STANDARD SPECIFICATIONS

FOR WATER, RECYCLED WATER AND SEWER FACILITIES

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Construction Specifications, Standard Drawings & Approved Materials

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STANDARD SPECIFICATIONS

Standard Specifications for Potable Water, Recycled Water and Sewer Facilities

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INTRODUCTION
February 1, 2008

In early 1999, several public water agencies in the East County region of San Diego County formed a committee to work toward the adoption and publication of a common set of Standard Specifications, Standard Drawings, and Approved Materials for construction of potable water, recycled water and sewer facilities. The intent of this effort was to simplify and standardize project requirements for those who provide materials and design or construct projects in the geographical areas administered by these water districts. This effort was the outgrowth of an existing Shared Resources Agreement between these public agencies.

The five original agencies signatory to this effort were Helix Water District, Lakeside Water District, Otay Water District, Padre Dam Municipal Water District, and Riverview Water District. These agencies adopted the name *Water Agencies' Standards Committee (WASC)* as the entity publishing the *Water Agencies' Standards - Specifications*, which became effective on April 2, 2001.

Between the original publication and the date shown above, three additional agencies, San Dieguito Water District, Ramona Municipal Water District, and Santa Fe Irrigation District, have also adopted the *Specifications*. Projects constructed within the jurisdictional boundaries of the agencies listed as Signatory Agencies must conform to the provisions of the current edition of the *Water Agencies' Standards - Specifications.*

It is the intent of the *WASC* that the *Specifications* be dynamic documents. Annual revisions have typically been made to the *Specifications*, and the *WASC* continues to meet on a regular basis and to issue revisions as warranted. The current *Specifications*, including all updates, are now only available through the Water Agencies' Standards website, www.sdwas.com. There is no charge for viewing, downloading, or printing the *Specifications.* Registration is not mandatory, however, automatic e-mail notification of updates to the *Specifications* will be sent to registered users only.

Please refer to Appendix "B" to apply for inclusion of additional products onto the Approved Materials List. Please refer to Appendix "C" for making comments or for proposing changes to the *Water Agencies' Standard Specifications*.

STANDARD SPECIFICATIONS

FOR POTABLE WATER, RECYCLED WATER AND SEWER FACILITIES

CONSTRUCTION SPECIFICATIONS, STANDARD DRAWINGS AND APPROVED MATERIALS

February 1, 2008

SIGNATORY AGENCIES

HELIX WATER DISTRICT
7811 University Avenue
La Mesa, CA 91941

LAKESIDE WATER DISTRICT
10375 Vine Street
Lakeside, CA 92040

OTAY WATER DISTRICT
2554 Sweetwater Springs Boulevard
Spring Valley, CA 91978-2004

PADRE DAM MUNICIPAL WATER DISTRICT
P. O. Box 719003
Santee, CA 92072-9003

RAMONA MUNICIPAL WATER DISTRICT
105 Earlham Street
Ramona, CA 92065

SAN DIEGUITO WATER DISTRICT
505 S. Vulcan Avenue
Encinitas, CA 92024

SANTA FE IRRIGATION DISTRICT
P.O. Box 409
Rancho Santa Fe, CA 92067-0409

The Water Agencies' Standard Specifications have been adopted by the agencies listed above for the installation of Potable Water, Recycled Water and Sewer Facilities within their service boundaries.

The above agencies are not responsible for use of all or any portion of this document on projects built or administered by any other public agency or private entity. No representation or warranty of any kind is made concerning the accuracy, completeness, suitability, or utility of any information or product discussed in this document, and the agencies listed above assumes no liability arising from such use.

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 01000 GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

Wherever the following terms or pronouns occur in these Standard Specifications or in related documents, the intent and meaning shall be interpreted as follows:

A. **"Approved Plans"** shall mean the official plans, profiles, typical cross-sections, working drawings, detail drawings, or exact reproductions thereof, approved by the District and other appropriate government agencies, which show the locations, character, dimensions, and details of the work required to construct the specified public improvements.

B. **"Approved Materials List"** shall mean the listing of those materials reviewed, tested, and allowed for use by the District for installation of its facilities (which may include potable water, recycled water and sewer facilities).

C. **"Board"** shall mean the Board of Directors of the Water Agency of jurisdiction.

D. **"Contractor"** shall mean the independent person, firm, corporation or partnership with whom the District or Developer contracts for the performance of the work or any part thereof covered by the Approved Plans and these Standard Specifications. Instructions or information given by the District to the Contractor's superintendent or agent on the Project shall be considered as having been given to the Developer.

E. **"Developer"** shall mean the independent person, firm, corporation or partnership whose purpose is the development of property. The Developer shall, at all times be represented on the Project in person or by a duly designated agent (Contractor or Private Engineer). Instructions or information given by the District to the Contractor's superintendent or agent on the Project shall be considered as having been given to the Developer.

F. **"District"** shall mean the Water Agency of jurisdiction.

For the unique purpose of these Standard Specifications, District shall also refer to the District's representative(s) acting within the scope of the particular duties entrusted to them.

The District shall resolve any and all issues which may arise with regard to the quality or acceptability of approved materials furnished or work performed, to the manner of performance and rate of progress of the work and shall answer all questions relating to the interpretation of the Standard Drawings, the Approved Plans, the job specifications, if any, and these Standard Specifications as well as the acceptable fulfillment of the Contract on the part of the Developer.

G. **"District Engineer"** or **"Engineer"** shall mean the District's Chief Engineer, or the District's General Manager, acting either directly or through properly authorized agents, such agents acting severally within the scope of the particular duties entrusted to them.

H. **"Inspector"** shall mean the District's authorized agent whose duties shall include those defined elsewhere within these Standard Specifications, but who shall not direct the work being performed.

I. **"Engineer of Work"** or **"Private Engineer"** shall mean a Civil Engineer or Structural Engineer registered or licensed in California who is qualified to act as an agent of the Developer in preparing plans for facilities to be approved and accepted by the District and incorporated thereafter into the District's system

J. **"Project"** or the **"Work"** shall mean the public improvement to be constructed in whole or part within the boundaries of the District.

K. **"Standard Drawings"** shall mean the standard details issued by the District for construction of District facilities.

L. **"Water Agencies' Design Guide"** or **"Water Agencies' Standards Design Guide"** or **"Design Guide"** shall mean the current version of the Water Agencies' Standards Design Guidelines for Potable Water, Recycled Water and Sewer Facilities as adopted and published by the member agencies of the Water Agencies' Standards Committee.

M. **"Water Agencies' Standards"** or **"Water Agencies' Standard Specifications"** or **"Standard Specifications"** shall mean the current version of the Water Agencies' Standard Specifications for Potable Water, Recycled Water and Sewer Facilities as adopted and published by the member agencies of the Water Agencies' Standards Committee.

1.02 LICENSE

The Contractor installing any new facilities or performing work on existing facilities within the District shall possess, prior to the start of the Project, a License, defined by the latest edition of the California Contractor's License Law and Reference Book, as:

A. Class A or C-34 for water pipeline installations.

B. Class A or C-42 for sewer pipeline installations.

C. Class A for major water and sewer facilities such as pump stations, reservoirs and treatment plants.

Any Contractor possessing a license other than a Class A must receive written approval from the District prior to initiating the work.

1.03 OPERATIONS IN PUBLIC RIGHT-OF-WAY

Work in public right-of-way shall be done in accordance with the requirements of the permit issued by the public agency in whose right-of-way the work is located, in addition to the requirements of the Approved Plans and Standard Specifications. If a permit is not required, the work shall conform to the standards of the public agency involved in addition to conforming to the Approved Plans and Standard Specifications.

1.04 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) REQUIREMENTS

The Contractor shall abide by the conditions of the Regional Water Quality Control Board, General Construction Activity Storm Water Permit and the project Storm Water Pollution Prevention Plan (SWPPP).

1.05 REFERENCE STANDARDS

The reference standards of the organizations listed below form a part of these Standard Specifications to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise stated.

	AGENCY	ADDRESS
AASHTO	American Association of State Highway and Transportation Officials	444 N. Capital St. Washington, D.C. 20004
ACI	American Concrete Institute	P.O. Box 19150 Detroit, MI 48219
ANSI	American National Standards Institute	1430 Broadway New York, NY 10018
ASA	American Standards Association	70 East 45th Street New York, NY 10017
ASME	American Society of Mechanical Engineers	345 E. 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials	1916 Race Street Philadelphia, PA 19103
AWS	American Welding Society	550 N.W. Le Jeune Rd. Miami, FL 33135
AWWA	American Water Works Association, Inc.	6666 W. Quincy Ave. Denver, CO 80235
CAL/ OSHA	State of California Occupational Safety and Health Administration	1006 Fourth Street Sacramento, CA 95814
CFR	Code of Federal Regulations	Office of Federal Register National Archives Administration Washington, D.C. 20408
CRSI	Concrete Reinforcing Steel Institute	228 N. La Salle St. Chicago, IL 60601
CSLB	Contractors State License Board	9821 Business Park Dr. Sacramento, CA 95827
Helix WD	Helix Water District	7811 University Ave. La Mesa, CA 91941-4927
Lakeside WD	Lakeside Water District	10375 Vine Street Lakeside, CA 92040
NACE	National Association of Corrosion Engineers	1440 South Creek Dr. Houston, TX 77084
NFPA	National Fire Protection Agency	Battery March Park Quincy, MA 02269

	AGENCY	ADDRESS
NSF	National Sanitation Foundation	P.O. Box 130140 Ann Arbor, MI 48113
Otay WD	Otay Water District	2554 Sweetwater Springs Blvd. Spring Valley, CA 91978
Padre Dam MWD	Padre Dam Municipal Water District	P.O. Box 719003 Santee, CA 92072-9003
Ramona MWD	Ramona Municipal Water District	105 Earlham St. Ramona, CA 92065-1599
San Dieguito WD	San Dieguito Water District	505 S. Vulcan Ave. Encinitas, CA 92024
Santa Fe ID	Santa Fe Irrigation District	P.O. Box 409 Rancho Santa Fe, CA 92067-0409
SDG&E	San Diego Gas and Electric Company	101 Ash Street San Diego, CA 92102
SSPC	Steel Structures Painting Council	4400 Fifth Ave. Pittsburgh, PA 1521
SSPWC	Standard Specifications for Public Works Construction (Greenbook)	Joint Cooperative Committee c/o Associated General Contractors of California 1255 Corporate Center Dr., Suite 100 Monterey Park, CA 91754
Sweetwater Authority	Sweetwater Authority	505 Garrett Ave. Chula Vista, CA 91910
UBC	Uniform Building Code	International Conference of Building Officials 5360 Workman Mill Rd. Whittier, CA 90601
UNI-B	Uni-Bell PVC Pipe Association	2655 Villa Creek Dr., Ste. 155 Dallas, TX 75234
UPC	Uniform Plumbing Code	International Conference of Plumbing and Mechanical Officials 20001 E. Walnut Dr. South Walnut, CA 91789
WADG	Water Agencies' Design Guide	www.sdwas.com
WAS	Water Agencies' Standards	www.sdwas.com

1.06 ORDER OF PRECEDENCE

The Approved Plans, together with these Water Agencies' Standard Specifications, shall govern the work to be done. Anything indicated in the Standard Specifications but not shown on the Approved Plans, or shown on the Approved Plans but not indicated in the Standard Specifications, shall be of like effect as though shown or indicated in both. In resolving inconsistencies between the Approved Plans and the various sections of the Standard Specifications, the order of precedence shall be as follows:

1. Technical Specifications (Standard Specifications Sections 2 through 16)

2. Appendices to the Standard Specifications

3. Standard Drawings

4. Approved Plans

5. Approved Materials Lists

6. General Specifications (Standard Specifications Section 1)

7. Reference Standards

Figure dimensions on drawings shall take precedence over scale dimensions. Detailed drawings shall take precedence over general drawings. The Contractor shall immediately notify District if any conflict, inconsistency, omission, error, or ambiguity is discovered between the Approved Plans and the various sections of the Standard Specifications.

