces of joints.
 - d. Apply flux to both male and female ends.
 - e. Insert end of tube into full depth of fitting socket.
 - f. Heat joint evenly.
 - g. Form continuous solder bead around entire circumference of joint, joints shall be wiped.
 - h. Runs shall contain unions at connections to equipment and at reasonable distances along the lengths of runs to permit convenient disassembly of piping and removal of equipment.
- D. Installing Valves and Accessories:
1. Provide supports for large valves, flow meters and other heavy items as shown or required.
 2. Install floor stands as shown and as recommended by the manufacturer.
 3. Provide lateral restraints for extension bonnets and extension stems as shown and as recommended by the manufacturer.
 4. Provide steel sleeves where operating stems pass through floor. Extend sleeves 2-inches above floor.
 5. Position valve operators as shown. When the position is not shown, install the valve so that it can be conveniently operated and as approved by PWD. Avoid placing operators at angles to the floors or walls.
- E. Unions:
1. Install dielectric unions wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping.
 2. Provide a union downstream of each valve with screwed connections.
 3. Provide screwed unions or flanged connections at each piece of equipment, where shown, and where necessary to install or dismantle piping.
- F. Eccentric Reducers: Use eccentric reducers where shown and where air pockets would otherwise occur in mains because of a reduction in pipe size.
- G. Transitions from One Type of Pipe to Another:
1. Provide all necessary adapters, dielectric gaskets, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
 2. Transitions from buried piping to exposed piping shall be of the buried piping type. All such transitions shall be exposed.
- H. Taking Existing Pipelines Out of Service:
1. Notify PWD at least 48 hours prior to taking pipeline out of service.

- I. Work on Existing Pipelines:
 1. Cut or tap pipes as shown or required with machines specifically designed for this work.
 2. Install temporary plugs to keep out all dirt, water and debris.
 3. Provide all necessary adapters, fittings, pipe and appurtenances required.

3.2 THRUST RESTRAINT

- A. Provide thrust restraint on all pressure piping systems.
- B. Thrust restraint may be accomplished by means of restrained pipe joints. Thrust restraints shall be designed for the axial thrust exerted by the test pressure.
- C. Restrained Pipe Joints:
 1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.
 - a. Restrain ductile iron pipe connected by flexible couplings or flanged coupling adapters by harnessing across the coupling or adapter using tie rods or extended bolts connecting between flanges.
 - b. Steel pipe shall have butt-welded joints, flanged joints, or flexible or mechanical coupling connectors. Provide tie rods connected to ears welded to the steel pipe for restraint at all flexible coupling connectors.

3.3 PAINTING

- A. Field painting is under Section 09900, Painting.

3.4 TESTING OF PIPING

- A. General:

Follow testing procedure detailed in section 15042.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15056

DUCTILE-IRON PIPE AND FITTINGS

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of ductile-iron pipe and fittings.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Trenching, Backfilling, and Compacting:	02223
2.	Concrete:	03300
3.	Chlorination of Domestic water Mains for Disinfection:	15041
4.	Hydrostatic Testing of Pressure Pipelines:	15042

C. Approved Manufacturers

1. Fittings
 - Tyler
 - Trinity Valley
 - Dayton
 - Nappco
2. Pipe
 - Pacific States
 - U.S. Pipe
 - American Pipe
3. Gaskets
 - Crane Company Cranite
 - Johns Manville 60 Asbestos
 - Garlock 7071

D. Use of Gray-Iron Fittings

Gray-iron fittings may not be substituted for ductile-iron.

PART 2 - MATERIALS

A. Ductile-Iron Pipe

1. Pressure class or thickness class of DIP shall be determined by the design method detailed in AWWA C150 the "Thickness Design Method."
1. Ductile-iron pipe shall be manufactured in accordance with AWWA C151.
2. All ductile-iron pipe shall be thickness class 50 for plain end pipe and thickness Class 53 for flanged spools unless indicated otherwise.
3. All ductile-iron pipe shall be cement-mortar lined in accordance with AWWA C104.
4. Unless otherwise called out on the plans, a "push-on" type joint shall be used. The joint dimensions and gasket shall be as specified in AWWA C111.
5. Flanges for ductile-iron pipe shall be the "screwed-on" type in accordance with AWWA C115.
6. The exterior surface of all ductile iron pipe and fittings shall be protected with a minimum 30-mill dry film thickness of shop applied polyurethane coating. Polyurethane coatings shall be Futures Coatings, Protec II PW, or Madison Chemical, Corropipe II Abrasion, or equal. Polyurethane coating shall be applied in strict accordance with the coating manufacturer's written instructions, including recommendations for surface preparation and priming of the ductile iron.

B. Ductile-Iron Fittings

1. Ductile-iron fittings shall be manufactured in accordance with AWWA C110, or AWWA C153. Compact body fittings, as described in AWWA C153, will not be permitted in vault structures.
2. All fittings shall be cement-mortar lined in accordance with AWWA C104.

3. All fittings shall be made with "push-on" joints designed for use with the type of pipe to be joined unless noted otherwise.
4. Mechanical joint fittings will be allowed only in areas specifically approved by the PWD as a substitute for other types of fittings.
5. Unless otherwise indicated on the drawings, all fittings with flanged ends shall be ductile iron class 150. The gasket surface shall have a serrated finish of approximately 16 serrations per inch, approximately 1/32-inch deep, with serrations in either a concentric or spiral pattern. In addition, all flanges shall meet the following tolerances:

Bolt circle drilling	$\pm 1/16$ inch
Bolt hole spacing	$\pm 1/32$ inch
Eccentricity of both circle and	$\pm 1/32$ inch

C. Gaskets

Gaskets shall be manufactured per AWWA C111, unless noted otherwise below.

D. Bolts, Nuts, and Washers

1. Bolts and nuts, for buried flanges, flanges located outdoors above ground, flanges located in open vaults and structures, and submerged flanges shall be Type 316 stainless steel, nuts shall be type 316 stainless steel, Teflon coated (Tripac 2000 or approved equal).
2. Provide one (1) washer for each nut. Washer shall be of the same material as the nuts.
3. The length of each bolt or stud shall be such that between 1/4 inch and 3/8 inch will project through the nut when drawn tight.

PART 3 - EXECUTION

A. General

Ductile-iron pipe and ductile iron fittings shall be installed in accordance with the applicable Sections of AWWA C600 and as specified herein.

B. Trenching, Backfilling, and Compacting

1. Trenching, backfilling, and compacting shall be in accordance with Section 02223 and as specified herein.
2. Backfill within the pipe zone, including the pipe base, shall be imported sand placed and compacted in accordance with Section 02223.
3. Backfill within the trench zone shall be native earth backfill placed and compacted in accordance with Section 02223.

C. Placement of Pipe in Trench

1. Lay pipes uphill if the grade exceeds 10%.
2. The radius of curvature of the trench shall determine the maximum length of pipe section that can be used without exceeding the allowable deflection at a joint. Combined deflections at rubber gasket or flexible coupling joints shall not exceed 2 degrees or that recommended by the manufacturer, if smaller.

The manufacturer's printed installation guide outlining the radius of curvature that can be negotiated with pipe sections of various lengths shall be followed if applicable.

3. The pipe shall be laid true to the line and grade shown on the plans within acceptable tolerances. The tolerance on grade is 1-inch. The tolerance on line is 2-inches.
4. Fittings shall be supported independently of the pipe.
5. Temporarily support fittings with wooden skids until thrust blocks and supports are poured, so that the pipe is not subjected to the weight of the fitting.
6. All exposed flanges and other metal surfaces not previously coated shall be coated after assembly with mastic, such as Carboline Kop-Coat 300M or approved equal. Stainless steel bolts need not be coated.

D. Anchors and Thrust Blocks

Concrete anchors and thrust blocks shall be poured against wetted undisturbed soil in accordance with Section 03300 and standard Drawings W-14 and W-15.

E. Flanged Connections

1. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe run.
2. Clean flanges by wire brushing before installing gasket.
3. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. Between 1/4 inch and 3/8 inch shall project through the nut when drawn tight.
4. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

F. Pipe Support

All exposed pipe shall be supported as detailed in the plans.

G. Disinfection

All piping shall be disinfected by chlorination in accordance with Section 15041.

H. Testing

All piping shall be hydrostatically pressure tested in accordance with Section 15042.

I. Bonding

All DIP pipe joints shall be electrically bonded for continuity in accordance with the standard Drawings. Cathodic test stations (CTS) shall be installed as shown on the plans and in accordance with the standard drawings.

J. Bonding Continuity Test

All DIP pipe joints will be electrically bonded and connected to a sacrificial anode or impressed current system. All DIP joints shall be tested for continuity. Continuity testing shall be conducted as follows:

All DIP pipelines constructed with electrical bonding cables shall be tested for electrical continuity. Additionally, all CTS will be inspected and tested for their serviceability. The PWD shall conduct all testing upon completion of construction and prior to acceptance.

The testing shall be done by qualified corrosion engineering personnel using Metrotech Model 850 Audio Frequency Pipe locator equipment by methods outlined below. The CTSs are to be utilized for this testing. The audio signal transmitter shall be connected to the pipe by way of the CTS wiring connected to the pipe. This will also verify that the CTS was installed correctly and are therefore serviceable. Continuity measurements are to be recorded beginning at each CTS and at equally spaced intervals equal to or shorter than the pipe joint lengths. All measurements recorded shall be those taken over the pipe centerline as indicated on the Metrotech Pipe Locator antennae display and with the antennae held in a true vertical position with the instrument readout panel up and the antennae pointed down.

The Metrotech Model 850 Audio Frequency Pipe Locator readings of "Signal Level" and "Pipe Depth to Centerline" when taken with the instrument in a vertical position over centerline of the pipe with the antennae nose placed in contact with the surface over the pipe is to be used to calculate "LOG Signal Level" at constant depth. A plot of "LOG Signal Level" (at constant depth) vs. Distance from CTS is compared with that for an all welded pipe of similar diameter. Plots of data taken over a cable bonded pipe joint are to have a "slope" with Distance from CTS that is unvarying and similar to that for welded pipe to demonstrate satisfactory electrical continuity of pipe joints. Only those data taken with the Metrotech Model 850 Audio Signal Transmitter operating at a constant eight (8) watts output are to be compared.

The Contractor shall correct all faults in electrical continuity for both pipeline joints and CTS and have the pipeline retested as described above at no additional cost to the PWD.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15057

COPPER, BRASS, AND BRONZE PIPE FITTINGS AND APPURTENANCES

PART 1 - GENERAL

A. Description

This section includes materials and installation of copper, brass, and bronze pipe, fittings and appurtenances.

B. Approved Manufacturers

1. All materials shall be the appropriate model number specified on standard drawings W-1 and W-2 as manufactured by the companies listed thereon and as additionally listed herein.
2. Copper Tubing
Redding
Mueller
3. Service Saddle
Jones J979
Mueller BR 2B & BR 2S
Ford 202B, 202 BS (1") & 202-size IP7 (2")
Smith-Blair 371 & 372
Ford S912 (for tapping C-900)
James Jones J996 (for tapping C-900)
4. Corporation Stop
Jones J-1935 & (1") & J-1931 (2")
Mueller B-25028
Ford FB-1100
5. Angle Meter Stop
Jones J-1963 WSG (5/8" & 1" mtrs), J-1974 W & J-1975 W (1-1/2" & 2" mtrs)
Mueller B-24258 (5/8" & 1" mtrs) & B-24286 (2" mtrs)
Ford BA 43-342W (5/8" mtrs), BA 43-444W (1" mtrs), BFA 13-777W (1-1/2" & 2" mtrs)
6. Customer Valve

Jones J-1908 (5/8" & 1" mtrs) & J-1913-W (1-1/2" & 2")
Ford B13-342 w/HT-34 (5/8"), B-13-444 w/HT-34 (1"), BF-13-777
w/HH-67 (2')

7. Insulating Pipe Bushings, Unions, or Couplings
Central
Smith Blair
Pipe Seal and Insulator Company

PART 2 - MATERIALS

A. Copper

1. Copper tubing shall conform to the requirements of ASTM B 88 for seamless copper water tube. Piping located aboveground or suspended within vaults shall be Type L. Buried piping shall be Type K. Copper pipe shall be of domestic manufacture.
2. Fittings shall be copper conforming to ASTM B 75 and ANSI B16.22, with solder end joints. Fittings 3/8 inch and smaller may have flared end connections or compression joint connections.
3. Solder shall be silver solder conforming to ASTM B 32, Grade 95TA. Solders containing filler elements, such as Lead (Pb), Zinc (Zc), Cadmium (Cad), Nickel (Ni), or Tin (Sn), will not be permitted.

B. Brass Pipe, Nipples, and Fittings

Short threaded nipples, brass pipe and fittings shall conform to ASTM B 43, regular wall thickness. Threads shall conform to ANSI B2.1. Teflon tape shall be applied to all threaded joints prior to make-up.

C. Bronze Appurtenances

1. All items specified herein shall be manufactured of bronze conforming to ASTM B 62, "Composition Brass or Ounce Metal Castings."
2. All size service saddles shall be of the double-strap type for any size of pipe. The straps (or bails) shall be flat and shall be manufactured of silicone bronze. The body shall be manufactured of bronze and shall be tapped for an iron pipe thread. Form the seal with the pipe with either a rubber gasket or an O-ring.

3. Corporation stops shall be, ball valve type and shall be manufactured of bronze. The inlet fitting shall be a male iron pipe thread when used with saddle and the outlet connection shall be a compression type or iron-pipe thread.
4. Angle meter stops shall be ball valve type and shall be manufactured of bronze. The inlet connection shall be a compression type or female iron-pipe thread and the outlet fitting shall be a meter flange or meter coupling. The inlet and outlet shall form an angle of 90 degrees on a vertical plane through the centerline of the meter stop. A rectangular lug and lock wing shall be provided on the top of the fitting to operate the shutoff mechanism. Two-inch angle meter stops shall be with "slotted" holes for 1-1/2-inch or 2-inch meters.
5. Customer Service valves shall be manufactured of bronze with lever-type turn handle. The inlet connection shall be a meter flange or a meter coupling and the outlet female iron pipe.

D. Flanges, Gaskets, Bolts, and Nuts

1. Connect to flanged valves and fittings with bronze flanges conforming to ANSI B16.24, Class 125 or Class 150, to match the connecting flange. Use solder end companion flanges.
2. Gaskets for flanged-end fittings shall be made of asbestos and synthetic rubber binder and shall be full face, 1/8-inch-thick John-Manville 60, John Crane Co. "Cranite," or equal.
3. When both adjoining flanges are bronze, use bronze bolts and nuts. Bolts shall conform to ASTM F 468, Grade C65100 or C63000. Nuts shall conform to ASTM F 467, Grade C65100 or C63000.
4. When only one of the adjoining flanges is bronze, use type 316 stainless-steel bolts nuts.
5. Connect to buried ferrous flanges with flange insulation kits. Bolts used in flange insulation kits shall conform to ASTM B 193, Grade B7. Nuts shall comply with ASTM A 194, Grade 2H. If the adjoining buried flange is bronze, use bronze bolts and nuts as described above, without a flange insulation kit.
6. Provide one (1) washer for each nut. Each washer shall be of the same material as the nut.

PART 3 - EXECUTION

A. Copper Tubing and Fittings

1. Cut tubing square and remove all burrs. Clean both the inside and outside of fitting and pipe ends with steel wool and muriatic acid before soldering. Prevent annealing of fittings and tubing when making connections. Do not miter joints for elbows or notch straight runs of pipe for tees.
2. Bends in soft copper tubing shall be long sweep. Shape bends with shaping tools. Form bends without flattening, buckling, or thinning the tubing wall at any point.
3. Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of the ASME Boiler and Pressure Vessel Code. Silver solder shall be used. Solder shall penetrate to the full depth of the cup in joints and fittings. Solders shall comply with ANSI B31.3, paragraph 328.
4. Buried piping shall be installed with some slack to provide flexibility in the event of a load due to settlement, expansion or contraction. A MINIMUM COVER OF 36 INCHES BELOW THE FINISHED STREET GRADE SHALL BE ADHERED TO. The tubing is to be bedded and covered with sand or select material as determined by the PWD Representative.
5. All domestic service laterals shall be 1-inch minimum size copper tubing. End connections shall be compression type.
6. All 2-inch size services shall be installed with straight lengths of soft copper water tube Type K. Solder or compression fittings are acceptable on only the corporation stop and angle meter stop. All couplings and adapters shall be silver soldered.
7. The service line shall extend perpendicular to the centerline of the street from the water main to the meter stop or structure, except in a cul-de-sac, where the service shall run in a straight line from the water main to the meter stop.

B. Service Saddle

1. The service saddle shall be no closer than 18 inches to a valve, coupling, joint, or fitting unless it is at the end of the main.
2. The surface of the pipe shall be filed to remove all loose material and to provide a hard, clean surface before placing the service saddle.

3. The service saddle shall be tightened firmly to ensure a tight seal; however, care shall be used to prevent damage or distortion of either the corporation stop or service saddle by over tightening.
4. The tap into the pipe shall be made in accordance with the pipe manufacturer's recommendation.
5. Service saddles connecting to PVC water mains shall be specifically designed for PVC pipe, and shall limit the torque to prevent over-tightening.

C. Installing Flange Bolts and Nuts

1. Lubricate bolt threads with graphite and oil prior to installation.
2. Set flanged pipe with the flange bolt holes straddling the pipe horizontal and vertical centerlines.

D. Insulating Bushings and Unions

Pipe or fittings made of nonferrous metals shall be isolated from ferrous metals by PVC insulating pipe bushings, union, or couplings.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15062

CONCRETE MORTAR LINED AND COATED STEEL PIPE

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install steel pipe and fittings.
2. The extent of steel pipe is shown on the Drawings.

B. Related Sections:

1. Section 02220, Earthwork, Excavation and Backfill.
2. Section 09900, Painting.
3. Section 15051, Buried Piping Installation.
4. Section 15052, Exposed Piping Installation.
5. Section 15096, Wall Pipes, Floor Pipes and Pipe Sleeves.
6. Section 15100, Valves and Appurtenances
7. Section 15950, Corrosion Control for Buried Piping.

1.2 QUALITY ASSURANCE

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

1. ANSI B 36.10, Welded and Seamless Wrought Steel Pipe.
2. ASTM A 53, Standard Specification for Pipe, Steel, Black and Hot Dipped.
3. AWWA, C200, Steel Water Pipe 6 Inch and Larger.
4. AWWA, C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4 Inch and Larger-Shop Applied.
5. AWWA, C207, Steel Pipe Flanges.
6. AWWA, C208, Dimensions for Fabricated Steel Water Pipe Fittings.
5. AWWA, C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
8. AWWA, C602, Cement-Mortar Lining of Water Pipelines in Place - 4 Inch and Larger.
9. AWWA, M11, Steel Water Pipe - A Guide for Design and Installation.
10. ANSI, B16.5, Steel Pipe Flanges and Flanged Fittings.
11. ASTM, A234, Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
12. ASTM, A370, Test Methods and Definitions for Mechanical Testing of Steel Product.

- 13. ASTM, E165, Practice for Liquid Penetrant Inspection Method.
- 14. AWS, D1.1, Structural Welding Code.