1.07 EXAMINATION OF APPROVED PLANS, SPECIFICATIONS, AND SITE

The Contractor shall carefully examine the site of the proposed work, the Approved Drawings, the Specifications, and all other pertinent documents. Contractor shall be satisfied as to the character, quality and quantities of work to be furnished, and as to the requirements of the Approved Plans and these Standard Specifications. The District will not be liable for any loss sustained by the Contractor as a result of any variance between conditions as shown on the Approved Plans and the actual conditions revealed during the progress of the work or otherwise.

1.08 QUALITY OF WORK AND MATERIALS

The work shall be performed in a thorough, worker-like manner in accordance with the Approved Plans and these Standard Specifications. All work shall conform to the lines and grades shown on said plans.

At least one member of the Contractor's workforce who is thoroughly familiar with the specified requirements of work and who is completely trained and experienced in the construction skills necessary for satisfactory completion of the work shall be present at the site, directing the work, at all times.

Adequate number of skilled workers and sufficient and appropriate equipment shall be present at the site prior to commencing daily construction operations.

The Engineer shall inform the Contractor if any person in the employ of the Contractor fails to or refuses to comply with the requirements of these Specifications, or appears to the Engineer to be incompetent or unfit, or acts in a disorderly, improper or unsafe manner. It shall be the Contractor's responsibility to dismiss any such person from the work site or take any other action deemed appropriate by the Contractor.

All equipment, materials, and supplies to be incorporated in the work shall be new. All equipment, material and supplies shall be produced in a good and worker-like manner. Materials to be used within the scope of work on the project shall be those listed in the current Approved Materials List. When the quality of a material, process, or article is not specifically set forth in the Approved Materials List, the Approved Plans, or the Specifications, the best available quality of the material, process, or article shall be provided.

The Contractor may offer as substitution any material, process, or article substantially equal or better in every respect to that so indicated or specified; provided, however, that if the material, process, or article offered by the Contractor is not, in the opinion of the District, substantially equal or better in every respect to that specified, then the Contractor must furnish the material, process, or article specified or one that in the opinion of the District is substantially equal or better in every respect.

1.09 SHOP DRAWING PROCEDURES

A. Unless amended by job specifications, Developer shall submit, at no expense to District, six (6) copies of all shop drawings, submittals, and manufacturer's cut sheets detailing the methods and materials intended for use on the project. Submittals shall be consecutively numbered, shall be accompanied by a transmittal letter marked with the number and title of the submittal, name of the project, name and address of the Contractor and supplier, along with contact persons for same, and shall be checked by and marked with the approval of the Contractor. In addition, any submittals that deviate from the requirements of the Contract shall be clearly noted and explained in the transmittal letter.

B. District will review the submittals so provided, and will return the submittals marked to indicate that submittals are approved or must be returned for revision. Unless amended by job specifications, District shall be allowed a minimum of ten (10) working days for the review of submittals. Submittals returned for revision must be corrected as noted and developer must re-submit shop drawings as noted above until approved by District. Review and approval of shop drawings by District shall not relieve developer of the responsibility for executing the work in accordance with these Standard Specifications, using proper methods of construction, nor from furnishing materials or work required but not indicated on the submittals.

C. Construction shall not begin on relevant portions of the work until shop drawing submittals have been approved by District. Shop drawings shall be submitted in a timely manner so as not to delay construction of the work.

1.10 MATERIALS

All materials shall be new and unused, of the quality defined in these Standard Specifications, selected from the Approved Materials List, and approved by the District Engineer. All materials to be used within a specific project and intended for equivalent uses shall be identical as to manufacturer and model number. Materials not identical as to manufacturer and model number to those approved by the District Engineer, materials that are damaged, or materials that are otherwise unacceptable to the District Engineer shall be rejected and immediately removed from the job site.

A. All materials shall be of the makes and models tested and approved for use. Selections shall be made from the current Approved Materials List. It is the Contractor's responsibility to verify that materials received for the job conform to the current Approved Materials List.

Products on the Approved Materials List may be disqualified at any time if the quality of the product is no longer judged as acceptable by the Engineer or if a higher-quality product becomes available.

B. Job-specific approval of materials not shown on the Approved Materials List is solely at the discretion of the District Engineer, and materials so approved shall not be construed as approved for general use. For job-specific consideration of materials not shown on the Approved Materials List, the shop drawing procedures outlined within this Section Requirements shall be followed.

1.11 PRE-CONSTRUCTION CONFERENCE

A. The Developer shall schedule a Pre-Construction Conference with the District's Inspection Department at least five (5) days prior to beginning any water or sewer work in the field. As a minimum, the attendees at this conference shall include:

1. The Owner or a designee, who is to be the on-site representative of the Owner of the project.

2. The Contractor's Superintendent.

3. Contractor's Competent Person.

4. The Soils Technician who is to verify backfill compaction.

5. The District Inspector.

B. In addition, the following persons shall be invited to the Pre-Construction conference upon request of the District:

1. A representative of the Agency of Jurisdiction.

2. Representative(s) of other utility companies.

C. The purpose of this meeting is to review the plans for the project relative to the requirements of the District's Standard Specifications, the Approved Plans, and the Approved Materials List. The Contractor shall be prepared to discuss, in detail, the project schedule, and shall provide the District with any schedules, submittals, lists, permits, or other information required by the Engineer, by these Standard Specifications or by the job specifications.

1.12 INSPECTION

All work and materials furnished shall be subject to inspection for compliance with these Standard Specifications and all other appropriate specifications.

The Contractor shall make application to the District for inspection at least five (5) days in advance of starting any work. Inspectors shall be recognized as authorized agents of the District, and their duties shall be to evaluate materials used and work performed. Instructions given by the Inspector shall be respected and executed by the Contractor.

The District shall at all times have access to the work wherever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for inspection. The Contractor shall provide adequate safe means by which to inspect the work.

Failure or oversight of any Inspector to condemn defective materials at the time of use, or to condemn improper work at the time it is performed, shall not diminish the Contractor's obligations to meet the requirements of the Approved Plans and these Standard Specifications. The Contractor shall remove and replace any faulty materials and work at no additional cost to the District upon discovery of the defects or upon receipt of notice from the District to do so.

Defective work or material may be rejected prior to the date of acceptance of the work notwithstanding that such defective work or material may have been previously inspected. Acceptance shall not constitute approval of latent defects or waiver of maintenance requirements.

Any work covered up or otherwise rendered inaccessible without approval or consent of the District must, if required by the District, be uncovered for examination at the Contractor's expense. Any work done in the absence of the Inspector without written permission shall be subject to rejection.

1.13 TESTING LABORATORY SERVICES

A. The Developer shall engage testing firms to provide the various testing required for the project. Soils testing is typically required for projects, but concrete testing or other types of testing may additionally be required. The testing firm shall provide a competent, on-site Soils Technician to perform the various compaction testing required for the project. All tests shall be performed at the direction of the Soils Technician and in a manner acceptable to the District. Soils testing shall be performed in accordance with Section 02223 of these Standard Specifications.

B. Prior to the District's acceptance of the project, a report of all soils tests taken shall be submitted to the District in accordance with Section 02223 of these Standard Specifications.

1.14 CONSTRUCTION STAKING AND PRESERVATION OF MONUMENTS

Staking of the various public improvements required shall be performed by the Developer's surveyor. Generally, stakes for alignment and grade shall be set at 7.6m (25') intervals. The survey shall conform to the lines, grades, and dimensions shown on the Approved Plans. The District shall give an account of the adequacy, readability, and frequency of the stakes provided and shall comment on any remedies required.

The Contractor shall preserve all monuments, benchmarks, survey marks, and stakes. In case of their removal or destruction by Contractor or its employees, agents or subcontractors, the Contractor shall be liable for the cost of their replacement.

1.15 ENVIRONMENTAL CONTROL

The Contractor shall abide by all applicable local, state and federal regulations, and by the conditions of the Regional Water Quality Control Board.

The Contractor shall provide effective measures where necessary to prevent operations from producing dust in an amount damaging to property or causing a nuisance as determined by the District. The Contractor shall be responsible for any damage due to dust originating from its operations.

The Contractor shall anticipate and correct any erosion problem arising from its operations.

1.16 PUBLIC SAFETY AND TRAFFIC CONTROL

A. The Contractor shall at all times conduct operations in a manner causing the minimum obstruction and inconvenience to public traffic. The Contractor shall not interfere with the normal operation of public transit vehicles unless otherwise authorized. Open trenches and excavations shall be provided with adequate barricades in accordance with the approved traffic control plan or the requirements of the agency of jurisdiction. At night, lights shall mark all open work and obstructions. The Contractor shall install and maintain all signs, lights, flares, barricades, traffic plates, railings, runways, stairs, bridges and other equipment necessary to safeguard the public. Safety instructions received from governmental authorities shall be followed, but compliance with such instructions shall not diminish the Contractor's responsibility or liability for accidents to workers or damage or injury to persons or property.

In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work, and the Contractor shall fully comply with all state, federal, and other laws, rules, regulations, and orders relating to the safety of workers and others.
The right of the District to conduct construction review or observation of the Contractor's performance does not include review or observation of the adequacy of the Contractor's safety measures in, on, or near the construction site.