1.3 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
 - 1. Shop drawings
 - a. Shop drawings showing dimensions and details of each type of pipe, joint fittings, fitting specials, valves, and appurtenances.
 - b. Joint and fitting wall construction details which indicate the type and thickness of cylinder; the position, type, size, and area of reinforcement; manufacturing tolerances; and all other pertinent information required for the manufacture of the product.
 - c. Joint details shall be submitted where deep bell or butt strap joints are required for control of temperature stresses.
 - d. Fittings and specials details such as elbows, reducers, wyes, tees, crosses, outlets, connections and test bulkheads, and nozzles or other specials where shown which indicate amount and position of all reinforcement. All fittings and specials shall be properly reinforced to withstand the internal pressure, both circumferential and longitudinal, and the external loading conditions as indicated in the Contract Documents.
 - e. Material lists and steel reinforcement schedules which include and describe all materials to be utilized.
 - f. Full and complete information regarding location, type, size, and extent of all welds shall be shown on the shop drawings. The shop drawings shall distinguish between shop and field welds.
 - g. Shop drawings shall indicate by welding symbols or sketches the details of the welded joints, and the preparation of parent metal required to make them.
 - 2. Design Calculations
 - a. Calculations supporting selected wall thickness.
 - b. Calculations supporting welded joint design.
- B. Certificates
 - 1. Certificate of compliance stating that all pipe and fittings furnished under this Section comply with ANSI B 36.10 and ASTM A 53, as applicable.
 - 2. Certificate of compliance stating that all pipe, special fittings, and other products and materials furnished under this Section comply with AWWA C200 and C205, as applicable.
 - 3. Submit all shop welding procedure specifications, including welder/welding operator qualifications, fabricator welding inspection qualifications, and welding documentation procedure specifications.

C. Test Reports

1. The CONTRACTOR shall furnish certified reports of the following tests:
 - a. Physical and chemical properties of all steel.
 - b. Hydrostatic test reports.
 - c. Results of production weld tests.
 - d. Upon request by the PWD, mill test reports on each heat from which steel is rolled will be submitted.

1.4 INSPECTION

A. Factory Inspection

1. All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of AWWA C200 and C205, respectively, as applicable, as supplemented by the requirements herein.
2. The CONTRACTOR shall notify the PWD in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.

1.5 WELDING

- A. All welding procedures used to fabricate pipe shall be pre-qualified under the provisions of AWS D1.1.
- B. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.
- C. All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used.
- D. Welders shall be qualified under the provisions of AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests.
- E. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

1.6 TESTING

- A. Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of AWWA C200 and C205, as applicable.
 1. Shop Testing of Steel Pipe Specials

- a. Upon completion of welding, but before lining and coating, each special shall be bulk headed and tested under a hydro-static pressure in accordance with section 15042.
 - b. No outside coating shall be applied over a seam prior to testing; however, mortar lining may be applied over a seam prior to hydrostatic testing, but under such conditions said pressure test shall be held on the pipe or fitting for a period of not less than 30 minutes.
2. Shop Testing of Steel Pipe
- a. After the joint configuration is completed and prior to lining with cement-mortar, each length of pipe of each diameter and pressure class shall be shop-tested and certified to a pressure of at least 80 percent of the yield strength of the pipe steel.
 - b. Production weld tests shall be conducted in compliance with AWWA C200. In addition to the frequency of tests required in AWWA C200, weld tests shall be conducted on pipe if there is a change in the welding procedure or welding equipment.
- B. The CONTRACTOR shall perform said material tests at no additional cost to the PWD. The PWD shall have the right to witness all testing conducted by the CONTRACTOR.
- C. In addition to those tests specifically required, the PWD may request additional samples of any material including mixed concrete and lining and coating samples for testing by PWD. The additional samples shall be furnished at no additional cost to the PWD.
- D. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Steel pipe shall be ASTM A 53 for piping 4-inch diameter and smaller and per AWWA C200 for piping 6-inch diameter and larger. Thickness class shall be as shown on the piping schedule in Section 2.10 herein.
- B. Material, manufacturing operations, testing and inspection of pipe shall be in conformance with applicable portions of ASTM A53 and AWWA C200.
- C. Mortar lined and coated steel pipe shall conform to AWWA C200 and C205, subject to the following supplemental requirements.
- D. Specials are defined as fittings, closure pieces, bends, reducers, wyes, tees, crosses, outlets, manifolds, and other steel plate specials, wherever located, and all in structures.

- E. Flanges shall conform to AWWA C207, Class D, or ANSI B16.5 150-lb class, as shown on drawings. 300-lb flanges shall conform to AWWA C207, Class F, or ANSI B16.5, 250-lb class, as shown on drawings. Flanges shall have flat faces with full face gaskets. Pipe flanges shall be attached with bolt holes straddling the vertical axis of the pipe.
- F. Dimensions of fabricated steel pipe fittings shall comply with AWWA C208.
- G. The pipe shall be of the diameter shown, furnished complete with welded joints, as indicated in the Contract Documents. All welded joints shall be single welds on the outside of the pipe.
- H. The inside diameter after lining shall not be less than the nominal diameter specified or shown.
- I. The pipe lining shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing and roughness.
- J. Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing shown on the Drawings.
- K. The CONTRACTOR shall be fully liable for the cost of replacement or repair of pipe and specials which are damaged during storage, loading, transport and off-loading.
- L. The CONTRACTOR shall legibly mark all pipes on both the inside and the outside and specials in accordance with the laying schedule and marking diagram. Each pipe shall be numbered in sequence and said number shall appear on the laying schedule and marking diagram in its proper location for installation.
- M. All special pipe sections and fittings shall be marked at each end indicating the top. The word "top" shall be painted or marked on the outside top spigot end of each pipe section.

2.2 STRUTTING

- A. Adequate strutting shall be provided on all specials, fittings, and straight pipe so as to avoid damage to the pipe and fittings during handling, storage, and hauling. In addition, the following requirements shall apply:
 - 1. The strutting shall be placed as soon as practicable after the mortar lining has been applied and shall remain in place while the pipe is loaded, transported, and unloaded.

2. The strutting materials, size, and spacing shall be adequate to support the earth backfill plus any greater loads which may be imposed when installed, including compaction equipment loads. Struts shall be accomplished with a minimum of a vertical strut set 3.5 feet from each end and at intervals not exceeding 15 feet.
3. Any pipe damaged during handling, hauling, storage, or unloading due to improper strutting shall be repaired or replaced.
4. The details of the strutting assembly shall be submitted for review by the CONTRACTOR prior to the start of pipe manufacture.

2.3 PIPE DESIGN CRITERIA

A. General

1. The pipe shall be steel pipe, mortar-lined and mortar-coated, with single field welded joints. The pipe shall consist of a steel cylinder, shop-lined with Portland cement-mortar with an exterior coating of cement mortar as noted herein.
2. The pipe shall be designed, manufactured, tested, inspected, and marked according to applicable requirements of AWWA C200 except as hereinafter modified.
3. The pipe shall be of the diameter and thickness indicated in the piping schedule.
4. Maximum pipe lengths for laying shall be 40 feet with shorter lengths provided as required.

2.4 DESIGN SPECIALS

- A. Except as otherwise provided herein, materials, fabrication and shop testing of straight pipe shall conform to the requirements of AWWA C200. Dimensions for fittings shall conform to AWWA C208. The minimum thickness of plate for pipe from which specials are to be fabricated shall be the greater of that determined by the following two formulas:

$$a. \quad T = \frac{P_w D/2}{Y/S_w}$$

$$b. \quad T = \frac{P_t D/2}{Y/S_t}$$

Where:

T = Steel cylinder thickness, inches

D = Outside diameter of steel cylinder, inches

P_w = Design working pressure, psi

P_t = Design transient pressure, psi

Y = Specified minimum yield point of steel, psi

S_w = Safety factor of 2.0 at design working pressure

S_t = Safety factor of 1.5 at design transient pressure

- B. In no case shall the design stress at design working pressure (Y/S_w) for mortar-coated steel pipe exceed 16,500 psi or 22,000 psi at design transient pressure (Y/S_t), nor shall plate thickness be less than the thickness of adjacent mainline pipe or the following:

<u>Nominal Pipe Diameter (in.)</u>	<u>Pipe Manifolds Piping Above Ground Piping in Structures</u>	<u>Elbows Bends Reducers</u>
24 and Under	3/16-inch	3/16-inch
25 to 48	1/4-inch	1/4-inch
Over 48	5/16-inch	5/16-inch

- C. Pipe installed on saddle supports shall be designed to limit the longitudinal bending stress to a maximum of 10,000 psi. Design shall be in accordance with the provisions of Chapter 7 of AWWA M-11.

2.5 MATERIALS

- A. Pipe manufactured under AWWA C200 shall be fabricated from sheet conforming to the requirements of Table 1 in Section 2. All longitudinal and girth seams, whether straight or spiral, shall be butt welded using an approved electric-fusion-weld process.
- B. All steel used for the fabrication of pipe shall have a maximum carbon content of 0.25 percent, a maximum sulfur content of 0.015 percent, and shall have a minimum elongation of 22 percent in a 2-inch gauge length.
- C. All steel used in fabricating pipe shall be tested for notch toughness using the Charpy V-Notch test in accordance with ASTM A370. The steel shall withstand a minimum impact of 25 ft. lb. at a temperature of 30 degrees F.
- D. Steel shall be fine-grained, fully kilned and manufactured by the continuous casting process.
- E. Cement for mortar shall conform to the requirements of AWWA C205; provided, that cement for mortar lining shall be Type II and mortar lining shall be Type II. Fly ash or pozzolan shall not be used as a cement replacement.

2.6 JOINT DESIGN

A. GENERAL

1. The standard field joint for steel pipe shall be a single-welded lap joint. Joints shall be provided with taps for air testing.
2. Mechanically coupled, sleeve coupled, and flanged joints shall be required where shown.
3. Butt-strap joints shall be used only where required for closures or where shown.
4. The joints furnished shall have the same or higher pressure rating as the abutting pipe.
5. Shop-applied interior linings and exterior coatings shall be held back from the ends of the pipe as indicated or as otherwise acceptable to the PWD.
6. All joints shall be restrained joints and shall be field-welded on the inside. Designs shall include considerations of stresses induced in the steel cylinder, the joint rings, and any field welds, caused by thrust at bulkheads, bends, reducers, and line valves resulting from the design working pressure. All joints to be field welded for thrust restraint shall have the joint rings attached to the cylinder with double fillet welds.

2.7 CEMENT MORTAR LINING OF PIPE

A. General

1. Except as otherwise required, interior surfaces of all steel pipe, fittings, and specials shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with AWWA C205.
 2. The progress of the application of mortar lining shall be regulated in order that all hand work, including the repair of defective areas is cured in accordance with the provisions of AWWA C205.
 3. During the lining operation and thereafter, the pipe shall be maintained in a round condition by suitable bracing or strutting.
 4. The lining machines shall be of a type that has been used successfully for similar work.
 5. If lining is damaged or found faulty at delivery site, the damaged or unsatisfactory portions shall be replaced with lining conforming to these Specifications at no additional cost to the PWD.
- B. The minimum lining thickness shall be 3/4-inches for all pipe diameters.
- C. The pipe shall be left bare where field joints occur as indicated. Ends of the linings shall be left square and uniform. Feathered or uneven edges will not be permitted.
- D. Defective linings, as determined by the PWD, shall be removed from the pipe wall and shall be replaced to the full thickness required. Defective linings shall be cut back to a square shoulder in order to avoid feathered edged joints.

- E. Cement-mortar for patching shall be the same materials as the mortar for machine lining, except that a finer grading of sand and mortar richer in cement shall be used when field inspection indicates that such mix will improve the finished lining of the pipe.
- F. For all pipe and fittings with plant-applied cement-mortar linings, the CONTRACTOR shall provide a polyethylene or other suitable bulkhead on the ends of the pipe and on all special openings to prevent drying out of the lining. All bulkheads shall be substantial enough to remain intact during shipping and storage until the pipe is installed.

2.8 CEMENT MORTAR COATING OF PIPE

- A. The exterior surfaces of pipe which will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of rust-inhibitive primer (8 mils).
- B. All pipe for buried service shall be coated with a 1-1/2-inch minimum thickness of reinforced cement-mortar coating.
 - 1. Unless otherwise indicated, exterior surfaces of pipe or fittings passing through structure walls shall be cement-mortar coated from the center of the wall or from the wall flange to the end of the underground portion of pipe or fitting.
 - 2. Unless otherwise specified, the reinforcement for the coating of pipe sections may be spiral wire, wire fabric, or wire mesh in accordance with AWWA C205.
 - 3. The welded wire fabric shall be securely fastened to the pipe with welded clips or strips of steel.
 - 4. The wire spaced 2 inches on centers shall extend circumferentially around the pipe. The ends of reinforcement strips shall be lapped 4 inches and the free ends tied or looped to assure continuity of the reinforcement.

2.9 FABRICATION OF SPECIALS

- A. General
 - 1. Specials and fittings shall conform to dimensions stipulated in AWWA C208.
 - 2. Reinforcement for wyes, tees, outlets, and nozzles shall be designed in accordance with AWWA Manual M-11. Reinforcement shall be designed appropriately for pressure class 150 or 300.
 - 3. Specials and fittings shall be equal in pressure design strength and shall have the same lining and coating as the adjoining pipe.
 - 4. Unless otherwise specified, the minimum radius of elbows shall be 2.5 times the pipe diameter and the maximum miter angle on each section of the elbow shall not exceed 11-1/4 degrees.
- B. Fittings may be fabricated from pipe that has been mechanically lined or coated.
- C. Not Used.

- D. Outlets 12-inch and smaller may be fabricated from Schedule 40 or heavier steel pipe in the standard outside diameters, i.e. 12-3/4 inch, 10-3/4 inch, 8-5/8 inch, 6-5/8 inch, and 4-1/2 inch. The CONTRACTOR shall provide for an additional eight (8) 4-inch pipe connections in the lump sum bid amount. These connections will be located by the PWD on the CONTRACTOR's shop drawings, to facilitate the CONTRACTOR's testing and disinfections operations.
- E. The design of outlet reinforcement shall be in accordance with the procedures given in Chapter 12 of AWWA Manual M-11, except that the design pressure, P , used in the M-11 procedure shall equal the greater of $1.25 P_w$ or $0.9376 P_t$. Unless otherwise indicated, outlets 2 inches in diameter and smaller need not be reinforced.
- F. In lieu of saddle or wrapper reinforcement as required by the design procedure in Manual M-11, pipe or specials with outlets may be fabricated in their entirety of steel plate having a thickness equal to the sum of the pipe wall plus the required reinforcement.
- G. Steel welding fittings shall conform to ASTM A234.
- H. Lining
 - 1. All requirements pertaining to thickness, application and during of lining indicated for straight pipe shall apply to specials, with the following proviso. If the special cannot be lined centrifugally, it shall be lined by hand. In such case, the lining shall be reinforced with 2-in by 4-in No. 12 welded wire fabric positioned approximately in the center of the lining. The wires spaced 2-in on centers shall extend circumferentially around the pipe with the fabric securely fastened to the pipe. Splices shall be lapped 4 inches and the free ends tied or looped to assure continuity.
 - 2. Outlets smaller than 4 inches in diameter shall be lined with liquid epoxy conforming to AWWA C210. Material shall be approved for domestic water use by the National Sanitation Foundation (NSF). Lining shall be applied in two equal coats of 8 mils, with a total dry film thickness of 16 mils minimum.
- I. Coating
 - 1. All requirements pertaining to thickness, application and curing of coating for straight pipe shall apply to specials. Unless otherwise indicated, the coating on the buried portion of a pipe passing through a structure wall shall extend to the center of the wall or the wall flange, if one is indicated.
- J. Specials and fittings that cannot be mechanically lined and coated shall be lined and coated by hand-application, using the same materials as are used for the pipe and in accordance with applicable AWWA C602 Standards. Coating and lining applied in this manner shall provide protection equal to that indicated for the pipe.

- K. Areas of lining that have been damaged by such fabrication shall be repaired by hand-applications in accordance with applicable AWWA C602 Standards.
- L. Flanges and blind flanges shall conform either to AWWA C207 class D, or ANSI B16.5 150-1b class for class 150 and to AWWA C207 class F, or ANSI B16.2 250 lb class for class 300 flanges. Flanges shall have flat faces with full face gaskets. Pipe flanges shall be attached with bolt holes straddling the vertical axis of the pipe unless applicable requirements of the above-referenced AWWA Standard C207.
- M. Ends for Mechanical-Type Couplings
 - 1. Except as otherwise required, where mechanical-type couplings are indicated, the ends of pipe shall be banded with Type C collared ends using double fillet welds. Where pipe 12-inch and smaller is furnished in standard schedule thicknesses, and where the wall thickness equals or exceeds the coupling manufacturer's minimum wall thickness, the pipe ends may be grooved.
- N. Flanges of wall fittings, except those on which sluice gates are to be mounted, shall be faced, drilled and tapped to receive stud bolts. Drilling shall conform to ANSI B16.1, Class 125. The flanges of all wall fittings on which sluice gates are to be mounted shall be stress relieved after fabrication and prior to final machining. The manufacturer shall furnish certification that the stress relieving was performed. Flanges of wall fittings which are connected to sluice gates shall be faced, drilled and tapped in accordance with the sluice gate manufacturer's recommendations.

2.10 SPECIAL COATING

- A. As shown on the construction plans, the pipeline shall receive a three-layer tape wrap coating on the pipe surface prior to the application of the cement mortar coating in accordance with AWWA C214, "Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines". The tape wrap coating shall be "Holiday" tested by the manufacture and be free of holes and voids. After the tape wrap coating has passed the "Holiday" testing, the pipe shall receive a coating of cement mortar in accordance with AWWA C205, "Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 in. and Larger – Shop Applied".

2.11 PIPING SCHEDULE

<u>PIPE DIA</u>	<u>CLASS</u>	<u>THICKNESS</u>
24"	350	0.1325" (5/16")
24"	300	0.1325" (5/16")
24"	200	0.1325" (5/16")

<u>PIPE DIA</u>	<u>CLASS</u>	<u>THICKNESS</u>
24"	150	0.1875" (3/16")
10"	300	0.125" (1/8")

<u>PIPE DIA</u>	<u>CLASS</u>	<u>THICKNESS</u>
12"	300	0.1875" (3/16")
12"	200	0.125" (1/8")
12"	150	0.125" (1/8")

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE

- A. Immediately before placing each section of pipe in final position for jointing, the bedding for the pipe shall be checked for firmness and uniformity of surface.
- B. When the pipe is being laid, it shall be turned and placed where possible, so that any slightly damaged portion will be on top. The damaged area shall be repaired for the protection of any exposed steel.
- C. All damaged areas along the pipe shall be repaired using materials and methods acceptable to the PWD.
- D. Moderate deflections and long radius curves may be made by means of beveled joint rings, by pulling standard joints, by using short lengths of pipe, or a combination of these methods; provided that pulled joints shall not be used in combination with bevels.
- E. The maximum total allowable angle for beveled joints shall be 5 degrees per pipe joint.
- F. The maximum allowable angle for pulled joints shall be in accordance with the manufacturer's recommendations or the angle which results from a 3/4 inch pull out from normal joint closure, whichever is less.
- G. All horizontal deflections or fabricated angles shall fall on the alignment. In locations where underground obstructions may be encountered, the chord produced by deflecting the pipe shall be no further than 6 inches from the alignment indicated.
- H. All vertical deflections shall fall on the alignment and at locations adjacent to underground obstructions, points of minimum earth cover, and pipeline outlets and structures. The pipe angle points shall match the angle points indicated.