The Contractor shall take immediate action to correct any condition adversely affecting public safety.

B. The Contractor shall submit a traffic control plan to the agency having jurisdiction and shall obtain approval prior to starting the work.

1.17 PROTECTION OF EXISTING FACILITIES

A. The Contractor's attention is directed to the possible existence of pipe and other underground improvements that may or may not be shown on the Approved Plans. Once discovered, the Contractor shall preserve and protect all such improvements whether shown on the Approved Plans or not. The Contractor shall provide and install suitable safeguards, and shall be responsible for the care and protection of all existing sewer and water pipe, electrical and telephone conduits, gas mains, culverts, or other above-ground or below-ground facilities or structures which may be encountered in or near the area of work. It shall be the responsibility of the Contractor to notify each agency of jurisdiction and utility company and to make arrangements for location of facilities prior to beginning construction. In the event of damage to existing facilities during the progress of the work, such facilities shall be replaced or restored to original condition, as determined by District, at the Contractor's expense.

B. The Contractor shall be responsible for determining in advance the location, elevation, alignment and pipe type and size of all existing pipelines to which connections are to be made. Potholing to determine location will be allowed only after providing the District with three (3) day's advance notice. The Contractor is required to contact Underground Service Alert (USA) at 1-800-227-2600 or 1-800-422-4133 for mark-out of all utilities in the area of the work.

C. If the Contractor, either before commencing work or during the course of the work, finds any discrepancy between specifications or drawings and the physical conditions at the site of the work, Contractor shall promptly notify the District in writing of such discrepancy.

1.18 PROTECTION OF LANDSCAPING

A. The Contractor shall be responsible for the protection of all trees, shrubs, fences, and other landscape items adjacent to or within the work area, unless specific removals are indicated on the Approved Plans.

B. In the event of damage to landscape items, including the thickness of topsoil, the Contractor shall replace the damaged items in kind, in a manner satisfactory to the District and the Developer.

C. When pipelines are proposed within planted or otherwise improved areas in public or private easements, the Contractor shall restore such areas to original condition after completion of the work.

D. When pipelines are proposed within unimproved areas, the ground surface shall be dressed smooth to the contour of the original ground and left in a neat, presentable condition, free of cleared vegetation, rubbish and other construction wastes. Rocks and clumps that cannot be readily covered by spreading shall be hauled away and disposed of by the Contractor.

E. Unimproved areas disturbed during construction of the pipeline shall be hydro seeded in accordance with these Standard Specifications.

1.19 PUBLIC UTILITIES

A. In case it should be necessary to relocate or temporarily maintain the property of any public utility or any other property, and it is understood that the cost of such relocation or temporary maintenance is not required to be borne by the owner of the utility or property, the Contractor shall bear all expenses incidental to the removal or temporary maintenance of such property in a manner satisfactory to said owner. It is understood that in such cases, the utility or property owner has the option of doing such work with his or her own forces, or permitting the work to be performed by the Contractor.

B. The right is reserved to the State, County, City, District or utility owners to enter at any time upon any street, alley, right of way or easement for the purpose of making changes for maintenance or repairs to their property necessitated by the Contractor's work.

1.20 UTILITIES CROSSING WATER, RECYCLED WATER OR SEWER FACILITIES

Wherever new utilities cross under or over water, recycled water or sewer facilities, the minimum vertical separation shall be 300mm (12”) unless otherwise approved by the District Engineer. All new utilities crossing under or over water, recycled water or sewer facilities shall remain exposed until inspected and approved by the District Engineer. Wherever new utilities cross under or over water, recycled water or sewer facilities, backfill and compaction within the limits of the water, recycled water, or sewer facility trench width shall be in strict conformance with the backfill and compaction requirements specified herein.

1.21 HORIZONTAL SEPARATION OF UTILITIES PARALLELING WATER, RECYCLED WATER OR SEWER FACILITIES

Wherever new utilities parallel water, recycled water or sewer facilities, the minimum horizontal separation shall be such that 900mm (36”) of undisturbed soil separates adjacent trench edges, unless otherwise approved by the District Engineer.

1.22 PROTECTION OF WORKERS IN TRENCH EXCAVATION

Whenever work involves trench excavation, the Contractor shall provide all necessary shoring, bracing, sloping, or other provisions to be made for worker protection from hazard of caving ground during the excavation. If such plan varies from the shoring system standards established by the Construction Safety Orders of the Division of Industrial Safety, a Civil Engineer or Structural Engineer registered in the State of California shall prepare the plans.

Contractor shall comply with the Safety Orders of California, Code of Regulations: Title 8, Section 1539 (Excavation, Trenches, Earthwork).

1.23 WORK WITHIN CONFINED SPACES

The Contractor shall comply with all Federal and State regulations for confined space entry. Work inside confined spaces as defined by the applicable regulations shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the Safety Orders of the California Code of Regulations Title 8 Article 108 sections 5156 et seq. for confined space entry have been performed and the area is verified as safe to enter.

1.24 CONSTRUCTION EQUIPMENT

The Contractor shall furnish appropriate construction equipment to perform the work in accordance with the Approved Plans and Specifications. Such equipment shall be in a good state of repair and shall be maintained in such state during the progress of the work. In no case shall the manufacturer's rating or capacity limitations for any equipment be exceeded.

1.25 STORAGE OF MATERIALS

All materials for use in the work shall be stored by the Contractor in such manner as to prevent damage from exposure to the elements, admixture of foreign materials, or from any other cause. The Contractor shall be entirely responsible for damage or loss by weather or other causes. The Material Safety Data Sheets (MSDS) for all products to be used in the work shall be kept on-site by the Contractor, and the material manufacturer's recommendations for proper storage of its products shall be strictly followed.

Materials shall not be stored on District property without the written permission of the Engineer. The Contractor shall be responsible to provide its own storage area or property. Materials for use on the work shall be stored on private property only as allowed by law and with the written permission of the property owner, and a copy of such permission shall be provided to the District. In addition, a release letter signed by said property owner and stating that materials are no longer stored on the property and that Contractor has restored the area to original condition is required prior to the filing of the Notice of Completion.

1.26 HOURS OF WORK

The normal hours of work shall be between the hours of 7:00 a.m. and 3:30 p.m., Monday through Friday, excepting District-recognized holidays. Alternate work hours may be arranged with the District to accommodate time-restricting schedules imposed on the Contractor by other agencies. The District shall receive written notice 5 days prior to any proposed change in work hours. In no case shall any work be performed outside of the normal working hours indicated above without prior approval by the District.

1.27 WATER AND POWER FOR CONSTRUCTION PURPOSES

Water for construction purposes:

A. All water used on the project shall be obtained from District's sources using a construction meter.

B. The construction meter and service connection shall be obtained from the District. The Contractor shall make arrangements with the District for payment of the deposit and installation of the meter.

C. The Contractor shall pay for all construction water used in accordance with District's Rules and Regulations.

D. Damage caused to the meter will be charged to the Contractor.

E. Water for construction purposes outside the District's service area shall be obtained from the District within which the project lies.

Contractor shall make all arrangements for electrical power required during construction.

1.28 HOUSEKEEPING DURING CONSTRUCTION AND FINAL CLEAN-UP

A. The Contractor shall provide suitable drainage and shall erect such temporary structures as are necessary to protect the work or materials from damage. The Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the work or the materials occasioned by any cause before the acceptance of the work by District and shall bear the expense thereof.

B. The Contractor shall, at all times during the course of the work, maintain work areas and all adjacent properties and public access roads free from accumulations of waste, debris, rubbish or construction materials.

C The Contractor shall conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

D. Dry materials and rubbish shall be moistened to prevent blowing dust. Loads of excavated materials leaving the site or being imported to the site shall be covered or moistened to prevent blowing dust.

E. Upon completion of the work, and before making application for acceptance of the work, the Contractor shall clean all rights-of-way, streets, borrow pits, and all other grounds occupied by him in connection with the work. All rubbish, excess materials, temporary structures and equipment shall be removed. All parts of the work shall be left in a neat and presentable condition, as determined by the Engineer, prior to acceptance of the work by District.

1.29 HAZARDOUS WASTE AND UNKNOWN PHYSICAL CONDITIONS

If conditions listed below are found during construction, or if any other conditions are found during construction that may be detrimental to the District's facilities being constructed, or to the health and safety of the public, the Contractor shall promptly notify the District.

A. Material that the Contractor or Engineer believes may be hazardous waste, as defined in Section 25117 of the Health and Safety Code, and is thus required to be removed to a Class I, Class II, or Class III disposal site in accordance with the provisions of existing law. If such material is discovered, Contractor shall immediately cease work and shall not disturb the job site except as required to protect public safety.

B. Subsurface or latent physical conditions at the site differing from those indicated.

C. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided in the Contract.

The Contractor shall promptly inform the District of any such conditions found during construction. The District shall investigate the conditions, and if it finds that the conditions do materially differ from those shown or expected, or do involve material that may be hazardous waste, Contractor shall cease work in the impacted area. If material that may be hazardous waste is discovered, the Developer shall insure that the appropriate government agencies are contacted prior to any further work being performed and that a solution is implemented.

1.30 WORK TO BE DONE

The work to be done consists of furnishing all materials, equipment, labor and all other items necessary for the construction and installation of a complete facility as shown on the Approved Plans and in accordance with these Standard Specifications. In some instances, the District may furnish certain materials and services, which will be expressly called out on the Approved Plans.

The District's approval of the plans prepared by a Private Engineer denotes agreement with the plans as prepared and is not an acceptance of responsibility as to accuracy. The Private Engineer shall be responsible for any errors, coordination with other agencies/utilities and interpretation of plans. The intent is that the completed Work shall be in general conformance with the Approved Plans and in accordance with the requirements of these Standard Specifications.

1.31 CHANGES TO THE WORK

If the District, due to conditions that change during the progress of the work, determines it impracticable for the Contractor to strictly comply with the Approved Plans or the Standard Specifications, the District may prescribe a modification of requirements. The District may at any time during the life of the project, by written order, make such changes as it may find necessary in the design, line, grade, form, location, dimensions, plan or material of any part of the work originally specified or shown on the Approved Plans.

If such changes increase the cost of material, or work to be performed, the difference in cost shall be borne by the Developer. All changes so performed shall be at no cost to the District.

The District shall provide written authorization for all changes to the work.

The following procedure shall be followed for revisions or changes to the Approved Plans:

A. Prints showing proposed changes shall be submitted to the District for review and approval.

B. If the changes will require an increase in bond amount, plans will be held until a new estimate has been prepared and a new bond has been placed with the District.