- I. For pipe wall thicknesses of 3/8-inch or less, the maximum radial offset (misalignment) for submerged arc and gas metal arc welded pipe shall be 0.1875 times the wall thickness or 1/16-inch, whichever is larger.
- J. For pipe wall thickness greater than 3/8-inch, the maximum radial offset shall be 0.1875 times the wall thickness or 5/32-inch, whichever is smaller.
- K. Bevels shall be provided on the bell ends.
- L. Mitering of the spigot ends will not be permitted.
- M. For pipe 42 inches in diameter and larger, pipe struts shall be left in place until backfilling operations have been completed.
- N. Struts in pipe smaller than 42 inches may be removed immediately after laying, provided, that the deflection of the pipe during and after backfilling does not exceed one (1) percent of the pipe outside diameter. After the backfill has been placed, the struts shall be removed and shall remain property of the CONTRACTOR.
- O. The openings of all pipe and specials where the pipe and specials have been cement-mortar lined in the shop shall be protected with suitable bulkheads to maintain a moist atmosphere and to prevent unauthorized access by persons, animals, water or any undesirable substance. The bulkheads shall be so designed to prevent drying out of the interior of the pipe. The CONTRACTOR shall introduce water into the pipe to keep the mortar moist where moisture has been lost due to damaged bulkheads.

3.2 WELDED JOINTS

- A. General
 - 1. Field welded joints shall be in accordance with AWWA C206. All joints shall be single welded, with taps provided for air testing.
 - 2. Adequate space shall be provided for welding and inspection of exterior welds.
 - 3. During installation of welded steel pipe in either straight alignment or on curves, the pipe shall be laid so that the lap joint clearance, at any point around the circumference of the joint, shall comply with the requirements of AWWA C206.
 - 4. Butt straps, where used or required, shall be a minimum of 6 inches wide, the same thickness as the pipe wall and shall provide for a minimum of 3/4-inch lap at each pipe joint.
 - 5. The pipe ends shall be cut straight on joints where butt straps are used for realignment, adjustment, or deflection, and fillet welds shall be made as indicated.

6. After the pipe and pipe joint are properly positioned in the trench, the length of pipe between joints shall be backfilled to at least 1 foot above the top of the pipe. Care shall be exercised during the initial backfilling to prevent movement of the pipe and to prevent any backfill material from being deposited on the joint.
7. To control temperature stresses, the unbackfilled joint areas of the pipe shall be shaded from the direct rays of the sun by the use of properly supported openings, umbrellas, tarpaulins, or other suitable materials for a minimum period of 2 hours prior to the beginning of the welding operation and until the weld has been completed. Shading materials at the joint area shall not rest directly on the pipe but shall be supported to allow air circulation around the pipe. Shading of the pipe joints need not be performed when the ambient air temperature is below 45 degrees F.
8. Prior to the beginning of the welding procedure, any tack welds used to position the pipe during laying shall be removed. Any annular space between the faying surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. The weld shall then be made in accordance with AWWA C206. Where more than one pass is required, each pass except the first and final one shall be peened to relieve shrinkage stresses; and all dirt, slag, and flux shall be removed before the succeeding bead is applied.
9. As soon as practicable after welding of each joint, all field-welded joints shall be tested by the liquid penetrant inspection procedure conforming to the requirements of ASTM E165 under Method "B" and "Leak Testing" All defects shall be chipped out, rewelded and retested. Upon retest, the repaired area shall show no leaks or other defects.
10. All welded joints, including butt strap connections, shall be air tested in the presence of the PWD.
11. Following tests of the joint, the exterior joint spaces shall be coated in accordance with these specifications after which backfilling may be completed.

3.4 JOINT COATING AND LINING

- A. The interior and exterior joint recesses shall be thoroughly wiped clean and all water, loose scale, dirt and other foreign material shall be removed from the inside surface of the pipe.
- B. The cement for joint grout and mortar shall be Portland cement acceptable under ASTM C150 and shall be of the same type used for the pipe coating.
- C. After the pipe has been laid and after sufficient backfill has been placed between the joints to hold the pipe securely in place, the outside annular space between pipe sections shall be completely filled with grout formed by the use of polyethylene foam-lined fabric bands. Welded wire fabric will be required over butt splices and any joints wider than 6 inches.

- D. The grout shall be composed of one part cement to not more than 2 parts sand, thoroughly mixed with water to a consistency of thick cream.
- E. The grout space prior to filling shall be flushed with water so that the surface of the joint to be in contact with the grout will be thoroughly moistened when the grout is poured.
- F. The joint shall be filled with grout by pouring from one side only, and shall be rodded with a wire or other flexible rod or vibrated so that the grout completely fills the joint recess by moving down one side of the pipe, around the bottom of the pipe and up the opposite side. Pouring and rodding the grout shall be continued to allow completion of the filling of the entire joint recess in one operation.
- G. Grouting of the outside joint spaces shall be kept as close behind the laying of the pipe as possible except that in no case shall grouting be closer than 3 joints of the pipe being laid.
- H. Grout Bands (Diapers)
 - 1. The grout bands or heavy-duty diapers shall be polyethylene foam-lined fabric with steel strapping of sufficient strength to hold the fresh mortar, resist rodding of the mortar and allow excess water to escape.
 - 2. The foam plastic shall be 100 percent closed cell, chemically inert, insoluble in water and resistant to acids, alkalis and solvents.
 - 3. The fabric backing shall be cut and sewn into 9-inch wide strips with slots for the steel strapping on the outer edges.
 - 4. The polyethylene foam shall be cut into strips 6 inches wide and slit to a thickness of 1/4-inch which will expose a hollow or open cell surface on one side.
 - 5. The foam liner shall be attached to the fabric backing with the open or hollow cells facing toward the pipe.
 - 6. The foam strip shall cover the full interior circumference of the grout band with sufficient length to permit an 8-inch overlap of the foam at or near the top of the pipe joint.
 - 7. Splices to provide continuity of the material will be permitted.
 - 8. The polyethylene foam material shall be protected from direct sunlight.
- I. The polyethylene foam-lined grout band shall be centered over the joint space with approximately equal widths extending over each pipe end and securely attached to the pipe with steel straps. After filling the exterior joint space with cement grout, the flaps shall be closed and overlapped in a manner that fully encloses the grout with polyethylene foam. The grout band shall remain in position on the pipe joint.
- J. Joint Lining

1. After the backfill has been completed to final grade, the interior joint recess shall be filled with mortar of stiff consistency mixed in proportions of one part cement to 2 parts sand.
 2. The mortar shall be tightly packed into the joint recess and troweled flush with the interior surface, and all excess shall be removed.
 3. At no point shall there be an indentation or projection of the mortar exceeding 1/16-inch.
 4. For pipe smaller than 24 inches in diameter, before the spigot is inserted into the bell, the bell shall be daubed with mortar containing one part cement to 2 parts sand. The spigot end then shall be forced to the bottom of the bell and excess mortar on the inside of the joint shall be swabbed out.
- K. The CONTRACTOR shall perform all work in a thorough and workmanlike manner by trained personnel, under the supervision of experienced personnel skilled in machine application of cement-mortar lining to pipelines of size comparable to this work.
- L. Curing of the in-place cement-mortar lining shall be in accordance with AWWA C602.
- M. The CONTRACTOR shall provide additional protective devices as required to ensure that the airtight covers, which maintain a moist condition in the pipeline, are not damaged.
- N. Defective areas encompassing the full diameter of the pipe shall be replaced by machine wherever the length measured along the pipe centerline is greater than 5 feet; otherwise defective areas may be replaced by hand.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15064

PVC PRESSURE DISTRIBUTION PIPE

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of polyvinyl chloride (PVC) distribution pipe.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Trenching, Backfilling, and Compacting:	02223
2.	Jacked Casing:	02315
3.	Concrete:	03300
4.	Painting and Coating:	09900
5.	Chlorination of Domestic water Mains for Disinfection:	15041
6.	Hydrostatic Testing of Pressure Pipe:	15042
7.	Ductile-Iron Pipe and Fittings:	15056
8.	Combination Air Release and Vacuum Relief Assembly:	15089
9.	Manual Valves:	15100
10.	Domestic and Recycled Facilities Identification:	15151

C. Approved Manufacturers

1. J-M Manufacturing
2. Vinyltech
3. Pacific Western
4. Certainteed

D. Application

1. Water distribution mains
2. PVC pipe may be used as a valve can riser.

E. Reference Standard

Conform to AWWA C900, "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inch through 12-inch for Water Distribution", and AWWA C-905, "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14-inch through 48-inch for Water Transmission and Distribution," unless noted otherwise below.

PART 2 - MATERIALS

A. PVC Pipe

1. PVC pipe shall be manufactured in accordance with AWWA C900. The pipe shall have gasket bell end or plain end with elastomeric gasket coupling.
2. Laying lengths shall be 20 feet with the manufacturer's option to supply up to 15% random (minimum length 10 feet).
3. Each pipe length shall be marked showing the nominal pipe size and O.D. base, the AWWA pressure class, and the AWWA specification designation (AWWA C900 or C905). For domestic water application, the seal of the testing agency that verified the suitability of the material for such service shall be included.
4. Pipe for recycled lines shall be marked as detailed in 15151.

B. Fittings

1. Fittings shall be ductile-iron conforming to Section 15056.
2. Bell size shall be for Class 200 cast-iron equivalent PVC pipe, including the rubber-ring retaining groove.
3. All castings shall be marked CI/PVC AWWA C110.

C. Manual Valves

Manual valves shall conform to Section 15100.

D. Rubber Rings

Rubber rings for use in the PVC couplings and fittings shall conform to the requirements of ASTM D 1869.

E. Service Saddles

All service saddles shall be designed for use on C900 OR C905 PVC pipe and in accordance with Section 15057.

F. Lubricants

Lubricant for pipe insertion shall be food grade, and biodegradable.

PART 3 - EXECUTION

A. General

1. The contractor shall install all the pipe, closure sections, fittings, valves, and appurtenances shown including pipe supports, bolts, nuts, gaskets, and jointing materials.
2. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trenches or structure shall be kept tightly closed to prevent the entrance of animals and foreign materials. The contractor shall maintain the inside of the pipe clean, sanitary, and free from foreign materials until its acceptance by the PWD.
3. Where closure sections are required by the contractor's installation operations, the sections shall be installed in accordance with the applicable sections of these specifications.
4. The pipe sections shall be laid in the trench to true alignment and grade in accordance with the drawings. Where the grade is not shown, pipe shall have a cover of 36 inches in paved areas and 48 inches in unpaved areas. The PWD shall approve the pipe grade.
5. Lay pipe on curves at a radius not less than specified by the pipes manufacturer.

B. Installation

1. Trenching, backfilling, and compacting shall be in accordance with Section 02223 and as specified herein.
2. Proper care shall be used to prevent damage in handling, moving, and placing the pipe. Tools and equipment satisfactory to the PWD Representative shall be provided and used by the contractor.

3. The contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source; shall assume full responsibility for any damage due to this cause; and shall pay for and perform the work to restore and replace the pipe to its specified condition and grade if any displacement occurs due to floating.
4. Place and compact a minimum of 4 inches of imported sand for the pipe base per Section 02223.
5. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.
6. Pipe shall be cut by a method recommended in the pipe manufacturer's installation guide, and as approved by the PWD Representative. When pipe is cut and is to be joined to a cast-iron fitting or another piece of pipe the end shall be beveled in the field or place of manufacture to create a beveled end equal in quality to the machined ends of the pipe as furnished by the manufacturer. Such machining shall not result in undercutting the wall thickness and must be approved by the PWD Representative before installation.
7. All connecting parts of pipe, rings, couplings, and castings shall be cleaned before assembly. After bearing has been obtained, couplings shall be assembled in a proper manner (as determined by the PWD Representative). The use of excessive lubricant will not be permitted, and the assembly of the couplings and rings shall be in accordance with the manufacturer's recommendations. The pipe manufacturer shall supply lubricant and rubber rings. All fittings and valves shall have joints that match the type of adjoining pipe.
8. All fittings and valves shall be supported so that the pipe is not subjected to the weight of these appurtenances.
9. Concrete thrust blocks of the size shown on Standard Drawing W-14 and W-15 and as specified herein shall be provided at the location of all cast-iron fittings, valves, fire hydrants, and end of line plugs.
10. Imported sand shall be used for backfill within the pipe zone per Section 02223.
11. Manual valves shall be installed in accordance with Section 15100.
12. Native earth backfill shall be placed and compacted within the trench zone in accordance with Section 02223. All backfill within 24 inches of a valve shall be clean, washed sand.

C. Installations within Jacked Casing

1. Certain portions of the project, such as crossings of some roads, highways, and railroads, may be required to be installed within a jacked casing pipe.
2. The casing size and type shall be in accordance with Section 02315.
3. Work shall not proceed without permission of the PWD Representative.
4. Refer to Standard Drawing W-10 for details.

D. Combination Air and Vacuum Relief Valves

1. Air release valve assemblies and combination air and vacuum valves shall be installed at each high point in the pipeline as shown on the drawings or as specified by the PWD Representative.
2. The tap for the air valves shall be made in a level section of pipe no closer than 18 inches to a bell, coupling, joint, or fitting.
3. Air release valve assemblies shall be installed in accordance with Standard Drawing W-16 and Section 15089.

E. Blow Off Assemblies

1. Either in-line type or the end-of-line type blow off assemblies shall be installed in accordance with the standard drawings at low points and locations noted on the plans and at such additional locations as required by the PWD Representative for removing water or sediment from the pipeline.
2. The assembly shall be installed in a level section of pipe.
3. The tap for blow off in the line shall be no closer than 18 inches to a valve, coupling, joint, or fitting unless it is at the end of the main.
4. Blow offs shall not be connected to any sewer, submerged in any stream, or installed in any manner that will permit back siphoning into the distribution system.
5. Blow offs shall be installed in accordance with Standard Drawing W-11 and the applicable sections of these specifications.

F. Pipe Identification

Warning and locator tape shall be installed on all on-site recycled water pipelines and domestic water piping installed within the limits of a recycled water irrigation system. The pipe identification shall be in accordance with Section 15151.

G. Locator Wire

A bare 14-gauge solid copper wire shall be placed continuously on the top center of the pipe. The wire shall not be spliced at any point, and shall be continuous from riser to riser. The wire shall be brought to the surface at valve locations and shall be accessible by removing the valve can cover. The wire shall be brought up the outside of the valve well and folded over between the inside of the valve can and the valve well. The wire shall be brought to within 6 inches of finish grade. The wire will include 4 feet of slack. The wire shall also be tapped in place by means of a plastic adhesive tape, placed at 10-foot intervals.

H. Thrust Blocks

1. Thrust blocks shall be constructed where shown on the drawings, or where directed by the PWD Representative and as specified herein. In general, thrust blocks will be placed at all angles greater than 5 degrees, at changes in pipe size, at fittings, at hydrant ells, and at valves.
2. The area and design of the bearing surface shall be per Standard Drawing W-14 and W-15.
3. The bearing surface shall be against undisturbed ground in all cases, except where unstable conditions are encountered. In unstable conditions, the bearing surface shall be as directed by the PWD Representative.
4. Unless otherwise directed by the PWD Representative, the blocking shall be placed so that the pipe and fitting joints are accessible for repair.
5. Metal harness of tie rods and pipe clamps shall be used to prevent movement if shown on the plans or directed by the PWD Representative.
6. Exposed ferrous rods and clamps shall be coated with bituminous mastic per Section 09900.
7. Reinforcing steel tie-down rods shall be used on all line valves.
8. The depth of thrust blocks below valves shall conform to the size of the valve and shall be cut into the side of the trench a minimum of 12-inches on each side.

9. Concrete for thrust blocks shall be class B concrete per Section 03300.
10. Mechanical restraint systems may be used only with prior PWD approval. Such systems shall be coated with 30-mils dry film thickness of shop applied polyurethane coating. Materials and bolts shall be stainless steel in accordance with Sections 09900, and 15056.

I. Slope Protection

1. Slope protection shall be installed where shown on the plans in accordance with Section 03300, wherever the profile of the ground surface above the pipeline exceeds 20% and where no pavement or other surfacing is to be laid over the facility.
2. The installation of the slope protection shall be considered a part of the work, and the contractor shall include the expense in the contract cost.
3. A 2-sack cement slurry encasement may be used as directed by the PWD Representative. The encasement shall extend to within 1-foot of the ground surface and to within 1-foot of the toe of slope in which the pipe is constructed.

J. Chlorination

All pipelines shall successfully be chlorinated in accordance with Section 15041 prior to connection to the existing distribution system.

K. Hydrostatic Testing

All pipelines shall pass a hydrostatic pressure test in accordance with Section 15042.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15072

ASBESTOS CEMENT DISTRIBUTION PIPE (6 Inch through 16 Inch)

PART 1 - GENERAL

A. Description

This section includes the materials, installation and testing of asbestos cement distribution pipe.

B. Related Work Described Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Trenching, Backfilling, and Compacting:	02223
2.	Jacked Casing:	02315
3.	Concrete:	03300
4.	Painting and Coating:	09900
5.	Chlorination of Domestic water Mains for Disinfection:	15041
6.	Hydrostatic Testing of Pressure Pipe:	15042
7.	Ductile Iron Pipe and Fittings:	15056
8.	PVC Pressure Distribution Pipe:	15064
9.	Combination Air Release and Vacuum Relief Valve Assembly:	15089
10.	Manual Valves:	15100
11.	Domestic and Recycled water Facilities Identification:	15151

C. Referenced Standards

1. AWWA C400 "Asbestos-Cement Transmission Pipe 6 in. through 16 in. for Water and Other Liquids."
2. AWWA C401, "The Selection of Asbestos Cement Distribution Pipe, 6 in. through 16 in. for water and other liquids."

D. Approved Manufacturers

1. Asbestos Cement Pipe
 - a. Certainteed
 - b. Capco

2. Asbestos Cement Pipe Closure Systems
 - a. J.M. Tuff-Link MOA
 - b. Certainteed Closure Couplings and Lengths
 - c. Capco Closure Couplings and Lengths

3. Asbestos Cement Pipe To Iron Pipe Transition Pieces
 - a. Capco ACP to IP transition pieces

PART 2 - MATERIALS

A. Asbestos Cement Pipe

1. ACP shall be of Class 150 or 200 as required. The pipe and couplings, shall comply with the latest edition of the following standards:

AWWA C400 Pipe and Coupling Mfg.
ASTM C296 Pipe and Coupling Mfg.
ASTM C500 Pipe and Coupling Mfg.

2. Pipe shall be hydrostatically tested at the factory to 525 psi for Class 150 and 700 psi for Class 200 and will be so marked on each major length.

3. Acceptable ACP shall have common profiles for interchangeability between rough-barrel dimensions, machined pipe ends, couplings, and rubber rings so as to facilitate future repairs. Pipe ends shall be step machined to provide automatic end separation without the use of mechanical spacers. When assembled, the pipe will have only two rubber rings per coupling.

4. The manufacturer of each shipment of pipe may be required to supply a statement certifying that each length of pipe has been subjected to the tests specified for ACP, and has been found to meet all the requirements of the aforementioned AWWA standard and as specified herein. The certification shall be filed with the PWD Representative before unloading the pipe material at the job site, and the manufacture shall mark all pipe to indicate that it has been subjected to and meets the certification requirements.

5. The pipe and couplings shall be carefully inspected for defects. Any length of pipe, couplings, sleeve, or rubber ring found to be defective in quality or material, or so damaged as to make repair and use impossible, shall be rejected and removed from the job site work the day the defect is discovered. In the event that a portion of a length of pipe is damaged, the damaged portion shall be cut off in an approved manner and discarded, and the remaining sound portions may be used after properly milling the pipe end. The contractor shall be responsible for any and all damage to materials, and shall pay the expense of repairing or replacing materials.
6. For 6 inches and larger, the standard length shall be 13 feet. Random lengths will not be allowed. Provide 6-1/2, 3-1/4, and 1-5/8 foot sections as required for closure sections and as shown on the plans.
7. Where the pressure class is not shown on the plans, all pipe shall be a minimum of Class 150 or as specified by the PWD Representative.

B. Fittings

1. Ductile-iron fittings shall conform to Section 15056.
2. All ring-gasketed fittings shall have ring grooves that conform to the same dimensions and tolerances that the manufacturer of the pipe specifies for asbestos-cement couplings. Each groove shall be gauged for tolerance before arriving at the construction site.

C. Rubber Rings

Rubber rings for use in the ACP couplings and fittings shall conform to the requirements of ASTM D 1869.

D. ACP Closure systems

1. PVC MOA
 - a. PVC MOA's shall conform to Section 15064 except as modified herein.
 - b. The outside diameter of PVC MOA's shall be the same as that of an ACP machined section. This dimension shall conform to AWWA C400. Table A1, dimension D2. Wall thickness shall conform to DR-18 for Class 150 and DR-14 for Class 200.
2. ACP Closure Couplings and Lengths

- a. ACP Closure Couplings and Lengths shall conform with all requirements of this specification.

E. Lubricants

Lubricant for pipe insertion shall be food grade, and biodegradable.

PART 3 - EXECUTION

A. General

1. The contractor shall install all the pipe, closure sections, fittings, valves, and appurtenances shown including pipe supports, bolts, Teflon coated nuts, gaskets, and jointing materials.
2. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trenches or structure shall be kept tightly closed to prevent the entrance of animals and foreign materials. The contractor shall maintain the inside of the pipe clean, sanitary, and free from foreign materials until its acceptance by the PWD.
3. Where closure sections are required by the contractor's installation operations, the sections shall be installed in accordance with the applicable sections of these specifications. Field cutting of AC pipe for closure sections will not be permitted.
4. The pipe sections shall be laid in the trench to true alignment and grade in accordance with the drawings. Where the grade is not shown, pipe shall have a cover of 42 inches in paved areas and 48 inches in unpaved areas. The PWD shall approve the pipe grade.
5. The pipe shall not be laid along curves at a radius less than that listed as described below:

The minimum-radius curves are determined by the limit of 2-degree deflection for asbestos-cement pipe joints with factory-assembled bell couplings:

<u>Length of Pipe Section</u>	<u>Minimum Curve Radius</u>
13.0 feet	370 feet
6.5 feet	185 feet

For curves of smaller radius, use ductile-iron fittings.

B. Installation

1. Trenching, backfilling, and compacting shall be in accordance with Section 02223 and as specified herein.
2. Proper care shall be used to prevent damage in handling, moving, and placing the pipe. Tools and equipment satisfactory to the PWD Representative shall be provided and used by the contractor. All pipe, fittings, valves, and other pipeline materials shall be lowered into the trench in a manner that prevents damage, and the pipe shall not be dropped, dragged, or handled in a manner that will cause bruises, cracks, or other damage. Rubber rings for pipe joints shall be stored and protected in a proper manner (as determined by the PWD Representative) to prevent deterioration.
3. The contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source; shall assume full responsibility for any damage due to this cause; and shall, at his own expense, restore and replace the pipe to its specified condition and if before any displacement occurs due to floating.
4. Bearing shall be obtained by placing mounds of imported sand near the ends of the pipe. These mounds shall extend across the trench; shall be at least 6 inches wide; and shall be high enough to ensure, after compaction, a clearance of at least 4 inches beneath the bottom of the pipe along its entire length. The mounds shall bring the pipe to true line and grade as shown on the plan and profile. The entire length of the pipe shall be bedded with imported sand and tamped well under and around the pipe at optimum moisture content.
5. Provide short pipe lengths and place a pipe joint within 3-1/4 feet of fittings, valves, encasement, vaults, and other structures to permit relative movement without cracking the pipe.
6. Pipe shall be cut with a special cutting tool specifically designed to minimize the creation of asbestos dust; as manufactured by the Pilot Manufacturing Company or equal, as approved by the PWD Representative. When pipe is cut and is to be joined to a cast-iron fitting, the end shall be machined in the place of manufacture to create a machined end equal in quality to the machined ends of the pipe as furnished by the manufacturer. Such machining shall not result in undercutting the wall thickness and must be approved by the PWD Representative before installation. Pipe cutting and machining will be permitted only when repairing or joining existing ACP, as determined by the PWD Representative. All work shall be in accordance with OSHA procedures.

7. All connecting parts of pipe, rings, couplings, and castings shall be clean before assembly. After bearing has been obtained, couplings shall be assembled in a proper manner (as determined by the PWD Representative). The use of excessive lubricant will not be permitted, and the assembly of the couplings and rings shall be in accordance with the manufacturer's recommendations. The pipe manufacturer shall supply lubricant and rubber rings. All fittings and valves shall have joints that match the type of adjoining pipe.
8. All fittings and valves shall be supported so that the pipe is not subjected to the weight of these appurtenances.
9. Concrete thrust blocks of the size shown on Standard Drawings W-13, W-14, W-15, & W-18, and as specified herein shall be provided at the locations of all cast-iron fittings, valves, fire hydrants, and end of line plugs.
10. Imported sand shall be used for backfill within the pipe zone per Section 02223.
11. Manual valves shall be installed in accordance with Section 15100.
12. Closures in A. C. Piping shall be made using an approved ACP closure system. A PVC MOA closure section shall NOT be inserted into a fitting or valve. The exterior surface of a PVC MOA shall not be roughened.
13. The contractor shall remove all broken or excess pipe from the job site in accordance with proper disposal procedures.

C. Installation within Jacked Casing

1. Certain portions of the project, such as crossings of some roads, highways, and railroads, may require installation within a jacked casing pipe.
2. The casing size and type shall be in accordance with Section 02315.
3. The method of casing spacer attachment, placement of casing, installation of pipe inside casing, closure of casing, and other work items shall be per Section 02315.
4. Work shall not proceed without permission of the PWD Representative.
5. Refer to Standard Drawing W-10.

D. Combination Air and Vacuum Release Valves

1. Air release valve assemblies and combination air and vacuum valves shall be installed at each point in the pipeline as shown on the drawings or as specified by the PWD Representative.
2. The tap for the air valves shall be made in a level section of pipe no closer than 18 inches to a bell, coupling, joint, or fitting. No tap shall be permitted in any machined section of ACP.
3. Valves shall be installed in accordance with Standard Drawing W-16 and Section 15089.

E. Blow Off Assemblies

1. Either in-line type or the end-of-line type blow off assemblies shall be installed in accordance with the standard drawings at locations noted on the plans and at such additional locations as required by the PWD Representative for removing water or sediment from the pipeline.
2. The assembly shall be installed in a level section of pipe.
3. The tap for blow off in the line shall be no closer than 18 inches to a valve, coupling, joint, or fitting unless it is at the end of the main. No tap will be permitted in any machined section of ACP.
4. Blow offs shall be installed in accordance with Standard Drawing W-11 and the applicable sections of these specifications.
5. Blow offs shall not be connected to any sewer, submerged in any stream, or installed in any manner that will permit back siphoning into the distribution system.

F. Pipe Identification

Warning and locator tape shall be installed on all recycled water pipelines and on-site domestic water piping. The pipe identification shall be in accordance with Section 15151.

G. Locator Wire

A bare 14-gauge solid copper wire shall be placed continuously on the top center of the pipe. The wire shall not be spliced at any point, and shall be continuous from riser to riser. The wire shall be brought to the surface at valve locations and shall be accessible by removing the valve can cover. The wire shall be brought up the outside of the valve well and folded over between the inside of the valve can

and the valve well. The wire shall be brought to within 6 inches of finish grade. The wire will include 4 feet of slack. The wire shall also be tapped in place by means of a plastic adhesive tape, placed at 10-foot intervals.

G. Thrust Blocks

1. Thrust blocks shall be constructed where shown on the drawings and as specified in the manufacturer's Instruction Manual or where directed by the PWD Representative and as specified herein. In general, thrust blocks will be placed at all angles greater than 5 degrees, at changes in pipe size, at fittings, at hydrant ells, and at valves.
2. The area and design of the bearing surface shall be per Standard Drawings W-14 and W-15.
3. The bearing surface shall be against undisturbed ground in all cases, except where unstable conditions are encountered. In unstable conditions, ACP shall not be used. Fully restrained pipe will be used.
4. Unless otherwise directed by the PWD Representative, the backing shall be placed so that the pipe and fitting joints are accessible for repair.
5. Metal harness of tie rods and pipe clamps shall be used to prevent movement if shown on the plans or directed by the PWD Representative.
6. Exposed non-steel rods and clamps shall be coated with bituminous mastic per Section 09900.
7. Reinforcing steel tie down rods shall be used on all in-line valves.
8. The depth of thrust blocks below valves shall conform to the size of the valve and shall be cut into the side of the trench a minimum of 12 inches on each side.
9. Concrete for thrust blocks shall be Class "B" per Section 03300.

H. Locator Wire

1. A bare 14-gauge solid copper wire shall be placed continuously on the top center of the pipe. The wire shall not be spliced at any point, and shall be continuous from riser to riser. The wire shall be brought to the surface at valve locations and shall be accessible by removing the valve can cover.
2. The wire shall be brought up the outside of the valve well and folded over between the inside of the valve can and the valve well. The wire shall be brought to within 6 inches of finish grade. The wire will include 6 feet of slack. The wire shall also

be tapped in place by means of a plastic adhesive tape, placed at 10-foot intervals.

I. Slope Protection

1. Slope protection and ductile pipe shall be installed where shown on the plans or wherever the profile of the ground surface above the pipeline exceeds 20%, and where no pavement or other surfacing is to be laid over the facility.
2. The installation of the slope protection shall be considered a part of the work, and the contractor shall include the expense in the contract cost.
3. A 2-sack cement slurry encasement may be used as directed by the-PWD Representative. The encasement shall extend to within 1-foot of the ground surface and to within 1-foot of the toe of slope in which the pipe is constructed.

J. Chlorination

All pipelines shall be chlorinated successfully in accordance with Section 15041 prior to connection to the existing distribution system.

K. Hydrostatic Testing

All pipelines shall pass a hydrostatic pressure test in accordance with Section 15042.

END OF SECTION

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STANDARD SPECIFICATIONS

SECTION 15089

COMBINATION AIR-RELEASE
AND VACUUM RELIEF VALVE ASSEMBLY

PART 1 - GENERAL

A. Description

This section includes materials and installation of combination air and vacuum valves.

Air release and vacuum relief assemblies to be provide and installed per AWWA C 512, unless noted otherwise in this section.

B. Application

1. Air release and vacuum relief valves shall be installed at high points in continuous lines 10-inches and larger or as shown on the plans.
2. If the profile changes during construction from that shown on the drawings, the air and vacuum release valves shall be installed at the high points in lines as constructed.
3. The installation shall be complete as shown on Standard Drawing W-16.

C. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- | | |
|---|-------|
| 1. Concrete: | 03300 |
| 2. Painting and Coating: | 09900 |
| 3. Hydrostatic Testing of Pressure Pipelines: | 15042 |
| 4. Copper, Brass and Bronze Pipe, Fittings and Appurtenances: | 15057 |
| 5. Manual Valves: | 15100 |

D. Approved Manufacturers

1. APCO Model 143C, and 145C
2. Val-Matic
3. Pipeline Products Company.

E. Air Release Valve Criteria

1. Air release shall be sized to accommodate the release of the maximum amount of entrained air that could be released in the system, as a function of the maximum differential in temperature and pressure which could result in air entrainment, or 2% of the volume of water passing through the system; whichever is greater.

F. Vacuum Relief Criteria

1. The vacuum relief shall be sized to accommodate 200% of the normal flow.

PART 2 - MATERIALS

A. Combination Air and Vacuum Relief

1. Materials of construction for combination air and vacuum relief valves shall be as described below:

<u>Item</u>	<u>Material</u>	<u>Specification</u>
Body and Cover	Cast iron Ductile iron	
Float, Lever, Poppet	Stainless steel	ANSI Type 316 (ASTM A240 or A276)
Seat	Rubber	Buna-N

2. Coat exterior of valves with one coat of primer and two coats of finish paint at the place of manufacture, applied per Section 09900.
3. Coat interior of valves with epoxy at the place of manufacture in accordance with Section 09900.

B. Steel Vented Pipe Vertical Cover

1. The steel vented pipe vertical cover shall be manufactured from 12-gauge steel or approved equal.

C. Service Piping

Water service piping utilized in the installation of the combination air and vacuum relief valve shall be Type K copper with bronze accessories per Section 15057.

D. PVC Pipe

PVC pipe nipple shall be Class C900 or C905 as described in Section 15064, Schedule 80.

PART 3 - EXECUTION

A. Location

1. Air release valve assemblies and combination air and vacuum valves shall be installed at each point in the pipeline as shown on the drawings or as specified by the PWD Representative.
2. The tap for the air valves shall be made in a level section of pipe no closer than 18 inches to a bell, coupling, joint, or fitting.
3. The center of the PVC sleeve shall be, except as otherwise approved by the PWD Representative, located as shown on Standard Drawing W-16 as described below:
 - a. Where concrete curb or asphalt concrete (AC) berm exists or is to be constructed, and the sidewalk is next to the property line; 2 feet 1 inch back of the face of the curb.
 - b. Where 6-foot wide or narrower sidewalk is to be installed or exist next to the curb; 10 inches back of sidewalk edge. Where there is insufficient Public Right-of-Way behind of the sidewalk, an easement will be required.
 - c. Where there is no curb or berm, the location shall be designated by the PWD Representative.

B. Installation

1. Air release assemblies and combination air and vacuum valves shall be installed in accordance with Standard Drawing W-16.
2. The tap and piping shall be installed per Section 15057.

3. The concrete pad and support shall be constructed per Section 03300.
4. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
5. The air and vacuum relief valve and the steel vented pipe cover shall be painted in accordance with Section 09900. The final coat of paint shall be applied immediately prior to the final inspection.
6. A bronze ball valve with handle shall be installed on the copper service line above the concrete slab.
7. A PVC nipple shall be installed between the shutoff valve and the air release valve.

C. Valve Pressure Testing

1. Test valves at the same time that the connecting pipelines are pressure tested. See Section 15042 for pressure testing requirements.
2. Protect or isolate any parts with a pressure rating is less than the test pressure.

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SECTION 15096

WALL PIPES, FLOOR PIPES AND PIPE SLEEVES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all floor pipes, pipe sleeves, wall pipes, other wall pieces, and escutcheons.
- B. Related Sections specified elsewhere:
1. Section 03300, Cast-In-Place Concrete.
 2. Division 15, Sections on Piping and Valves.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
 2. ANSI B16.4, Cast-Iron Threaded Fittings.
 3. AWWA C104 (ANSI A21.4), Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 4. AWWA C110 (ANSI A21.10), Ductile-Iron and Gray-Iron Fittings, 3-in. Through 48-in., for Water and Other Liquids.
 5. AWWA C111 (ANSI A21.11), Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
 6. AWWA C115 (ANSI A21.15), Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges.
 7. AWWA C151 (ANSI A21.51), Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
 8. AWWA C200, Steel Water Pipe 6 Inches and Larger.
 11. ASTM A123, Floor and Wall Sleeves.

1.3 SUBMITTALS

The following shall be submitted in compliance with section 01300.

- A. Shop Drawings: Submit for approval the following:
1. Detailed drawings and data on all wall and floor pipe, and pipe sleeves. Submit and coordinate these with Shop Drawings required for all piping systems.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 15051, Buried Piping Installation, and Section 15052, Exposed Piping Installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wall and Floor Pipes:
 - 1. Material: Same as specified for the piping connected to wall or floor pipe, unless otherwise approved by PWD.
 - 2. End Connections: As shown or approved.
 - 3. Thickness: Same as specified for the piping connected to wall or floor pipe.
 - 4. Collars: Provide collars at mid-point of wall for anchorage and water tightness.
 - 5. Pipes ends shall be flush with wall face unless otherwise shown.
 - 6. Flanged ends and mechanical joint bells shall be drilled and tapped for studs. Provide studs of same material as connected piping except buried studs shall be of Type 316 stainless steel.
 - 7. Length: Wall fittings shall be equal to the thickness of the wall in which they are installed plus the exterior projection required for joint connections.
 - 8. Steel pipe which is cast into walls shall have a collar at mid-point of wall for anchorage and water tightness, as shown or as required.

- B. Pipe Sleeves:
 - 1. Ferrous and Plastic Pipe: Use standard weight galvanized steel pipe unless otherwise shown.
 - 2. Size sleeves to provide annular space required to accommodate mechanical
 - 3. Link-type seals that are used.

- C. Cast Wall Sleeves:
 - 1. Material: Ductile iron furnished with integral wall collar.
 - 2. Dimensions: As required for mechanical joint pipe to pass through sleeve. Length as required.

- D. Mechanical Seals: Provide link-type mechanical seals in pipe sleeves with adjusting bolts suitable for 20 psi working pressure.
 - 1. Type: Mechanical seals through non-fire rated walls:
 - a. Pressure Plate: Glass reinforced nylon plastic.
 - b. Bolts and Nuts: 18-8 stainless steel.
 - c. Sealing Element: EPDM rubber.
 - 2. Type: Mechanical seals through fire-rated walls; two independent mechanical seal assemblies required:
 - a. Pressure Plate: Low carbon steel, galvanized.
 - b. Bolts and Nuts: Low carbon steel, galvanized.
 - c. Sealing Element: Silicone rubber.
 - 3. Product and Manufacturer: Seals shall be as manufactured by:
 - a. Thunderline Corporation.
 - b. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall Pipes: Install as shown and in accordance with approved Shop Drawings.
- B. Pipe Sleeves:
 - 1. Use sleeves wherever pipes pass through walls, partitions, floors, and roofs unless otherwise shown.
 - 2. All sleeves through floor slabs shall extend a minimum of 2 inches above finished floor.
 - 3. Anchor sleeves to concrete and masonry walls as shown or otherwise approved.
 - 4. Sleeves through walls shall be flush with wall face.
 - 5. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.
 - 6. Use link type seals to seal sleeve against hydrostatic pressure. Size Sleeves to provide annular space required to suit link type mechanical seals that are used.
 - 7. Do not install sleeves and pipes through structural members unless specifically shown and approved by PWD.
 - 8. Size sleeves to provide annular space as follows:

<u>Pipe Size</u>	<u>Annular Space Requirement</u>
Less than 2-in.	1/2-in. To 3/4-in.
2-in. To 4-in.	3/4-in. To 1-1/4-in.
6-in. To 12-in.	1-1/4-in. To 2-in.
Over 12-in.	2-in. To 3-in.