C. If the changes do not affect the bonding amount, as determined by the District Engineer, the plans shall be reviewed and upon approval, the Private Engineer shall be notified to make the corrections on the original drawings. A print of the revised plan shall then be submitted to the District for final checking and approval. A signature block shall be added to the plans to indicate approval of changes made.

D. After these steps have been taken, the Contractor may proceed with the revised construction.

1.32 RECORD DRAWINGS

A. During the course of the work, the Contractor shall keep accurate and updated records of the changes made to the work. The changes may be dictated by field conditions, unknown obstructions, design oversight, or other circumstances determined to be in the best interest of the District.

B. At the end of the project, the Contractor shall provide the District with two sets of prints, with all changes redlined. In addition to the field changes, the correct location of all water and sewer services and driveway centerlines with stations shall be indicated. The District's field representative shall verify that all changes have been included. All revisions will be incorporated.

C. The District's Engineering Department will send one of the redlined sets to the Private Engineer, who will incorporate the changes onto the original mylars, prior to accepting them as final record drawings of the work.

D. The Private Engineer will provide the District with the following:

1. Original mylars if on District title block

2. Reproducible reverse mylars if not on District title block

3. Electronic data per District requirements

E. Only photo mylars or digital mylars of 4 or 5 mil thickness will be accepted. Mylars must be made from the original mylars and not from interim mylars or sepias. Each sheet shall incorporate a "Record Drawing" box signed by the Engineer of Work.

1.33 PROJECT CLOSEOUT AND FINAL ACCEPTANCE

The District's Board of Directors or designee shall be responsible for final acceptance of all projects. The following items of work shall be completed prior to final acceptance by District:

A. The project has been completed in accordance with the Approved Plans, the job specifications and these Standard Specifications.

B. Final inspection has been performed by District. Any "punch list" items generated by preliminary inspection shall have been completed.

C. Record drawings reflecting any changes to the project have been submitted to the District's Inspection Department in accordance with these Standard Specifications.

D. A Soils Test Report has been submitted to the District in accordance with Section 02223 of these Standard Specifications.

E. All costs and fees relevant to the work have been paid to District by the Developer.

F. All aspects of the Construction Agreement have been completed to the satisfaction of the District.

Following final acceptance by the District, the District will prepare a Notice of Completion and will have such Notice recorded by the County Recorder.

1.34 WARRANTY

A. The work shall be guaranteed against failure due to defective materials or workmanship for a period of one (1) year from the recording date of the Notice of Completion. The one-year warranty period shall not, in any way, affect the liability of any party for latent or patent defects allowed for under State law.

B. All repairs shall be made pursuant to the Development Agreement with the District and in accordance with the District's Rules and Regulations and current Standard Specifications.

1.35 WARRANTY INSPECTION

The District will perform a warranty inspection prior to the expiration of the one-year warranty period. The Developer will be notified in writing of any deficiencies revealed by this inspection. The warranty bond will not be released until the required repairs are completed. If the warranty inspection is satisfactory, the District will release the warranty bond at the end of the one-year warranty period.

PART 2 MATERIALS

"Not Used"

PART 3 EXECUTION

"Not Used"

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 01070 ABBREVIATIONS

PART 1 GENERAL

1.01 DESCRIPTION

This section describes abbreviations and how they are used in these specifications and on the Approved Drawings.

1.02 REFERENCED STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

CSI TD-2-4	-	Construction Specifications Institute Abbreviations
SSPWC	-	Standard Specifications for Public Works Construction "Greenbook"

1.03 DESCRIPTION

A. When references are made in these specifications to the standards, specifications, or other published data of various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only.

B. If an abbreviation is not listed below it shall be as described in Document TD-2-4 of the Construction Specifications Institute (CSI).

C. Where the use of the San Diego Area Standard Specifications for Public Works Construction "Greenbook" or Regional Standard Drawings are required, reference should be made to the SSPWC for the use and description of abbreviations.

D. Abbreviations can have more than one meaning. The abbreviation shall be considered with respect to different disciplines where the context in which each is used makes the meaning clear.

1. Example:

a. FF means "finish floor" when referring to a floor slab.

b. FF means "flat face" when referring to a pipe flange.

E. Discrepancies shall be noted and brought to the District's attention for interpretation.

1.04 LIST OF ABBREVIATIONS

The following list of abbreviations is for use in these Standard Specifications and the Approved Plans:

ABBREVIATION	TERMS
A	Ampere/Area
AA	Aluminum Association
AASHTO	American Association of State Highway and Transportation Officials
AB	Anchor Bolt/Aggregate Base
ABAN	Abandoned
ABC	Asphalt Base Course
AC	Acre/Asphalt Concrete/Alternating Current
ACI	American Concrete Institute
ACP	Asbestos-Cement Pipe
ACU	Access Door
AE	Architect-Engineer
AFF	Above Finished Floor
AGG	Aggregate
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
AL	Aluminum
AMB	Ambient
AMP	Ampere
ANG	Angle
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ARCH	Architecture/Architectural
ARV	Air-Release Valve
ARVV	Air-Release and Vacuum Valve
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPH	Asphalt
ASSY	Assembly
ASTM	American Society for Testing and Materials
ATS	Automatic Transfer Switch
AVE	Avenue
AVG	Average
AWG	American Wire Gage
AWS	American Welding Society
AWWA	American Water Works Association
BB	Back-to-Back
BC	Beginning of Curve/Back of Curb/Bare Copper
BEG	Begin
BETW	Between
BF	Blind Flange
BFV	Butterfly Valve
BHP	Brake Horsepower
BK	Back/Brake
BKR	Breaker
BL	Building
BLK	Block
BLVD	Boulevard
BM	Bench Mark/Beam
BO	Blowoff
BOP	Bottom of Pipe

ABBREVIATION	TERMS
BOT	Bottom
BP	Baseplate
BRG	Bearing
BRNZ	Bronze
BTN	Button
BTU	British Thermal Unit
BUR CBL	Buried Cable
BVC	Begin Vertical Curve
BW	Block Wall
C	Conduit/Celsius/Civil Drawings/Copper
CAB	Crushed Aggregate Base
CAP	Capacity
CB	Catch Basin/Circuit Breaker
CC	Cooling Coil
C-C	Center-to-Center
CCB	Concrete Block
CD	Cross Drain/Condensate Drain/Ceiling Diffuser
CEM	Cement
CF	Cubic Feet/Curb Face
CFH	Cubic Feet Per Hour
CFM	Cubic Feet Per Minute
CFS	Cubic Feet Per Second
CG	Construction Grade
C&G	Curb and Gutter
CHG	Change
CHKD PL	Checkered Plate
CI	Cast-Iron
CIP	Cast-In-Place/Cast-Iron Pipe
CISP	Cast-Iron Soil Pipe
CISPI	Cast-Iron Soil Pipe Institute
CJ	Construction Joint
CL	Centerline/Class/Clearance/Chlorine
CLR	Clear
CMLCSP	Cement-Mortar Lined & Coated Steel Pipe
CMLSP	Cement-Mortar Lined Steel Pipe
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CMU	Concrete Masonry Unit
CO	Cleanout/Conduit Only
COL	Column
COMM	Communication
COMP	Composite
COMPL	Complete
CONC	Concrete
CONN	Connection
CONST	Construct or Construction
CONT	Continuous
CONTR	Contractor
COORD	Coordinate/Coordinated
COP	Copper
COR	Corner
CORP	Corporation
CP	Cathodic Protection
CPLG	Coupling
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard, US Department of Commerce

ABBREVIATION	TERMS
CT	Center Top/Current Transformer
CTG	Coating
CTR	Center
CULV	Culvert
CU YD, CY	Cubic Yard
CYL	Cylinder
D	Degree of Curvature
DB	Direct Buried/Decibel
DBL	Double
DC	Direct Current
DEPT	Department
DET	Detail/Detour
DG	Decomposed Granite
DI	Drop Inlet
DIA	Diameter
DIAG	Diagonal
DIM	Dimension
DIMJ	Ductile-Iron Mechanical Joint
DIP	Ductile-Iron Pipe
DIPRA	Ductile-Iron Pipe Research Association
DISCH	Discharge
DIST	Distance
DMH	Drop Manhole
DN	Down
DR	Drain/Door
DSL	Diesel
DWG	Drawing
DWY	Driveway
E	East/Electrical Drawings
EA	Each
EC	End of Curve
ECC	Eccentric
ED	External Distance
EE	Each End
EF	Each Face/Exhaust Fan
EFF	Efficiency
EFL	Effluent
EGL	Energy Grade Line
EL	Elevation/Each Layer
E/L	Easement Line
ELEC	Electric
ELP	Elliptical
ENC	Encasement or Encased
ENCL	Enclosure
ENG	Engine
ENGR	Engineer
EOS	Equivalent Opening Size
EP	Edge of Pavement/Explosion Proof
EPA	Environmental Protection Agency (Federal)
EQ	Equation
EQL	Equal
ESMT	Easement
EST	Estimate or Estimated
ETC	And so Forth
EVC	End Vertical Curve

ABBREVIATION	TERMS
EW	Each Way
EXC	Excavate or Excavation
EXP	Expansion
EXST	Existing
EXT	Exterior/Extension
F	Fahrenheit/Floor
FAB	Fabricate
FBRBD	Fiberboard
FC	Foot-Candle
FCO	Floor Cleanout
FCV	Flow Control Valve
FD	Floor Drain
FDN	Foundation
FE	Flanged End/Fence
FED SPEC	Federal Specification
FF	Finished Floor/Flat Face
FG	Finished Grade
FH	Fire Hydrant
F&I	Furnish and Install
FIG	Figure
FIP	Female Iron Pipe Thread
FIT	Fitting
FL	Floor/Flow Line
FLG	Flange
FM	Force Main/Factory Mutual
FMH	Flexible Metal Hose
FNSH	Finish
FOC	Face of Concrete
FPC	Flexible Pipe Coupling
FPM	Feet Per Minute
FPS	Feet Per Second
FS	Finished Surface/Floor Sink/Federal Specifications
FSTNR	Fastener
FT	Feet
FTG	Footing
FUT	Future
G	Gas/General Drawings/Gram
GA	Gage
GAL	Gallon
GALV	Galvanized
GB	Grade Break
GDR	Guard Rail
GE	Grooved-End
GENL	General
GFI	Ground Fault Interrupter
GM	Gas Main
GND	Ground
GPD	Gallons Per Day
GPM	Gallons Per Minute
GR	Grade
GSKT	Gasket
GUT	Gutter
GV	Gate Valve

ABBREVIATION	TERMS
H	Humidistat/Horizontal
HARN	Harness
HB	Hose Bib
HD	Heavy Duty
HDPE	High-Density Polyethylene Pipe
HGL	Hydraulic Grade Line
HGT	Height
HMWPE	High-Molecular Weight Polyethylene
HORIZ	Horizontal
HP	Horsepower/High Pressure
HPT	High Point
HR	Hour/Handrail
HS	High Strength
HV	Hose Valve
HVAC	Heating, Ventilating, and Air Conditioning
HW	Headwall/Hot Water
HWD	Helix Water District
HWL	High Water Level
HWY	Highway
HYDR	Hydraulic
HZ	Hertz (cycles per second)
I	Intersection Angle/Instrumentation Drawings
ICBO	International Conference of Building Officials
ID	Inside Diameter
IE	Invert Elevation
IN	Inches
INCL	Include
INL	Inlet
INSUL	Insulating
INSTL	Install or Installation
INT	Interior
INTR	Intersection
INV	Invert
I/O	Inlet/Outlet
IP	Iron Pipe
IPS	Iron Pipe Size
IPT	Iron Pipe Thread
IRR	Irrigation
JB	Junction Box
JCT	Junction
JN	Join
JT	Joint
KG	Kilogram
KIPS	Thousands of Pounds
KM	Kilometer
KPA	Kilopascal
KV	Kilovolt
KW	Kilowatt
KWH	Kilowatt-Hour
KWHM	Kilowatt-Hour Meter
L	Length of Curve/Long/Landscaping Drawings
LATL	Lateral
LB	Pound

ABBREVIATION	TERMS
LCL	Local
LF	Linear Foot
LNDSCP	Landscaping
LOCN	Location
LP	Light Pole
LPT	Low Point
LR	Long Radius
LS	Lift Station
LT	Left/Light
LWC	Lightweight Concrete
LWIC	Lightweight Insulating Concrete
LWD	Lakeside Water District
LWL	Low Water Level
M	Mechanical Drawings/Meter
MATL	Material
MAX	Maximum
MB	Machine Bolt/Megabyte/Millibars
MC	Metal Channel
MCM	Thousand Circular Mils
ME	Machined End
MECH	Mechanical
MFR	Manufacturer
MG	Million Gallons/Milligram
MGD	Million Gallons Per Day
MH	Manhole
MHZ	Megahertz
MI	Malleable Iron/Mile
MIL	Military Specifications
MIL-	Military Specification (leading symbol)
MIN	Minimum
MIP	Male Iron Pipe Thread
MISC	Miscellaneous
MJ	Mechanical Joint
MM	Millimeter
MO	Motor Operator/Motor Operated/Masonry Opening
MOD	Modification
MON	Monument
MOT	Motor
MOV	Motor Operated Valve
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
MTD	Mounted
N	North/Neutral/Nitrogen
NA	Not Applicable
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
N & C	Nail and Cap
NC	Normally Closed
NCV	Normally Closed Valve
NE	Northeast
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFC	National Fire Code
NFPA	National Fire Protection Association
NIC	Not in Contract

ABBREVIATION	TERMS
NIP	Nipple
NO	Number/Normally Open
NOM	Nominal
NPT	National Pipe Taper
NRS	Non-Rising Stem
NSF	National Sanitation Foundation
NTS	Not to Scale
NTU	Nephelometric Turbidity Units
NW	Northwest
NWL	Normal Water Level
OA	Overall/Outside Air
OC	On Center/Overcurrent
OD	Outside Diameter
OE	Or Equal
OF	Outside Face
OFCI	Owner-Furnished Contractor-Installed
OFCR	Owner-Furnished Contractor-Relocated
OPER	Operator
OPNG	Opening
OPP	Opposite
OSHA	Occupational Safety and Health Administration
O TO O	Out to Out
OUTL	Outlet
OVFL	Overflow
OVHD	Overhead
OWD	Otay Water District
P	Pole
PARA	Paragraph
PB	Push Button/Pull Box
PC	Point of Curvature/Programmable Controller
PCA	Portland Cement Association
PCC	Point of Compound Curvature/Portland Cement Concrete
PDMWD	Padre Dam Municipal Water District
PE	Plain End/Polyethylene/Professional Engineer
PEN	Penetration
PG	Pressure Gage
PI	Point of Intersection
PJTN	Projection
PKWY	Parkway
PL	Plate/Property Line
PLATF	Platform
PLF	Pounds Per Lineal Foot
PM	Parcel Map
PNL	Panel
PO	Push-On
POB	Point of Beginning
POC	Point of Connection
POR	Portion
PP	Power Pole/Polypropylene
PPB	Parts Per Billion
PPM	Parts Per Million
PR	Pair
PRC	Point of Reverse Curve
PRESS	Pressure

ABBREVIATION	TERMS
PRL	Parallel
PRPSD	Proposed
PRVC	Point of Reverse Vertical Curve
PSI	Pounds Per Square Inch
PSIG	Pounds Per Square Inch Gage
PSF	Pounds Per Square Foot
PT	Point of Tangency
PV	Plug Valve
PVC	Polyvinyl Chloride/Point of Vertical Curvature
PVI	Point of Vertical Intersect
PVMT	Pavement
PWR	Power
Q	Flow Rate
QTY	Quantity
R	Right/Radius
RAF	Return Air Fan
RC	Reinforced Concrete
RCP	Reinforced Concrete Pipe
RCPA	Reinforced Concrete Pipe Arch
RD	Road
RDC	Reduce
RDCR	Reducer
RDWY	Roadway
REF	Reference
REINF	Reinforce or Reinforced
RELOC	Relocate
REQD	Required
RES	Reservoir
REV	Revise/Revision
RF	Raised Face
RH	Relative Humidity
RJ	Restrained Joint
RND	Round
RM	Record Map
RMWD	Ramona Municipal Water District
ROS	Record of Survey
RPM	Revolutions Per Minute
RS	Road Survey
RSD	Regional Standard Drawings
RST	Reinforcing Steel
RT	Right
R/W	Right-of-Way
RWGV	Resilient-Wedge Gate Valve
S	South
SA	Sweetwater Authority
SAE	Society of Automotive Engineers
SAN	Sanitary
SC	Seal Coat
SCADA	Supervisory Control and Data Acquisition
SCFM	Standard Cubic Feet Per Minute
SCHED	Schedule
SCRN	Screen
SD	Storm Drain
SD CO	San Diego County

ABBREVIATION	TERMS
SDG	Siding
SDWD	San Dieguito Water District
SE	Southeast
SECT	Section
SF	Square Feet
SFID	Santa Fe Irrigation District
SGL	Single
SH	Sheet/Sheeting/Shielded
SHT	Sheet
SIM	Similar
SKWK	Sidewalk
SLP	Slope
SLV	Sleeve
SM	Sheet Metal
SOL	Solenoid
SOV	Solenoid-Operated Valve
SP	Space/Steel Pipe/Static Pressure/Spare/Stand Pipe
SPCG	Spacing
SPEC	Specification
SPLC	Splice
SPRT	Support
SQ	Square
SS	Sanitary Sewer/Stainless Steel
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
ST	Street
STA	Station
STBY	Standby
STD	Standard
STK	Stake
STL	Steel
STR	Straight
STRL	Structural
STRUCT	Structure
STS	Storm Sewer
SURF	Surface
SW	Southwest
SWG	Swing
SYMM	Symmetrical
SYS	System
T	Ton/Tangent Length of Curve
TAN	Tangent
T/B	Top of Beam
TB	Top of Bank/Terminal Board
T&B	Top and Bottom
TBG	Tubing
TBM	Temporary Bench Mark
TC	Top of Curb
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
TEL	Telephone
TEMP	Temperature/Temporary
THB	Thrust Block
THD	Thread or Threaded
THH	Thrust Harness

ABBREVIATION	TERMS
THK	Thick
TO	Turnout
T/O	Top of
TOC	Top of Concrete/Top of Curb
TOP	Top of Pipe
TOS	Top of Slab
TOT	Total
TP	Telephone Pole
TRA	Tie Rod Assembly
TRD	Thread
TS	Tube Sheet
TYP	Typical
UBC	Uniform Building Code
UD	Underdrain
UG	Underground
UL	Underwriters Laboratories, Inc.
ULT	Ultimate
UON	Unless Otherwise Noted
UPC	Uniform Plumbing Code
UTC	Underground Telephone Cable
UTIL	Utilities
V	Vent/Valve/Volt/Vertical
VAC	Vacuum/Volts, Alternating Current
VC	Vertical Curve
VEL	Velocity
VERT	Vertical
VFD	Variable Frequency Drive
VOL	Volume
VPC	Vertical Point of Curve
VPI	Vertical Point of Intersection
VPT	Vertical Point of Tangency
W	West/Watt/Wide/Water/Wire
W/	With
WADG	Water Agencies' Design Guide
WAS	Water Agencies' Standards
WASC	Water Agencies' Standards Committee
WE	Weld End
WG	Water Gage
WL	Waterline
WLD	Welded
WM	Water Meter
W/O	Without
WP	Waterproof/Working Point
WSE	Water Surface Elevation
WSP	Water Stop
WT	Weight
WTR	Water
WWF	Welded Wire Fabric
WWM	Woven Wire Mesh
WWR	Welded Wire Reinforcement
YCO	Yard Cleanout
YD	Yard
YP	Yield Point

ABBREVIATION	TERMS
YR	Year
YS	Yield Strength

PART 2 MATERIALS

"NOT USED"

PART 3 EXECUTION

"NOT USED"

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 02202 SLOPE PROTECTION AND EROSION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation for slope protection and erosion control.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ACI 301	-	Specifications for Structural Concrete for Buildings
ACI 318	-	Building Code Requirements for Reinforced Concrete
ASTM A 185	-	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM C 90	-	Standard Specification for Load-Bearing Concrete Masonry Units
ASTM C 150	-	Standard Specification for Portland Cement
ASTM C 476	-	Standard Specification for Grout for Masonry
ASTM C 615	-	Standard Specification for Granite Dimension Stone
ASTM E 162	-	Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, and 15000

1.04 LOCAL AND STATE AGENCY REQUIREMENTS

Slope protection and erosion control shall be accordance with the requirements of the Agency of Jurisdiction, the Regional Standards, and the Regional Water Quality Control Board.

PART 2 MATERIALS

2.01 CUT-OFF WALLS

Cut-off walls shall be one of three types according to the Standard Drawings. The following materials are acceptable for the various configurations in the construction of the walls, as shown on the drawings:

A. Portland Cement: Cement shall be Type II per ASTM C 150.

B. Concrete: Per ACI 301. Compression strength shall be 17.2 MPa (2500 PSI) minimum (560-D-3250) with 100mm (4") slump maximum. All admixtures (i.e. air-entraining, accelerators, water-reducing or pozzolan, etc.) shall be per manufacturer's recommendations. Calcium chloride shall not be used in concrete.