9. Seal annular spaces between pipe and sleeve material with non-shrink epoxy grout material.
- C. Install wall and ceiling plates in accordance with the manufacturer's recommendations and the approved Shop Drawings.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15100

MANUAL VALVES

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of manually operated valves and detector check valves.

Manual valves to be supplied and installed per applicable sections of AWWA C500, unless noted other wise below.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Trenching, Backfilling, and Compacting:	02223
2.	Concrete:	03300
3.	Painting and Coating:	09900
4.	Hydrostatic Testing of Pressure Pipelines:	15042
5.	Ductile-Iron Pipe and Fittings:	15056
6.	Domestic and Recycled water Facilities Identification.	15151

C. Approved Manufacturers and Models

1. Gate Valves - Aboveground Smaller Than 3 Inch
Crane 438
Stockham 103
2. Gate Valves - Buried Smaller Than 3 Inch
StockhamG-739, or G-745
Kennedy 597X or 561X
Mueller

3. Gate Valves - 3 Inch and Larger
 Mueller, Series A-2380
 Clow, List 14
 M&H
 Kennedy
4. Butterfly Valves
 Pratt Groundhog
 Keystone
 DeZurik
5. Resilient Wedge Gate Valves: 4 Inch through 12 Inch
 Clow RW F6100
 American Flow Control Series 500
 M & H
 Kennedy
 American AVK Co.
6. Tapping Sleeves
 JCM 432
 Powerseal 3490
 Cascade Waterworks CST-EX
- 2 7. Valve Boxes

Domestic water
 Brooks Products No. 3RT
 Eisel Enterprises Inc., #10-VB

Recycled water
 Brooks Products No. 4 TT
 Eisel Enterprises Inc., #4TT-VB
8. Detector Check Valves

All units must be in the latest edition of the list of approved backflow devices as supplied by the "Foundation for Cross Connection Control and Hydraulic Research" by the U.S.C. school of engineering.

D. Reference Standards

Valves shall conform, as applicable, with the latest editions of the following codes and standards.

AWWA C500 Gate Valves

AWWA C504 Rubber-Seated Butterfly Valves
AWWA C509 Resilient Wedge Gate Valves
ASTM B62 Composition Brass or Ounce Metal

ASTM D 429 Castings
Ductile Iron Castings for Valves
Ductile Iron Pipe Flanges
Tests for Rubber Property - Adhesion
to Rigid Substrates

E. Flanged End

All valves connecting to mains shall be flanged on both sides to allow for the use of test plates during the pressure testing.

F. Single Type of Valve

The developer shall choose an approved valve and then use only that valve throughout the development.

G. Detector Check Assembly

1. Valves for the Detector check assembly are to be part of an integral unit, assembled by the detector check manufacturer.

H. Butterfly Valves

Butterfly valves shall only be used on lines 14 inches and larger or as specifically shown on the plans.

I. Resilient Wedge Valves

Resilient wedge valves shall be used on all pressure class 150 lines 4 inch through 12 inch.

PART 2 - MATERIALS

A. General

1. Valves shall be installed complete with operating hand wheels or levers, extension stems, worm gear operators, operating nuts, and wrenches required for operation.

2. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body or bonnet or shown on a permanently attached plate.
3. Valve body and trim casting shall be of domestic origin.
4. Body bolts for all buried valves shall be 316, or 18-8 stainless steel.

B. Valve Operators

1. Provide lever or wrench operators having adjustable, "position indicator" for exposed valves smaller than 6 inches.
2. Provide 2-inch AWWA operating nuts for buried and submerged valves.
3. Provide gear operators on butterfly valves 6 inches and larger. Gear operators for valves 8 inches through 20 inches shall be of the worm and gear, or of the traveling nut type.
4. Gear operators shall be enclosed, suitable for running in oil with seals provided on shafts to prevent entry of dirt and water into the operator. Gear operators for valves located above ground or in vaults and structures shall have hand wheels.

Minimum hand wheel diameter shall be 12 inches. The operator shall contain a dial indicating the position of the valve disc or plug. Gear operators for buried or submerged valves shall have 2-inch square AWWA operating nuts.

5. For buried or submerged service, provide watertight shaft seals and watertight valve and actuator cover gaskets.

Provide totally enclosed operators designed for buried or submerged service.

6. Traveling nut and worm and gear operators shall be of the totally enclosed design so proportioned as to permit operation of the valve under full operating head with a maximum pull of 80 pounds on the hand wheel or crank. Provide stop limiting devices in the operators in the open and closed positions. Operators shall be of the self-locking type to prevent the disc or plug from creeping. Design operator components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for hand wheel or chain wheel operators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.

7. Operators on buried valves shall produce the required torque on the operating nut with a maximum input of 150 foot-pounds.
8. Valve operators, hand wheels, or levers shall open by turning counterclockwise.

C. Painting and Coating

1. Coat metal valves (except bronze and stainless-steel valves) located above ground or in vaults and structures in accordance with Section 09900. Apply the specified prime coat at the place of manufacture. Apply finish coat in field. Finish coat shall match the color of the adjacent piping. Coat hand wheels the same as the valves.
2. Coat buried metal valves at the place of manufacture per Section 09900.
3. Valves 4 inches and larger shall be 100% powder epoxy fusion bonded coated on their interior metal surfaces excluding seating areas and bronze and stainless-steel pieces in accordance with AWWA C550 and these specifications. The coating materials used must be NSF or UL approved. Sandblast surfaces in accordance with SSPC SP-5 Coat the interior ferrous surfaces using one of the following methods:
 - a. Apply powdered thermosetting epoxy (3M Scotchkote 206N or 134 or equal) per the manufacturer's application recommendations to a thickness of 8 to 10 mils.
 - b. Where, in the Engineer's opinion, because of the nature of the item being coated it would be impossible to use the fusion-bonded powder epoxy method without causing damage to the item, the use of a liquid epoxy, factory applied by the manufacturer of the item being coated, will be permitted. Said liquid epoxy shall be as specified herein.

The use of liquid epoxy other than those specified, including the equipment manufacturer's proprietary coating system, must be reviewed and approved by the Engineer prior to use.

All valve coatings shall be factory applied. Coating applied by the valve distributor will not be permitted.

D. Valves

Aboveground Ball Valves 3 Inches and Smaller

1. Aboveground threaded end ball valves, 1/4 inch through 3 inches, for water service shall be non-rising stem, screwed bonnet, solid wedge disc type having a minimum working pressure of 220 psi.
2. Materials of construction shall be as described below:

<u>Component</u>	<u>Material</u>	<u>Specification</u>
Body	Bronze	ASTM B 62
Bonnet	Bronze	ASTM B 62
Disc	Bronze	ASTM B 62
Stem	Bronze or copper silicon	ASTM B 62, B 99 (Alloy 651), B 584 B 371 (Alloy 694)

3. Stem material shall have a minimum tensile strength of 60,000 psi and minimum yield strength of 30,000 psi.
4. Hand wheels shall be brass.
5. Packing shall be Teflon.

E. Buried Gate Valves Smaller Than 3 Inches

1. Buried gate valves for air or water service shall be iron body, bronze mounted, non-rising stem type, double disc, parallel seat, and shall have a working pressure of at least 200 psi.
2. Valves shall have flanged or threaded ends to match the pipe ends.
3. Valves shall have a 2-inch AWWA operating nut.
4. Materials of construction shall be as described below:

<u>Component</u>	<u>Material</u>	<u>Specification</u>
Body, Bonnet, stuffing Box Operating Nut,	Cast iron or Ductile iron	--
Bonnet Bolts	316 stainless --	
Stuffing Box Bolts	316 stainless --	
Discs, Disc Nut, Disc Ring, Seat Ring	Bronze	ASTM B 62
O-Rings	Synthetic rubber	ASTM D2000
Stem	Copper silicon or manganese bronze	ASTM B 584, Alloys C86200, C86300, C86400, C87500, or C87600

F. Gate Valves 3 Inches and Larger

1. Valves shall conform to AWWA C500 and the following.
2. Gate valves shall be designed for a working pressure of 150 psi or 250 psi as required.
3. Valves shall be ductile iron bodied, solid bronze internal working parts, parallel faced, bottom wedging double-discs, non-rising stem opening to the left, O-Ring seals, and a 2-inch-square operating nut.

4. Materials of construction shall be as described below:

<u>Component</u>	<u>Material</u>	<u>Specification</u>
Body, Bonnet Operating Nut, Stuffing Box	Cast iron or Ductile iron	--
Bonnet Bolts	Stainless steel	Type 316
Stuffing Box Bolts	Stainless steel	Type 316
Interior Parts, Discs	Bronze	ASTM B 62
O-Rings	Synthetic rubber	ASTM D2000

5. Gate valve stems shall be of low zinc content (2%), having a minimum tensile strength of 70,000 psi, a yield strength of 40,000 psi, and 12% elongation in 2 inches. The stem is to be visibly marked so that it meets this requirement.
6. Furnish gate valves with ends as specified on plans or by the PWD Representative.

G. Tapping Valves

1. Tapping valves shall conform with all requirements for gate valves 3 inches and larger and the additional requirements listed herein.
2. All valve ends shall be flanged. The flange on one end shall have slotted boltholes to fit all standard tapping machines.
3. Seat rings shall be oversized to permit the use of full-size cutters.
4. Resilient wedge valves may be used as tapping valves. Provided that the disk fully retracts to produce a full port opening.

H. Tapping Sleeves

1. Tapping sleeves shall be full circle stainless steel.

2. Gaskets shall be Buna-N rubber with a wide cross section.
3. All bolts nuts, and washers shall be Type 316 stainless steel; nuts shall be 316 stainless steel, and Teflon coated, Tripac 2000 or approved equal.

I. Butterfly Valves

1. Butterfly valves shall be short body, conforming to AWWA C504, Class 150. Minimum working differential pressure across the valve disc shall be 150 psi unless specified otherwise on the drawing.
2. Butterfly valves shall be furnished and installed with the type of ends as shown on the plans and as herein specified. Wafer style valves will not be permitted.
3. Each valve body shall be tested under a test pressure equal to twice its design water working pressure.
4. Valves shall be bubble tight at rated pressures and shall be satisfactory for throttling service and frequent operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the full-open position to the tight-shut position.
5. Flanged ends shall be ductile iron, class 250.
6. Valve shafts shall be Type 316 stainless steel with Type 316 stainless-steel journals and static seals. Valve shafts shall be dual stub shafts or a one-piece shaft extending completely through the valve disc.

7. Materials of construction shall be as described below:

<u>Component</u>	<u>Material</u>	<u>Specification</u>
Body	Cast iron or ductile iron	
Exposed Body Capscrews,	316 Stainless steel 316 Stainless steel	
Bolts	316 Stainless steel Teflon coated, Tripac 2000 or approved equal	
Discs	Cast iron ductile iron, or Ni-Resist	

8. The rubber seat shall be an integral part of the valve body. Rubber seats fastened to the disc by any means shall not be permitted.

J. Resilient-Seated Gate Valves

1. Valves shall conform to AWWA C509 and the requirements listed herein.
2. All valves shall be bubble tight at 200 psi working pressure.
3. Valves shall have non-rising low zinc stems, opening by turning left and provided with 2-inch-square operating nut. Outside stem and yolk valves shall be used on backflow device shutoff valves.
4. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.
5. Stuffing boxes shall be O-ring seal type with two rings located in stem.
6. Low friction torque reduction thrust bearings shall be located both above and below the stem collar.

7. Materials of Construction shall be as described below:

<u>Component</u>	<u>Material</u>	<u>Specification</u>
Body, Operating Nut Bonnet, Seal Plate Gate	Cast Iron of Ductile Iron Cast Iron Ductile Iron	ASTM A 126 Class B
Bonnet and Seal Bolts	316 Stainless Steel	
O-Rings	Synthetic Rubber	ASTM D2000

8. All internal working parts (excluding gate) shall be all bronze containing not more than 2 percent aluminum or more than 7 percent zinc.

Valve stems shall be cast or forged from bronze having a tensile strength of not less than 60,000 psi, a yield point of not less than 30,000 psi, and an elongation of not less than 10 percent in 2 inches.

9. All gates shall be encapsulated in Buna-S rubber or nitrile elastomer.

K. Bolts and Nuts for Flanged Valves

Bolts and nuts for flanged valves shall be stainless steel in accordance with Section 15056.

L. Gaskets

Gaskets for flanged end valves shall be as described in Section 15056.

M. Valve Boxes for Buried Valves

1. Valve extension pipe material shall be 8-inch PVC pipe.
2. Design cast iron cap to rest within a frame on a cast-in-place concrete ring surrounding the valve extension pipe; size the tapered skirt of the cap for a close fit inside the upper sleeve portion of the valve box. Caps for the domestic water system shall be circular with the word "WATER" cast on the cap. Caps for the recycled water system shall be triangular with "NDW" cast on the cap. Coat the cap and frame with asphalt or coat-tar paint.

N. Extension Stems for Buried Valve Operators

1. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 24 to 36 inches below the surface of the ground and/or box cover.
2. Extension stems shall be steel and shall be complete with 2-inch-square operating nut.
3. Valve stem extensions shall be of a solid design (no pinned couplings permitted) with guides.
4. Valve extensions shall conform to Standard Drawing W-9.

PART 3 - EXECUTION

A. Joints

1. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean the flanges by wire brushing before installing flanged valves.

Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

2. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound to Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
3. The contractor shall inspect rubber ring grooves of valves before installation for ridges or holes that would interfere with the rubber ring. Interferences with the rubber ring shall be corrected to a satisfactory connection or the valves replaced, as required by the PWD. (All valves shall have the same rubber-ring groove profile as the groove of the pipe couplings furnished with the pipe.)

B. Butterfly Valve Operators

Butterfly valves shall be installed with the operators on the street centerline side of the pipeline or in the position shown in Standard Drawing W-13.

C. Exterior Protection

1. All exposed flanges and other metal surfaces and all damaged coatings shall be coated after assembly with bituminous mastic per Section 09900.
2. Wrap buried valves with 8-mil polyethylene wrap per AWWA C105.

D. Concrete Supports

1. Valves shall be anchored in concrete as shown in Standard Drawing W-13.
2. Concrete supports will not be required under valves bolted to flanged fittings.
3. Temporarily support valves with wooden skids until permanent supports are poured so that the pipe is not subjected to the weight of the valve.
4. All concrete anchors and thrust blocks specified or required by the PWD Representative are considered as part of the pipeline installation.

E. Valve Boxes

1. Valve boxes shall be firmly supported and shall be kept centered and plumb over the operating nut of the valve.
2. Beveled sections of pipe will not be allowed at the top of the valve extension pipe. The top cut shall be square and machine made.
3. During the construction of new tracts, the valve extension pipes for "key valves" shall extend well above the ground level to permit ease of location in case of emergency shutoffs.
4. The box cover shall be flush with the surface of the finished pavement or at any other level designated by the PWD Representative.

F. Backfill

1. All backfill within 24 inches of a valve shall be clean, washed sand.

2. Backfill is to be placed and compacted in accordance with Section 02223.

G. Valve Leakage Testing

1. Test valves for leakage at the same time that the connecting pipelines are tested. See Section 15042 for pressure testing requirements.
2. Valves shall have a pressure rating higher than or equal to the test pressure.

H. Tapping Sleeves

Tapping valves shall be installed per PWD standard detail W-22, and as modified below.

1. The tapping sleeve shall be installed in accordance with the manufacturer's instructions and to the satisfaction of the PWD Representative.
2. The pipe barrel shall be thoroughly cleaned with a wire brush to provide a smooth, hard surface for the sleeve.
3. The sleeve shall be supported independent of the pipe during the tapping operation.
4. The sleeve shall be pressure tested in the presence of the PWD Representative prior to tapping.
5. Thrust blocks shall be provided at the tapping sleeve.
6. Size on size taps will not be permitted. For size on size connections a "Tee" is to be cut in.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15112

BACKFLOW PREVENTERS

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of backflow prevention assemblies.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Concrete:	03300
2.	Ductile-Iron Pipe and Fittings:	15056
3.	Copper, Brass, and Bronze pipe, Fittings, and Appurtenances:	15057
4.	Manual Valves:	15100
5.	Meters:	15150

C. Approved Assemblies

The backflow prevention assembly shall be included in the latest edition of the "List of Approved Backflow Prevention Assemblies," Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, School of Engineering.

D. Application

1. A backflow prevention device shall be installed at all locations where the potential for a backflow condition into the PWD's domestic water mains exists.
2. The type of device required depends on the level of potential hazard that exists.

E. Double Check Detector Check Assembly, or Reverse Pressure Principle Assembly

1. A double check detector check assembly, or reverse pressure principle assembly (RPPA) shall be at all buildings meeting one or more of the following requirements:
 - a. Three stories or higher.
 - b. Having a private on-site fire protection system or a private on-site distribution system with two or more separate connections to the PWD's domestic water mains.
2. The PWD will maintain only the upstream mainline shut-off valve and service to the point of connection of the assembly and the by-pass meter.
3. The PWD Backflow Prevention Specialist, will make the final determination of, and what type of backflow device is required.

PART 2 - MATERIALS

A. Shut-Off Valves

1. The shut-off valves for assemblies 3-inch and larger shall be resilient seat gate valves conforming to Section 15100. Ball valves shall be used on assemblies smaller than 3-inch.
2. Shut-off valves shall have outside stems and yokes.

B. Ductile Iron Piping and Fittings

Ductile iron piping and fittings shall be furnished and installed in accordance with Section 15056.

C. Concrete

Concrete thrust blocks and supports shall be in conformance with Section 03300.

D. By-Pass Piping

By-pass piping shall be copper or brass conforming to Section 15057.

E. Backflow Prevention Assembly

All backflow prevention assemblies shall conform to the latest edition of AWWA C506 and the "Manual of Cross-Connection Control", Foundation for Cross-

Connection Control and Hydraulic Research, University of Southern California, School of Engineering.

F. By-Pass Meter

The by-pass meter shall conform to the requirements of Section 15150 and shall be compatible with the backflow device on which it is installed. The backflow prevention assembly and the by-pass meter shall be furnished as one complete unit. All by-pass meters shall be 5/8-inch by 3/4-inch.

G. Corrosion Protection:

Backflow prevention assemblies shall be epoxy lined and coated in accordance with these specifications.

PART 3 - EXECUTION

A. Installation

Installation of the double detector check assembly, or a reduced pressure principle assembly will be per PWD standard drawing W-17, and W-19 respectively, and as noted below.

1. Installation shall comply with the latest plumbing codes and applicable local agency requirements.
2. Installation shall comply with the requirements of the latest edition of the Manual of Cross-Connection Control.

B. Testing

1. Upon completion of the installation of the device, a test shall be performed and a certificate of the adequacy and operational compliance shall be furnished to the PWD. The tests shall be performed by a testing agency approved by the Orange County Health Department.

END OF SECTION

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STANDARD SPECIFICATIONS

SECTION 15139

FIRE HYDRANTS

PART 1 - GENERAL

A. Description

This section includes the materials, installation and testing of fire hydrants.

Hydrants shall be supplied and installed per PWD standard drawings W-6 and W-7, AWWA C 503 and as described here in.