C. Masonry: All masonry units shall conform to ASTM C 90, with a minimum compression strength of 10.3 MPa (1500 PSI) minimum @ 28 days.

D. Reinforcing Steel and Welded Wire Reinforcement: Bars shall be per ASTM A 615, Grade 60. Welded wire reinforcement shall be per ASTM A 185. Reinforcing steel and welded wire reinforcement shall be installed in accordance with the Standards Drawings.

E. Mortar: Mortar shall consist of 1 part Portland cement, 1/4 to 1/2 part lime putty or hydrated lime, and sand equal to 2 1/4 to 3 times the sum volumes of cement and lime used and shall conform to ASTM C 476. Mortar compressive strength shall be 12.4 MPa (1800 PSI) minimum @ 28 days.

2.02 SEED MIX (HAND SEEDED)

Where a prescribed seeding or planting palette has not already been designated by the general land-use agency for the project, a site-specific seed mixture list is to be prepared by the Contractor and presented to the District for comment and approval prior to the purchase of any seed and/or planting materials. An example of a seed mixture list for coastal sage scrub re-vegetation is as follows:

BOTANICAL NAME	COMMON NAME	Seed Mix In Kg/Hectare (lbs/acre)
Eriogonum Fasiculatum	Flat-Top Buckwheat	2.24 (2.0)
Artemisia Californica	California Sagebrush	8.97 (8.0)
Lotus Scoparius	Deerweed	5.60 (5.0)
Salvia Apiana	White Sage	1.12 (1.0)
Eriophyllum Confertiflorum	Golden Yarrow	2.24 (2.0)
Yucca Whipplei	Our Lord's Candle	0.56 (0.5)
Vulpia Muralis 'Zorro'	Zorro Fescue	8.97 (8.0)
Plantago (Insolaris) Ovata	Plantain	3.36 (3.0)
Eschscholzia Californica	California Poppy	3.36 (3.0)
Lupinus Hirsutissimus	Stinging Lupine	3.36 (3.0)
Phacelia Parryi	Bluebells	1.12 (1.0)

2.03 HYDRO SEED MIX

The hydro seed mix shall be a bonded matrix consisting of wood fiber, fertilizer and high quality live seed (per Item 2.02 above) in the following proportions:

Seed	See SEED MIX above
Fiber mulch	2,240 Kg/Hectare (2,000 lbs/acre)
Slow release fertilizer 20-10-5	168 Kg/Hectare (150 lbs/acre)
Soil binder	112 Kg/Hectare (100 lbs/acre)

Mix soil binder at the rate of 1 Kg. of concentrate per 208.6 liters of water (1 lb per 25 gallons).

PART 3 EXECUTION

3.01 SURFACE RESTORATION

A. Hand seeding and hydro seeding: Unimproved areas disturbed during the course of construction shall be reseeded by one of the following methods. Hand seeding may be used when the area to be seeded is 0.4 Hectare (1.0 acre) or less. Hydro seeding shall be used on all areas in excess of 0.4 Hectare (1.0 acre). The landscape contractor shall provide all labor, materials, tools and equipment necessary to complete all work as required.

1. Hand seeding shall be performed using the mixture listed above. Seeding shall be performed on prepared topsoil. Depending on the time of year, application of water may be required to speed germination.

2. Hydro seeding shall be performed using the mixture listed above. A landscape contractor licensed to perform this type of work shall install hydro seeding. Preparation of the topsoil and maintenance of the area after seeding shall be performed per the requirements and recommendations of the hydro-seeding contractor. The District, as shown on the Approved Drawings, may require a temporary irrigation system. Apply the hydro seed mixture in the form of slurry consisting of fiber mulch, seed, soil binder, fertilizer, and water. When hydraulically sprayed on the soil surface, the mix shall form a uniform blotter-like ground cover of seed, fertilizer, binder and fiber mulch.

B. Slope Protection:

1. Slopes from 0% to 20%:

Apply hand seeding or hydro seeding per directions described above.

2. Slopes from 20% to 50%:

In addition to the seeding, the following additional slope protection shall be employed:

a. Cut-off Walls:

Cut-off walls shall be installed in accordance with the Standard Drawings and as described below:

Cut-off walls shall be constructed of Portland cement concrete, welded wire reinforcement, and reinforcing steel as described above. The concrete and reinforcement shall be installed per ACI 318.

Alternate #1 - Cut-off walls may be constructed of 200mm x 200mm x 400mm (8" x 8" x 16") concrete block reinforced, each course, with #9 welded wire reinforcement and #4, grade 60, reinforcing bars every other core. Fill all cores with 560-D-3250 concrete. Placement of reinforcing steel shall be per ACI 318.

b. Chevrons:

V-type interception ditches or chevrons shall be installed at 7.6m (25') intervals. The ditches shall be 300mm (12”) deep and shall be skewed in a down slope direction at 45^{o} on each side of the centerline of the easement (i.e. the higher end of the skewed ditch shall be at the centerline and the lower ends of the ditch shall be at the two edges of the easements).

3. Slopes over 50%:

In addition to the seeding, the following additional slope protection shall be employed:

a. Additional Seed:

Annual rye seed, at the rate of 22.4 Kg/Hectare (20 #/acre), shall be included in the seed mix.

b. Cut-off wall and blanket:

Cut-off walls and blanket shall be constructed of Portland cement concrete, welded wire reinforcement, and reinforcing steel as described above. The concrete and reinforcement shall be installed per ACI 318.

Reinforced concrete cut-off walls and the 150mm (6") thick concrete blanket shall be installed in accordance with the Standard Drawings. Block walls are not allowed on slopes over 50%.

c. Chevrons:

V-type interception ditches or chevrons shall be installed as described above.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 02223 TRENCHING, EXCAVATION, BACKFILL AND COMPACTION

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing and installation for trench excavation, backfill, and compaction of piping, conduit, manholes and vaults.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM C 131	-	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 150	-	Portland Cement
ASTM D 75	-	Practice for Sampling Aggregates
ASTM D 1556	-	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	-	Test Method for Moisture-Density Relations of Soils Using a Modified Effort
ASTM D 2419	-	Test Method for Sand Equivalent Values of Soil and Fine Aggregate
ASTM D 2922	-	Test Method for Density of Soil in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	-	Test Method for Water Content of Soil and Rock in Place by Nuclear Methods
ASTM D 3776	-	Test Method for Mass Per Unit Area (Weight) of Woven Fabric
ASTM D 4253	-	Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Plate
ASTM D 4254	-	Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4632	-	Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	-	Test Method for Determining the Apparent Opening Size of a Geotextile
CAL-OSHA	-	Title 8 General Industry Safety Orders

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02202, 03461, 03462, 15000, 15044, 15056, 15061, 15064, and 15065

1.04 GEOTECHNICAL TESTING

The Developer or Contractor shall engage the services of a geotechnical engineering firm or individual licensed in the State of California to monitor soil conditions during earthwork, trenching, bedding, backfill and compaction operations. Sampling and testing procedures shall be performed in accordance with the Reference Standards and as follows:

A. The soils technician shall be present at the site during all backfill and compaction operations. Failure to have the soils technician present will subject such operations to rejection.

B. Density and optimum moisture content of soil shall be determined by the use of the sand cone method, ASTM D 1556, or nuclear density gauge method, ASTM D 2922 & D 3017. Since the composition of the pipe and the walls of the trench have an effect on the nuclear density gauge output, a minimum of 25% of the density and optimum moisture tests shall be made using the sand cone method.

C. Determine laboratory moisture-density relations of existing soil by ASTM D 1557, Method C and/or D (formerly ASTM D 4253 and ASTM D 4254).

D. Determine the relative density of cohesionless soils by ASTM D 1557, Method C and/or D (formerly ASTM D 4253 and ASTM D 4254).

E. Sample backfill material by ASTM D 75.

F. Express "relative compaction" as a percentage of the ratio of the in-place dry density to the laboratory maximum dry density.

A report of all soils tests performed shall be stamped and signed by the soils firm or individual and shall be submitted by the Contractor prior to the filing of the Notice of Completion by the District. The report shall document the sampling and testing of materials, the location and results of all tests performed, and shall certify that materials and work are in compliance with this specification.

1.05 PIPE ZONE

The pipe zone includes the full width of the trench from 150mm (6") below the bottom of the pipe to 300mm (12") above the top of the pipe and extends into manhole or vault excavations to the point of connection to or penetration of such structure.

1.06 TRENCH ZONE

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the pavement zone in paved areas, or to the existing surface in unpaved areas, and extends into manhole or vault excavations above the pipe zone.

1.07 PAVEMENT ZONE

The pavement zone includes the concrete or asphalt concrete pavement and aggregate base section placed over the trench zone and extends into manhole or vault excavations above the trench zone.

1.08 PROTECTION OF EXISTING UTILITIES AND FACILITIES

The Contractor shall be responsible for the care and protection of all existing utilities, facilities and structures that may be encountered in or near the area of the work in accordance with Section 01000.

1.09 PROTECTION OF EXISTING LANDSCAPING

The Contractor shall be responsible for the protection of all trees, shrubs, fences, and other landscape items adjacent to or within the work area in accordance with Section 01000.

1.10 ACCESS

The Contractor shall provide continuous, unobstructed access to all driveways, water valves, hydrants, or other property or facilities within or adjacent to the work areas.

1.11 SAFETY

A. Protection of workers within trenches shall be as required by the California Labor Code and in accordance with Section 01000.

B. All excavations shall be performed in a safe manner and shall be protected and supported in accordance with CAL-OSHA regulations.

C. Barriers and traffic delineators shall be placed in accordance with the requirements of the agency having jurisdiction.

1.12 BLASTING

Blasting for excavation shall not be performed without the written permission of the District. Procedures and methods of blasting shall conform to all Federal, State and local laws and ordinances.

1.13 PIPE JACKING

Pipe jacking may be permitted in accordance with Section 15125. District approval is required in advance of such operations.

1.14 EXCESS EXCAVATED MATERIAL

A. The Contractor shall remove and legally dispose of all excess excavated material and demolition debris.

B. It is the intent of these specifications that all surplus material shall be legally disposed of by the Contractor. Before acceptance of the work by District, the Contractor shall provide the District with written releases signed by all property owners with whom the Contractor has entered into agreements for disposing of excess excavated material, absolving the District from any liability connected therewith.

1.15 FILTER FABRIC

Filter fabric shall be used when excessively wet, soft, spongy, or similarly unstable material is encountered or in areas of suspected high groundwater in accordance with the soils technician's recommendation and the approval of the District Engineer.

1.16 CHANGES IN LINE AND GRADE

In the event obstructions not shown on the plans are encountered during the progress of the work, and which will require alterations to the plans, the District Engineer shall have the authority to change the plans and order the necessary deviation from the line and grade, in accordance with Section 01000. The Contractor shall not deviate from the specified line and grade without prior written approval by the District Engineer.

1.17 HYDROSTATIC TESTING

Pre-testing of the piping system may be performed for the Contractor's convenience at any time. However, the final hydrostatic pressure test shall be as described in Section 15044.

PART 2 MATERIALS

2.01 GENERAL

The Contractor shall furnish backfill material as specified below. All materials used in and above the pipe zone shall be capable of attaining the required relative density.

2.02 IMPORTED GRANULAR MATERIAL - PIPE ZONE

Imported Granular Material shall be used within the Pipe Zone for installations of all pressure pipe and tubing.

The Imported Granular Material shall be quarry waste (decomposed granite) free from organic matter. Material shall have a sand equivalent value of not less than 30 per ASTM D 2419, a coefficient of uniformity of 3 or greater, and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent Passing By Weight
25mm (1")	100
19mm (3/4")	90 – 100
4.75mm (No. 4)	50 – 95
600µm (No. 30)	25 – 45
75µm (No. 200)	3 – 15

Native materials may not be used in lieu of Imported Granular Material within the Pipe Zone unless such native materials meet all of the requirements specified above and specific written permission has been obtained from the District Engineer.

2.03 CRUSHED ROCK - PIPE ZONE

Crushed Rock shall be used within the Pipe Zone for installations of all non-pressure pipe. Crushed rock shall be clean crushed stone free of organic matter. Crushed rock shall be certified to contain less than 1% asbestos by weight or volume and shall conform to the following gradation:

U. S. Standard Sieve Size	Percent Passing By Weight
25mm (1")	100
19mm (3/4")	90-100
12.5mm (1/2")	30-60
9.5mm (3/8")	0-20
4.75mm (No. 4)	0-5
2.36mm (No. 8)	----

In addition, crushed rock for use within the pipe zone shall meet or exceed the following requirements for resistance to abrasion or impact as measured using ASTM Test Method C 131, Test Sample Grading B:

100 Revolutions:	15% Maximum Loss by Weight
500 Revolutions:	52% Maximum Loss by Weight

2.04 IMPORTED GRANULAR MATERIAL - TRENCH ZONE

Imported Granular Material shall be used within the Trench Zone for installations of all pressure pipe and tubing and all non-pressure pipe.

Imported Granular Material for use within the Trench Zone shall conform in all ways to Imported Granular Material specified for use within the Pipe Zone.

Native materials may not be used in lieu of Imported Granular Material within the Trench Zone unless such native materials meet all of the requirements specified for Imported Granular Material within the Pipe Zone and specific written permission has been obtained from the District Engineer.

2.05 SAND-CEMENT SLURRY

Sand-cement slurry shall consist of two sacks, 85.3kg (188 pounds) of Portland cement per cubic yard of sand and sufficient moisture for workability. District approval is required for use of sand-cement slurry as a backfill material.

2.06 TRENCH PLUGS

Trench plugs consisting of compacted Imported Granular Material or sand-cement slurry shall be installed on piping systems that are backfilled with crushed rock.

2.07 FILTER FABRIC

Filter fabric shall be manufactured from polyester, nylon, or polypropylene. Material shall be of non-woven construction and shall meet the following requirements:

Grab tensile strength (ASTM D 4632):	45.4kg (100 lbs) minimum for a 25mm (1") raveled strip
Weight (ASTM D 3776):	152.6g/m^2 (4.5 oz./yd^2)
Apparent opening size (ASTM D 4751):	0.150mm (0.006")

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

A. 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.

B. Organic material from clearing and grubbing operations will not be incorporated in the trench backfill and shall be removed from the project site or retained and incorporated into the topsoil.

3.02 PAVEMENT, CURB, AND SIDEWALK REMOVAL

Bituminous or concrete pavements, curbs, and sidewalks shall be removed and replaced in accordance with the requirements of the agency having jurisdiction.

3.03 DEWATERING

A. The Contractor shall provide and maintain at all times during construction ample means and devices to promptly remove and dispose of all water from any source entering excavations or other parts of the work.

B. Dewatering shall be performed by methods that will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Dewatering methods may include well points, sump points, suitable rock or gravel placed as pipe bedding for drainage and pumping, temporary pipelines, or other means, all subject to the approval of the District Engineer. The cost of all dewatering activities shall be borne by the Developer or Contractor.

C. Sewer systems shall not be used as drains for dewatering trenches or excavations, nor for disposal of collected or accumulated groundwater, without the approval of the agency of jurisdiction.

D. Concrete shall not be poured in water, nor shall water be allowed to rise around concrete or mortar until it has set at least four hours.

E. The Contractor is responsible for meeting all Federal, State, and local laws, rules and regulations regarding the treatment and disposal of water from dewatering operations at the construction site.

3.04 SHORING AND SHIELDING

A. The Contractor's design and installation of shoring shall be consistent with the rules, orders, and regulations of CAL-OSHA.

B. Excavations shall be shored, sheeted, and supported 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.

C. The sheeting and shoring shall be arranged so as not to place any stress on portions of the completed work until the general construction has proceeded far enough to provide ample strength.

D. Care shall be exercised in the moving or removal of trench shields, sheeting, and shoring to prevent the caving or collapse of the excavation faces being supported.

3.05 CORRECTION OF OVEREXCAVATION

Overexcavations shall be corrected by backfilling with approved imported granular material or crushed rock, compacted to 90% relative compaction, as directed by the District Engineer.

3.06 FOUNDATION STABILIZATION

A. When unsuitable soil materials are encountered, the unsuitable material shall be removed to the depth determined necessary in the field by the Soils Technician, and as acceptable to the District Engineer. The sub-grade shall be restored with compacted Imported Granular Material or crushed rock as recommended by the Soils Technician. Place the appropriate bedding or base material on this restored foundation.

B. When rock encroachment is encountered, the rock shall be removed to a point below the intended trench or excavation sub-grade as determined necessary in the field by the Soils Technician, and as acceptable to the District Engineer. The sub-grade shall be restored with compacted Imported Granular Material as recommended by the Soils Technician. Place the appropriate bedding or base material on this restored foundation.

C. When excessively wet, soft, spongy, or similarly unstable material is encountered at the surface upon which the bedding or base material is to be placed, the unsuitable material shall be removed to the depth determined necessary in the field by the Soils Technician, and as acceptable to the District Engineer. Restore the trench with crushed rock enclosed in filter fabric as directed by the District Engineer. Larger size rocks, up to 75 mm (3"), with appropriate gradation, may be used if recommended by the Soils Technician. Place the appropriate bedding or base material on this restored foundation.

3.07 TRENCH EXCAVATION AND PLACEMENT OF BEDDING

A. Excavate the trench to the lines and grades shown on the drawings with allowance for 150mm (6") of pipe bedding material. The trench section shall be as shown on the Standard Drawings.

B. The maximum length of open trench shall be 152m (500') except by permission of the District, City or County. The distance is the collective length at any location, including open excavation and pipe laying, which has not been backfilled to the elevation of the surrounding grade.

C. Trench walls shall be sloped or shored per the requirements of CAL-OSHA.

D. The trench bottom shall be graded to provide a smooth, firm, and stable foundation that is free from rocks and other obstructions.

E. Place the specified thickness of bedding material over the full width of the trench. Grade the top of the pipe base ahead of the pipe laying to provide a firm, uniform support along the full length of pipe.

F. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

G. Trenches for main pipelines and all appurtenances shall be backfilled with the materials and methods as specified for the Pipe Zone, Trench Zone and Pavement Zone.

H. Trench widths shall be in accordance with the Standard Drawings.

I. Trench depth shall be as required to install pipelines in accordance with the Approved Plans and the Water Agencies' Design Guide. Unless shown otherwise on the Approved Plans, the minimum depth of cover for pipelines shall be as follows:

Pipeline Type	Minimum Cover Required
Potable Water	0.91m (36")
Recycled Water	1.22m (48")
Sewer	1.52m (60")

J. Final street sub-grade shall be established prior to the excavation of pipeline trenches. Minimum cover above pipe shall be 24" for hydrotesting.

3.08 MANHOLE AND VAULTS

A. The Contractor shall prepare an excavation large enough to accommodate the structure and permit grouting of openings and backfilling operations. The walls of the excavation shall be sloped or shored per the requirements of CAL-OSHA.

B. Manholes and vaults shall be placed at the location and elevation shown on the plans, on undisturbed soils and 150mm (6") of compacted crushed rock base.

C. Manhole and vault excavations shall be backfilled with the materials and methods as specified for the Pipe Zone, Trench Zone and Pavement Zone.

3.09 COMPACTION REQUIREMENTS

A. Compaction shall be accomplished by mechanical means. Consolidation by water settling methods such as jetting or flooding is prohibited.

B. If the backfill fails to meet the specified relative compaction requirements; the backfill shall be reworked until the requirements are met. All necessary excavations for density tests shall be made as directed by the Soils Technician, and as acceptable to the District Engineer. The requirements of the Agency having jurisdiction shall prevail on all public roads.

C. Compaction tests shall be performed at random depths, and at random intervals not to exceed 45m (150'), as directed by the Soils Technician or District Engineer.

D. Relative compaction shall be determined by the impact or field compaction test made in accordance with ASTM D 1557 Procedure C.

E. 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 follows:

1. Pipe zone - 90% relative compaction.

2. Trench zone - 90% relative compaction.

3. Structural section in paved areas - per agency requirements, 95% minimum.

4. Imported Granular Material for over excavation or foundation stabilization - 90% relative density.

F. All excavations are subject to compaction tests.

3.10 TRENCH PLUGS

Trench plugs shall be installed at 60m (200') intervals along the entire length of piping systems. Trench plugs shall be 3m (10') in length and shall encompass the entire pipe zone. Additional trench plugs may be required as directed by the District Engineer.

3.11 PIPE ZONE BACKFILL

A. Care shall be taken in placing the imported granular backfill material simultaneously around the main pipeline and appurtenance pipes so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe or on the sides of the pipe. Care shall be taken to place material simultaneously on both sides of the pipe to prevent lateral movement. This area shall be mechanically compacted to attain 90% relative density. Care shall be taken when compacting appurtenance laterals 50mm (2”) and smaller to prevent the crushing or denting of the copper lateral. Additional lifts of 300mm (12") or less thickness may be required on 400mm (16") or larger diameter pipe to attain complete support of the haunch area. Soils tests may be taken on this layer of backfill.