B. Related Work Described Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Trenching, Backfilling, and Compacting:	02223
2.	Concrete:	03300
3.	Painting and Coating:	09900
4.	Hydrostatic Testing of Pressure Pipelines:	15042
5.	PVC Pipe and Fittings:	15064
6.	CML&C Pipe and Fittings:	15062
7.	DIP Pipe and Fittings:	15056
8.	Manual Valves:	15100

C. Approved Types

1. Wet Barrel Hydrants

a. Residential Use

James Jones 3700 (Hydrant Head and Fluted Spool),
Clow 2050
American AVK 2470

b. Commercial and Industrial Use

James Jones 3775 (Hydrant Head and Fluted Spool), or
Clow 2065

2. Reflectors

Stimsonite #88
Ray-O-Lite

3. Wet Barrel Hydrant Break-off Check Valves

Clow No. 40

PART 2 - MATERIALS

A. Wet Barrel Hydrant

1. Hydrant Top Section

- a. Fire hydrants shall have individual valves for each outlet.
- b. All outlets shall have National Standard Hose Threads.
- c. The hydrant top section shall be manufactured of bronze conforming to ASTM B 62.
- d. All interior-working parts, including stems, shall be of bronze containing no more than 7% zinc or 2% aluminum.
- e. Hydrants are to be provided with:
1-1/2-inch sized pentagon-shaped operating nut, and
1-1/2-inch cap nuts.
- f. All fire hydrants shall have the name of the manufacturer cast onto the hydrant body or shown on a permanently attached plate.
- g. Plastic outlet nozzle caps shall be provided for all outlets. Caps shall be securely chained to the barrel with non-kinking metal chain in a manner to permit free rotation of the cap.

2. Bury Section

- a. The bury section shall be ductile iron in conformance with Section 15056.
- b. Bury depth will normally be 48 inches for distribution mains and 54 inches for transmission mains, but different depth buries on fire hydrant buries may be required to fit abnormal pipe depths depending upon field conditions.

- c. All wet-barrel fire hydrant cast-iron buries are to be cement lined.
- d. When using a break-off check: bolts shall be stainless steel 316, standard non-breakaway.

B. Break-Away Bolts

- 1. Break-away bolts shall be used to join the bury section to the hydrant top section.
- 2. All bolts, and nuts, shall be stainless steel 316.

C. Valve

The shut-off valve shall be a resilient-seated gate valve per Section 15100, including the valve box. Butterfly valves will not be permitted on fire hydrant laterals.

D. Ductile Iron Pipe

Ductile iron pipe shall be per Section 15072.

E. Ductile Iron Pipe and Fittings

Ductile-iron Pipe and fittings shall be in accordance with Section 15056.

F. Concrete

Concrete pads, thrust blocks and supports shall be Class B concrete conforming to Section 03300.

G. Gaskets

Gaskets shall be of asbestos composition per Section 15056.

H Reflectors

Reflectors shall be 4" x 4" square shoulder type with 2-way blue color lenses.

PART 3 - EXECUTION

A. General

1. Fire hydrant assemblies shall be installed in accordance with the standard drawing and as specified herein, and shall include the connection to the main, the fire hydrant, hydrant bury, shutoff valve, valve well and valve box, connection piping, concrete thrust blocks, and appurtenances.
2. Refer to Standard Drawing W-6 or W-7.

B. Location

Fire hydrant assemblies shall be located as shown on the plans; as approved by the Fire Marshall and by the PWD. The center of the fire hydrant shall be, except as otherwise approved by the PWD Representative, located as described below:

1. Where concrete curb or asphalt concrete (AC) berm exists or is to be constructed, and the sidewalk is next to the property line; 2 feet 6 inches back of the face of the curb.
2. Where 6-foot-wide or narrower sidewalk is to be installed or exist next to the curb; 18 inches back of sidewalk edge. Where there is insufficient Public Right-of-Way behind the sidewalk, an easement will be required. For sidewalks wider than 6 feet; 30 inches back of the curb face.
3. Where there is no curb or berm, the location shall be designated by the PWD Representative.
4. The flange elevation at the base of the hydrant shall be set 4-inches above the curb or sidewalk, or the surrounding graded area, or as approved by the PWD Representative. Spools less than 6-inches in length will not be permitted when correcting the flange elevation.

C. Trenching, Backfilling, and Compacting

1. All trenching, backfilling, compaction and other excavation shall be in accordance with Section 02223.
2. All backfill within 24 inches of a valve shall be imported sand.

D. Valve and Valve Box

The valve and valve box shall be installed in accordance with Section 15100.

E. Pipe

Ductile Iron pipe shall be installed in conformance with Section 15056.
PVC pipe shall be installed in conformance with Section 15064.

F. Break-Away Bolts

1. Break-away bolts shall be installed with the threads toward the top of the hydrant.
2. Pack the hollow bolts with silicon sealant or heavy grease.

G. Concrete

The concrete pad and thrust blocks shall be Class B concrete placed per Section 03300.

H. Painting and Coating

All fire hydrants shall be internally coated with fusion-bonded epoxy.

All fire hydrants shall be painted with one prime coat and two finish coats of safety yellow paint in the place of manufacture. Before the fire hydrant has been installed in accordance with Section 09900. A final touch-up coat shall be applied just prior to the final inspection.

I. Testing

Test hydrants at the same time that the connecting pipeline is pressure tested. See Section 15042 for pressure testing requirements.

J. Reflectors

After final paving, the location of each fire hydrant shall be marked with a blue reflector placed 1 foot to the hydrant side of the street centerline. The reflector shall be attached with a two-component epoxy compatible with the reflector and per the manufacturer's recommendation. The reflector shall be oriented so that the lenses are visible from the street centerline.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15150

METERS

PART 1 - GENERAL

A. Description

This section describes the purchase, materials, installation and testing of meter assemblies.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Structure Excavation:	02200
2.	Concrete:	03300
3.	Precast Concrete Vaults:	03462
4.	Painting and Coating:	09900
5.	Copper, Brass, and Bronze Pipe, Fittings, and Appurtenances:	15057
6.	Ductile-Iron Pipe and Fittings:	15056
7.	Manual Valves:	15100

C. Approved Manufacturers

1. Displacement Type - 5/8 inch through 2-inch
Sensus SR-II
Neptune Trident 10
Badger Recordall
2. Turbine Meters
SensusSeries "W"
Schlumberger trident series
Badger
3. Compound Meters
Sensus SRH

Neptune True/Flow
Badger Recordal

4. Propeller Meters
McCrometer
Water Specialties
Sparling
5. Fire Service Meter Assembly
Sensus Fireline
Protectus III
6. V-Cone Flow Meters
McCrometer V-cone flow meter

D. Residential Meters

1. The developer shall expose and set to grade all angle meter stops prior to requesting installation of the meters.
2. The developer is responsible for the installation of the meter box and angle meter stop.
3. Prior to occupancy, the PWD will, upon finding the installation to be acceptable, record all meter account information and padlock the curb stop in the off position. The developer will subsequently be relieved of any additional responsibility for consumption or service charges for this service.
4. Subsequent applications for permanent service shall be made in accordance with the PWD's Rules and Regulations.

E. By-Pass Line

1. A by-pass line shall be installed on all meter assemblies 3-inch and larger. A by-pass line is not required under the following conditions, as determined by the PWD.
 - a. A by-pass line is not required when the facility is serviced by multiple metered connections.
 - b. A by-pass line is not required on irrigation services.
2. A lockable corporation stop or valve shall be installed in all by-pass lines.

3. A by-pass line may be required on smaller installations that require continuous service.

PART 2 - MATERIALS

A. General

1. All meters shall be new and of current manufacture design.
2. All parts of the meters of the same size and model shall be interchangeable.

B. Registers

1. The registers on all meters shall have straight reading dials with full sweep test circles.
2. All registers are to be calibrated to read in cubic feet.
3. All registers are to be direct read. This may require the stamping of a zero or zeros on the register dial face. The last two digits including the zero or zeros stamped on the register dial face shall be easily distinguishable from the balance of the digits either by contrast of white numbers on black or red numbers on white.
4. Registers for positive displacement, compound, and turbine meters are to be hermetically roll sealed.
5. Register gears shall be self-lubricating molded plastic unless stated otherwise. Register gears for propeller meters may be bronze.
6. Registers for positive displacement and turbine meters shall not have replaceable change gears.
7. Registers shall be driven by a magnetic coupling.
8. All register lenses shall be tempered glass.
9. All registers shall be provided with low flow detectors.
10. All registers shall be oriented to read from the inlet side of the meter.
11. The register must be attached to the meter case by a bayonet attachment. The register assembly shall be able to mount any of four positions. On positive displacement meters the standard mount position shall read from the meter inlet side.

C. Stainless Steel Hardware

All bolts, nuts, cap screws, studs, and washers shall be Type 316 stainless steel ASTM A 193 B8M for bolts, and ASTM A 194 8M for nuts

D. Displacement Type Meters (5/8 inch through 2 inch)

1. Meters shall conform to the material and performance requirements of AWWA C700, as most recently revised, and as specified herein.
2. The manufacturer shall furnish certified results for each meter showing that it has been tested for accuracy of registration and that it complies with accuracy and capacity requirements of AWWA C700 when tested in accordance with AWWA Manual M6.
3. All meters body components resisting pressure shall be bronze.
4. All register boxes and covers shall be synthetic polymer or bronze.
5. Casing bolts shall be stainless steel or bronze.
6. All internal hardware shall be stainless steel.
7. 5/8-inch through 1-inch meters shall have external straight threads. 1½-inch and 2-inch meters shall have flanges on ends.
8. The face-to-face length and maximum profile height of the meter shall be as described below:

<u>Meter Size (inches)</u>	<u>Face-to-Face Dimension (inches)</u>	<u>Maximum Profile Height Centerline Inlet to Register Cover (inches)</u>
5/8	7-1/2	3-1/4
5/8 by 3/4	7-1/2	3-1/4
1	10-3/4	3-1/4
1-1/2	13	4-1/4
2	17	5

9. All meters shall have plastic or stainless steel internal strainers.
10. All registers and register boxes shall be secured to the main casing by acceptable tamper-proof means. Safety wiring of standard bolts and screws is NOT considered an acceptable method of tamper proofing.
11. The serial number of each meter shall be imprinted on the register box cover, and the main case.
12. Register shall be removable without reducing pressure or removing the main case from the installation.
13. All positive displacement meters shall be supplied with the following warranty, which shall not be prorated under any conditions:
 - a. All meters shall be guaranteed to maintain new-meter accuracy ($\pm 1\frac{1}{2}\%$) for five years.

- b. All measuring chambers and disks or pistons shall be guaranteed against malfunction for fifteen years.
- c. All registers shall be guaranteed for twenty-five years.

E. Turbine Meters (1½-inch and larger)

- 1. All meters shall conform to AWWA C701 Class II and the requirements specified herein.
- 2. The manufacturer shall furnish certified test results for each meter showing that it has been tested for accuracy of registration and that it complies with accuracy and capacity requirements of AWWA C701 when tested in accordance with AWWA Manual M6.
- 3. Turbine meters shall have all bronze main cases.
- 5. Straightening vanes shall be provided in the main case of all meters.
- 7. A calibration-adjusting vane located in the measuring chamber shall be provided on all meters.
- 8. All rotors shall be thermoplastic with graphite bearings (PTFE) rotating on a stainless steel or tungsten carbide shaft.
- 9. All motion shall be transmitted from the rotor to the register through a magnetic coupling.
- 10. All register boxes and covers shall be bronze.
- 11. All registers and register boxes shall be secured to the measuring chamber by acceptable tamper-proof means. Safety wiring of standard bolts and screws is NOT considered an acceptable method of tamper proofing.
- 12. All turbine meters shall be equipped with strainers. The strainer body and cover shall be cast bronze or ductile iron. Cast or ductile iron will be permitted only on 8-inch and larger or fire service strainers. All cast or ductile iron strainers shall be epoxy lined in accordance with Section 09900. All strainers shall be furnished with bronze or stainless steel screens with an effective open area at least double the area of the meter. On metered fire service installations, a U.L. approved strainer with an effective open area at least 4 times the equivalent open area of the meter will be required.
- 13. All measuring chamber, strainer cover, and flange bolts shall be Type 316 stainless steel.

14. The serial number of each meter shall be imprinted on the register cover, and the main case.

F. Compound Meters (3-inch and larger)

1. All meters shall conform to AWWA C702 and the requirements specified herein.
2. The manufacturer shall furnish certified test results for each meter showing that it has been tested for accuracy of registration and that it complies with accuracy and capacity requirements of AWWA C702 when tested in accordance with AWWA Manual M6.
3. Compound meters shall have all bronze main cases.
4. All compound meters shall have flanged connections.
5. A test plug shall be provided in the outlet side of the main case of all meters.
6. The measuring chamber shall be capable of operating within the specified AWWA accuracy limits without recalibration when transferred from one main case to another.
7. A calibration-adjusting vane located in the measuring chamber shall be provided on all meters.
8. All rotors shall be thermoplastic with graphite bearings rotating on a stainless steel shaft.
9. All motion shall be transmitted from the rotor to the register through a magnetic coupling. Worm gears will NOT be permitted.
10. All register boxes and covers shall be bronze or synthetic polymer.
11. All registers and register boxes shall be secured to the measuring chamber by acceptable tamper-proof means. Safety wiring of standard bolts and screws is NOT considered an acceptable method of tamper proofing.
12. All compound meters shall be equipped with strainers. The strainer body and cover shall be bronze or cast or ductile iron. Cast or ductile iron will be permitted only on 10-inch and larger or fire service strainers. All cast or ductile iron strainers shall be epoxy lined in accordance with Section 09900. All strainers shall be furnished with bronze or stainless steel screens with an effective open area at least double the area of the meter.
13. All measuring chamber, strainer cover, and flange bolts shall be Type 316 stainless steel.
14. The serial number of each meter shall be imprinted on the register cover, and main case.

G. Fire Line Meter Assembly

1. A fire line meter assembly may be required for residential structures and commercial and industrial installations where separate fire service installations are not provided.

2. Furnish complete Fire line meter assemblies assembled by a single manufacturer. Each fire line meter assembly shall consist of a U.L. approved strainer with a stainless steel strainer basket, a turbine meter sized for fire flow, a positive displacement or turbine meter sized for maximum demand without fire flow, positive displacement meter piping, lockable ball valves to isolate the positive displacement meter, a check valve downstream of the positive displacement meter, and an internally weighted or spring loaded check valve adjusted to open prior to exceeding the maximum flow range of the positive displacement meter. The positive displacement meter piping shall extend from the outlet of the strainer to the downstream side of the swing check valve.
3. Each fire line meter assembly shall be constructed of components conforming to the appropriate sections of these specifications.
4. Cast iron or steel components shall be epoxy lined and coated per Section 09900.
5. Each fire line meter assembly shall conform the AWWA C703 and shall be U.L listed, and shall be F.M. approved for fire service use.

H. Propeller Meters

1. All propeller meters shall conform to AWWA C704 and the requirements specified herein.
2. The main casing may be steel or cast-iron and shall be epoxy lined and coated.
3. The main casing may be flanged or plain end as specified by the PWD Engineer.
4. Meter head shall be mounted on a flanged connection for easy removal of all interior parts from the pipe tee without disturbing the connections to the pipeline.
5. The drive mechanism shall be by means of stainless steel gears and shafting or flexible cable drives.
6. All meters shall be polyethylene propellers.
7. Bronze gearboxes on the propeller drive shafts are required.
8. Each meter tube shall be equipped with straightening vanes mounted immediately preceding the propeller.

I. Totalizer - Transmitter

1. The totalizer - transmitter shall be furnished with all necessary mounting hardware for operation from the meter.
2. The transmitter shall have integrally mounted electronic circuitry to convert to both a true 2-wire 4-20 Ma DC output linear to flow rate and a true 2-wire scaled pulse.

- a. The 4-20 Ma DC output shall operate from an external regulated 18-30 V - DC power supply with load capacity of 575 ohms at 28 V - DC. The accuracy of the 4-20 Ma output shall be better than +/- 0.5% of scale.
- b. The pulse output shall operate from an external regulated 10-30 V - DC power supply which can be either the 4-20 Ma DC power supply or a separate power supply. The pulse circuit voltage drop across the transmitter shall be 3 V - DC or less. Each pulse shall represent the volume of the least significant totalizer digit.

J. Precast Vaults

Precast meter vaults and boxes shall conform to Section 03462 and the standard drawings.

K. Copper, Brass, and Bronze Pipe, Fittings, and Appurtenances

All service connection and by-pass piping shall conform to Section 15057.

L. Ductile-Iron Pipe and Fittings

All piping for meter assemblies 3-inch and larger shall conform to Section 15056.

M. Manual Valves

1. All valves shall conform to Section 15100.
2. All valves on by-pass shall be lockable in the closed position. On 3-inch and larger by-pass lines, O. S. & Y valves with a chain and lock are permitted.

N. V-Cone Flow Through Meter

1. Meter:

The meter shall be a V-cone differential pressure producing flow meter. It shall have a primary flow element of constant area installed in the pipe the meter measures. The primary element, and support members shall be constructed of 316 stainless steel, and shall be epoxy coated. The primary elements with rotating or moving parts in the flow stream are not acceptable.

The meter shall have an accuracy of 0.5% of the actual flow within the designated flow range. The meter shall not require more than a total of seven (7) pipe diameters of straight run included in the length of the meter.

The meter tube shall be constructed of carbon steel, schedule 40 pipe, with ANSI 150-pound flanges. The tube shall be epoxy lined and coated as specified herein.

The support member shall be capable of maintaining the cone's orientation in flows up to 20 foot per second. The upstream pressure taps shall be 1/2 inch female NPT, and downstream pressure taps shall sense pressure at the centerline of the flow stream.

2. Flow Transmitters:

Flow transmitters shall have diaphragms and drain valves made of 316 stainless steel, with bolts and flanges of Cadmium Plated Carbon Steel, housed in NEMA 4 enclosures. The fill fluid shall be silicone oil.

The accuracy shall be within 0.25% of calibrated span for a range of 20% to 100% of flow including the combined effects of linearity, hysteresis and repeatability.

The flow transmitter shall have a range as specified by the PWD and shall provide a 4-20 MA DC output with adjustable damping proportional to flow rate.

The flow transmitters shall be Rosemount Smart family Model 1151. Transmitter shall be supplied with 3-valve manifolds No. 01151-150-0001. Transmitter shall be adjusted and calibrated by the meter manufacturer.

V-cone meter and transmitter shall be supplied as a unit. The unit shall be factory tested and calibrated. Certified test results shall be furnished with each assembly.

PART 3 - EXECUTION

A. Meter Installations

1. The contractor shall install all residential meters per standard drawings W-1 or W-2.
2. All 3-inch and larger meter installations shall conform to standard drawings W-20, or W-21.

B. Excavation and Backfill

Excavation and backfill for the meter installation shall be in accordance with Section 02200.

C. Service Piping

1. All piping for service lines and by-pass lines up to 2-inch shall be installed in conformance with Section 15057.
2. The piping for all service installations 3-inch and larger shall be in accordance with Section 15056 and the applicable standard drawing.

D. Test Tap

On services 3 inches and larger, a 2-inch service saddle or welded coupling and corporation stop shall be installed on the spool downstream of the meter. The tap shall be located a minimum of two pipe diameters downstream of the meter. In lieu of a test tap, a tee with a tapped blind flange may be installed immediately downstream of the meter. On propeller meter installations, the PWD Representative will determine the location of the test tap.

E. Meter Vault

All precast concrete meter vaults shall be installed in accordance with Section 03462 and the Standard Drawings.

F. Concrete Work

All thrust blocks, foundations, and supports shall be of the sizes shown in the applicable standard drawings and conform to Section 03300.

G. Valves

All valves installed shall conform to the Section 15100.

H. Painting and Coating

1. All exposed and buried piping shall be painted or coated in accordance with Section 09900.
2. The meter reading lids on all recycled water services shall be painted in accordance with Section 09900.

I. Testing

1. All meter services shall be hydrostatically pressure tested during the testing of pipeline in accordance with Section 15042.

END OF SECTION

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STANDARD SPECIFICATIONS

SECTION 15151

DOMESTIC AND RECYCLED WATER FACILITIES IDENTIFICATION

PART 1 - GENERAL

A. Description

All domestic water systems and appurtenances shall be identified as herein described. All recycled water systems shall be identified as described in the "Rules and Regulations for Users of Recycled Water", unless the issue is not covered. In which case recycled water systems and appurtenances shall be identified and herein described.

This section describes special identification, markings, materials and their installation procedures for domestic and recycled water facilities.

All water systems and appurtenances must be marked as described here in to avoid confusion with other utilities and between each other.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Painting and Coating:	09900
2.	PVC Pressure Distribution Pipe:	15064
3.	Manual Valves:	15100
4.	Ductile Iron Pipe & Fittings:	15056
5.	Combination Air Release and Vacuum Relief Valves:	15089
6.	Fire Hydrants	15139
7.	Water Meters	15150
8.	Asbestos Cement Distribution Pipe:	15072

C. Approved Manufacturers

1. Warning Tape

- a. Griffolyn Company, Inc.
10020 Mykawa Road

P.O. Box 33248
Houston, TX 77033
Phone: (713) 943-0070 or (800) 231-6074
- b. Terra Tape, Division of Reef Industries
P. O. Box 33310
Houston, TX 77233
Phone: (800) 231-2417

2. Warning Labels and Signs

In all cases the warning labels or signs must be approved prior to installation. Failure to receive prior approval may result in the Owner, Applicant, or customer removing such sign(s) and providing approved replacement(s). All costs will be at the Applicant's, Owner's or customer's expense. Failure to comply with these requirements, as set forth herein will result in termination of service as provided for in the PWD's Rules and Regulations Sections 600 and 700.

3. Recycled water Quick-Coupling Valve:

Nelson 7645 and 7641 key. Recycled water quick coupling valves must have Acme threads.

4. Domestic water quick coupling valves must have non-Acme threads.

5. Witness Markers

- a. Carsonite Water line Markers
Carsonite International
1301 Hot Springs Road
Carson City, NV 89706
Phone (800) 648-7974

D. Stenciled Pipe

- 1. The use of stenciled pipe will be accepted as an alternative to the use of warning tape.
- 2. PVC, carrying water shall have the words "RECYCLED WATER" stenciled with 2-inch purple letters. PVC, carrying Domestic water shall have the words "DOMESTIC WATER" stenciled with 2-inch blue letters. Lettering

shall be on both sides of the pipe in at least three places in a 13-foot section of pipe (total six places per section of pipe).

3. Stenciled on-site PVC Recycled piping shall be white with purple stenciling. Alternately purple pipe with black letters may be used.

The stenciling shall appear on both sides of the pipe with the marking "RECYCLED WATER" in 5/8-inch letters repeated every 12 inches.

E. Valve Boxes

1. All valve boxes for recycled water facilities shall have triangular valve box covers with the inscription "RECYCLED " cast thereon per Section 15100, and shall be painted purple. Valve boxes for domestic water systems shall be as specified in Section 15100.

All valve boxes installed in unpaved areas (open space areas) shall be marked with a witness pole; in addition to the above referenced markings.

F. Color and Painting Schedule

1. Recycled water facilities shall be painted purple per Section 09900.
2. Domestic water facilities shall be blue, with the exception of fire hydrants, which shall be painted as specified in Section 15139.
3. Witness poles for recycled water lines, valves and appurtenances shall be purple
3. Witness poles for domestic water lines, valves and appurtenances shall be blue.

G. Restriction of Public Access

1. All on-site recycled water facilities shall be restricted from public access so that the general public cannot draw water from the system. Facilities such as wash-down hydrants (typically found at tennis courts), blow off hydrants, blow offs on strainers, and other such facilities, shall be restricted from public access.
2. Recycled water facilities, both above and below grade, shall be housed in an approved lockable container colored purple. A sign reading "CAUTION: RECYCLED WATER" shall be installed, its size approved by the PWD Representative. An alternative acceptable means of restricting public access is the use of valves that operate by means of a recessed key slot or by means of hexagonal heads (such as those typically found on fire

hydrants). Other means of restricting public access may be approved by the PWD Representative.

H. Warning Signs and Labels

1. The PWD requires warning labels to be installed on all appurtenances in vaults, such as, but not limited to, air release valves, blow offs, and meters, and on designated facilities, such as, but not limited to, controller panels and wash down or blow off hydrants on water trucks and temporary construction services.
2. Each pump and every pipe shall be identified with a painted label. In the fenced pump station area; at least one sign shall be posted on the fence that can be readily seen by all operations personnel utilizing the facilities.
3. Painted labels may, at the PWD Representative's discretion be acceptable in lieu of plastic labels.

I. Quick-Coupling Valves

1. In order to prevent unauthorized use, all recycled irrigation quick-coupling valves shall be operated only with a special coupler key with an acme thread for opening and closing the valve.
2. Quick-coupling valves used in domestic water systems shall be operated with a coupler key not using an acme thread for opening and closing the valve, and with a brass cover.
3. A warning sign shall be attached to each recycled irrigation valve as specified herein.

J. Domestic water Piping

1. All domestic water piping shall be installed with domestic water identification.
2. All PVC domestic water piping shall be blue or shall be white with blue stenciling appearing on both sides of the pipe with the marking "DOMESTIC WATER" in 5/8-inch letters repeated every 12 inches.
3. Blue warning tape identifying it as a domestic water line and stating "CAUTION: DOMESTIC WATER LINE BURIED BELOW" may be used as an alternate to blue or stenciled pipe. The tape shall run continuously for the entire length of the main line piping. The tape shall be attached to the top of the pipe with plastic tape banded around the warning tape and pipe every 5 feet on center.

PART 2 - MATERIALS

A. Buried Piping Warning Tape

The plastic warning tape shall be an inert plastic film specifically formulated for prolonged underground use and shall be prepared with black printing on a purple field having the words, "CAUTION: RECYCLED WATER-LINE." Warning tape for domestic water pipeline shall be blue with black printing having the words, "CAUTION: DOMESTIC WATER-LINE BURIED BELOW." The minimum thickness shall be 4 mils and the overall width of the tape shall be 12 inches (for 8-inch pipe) and 6 inches (for 6-inch and smaller pipe).

B. Warning Labels

Labels shall be inert plastic film specifically formulated for prolonged exposure and shall be prepared with black printing on a purple field having the words: "CAUTION: RECYCLED WATER FACILITY". The minimum thickness shall be 4 mils for adhesive backed labels and 10 mils for tag type labels. Tag type labels shall have reinforced tie holes and shall be attached with heavy-duty nylon fasteners. The PWD's Representative will dictate by each individual application and subject to acceptance the size, type of label and location. The minimum size shall be 1/2-inch high letters.

C. Quick-Coupling Valves

Quick-coupling valves used in recycled irrigation system shall conform to the following:

1. Quick-coupling valves shall be 3/4 or 1-inch nominal size, Nelson 7645 with 7641 key or approved equal, with brass construction and a normal working pressure of 150 psi.
2. In order to prevent unauthorized use, the valve shall be operated only with a special coupler key with an acme thread for opening and closing the valve.
3. The cover shall be permanently attached to the quick-coupling valve. It shall be purple rubber or vinyl.
4. Special or locking covers may be required by the PWD and shall be noted on the plans during the plan check review.

PART 3 - EXECUTION

A. Installation of Pipe Warning Tape

Warning tapes shall be installed 12 –inches to 18 inches directly over the top of the pipe longitudinally and shall be centered. The warning tape shall be installed continuously for the length of the pipe and shall be fastened to each pipe length by plastic adhesive tape banded around the pipe and warning tape at no more than 5-foot intervals. Taping attached to the sections of pipe before installing in the trench shall have 5-foot minimum overlap for continuous coverage. All risers between the main line and control valves shall be installed with warning tape.

B. Installation of Warning Labels

Warning labels shall be firmly attached to all appurtenances using heavy-duty nylon fasteners.

C. Installation of Witness Markers

Witness markers shall be installed over pipe in unpaved areas, open space areas, at appurtenances, including but not limited to valves, air release/vacuum breaks, dead ends, inflection points, tees, and every 500 feet.

Witness markers shall be embedded into the soil at least 18" and shall be equipped with a barb or other such device to Provide a sure grip in the surrounding soil.

END OF SECTION

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STANDARD SPECIFICATIONS

SECTION 15162

FLEXIBLE PIPE COUPLINGS

PART 1 - GENERAL

A. Description

This section includes materials and installation of flexible gasketed sleeve-type compression pipe couplings.

B. Related work

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- | | | |
|----|--|-------|
| 1. | Painting and Coating: | 09900 |
| 2. | Hydrostatic Testing of Pressure Pipelines: | 15042 |

C. Approved Manufacturers

1. Flexible Couplings
Smith Blair 441
Romac 501
Powerseal 3501
JCM 215 & 216
2. Transition Couplings
Smith Blair 441
Romac 501
Powerseal 3501
JCM 215 & 216

3. Flanged Coupling Adapters
JCM 301
Smith Blair 912 or 913
Romac FC 400

PART 2 - MATERIALS

A. Coupling Sleeve and Flanges

Coupling sleeves and flanges shall be ductile iron.

B. Bolts and Nuts for Flanges

1. Bolts and nuts for buried and submerged flanges, flanges in underground vaults and structures, and flanges located outdoors above ground shall be Type 316 stainless. Nuts shall be 316 stainless steel, Teflon coated, Tripac 2000 or approved equal.
2. Provide one (1) washer for each nut. Each washer shall be of the same material as the nut.

C. Painting and Coating

All cast components shall be epoxy lined and coated per Section 09900.

PART 3 - EXECUTION

A. Installation of Flexible Pipe Couplings

1. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installing. Install expansion joints per manufacturer's recommendations. Install expansion joints so that 50% of total travel is available for expansion and 50% is available for contraction.
2. Lubricate bolt threads with graphite and oil prior to installation.

B. Field Coating

1. Coat buried flexible pipe couplings, transition couplings, and flanged coupling adapters per Section 09900. Then wrap the couplings with 8-mil polyethylene wrap per AWWA C105.
2. Coat flexible pipe couplings (including joint harness assemblies), transition couplings, and flanged coupling adapters located indoors, in vaults and

structures, and above ground with the same coating system as specified for the adjacent pipe. Apply prime coat at factory.

C. Hydrostatic Testing

Hydrostatically test flexible pipe couplings, expansion joints, and expansion compensators in place with the pipe being tested. Test in accordance within Section 15042.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15300
AUTOMATIC CONTROL VALVES

PART I - GENERAL

A. Description

This section covers the work necessary to furnish and install the various self-contained automatic process valves.

Items of equipment specified herein shall be the end products of only one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacture's service.

B. Related Work

1.	Trenching, Backfilling, and Compacting:	02223
2.	Concrete:	03300
3.	Painting and Coating:	09900
4.	Hydrostatic Testing of Pressure Pipelines:	15042
5.	Ductile-Iron Pipe and Fittings:	15056
6.	Domestic and Recycled water Facilities Identification:	15151

C. Approved Manufacture's

1. Check Valves

Valve shall be model 81G-02KC with X101 Valve Position Indicator (installed by valve manufacturer) as manufactured by Cla-Val Company.

2. Solenoid Control Valves

Valve shall be model 136G-03YBCSFKC with Limit Switch Assembly Model X105LCW (installed by valve manufacturer) as manufactured by Cla-Val Company.

3. Pressure Reducing Valves

Valve shall be model 90G-01YBKC (90G-01YSFC for valves 3 inches and smaller), with X101 Valve Position Indicator (installed by valve manufacturer) as manufactured by Cla-Val Company.

4. Pressure Relief / Pressure Sustaining Valves

Valve shall be model 50G-01SBKC with Limit Switch Assembly Model X105LOW (installed by valve manufacturer) as manufactured by Cla-Val Company.

5. Surge Anticipator Valves

Valve shall be model 52G-01BKC with Limit Switch Assembly Model X105LOW (installed by valve manufacturer) as manufactured by Cla-Val Company.

6. Pump Controller Valves

Valve shall be model 60G-11 BKC with Limit Switch Assembly Model X105LCW (installed by valve manufacturer) as manufactured by Cla-Val Company.

7. Altitude Valves

Valve shall be model 610-01

PART II - MATERIALS

A. Complete Assemblies

All valves shall be complete, with all necessary operating appurtenances included in the work under this section.

B. Interior Lining and Exterior Coating

A fusion bonded epoxy coating shall be applied to internal and external ferrous valve surfaces. Coating shall be per AWWA C550. Unless specified otherwise, here-in.

C. Check Valve

This valve shall be a hydraulically operated, diaphragm-actuated, globe pattern valve. It shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. The diaphragm assembly contacting a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be

the only moving part and shall form a sealed chamber in the upper portion of the valve, separation-operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the valve.

Valve shall be of indicated size and shall be of manufacturer's standard ductile iron with stainless steel trim (seat, disc guide, cover bearing spring, stem nut, and stem). Valve shall have a 200-psi pressure rating with Class 250 ductile iron flanges. Interior ferrous surfaces shall be lined and coated with fusion-bonded epoxy.

The design shall preclude cavitation erosion, fouling of working surfaces, and other effects adverse to reliability. Seats and other trim shall be secured by means precluding their loosening by hydraulically induced vibrations; and the fit of stems in guides and guide lengths shall preclude any binding, scraping, or deviation from true alignment affecting the free movement of working parts.

All repairs shall be possible without removing the valve from the line.

The pilot shall contain auxiliary controls that permit the adjustment of the opening and closing speeds, and shall be set for fast opening and slow closing.

Pilot valves shall be all bronze conforming to ASTM B62 with stainless steel trim. Hydraulic control and sensing lines shall be copper, conforming to Section 15050, herein.

D. Solenoid Control Valve

This valve shall be a hydraulically operated, diaphragm-actuated, globe pattern valve. It shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. The diaphragm assembly contacting a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating the operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the valve.

Valve shall be of indicated size and shall be of manufacturer's standard ductile iron with stainless steel trim (seat, disc guide, cover bearing spring, stem nut, and stem). Valve shall have a 200-psi pressure rating with class 250 ductile iron flanges. Interior ferrous surfaces shall be lined and coated with liquid epoxy.

The design shall preclude cavitation erosion, fouling of working surfaces, and other effects adverse to reliability. Seats and other trim shall be secured by means precluding their loosening by hydraulically induced vibrations; and the fit of stems in guides and guide lengths shall preclude any binding, scraping, or deviation from true alignment affecting the free movement of working parts.

All repairs shall be possible without removing the valve from the line.

The pilot control shall be a solenoid valve controlling a diaphragm-operated three-way auxiliary valve. The control system shall include opening and closing speed controls, a wye strainer and limit switch Model X105LCW.

Pilot valves shall be all bronze conforming to ASTM B62 with stainless steel trim. Hydraulic control and sensing lines shall be copper, conforming to Section 15050, herein.

E. Pressure Reducing Valve

This valve shall maintain constant downstream pressure, and shall maintain this pressure within limits without causing surges. The main valve shall be a hydraulically operated, diaphragm-actuated, globe or angle pattern valve. It shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. The diaphragm assembly contacting a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating the operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall not be pistons operating the valve or pilot controls.

The valve shall be of indicated size and shall be of manufacturer's standard ductile iron, with stainless steel trim (seat, disc guide, cover bearing spring, stem nut, and stem). Valve shall have a 200-psi pressure rating with Class 250 ductile iron flanges. Interior ferrous surfaces shall be lined and coated with fusion-bonded epoxy.

The design shall preclude cavitation erosion, fouling of working surfaces, and other effects adverse to reliability. Seats and other trim shall be secured by means precluding their loosening by hydraulically induced vibrations; and the fit of stems in guides and guide lengths shall preclude any binding, scraping, or deviation from true alignment affecting the free movement of working parts.

All repairs shall be possible without removing the valve from the line.

The pilot control shall be a direct-acting, adjustable, spring-loaded, diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice.

The pilot valve system shall have a direct acting adjustable, spring-loaded pilot, diaphragm-actuated valve, designed to permit flow in the pilot valve system whenever the controlling pressure exceeds the spring setting. The pilot valve system shall also contain a strainer needle valve assembly that shall control the opening or the main valve.

Pilot valves shall be all bronze conforming to ASTM B62 with stainless steel trim. Hydraulic control and sensing lines shall be copper, conforming to Section 15050, herein.

F. Pressure Relief Valve

This valve shall maintain constant upstream pressure by bypassing or relieving excess pressure, and shall maintain pressure within a limit without causing surges. The main valve shall be a hydraulically operated, diaphragm-actuated, globe or angle pattern valve. It shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. The diaphragm assembly contacting a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating the operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the valve.

The pilot control shall be a direct-acting, adjustable, spring-loaded, diaphragm valve, designed to permit flow when controlling pressure exceeds spring setting. The pilot control system shall operate such that as excess line pressure is dissipated, the main valve shall gradually close to a positive, drip-tight seating.

Valve shall be of indicated size and shall be of manufacturer's standard ductile iron, with stainless steel trim (seat, disc guide, cover bearing spring, stem nut, and stem). Valve shall have a 200-psi pressure rating with Class 250 ductile iron flanges. Interior ferrous surfaces shall be lined with fusion-bonded epoxy.

The design shall preclude cavitation erosion, fouling of working surfaces, and other effects adverse to reliability. Seats and other trim shall be secured by means precluding their loosening by hydraulically induced vibrations; and the fit of stems

in guides and guide lengths shall preclude any binding, scraping, or deviation from true alignment affecting the free movement of working parts.

All repairs shall be possible with-out removing the valve form the line.

The pilot valve system shall have a direct acting, adjustable, spring-loaded pilot, diaphragm-actuated valve, designed to permit flow in the pilot valve system whenever the controlling pressure exceeds the spring setting. The pilot valve system shall also contain a strainer needle valve assembly that shall control that closing of the main valve.

Pilot valves shall be all bronze conforming to ASTM B62 with stainless steel trim. Hydraulic control and sensing lines shall be copper, conforming to Section 15050, herein.

G. Surge Anticipator Valve

This valve shall be hydraulically operated with pilots that will cause the main valve to open on a low-pressure wave or a high-pressure wave. The high-pressure pilot shall be set to open at any pressure above the normal operating pressure. The low-pressure pilot shall be set to open the main valve at any pressure below its normal operating pressure. The low-pressure pilot shall allow the main valve to open quickly to a preset amount as controlled by a hydraulic limiter.

The main valve shall be a hydraulically operated, diaphragm-actuated, globe or angle valve. The valve stem shall be guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat.

The main valve shall have a single removable and a renewable disc having a rectangular cross-section and contained on three and one-half sides. No external packing glands are permitted. The diaphragm must be used as a seating surface and there shall be no pistons operating the main valve or any pilot controls.

The design shall precluded cavitation erosion, fouling of working surfaces, and other effects adverse to reliability. Seats and other trim shall be secured by means precluding their loosening by hydraulically induced vibrations; and the fit of stems in guides and guide lengths shall preclude any binding, scraping, or deviation from true alignment affecting the free movement of working parts.

The pilot control shall be a direct acting, adjustable, spring-loaded, diaphragm valves. The pilot valve system shall contain a strainer needle valve assembly that shall control the closing of the main valve. The pilot valve system shall also contain a check valve that is installed on one of the main valve cover connections. Install this check valve so that if low pressure occurs at the inlet of the valve it will open up and relieve the cover pressure to the inlet side of the valve.

Valve shall be of indicated size and shall be of manufacture's standard ductile iron, with stainless steel trim (seat, disc guide, cover bearing spring, stem nut, and stem). Valve shall have a 200-psi pressure rating with Class 250 ductile iron flanges. Interior ferrous surfaces shall be lined with fusion-bonded epoxy.

All repairs shall be possible with-out removing the valve form the line.

Pilot valves shall be all bronze conforming to ASTM B62 with stainless steel trim. Hydraulic control and sensing lines shall be copper, conforming to Section 15050, herein.

H. Pump Control valve - Booster Type

This valve shall be a hydraulically operated, single seated, diaphragm actuated, composition disc, dual-port globe style valve with solenoid valve control. The valve shall have a built-in check feature; designed to operate with pump controls to start and stop pump against a closed valve.

Valves shall have emergency shutdown power check features for surge protection as described below: upon power failure, solenoids de-energize and a check valve in the diaphragm unit shall release to effect closure under spring action when flow stops before flow reversal can occur.

Valve shall be of indicated size and shall be of manufacture's standard ductile iron, with stainless steel trim (seat, disc guide, cover bearing spring, stem nut, and stem). Valve shall have a 200-psi pressure rating with Class 250 ductile iron flanges.

Stems, disc-seats, guides and other trim shall be non-magnetic stainless steel. All work surfaces of valve, and component parts, shall have smooth polished surfaces, and shall be precision machined as applicable. Synthetic materials used for discs and diaphragms shall have a proven record of high durability and shall be composition Buna "N". Interior ferrous surfaces shall be lined with fusion-bonded epoxy.

Pilot valves shall be all bronze conforming to ASTM B62 with stainless steel trim. Hydraulic control and sensing lines shall be copper, conforming to Section 15050, herein.

A manual control override shall be provided on the valve assembly. The design shall precluded cavitation erosion, fouling of working surfaces, and other effects adverse to reliability. Seats and other trim shall be secured by means precluding their loosening by hydraulically induced vibrations; and the fit of stems in guides

and guide lengths shall preclude any binding, scraping, or deviation from true alignment affecting the free movement of working parts.

The valve shall be provided with a SPDT limit switch actuated by the control rod. The switch shall indicate: 1) When the valve is fully closed; 2) When the valve is not fully closed.

All repairs shall be possible with-out removing the valve form the line.

PART III - EXECUTION

A. Manufacturer's Services

A manufacturer's representative for the equipment specified herein shall be present at the job site and/or classroom designated be the Owner for that minimum personnel-days listed for the services hereunder, travel time excluded: One (1) personnel day for equipment start up, and, one (1) personnel-day for post start-up training.

Start up services and training of Owner's personnel shall be at such times as requested by the Owner.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15950

CORROSION CONTROL FOR BURIED PIPING

PART 1 - GENERAL

1.1 SCOPE

- A. The work shall include the furnishing of all labor, equipment, materials, including anodes, wiring, coke breeze, backfill, pipeline coatings and all other equipment and accessories required for a complete cathodic protection system, including the cathodic protection control unit and anode well.
- B. All work shall be completed as indicated on the drawings or specified herein, and the entire job shall be left clean and completely ready for use.
- C. The Contractor or subcontractor who will be drilling and loading the anode well shall have a minimum of five (5) years experience in the construction of anode wells, and shall submit a resume of his previous experience with this proposal.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Anodes:
 - 1. Anodes shall be graphite rods with minimum dimensions of four (4) inches in diameter by eighty (80) inches long. The anodes shall be suitable for use in seawater. Each anode shall have good electrical conductivity and be equipped with a number 6 AWG 7 strand copper conductor with high molecular weight polyethylene insulation (HMWPE). Each anode shall be provided with continuous uncut cable. Cable to anode attachment shall be as shown on the drawings. All anodes shall have slow set epoxy resin capped ends. Anode heads shall be encapsulated with heat shrinkable polyethylene caps. The interior of the heat shrink caps shall be precoated with an elastic sealant. Heat shrink caps shall be Raychem brand or an approved equal. The cable shall join the feeder cable on the anode lead junction board. If required by the Inspector, the Contractor will make tests and install the anodes in the most conductive portions of the hole. This requirement will supersede the drawings.

B. Coke Breeze:

1. Coke breeze used for backfill shall be calcined petroleum, Asbury 218 or equal. The coke breeze shall have the following physical and chemical analysis:

Physical Analysis:

85% to pass a 3/8 inch screen
100% to pass a 1/2 inch screen

Chemical Analysis:

Moisture	-	0.10% Max.
Volatile Matter	-	0.50% Max.
Fixed Carbon	-	99.00% Min.
Ash	-	0.50% Max.
Sulfur	-	0.95% Max.

The Contractor shall provide certification that the coke breeze used on the project meets or exceeds the above requirements.

C. Electric Ground Rods:

1. The electric grounds shall be installed as shown on the drawings and as required by the code. The ground rods shall be copper clad steel 3/4 inch in diameter and 10 feet long and ground conductor shall be attached by means of an approved non-ferrous metal clamp.

D. Exothermic Welds:

1. Exothermic welds shall be either Cadweld or Thermoweld. Molds shall be graphite and shall be sized to fit the wire being welded, and the pipe. Charges shall be no greater than 15 grams.

2.2 CATHODIC RECTIFIER UNIT

- A. The cathodic rectifier shall have dual pulse rectifier units. Each unit shall be 500 Watt air-cooled Pulse DC Rectifier, 115/230V/1.5/5.0khz. The rectifiers shall have the capability of being synchronized together to allow them to operate on a single or multiple pipelines while connected to a single ground bed. Each rectifier shall have enhanced distributed current capability. The current distributed by any one power unit can be controlled independently from the current distributed by the other power unit that makes up the rectifier. The current from each power unit can be independently directed to where it is needed most, by a simple knob adjustment to each power unit. The dual rectifier unit shall be Model 2015-A-2 as manufactured by Farwest Corrosion Control Co., or equal. Each rectifier shall be equipped with 480V single pole AC and DC surge arrester, as manufactured by Cooper or equal. The rectifier units and support components shall be housed

in a weather resistant decorative enclosure as shown on the drawings. The enclosures shall be painted per Section 09900.

- B. The anode junction and structure distribution boards shall be fabricated from either PVC or phenolic and shall have provisions for each individual anode lead wire and structure lead wire as shown on the drawings.
- C. All hardware; bolts, nuts, washers, etc.; shall be brass. The buss bars shall be pure copper. Shunts for the anodes shall be Holloway type SS, rated at .001 ohms.
- D. All wires shall be attached to the buss bars with setscrew type copper lugs.
- E. Anode junction and structure distribution boards shall be mounted inside of the ornamental rectifier cabinet as shown on the drawings and shall be mounted so that there is a minimum of ½-inch clearance between any component on the junction board and the mounting hardware.

2.3 GROUNDING CELL AND GROUNDING CELL CONTROLLER

- A. Grounding cells shall consist of high purity zinc anodes. Each anode shall be equipped with a minimum of 24 feet of #4 AWG HMWPE covered stranded copper wire. The backfill around the anodes shall consist of 75% Gypsum, 20% Bentonite and 5% Sodium Sulfate. The backfill mixture shall be placed around each anode after they have been lowered into the hole. The backfill shall be saturated with 20 gallons of water prior to placing the select native backfill in the remainder of the hole.
- B. The grounding cell controller shall be constructed as shown on the plans and include two (2) gate type controller diodes each with a forward current rating of 30 amps minimum and a reverse voltage capability of 600 V.

2.4 WIRE AND CABLE (INSULATED) – ANODE, STRUCTURE, GROUND AND BOND CABLES

- A. The insulated wires and cables shall be especially designed for cathodic protection service, suitable for direct burial in corrosive soil areas and shall be as shown below. The size (gauge) shall be as shown on the drawings and as specified herein. It shall have high molecular weight polyethylene insulation (HMWPE). The insulation shall comply with ASTM D-1248 Grade E5 and have excellent resistance to moisture, acids, alkalis, hydrocarbons, oil and grease and must be applied in a single extrusion over the conductor. The insulation shall be surface printed with the conductor size, the manufacturer, "HMWPE Cathodic Protection Cable".

- B. Anode wires shall be #6 AWG, Houston or Rome brand, single conductor, seven-stranded copper wire with high molecular weight polyethylene insulation, or an approved equal. Anode wires shall be of sufficient lengths to extend from the installed anode segment to the junction box without any splices.
- C. Anode wires shall be tagged or permanently marked at the free end with a number that would correspond to the anode's position in the drill hole. The bottom anode shall be #1.
- D. Colored tape shall be affixed to the anode wire, during fabrication, at a point on the wire that would represent the top of the drill hole, or ground level. These tape marks will be used to assure the anode's proper depth placement in the drill hole. Tape marks will be inspected at the jobsite for proper positioning. If any tape marks are found to be incorrect, the entire anode assembly may be rejected by the Engineer.
- E. The anode wires shall be placed on individual spools, one for each anode, and shall be lowered into the drill hole directly off the spool. The anode wire shall not be unrolled from the spool prior to the anode being placed into the hole, unless directed by the Engineer.
- F. Cathode structure wires shall be #4 AWG, Houston or Rome brand, single conductor, seven-stranded copper wire with high molecular weight polyethylene insulation, or an approved equal. Cathode wires shall be of sufficient length to reach from the existing pipeline test stations to the rectifier without any splices.
- G. Insulation on all wires shall be free from any nicks, cuts, abrasions, and/or sharp bends measuring less than two inches in diameter. Any such damage will result in rejection of the wire.

The cable shall be copper and as shown on the drawings or as required by the Engineer.

		Minimum Thickness of
<u>AWG Size</u>	<u>No. Of Strands</u>	<u>Insulation (1/64ths)</u>
No. 8	7	7
No. 6	7	7
No. 4	7	7
No. 2	19	8
No. 1	19	8
No. 1/0	19	8

The Contractor shall make inspections of the job to determine the exact lengths, quantities and amounts of materials required to provide a complete installation.

2.5 MAIN DISCONNECT

- A. Square D disconnect shall be NEMA 4X weatherproof and for use with rigid conduit (similar to Square D 221 ARD).

2.6. CONDUIT AND FITTINGS

- A. Rigid metal conduit and non-metallic conduit shall be in accordance with Division 16.

PART 3 – EXECUTION

3.1 EXECUTION

- A. Minimum depths, approximate lengths of excavations and anode depths, are given on the plans. The Contractor shall determine the exact excavation length required to give a completed job. Trenches shall be excavated along straight lines and in accordance with Section 306 of the SSPWC.

3.2 BACKFILLING OF TRENCHES

- A. If a particular material is not designated, trenches shall be backfilled with native earth. All soil used as backfill must be free of all rock, gravel, metallic debris or similar hard material that is larger than one inch in diameter.
- B. A minimum of 1 foot of densified sand shall be placed over any pipeline exposed during the work and all cables installed horizontally whether or not in conduit per Section 306-1.3.3 of the SSPWC. All remaining backfill, other than for anode holes, shall be compacted to a density of ninety (90) percent as shown by the ASTM Standard Test Method No. D 1557-58T (latest revision).
- C. Backfill shall be made so that the finished trenches will conform to the grade as it existed before the commencement of the work.

3.3 ANODE WELL

- A. General:
 - 1. The anode well shall be installed as detailed and at the locations indicated on the drawings. The anode well shall be dug by a rotary drilling rig. Steel casing, if required, shall be pulled after the anodes and coke backfill are in position. Installation and removal of casing or repair, if required, to anodes as a result of this operation, shall be done at the Contractor's expense.

B. Drilling:

1. The Contractor shall provide labor, equipment and supplies to drill one (1) hole to completed dimensions shown on plans. The portion of the hole that will contain the anode assembly shall remain uncased, and the remaining portion shall be encased as shown on the drawings and specified herein. Contractor/Driller shall keep a certified well drillers log during the entire drilling process and a copy of such shall be furnished to the PWD Engineer at the conclusion of the drilling process.
2. The Contractor shall notify Underground Service Alert, at (800) 422-4133, a minimum of two working days before any drilling begins. It is the responsibility of the Contractor to verify the location of all existing utilities prior to drilling. Any damage to existing utilities that may occur during the course of the project, and the repair of such, shall be the responsibility of the Contractor.

C. Anode and Vent Pipe Placement:

1. The anodes shall be lowered into the well one at a time and suspended in the hole from no less than a two-inch diameter bar or pipe. The bar or pipe shall be placed directly over the center of the hole. The anode wires shall be taped to themselves and shall not be tied in a knot around the bar or pipe. Generally, each anode shall be placed in the hole at depths shown on the drawings, using colored tape marks as depth verification. However, field modifications in anode placement may be made according to the driller's log if deemed necessary by the Engineer. At no time during installation shall the anode wires be bent or kinked around anything less than a two-inch bar or pipe. At no time during installation shall the anode that is being placed in the hole be allowed to make any contact with the anode below it. Caution shall be taken so as to not nick or cut any of the anode wires. Any such nicks or cuts could result in the rejection of the entire anode groundbed, if deemed necessary by the Engineer.
2. The two-inch Schedule 40 PVC vent pipe shall be lowered into the well after anode placement. The vent pipe shall be perforated throughout the coke breeze column with 3/8-inch holes on four-inch centers, drilled at 90 degrees apart. The vent pipe joints shall be glued and one #10 by 1/2-inch long self drilling stainless steel screw shall be placed in each joint. The vent pipe shall extend to the bottom of the hole as shown on the drawings. A PVC cap shall be installed on the bottom of the vent pipe prior to placement in the hole. The vent pipe shall be routed to the surface and installed as shown on the drawings.

D. Backfill Of Anode Well Hole:

1. Backfill with coke breeze from the bottom of the hole to a point above the top anode as shown on the drawings. The coke breeze shall be thoroughly wetted, and poured into the hole. The coke breeze shall be poured at such a rate and manner that it will not "bridge" in the annular space between the anodes and the edge of the hole. Prior to backfilling operations, the hole shall

be flushed with clean water from the bottom of the hole up to remove drilling mud and cuttings to the satisfaction of the Engineer, the California Department of Health Services, Regional Water Quality Control Board and any other concerned regulatory authorities.

2. The Contractor shall electrically log the anodes during the backfill of the coke breeze to insure that all anodes are covered with coke breeze using the following method: A minimum 12 VDC power source shall be impressed on each individual anode, one at a time, using the anode wire as positive and a wire attached to a pipeline test station lead as negative. The amperage shall then be measured through a shunt with a millivolt meter. Amperage shall be measured and recorded on each individual anode during the following steps:
 - a. Prior to coke breeze being placed into the hole.
 - b. As the wetted coke breeze is being poured into the hole, using the measurements to determine when each anode has been covered with coke breeze.
 - c. After the wetted coke breeze has been poured and is in place to a point above the top anode as shown on the drawings.

Anode wires shall then be connected together and a minimum 12 VDC impressed on the entire anode groundbed. Voltage and amperage shall then be measured and recorded to determine the total groundbed resistance.

3. A copy of these measurements shall be furnished to the Engineer upon completion of the backfilling process.
4. Backfill from the top of the coke column to ground level shall consist of a cement grout and Bentonite slurry, pumped through a minimum two inch I.D. grout pipe in compliance with PWD requirements and all laws and regulations regarding anode wells installed at this location. The grout pipe shall extend into the hole to a minimum depth of 50 feet from ground level. After the cement grout is in place, the grout pipe shall be removed from the hole and hauled from the jobsite by the Contractor. The grout pumping process shall not be started until the coke breeze has been in place for a minimum of two hours and shall be completed within 24 hours of placement of the coke breeze. The entire grout pumping process shall be completed prior to the drilling rig leaving the jobsite.

E. Grout Seal:

1. The Contractor shall install a grout seal at the anode well as indicated on the drawings. The grout used for this seal shall be a workable slurry consisting of Portland Cement, Bentonite, and water. Water content shall not exceed 6 gal. per 1 sack of cement. Bentonite shall be added to the cement grout in a quantity that is equivalent to 6% by weight of cement.

F. Concrete:

1. The Contractor shall install concrete pads at the locations and as shown on the drawings. The concrete used in these pads shall be class 560-C-3250.

3.4 DISPOSAL OF DRILLER'S MUD

- A. The Contractor, or his Subcontractor, shall dispose of the "Driller's Mud" used for drilling of the anode well in a manner acceptable to all cognizant agencies. The Contractor shall have the spent "Driller's Mud" tested for hazardous and toxic components in accordance with the California Code of Regulations (CCR), Title 22, Division 4, Environmental Health. If deemed hazardous or if required by any governing agency, the spent material must be removed, transported and disposed of in strict accordance with Title 22 and all appropriate hazardous waste laws and regulations. A written notification of the intent to dispose of the waste must be made to the State of California Department of Public Health Services whether sold to a recycling firm or consigned to a hazardous waste hauler. A receipt, in the format acceptable to the regulating authority, for the disposition of these materials shall be obtained from the consignee, and a certified copy given the PWD showing the amounts and destination or end use. The cost for processing and disposing of these wastes shall be included in the various bid items set forth in these documents and no additional compensation will be granted therefore.

3.5 START-UP AND TESTING

- A. Contractor shall test the cathodic rectifier station under actual operating conditions prior to final acceptance by the PWD. During the test all control settings shall be adjusted as directed by the Engineer. Representatives of the rectifier unit supplier shall be present to make adjustments as required during testing at no additional cost to the PWD.

3.6 EXOTHERMIC WELDS

- A. The pipeline coating shall be removed from a 3 inch by 3-inch area and the steel cleaned to bright, shiny metal by mechanical grinding. A proper sized copper sleeve shall be placed over the wire prior to welding. Only enough insulation shall be removed to permit the welding process.
- B. The finished weld shall be tested for adherence by striking the weld with five sharp raps from a minimum 12 -ounce hammer. If any signs of adhesion loss are present between the weld and the steel as a result of this test, the entire weld shall be removed and the cleaning and welding process repeated. After the weld has been allowed to cool, the entire connection shall be encapsulated with a Royston "Handy Cap" No. 2 weld cover and the pipe shall be restored in accordance with the Specifications.

END OF SECTION

CITY OF SAN JUAN CAPISTRANO PUBLIC WORKS DEPARTMENT

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