B. After the spring line backfill has been approved by the Soils Technician, backfill of the remainder of the Pipe Zone may proceed. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.

C. Place and compact the imported granular material at a maximum of 300mm (12”) lifts. Compact all material placed in the Pipe Zone by mechanical methods. Sand cone tests shall be taken on this layer of backfill.

D. The use of a backhoe-mounted compaction wheel is prohibited within the pipe zone to 300mm (12”) above the top of the pipe.

E. Under no circumstances shall consolidation by water settling or water-setting methods (i.e. jetting, diking, etc.) be permitted.

3.12 TRENCH ZONE BACKFILL

A. After the Pipe Zone material has been placed, compacted, approved by the Soil Technician and accepted by the District Engineer, backfill in the Trench Zone may proceed.

B. Compaction using vibratory equipment, tamping rollers, pneumatic tire rollers, or other mechanical tampers shall be performed with the type and size of equipment necessary to accomplish the work. 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, fitting, manhole, or structure damaged by the installation operations as directed by the District Engineer.

3.13 PAVEMENT ZONE BACKFILL AND RESTORATION

A. After the Trench Zone material has been placed, compacted, approved by the Soil Technician, and accepted by the District Engineer; backfill in the Pavement Zone may proceed as necessary in accordance with the requirements of the agency having jurisdiction.

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

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 03000 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION

This section describes materials and methods for formwork, reinforcement, mixing, placement, curing and repairs of concrete, and the use of cementitious materials and other related products. This section includes concrete, mortar, grout, reinforcement, thrust and anchor blocks, valve support blocks and manhole bases.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

- ASTM A 185 - Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
- ASTM A 615/A 615M - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- ASTM C 150 - Specification for Portland Cement
- ASTM C 494 - Specification for Chemical Admixtures for Concrete
- ASTM C 881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete
- CRSI - Recommended Practice for Placing Reinforcing Bars
- SSPWC - Standard Specifications for Public Works Construction "Greenbook"

1.03 RELATED WORK SPECIFIED ELSEWHERE

- WAS Standard Drawings
- WAS Standard Specifications 01000, 02223, 03461, 03462, 15000, 15041, 15044, 15056, 15061, 15064, 15074, 15102, 15108, 15112, and 15300.

1.04 APPLICATIONS

The following materials, referenced in other sections, shall be provided and installed in accordance with this specification for the applications noted below:

A. Concrete for thrust and anchor blocks for horizontal and vertical bends, ductile-iron or steel fittings, fire hydrant bury ells, support blocks for valves 100mm (4") and larger, collars, cradles, curbs, encasements, gutters, manhole bases, protection posts, sidewalks, splash pads, and other miscellaneous cast-in-place items, all in accordance with the Standard Drawings.

B. Certified hand-mixed concrete may be permitted when the volume of concrete required is less than 0.76 cubic meters (1.00 cubic yards) with approval from the District Engineer.

C. Mortar for filling and finishing the joints between manhole and vault sections and setting manhole grade rings and cover frames. Mortar may also be used for repairs of minor surface defects of no more than 6.35mm (¼") in depth or 12.7mm (½") in width on non-structural, cast-in-place items such as splash pads or concrete rings around manholes. (Note that large voids, structural concrete, and pipe penetrations into vaults shall be repaired with non-shrink grout; repairs to precast manholes and vaults and cast-in-place manhole bases shall be repaired with an epoxy bonding agent and repair mortar, as outlined below.)

D. Epoxy bonding agent for bonding repair mortar to concrete on repairs to damaged surfaces of precast or cast-in-place concrete manholes and vaults.

E. Repair mortar for repair to damaged surfaces of precast or cast-in-place concrete manholes and vaults. An epoxy-bonding agent shall be used in conjunction with repair mortar.

F. Non-shrink grout for general-purpose repair of large construction voids, pipe penetrations into vaults and grouting of base plates for equipment or structural members.

G. Epoxy adhesives for grouting of anchor bolts.

H. Protective epoxy coating for application to reinforcing steel within existing concrete structures exposed during construction.

I. Damp-proofing for application to the exterior surfaces of concrete manholes and vaults located at or below the water table or where showing evidence of moisture or seepage, and as directed by the District Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

Deliver reinforcing steel to the site bundled and tagged with identification. Store on skids to keep bars clean and free of mud and debris. If contaminated, all bars shall be cleaned by wire brushing, sand blasting, or other means prior to being set in forms.

PART 2 MATERIALS

2.01 CONCRETE

A. All Portland cement concrete shall conform to the provisions of Sections 201, 202 and 303 of the Standard Specifications for Public Work Construction (Greenbook).

B. All applications shall use a minimum of Class 560-C-3250 concrete, unless otherwise directed by the District Engineer. Mix design requirements for 560-C-3250 concrete shall be in conformance with the latest edition of the Greenbook, Section 201. The maximum slump shall be 100mm to 150mm (4" to 6").

C. In certain circumstances, rapid-setting concrete may be required. Accelerating admixtures shall conform to ASTM C-494 and may be used in the concrete mix as permitted by the District Engineer. Calcium chloride shall not be used in concrete.

D. Certified hand mixed concrete materials type and proportions shall be submitted and approved by the District Engineer prior to application on site. The maximum slump shall be 100mm to 150mm (4” to 6”).

2.02 REINFORCING STEEL

A. Reinforcing steel shall conform to ASTM A 615, Grade 60.

B. Reinforcing steel shall be fabricated in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute.

2.03 WELDED WIRE REINFORCEMENT

Welded wire reinforcement shall conform to ASTM A 185.

2.04 TIE WIRE

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

2.05 BAR SUPPORTS

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

2.06 FORMS

A. Forms shall be accurately constructed of clean lumber. The surface of forms against which concrete is placed shall be smooth and free from irregularities, dents, sags, or holes.

B. Metal form systems may be used upon approval of the District Engineer. Include manufacturer's data for materials and installation with the request to use a metal form system.

2.07 MORTAR

Cement mortar shall consist of a mixture of Portland cement, sand, and water. One part cement and two parts sand shall first be combined, and then thoroughly mixed with the required amount of water.

2.08 EPOXY BONDING AGENT

The epoxy bonding agent shall be an epoxy-resin-based product intended for bonding new mortar to hardened concrete and shall conform to ASTM C 881. The bonding agent shall be selected from the Approved Materials List.

2.09 REPAIR MORTAR

Repair mortar shall be a two-component, cement-based product specifically designed for structurally repairing damaged concrete surfaces. The repair mortar shall exhibit the properties of high compressive and bond strengths and low shrinkage. A medium-slump repair mortar shall be used on horizontal surfaces, and a non-sag, low-slump repair mortar shall be used on vertical or overhead surfaces. Repair mortar shall be selected from the Approved Materials List.

2.10 NON-SHRINK GROUT

Non-shrink grout shall be a non-metallic cement-based product intended for filling general construction voids or grouting of base plates for equipment or structural members. The non-shrink grout shall exhibit the properties of high compressive and bond strengths and zero shrinkage and

shall be capable of mixing to a variable viscosity ranging from a dry pack to a fluid consistency as required for the application. The non-shrink grout shall be selected from the Approved Materials List.

2.11 EPOXY ADHESIVE

Epoxy adhesive shall be a high-modulus epoxy-resin-based product intended for structural grouting of anchor bolts and dowels to concrete. The epoxy adhesives shall conform to ASTM C 881. A pourable, medium-viscosity epoxy shall be used on horizontal surfaces, and a heavy-bodied, non-sag epoxy gel shall be used on vertical surfaces. The epoxy adhesives shall be selected from the Approved Materials List.

2.12 PROTECTIVE EPOXY COATING

The protective epoxy coating shall be an epoxy-resin-based product exhibiting high bond strength to steel and concrete surfaces and shall conform to ASTM C 881. The protective epoxy coating shall be selected from the Approved Materials List.

2.13 DAMP-PROOFING FOR CONCRETE STRUCTURES

Damp-proofing material shall consist of two coats of a single-component self-priming, heavy-duty cold-applied coal tar selected from the Approved Materials List.

PART 3 EXECUTION

3.01 FORMWORK

A. The Contractor shall notify the District Engineer a minimum of one working day in advance of intended placement of concrete to allow for checking the form lines, grades, and other required items before placement of concrete.

B. The form surfaces shall be cleaned and coated with form oil prior to installation. The form surfaces shall leave uniform form marks conforming to the general lines of the structure.

C. The forms shall be braced to provide sufficient strength and rigidity to hold the concrete and to withstand the necessary fluid pressure and consolidation pressures without deflection from the prescribed lines.

D. Unless otherwise indicated on the plans, all exposed sharp concrete edges shall be 19mm (¾") chamfered.

3.02 REINFORCEMENT

The following procedures apply to all cast-in-place concrete with the exception of thrust blocks and valve support blocks. No reinforcement is required for concrete thrust blocks or concrete valve support blocks.

A. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.

B. All reinforcing steel shall be of the required sizes and shapes and placed where shown on the drawings or as directed by the District Engineer.

C. Do not straighten or re-bend reinforcing steel in a manner that will damage the material. Do not use bars with bends not shown on the drawings. All steel shall be cold bent - do not use heat.

D. All bars shall be free from rust, scale, oil, or any other coating that would reduce or destroy the bond between concrete and steel.

E. Position reinforcing steel in accordance with the Approved Plans 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 concrete coverage equal to that required of the bars. If required by the District Engineer, the Contractor shall install bars additional to those shown on the drawings for the purpose of securing reinforcement in position.

F. Place reinforcement a minimum of 50mm (2") clear of any metal pipe, fittings, or exposed surfaces.

G. The reinforcement shall be so secured in position that it will not be displaced during the placement of concrete.

H. All reinforcing steel, welded wire reinforcement, and tie wire shall be completely encased in concrete.

I. Reinforcing steel shall not be welded unless specifically required by the Approved Plans or otherwise directed by the District Engineer.

J. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.

K. Minimum lap for all reinforcement shall be 40 bar diameters unless otherwise specified on the Approved Plans.

L. Place additional reinforcement around pipe penetrations or openings 150mm (6") diameter or larger. Replace cut bars with a minimum of 1/2 of the number of cut bars at each side of the opening, each face, each way, same size. Lap with the uncut bars a minimum of 40 bar diameters past the opening dimension. Place one same size diagonal bar at the four diagonals of the opening at 45° to the cut bars, each face. Extend each diagonal bar a minimum of 40 bar diameters past the opening dimension.

M. Welded wire reinforcement is to be rolled flat before being placed in the form. Support and tie welded wire reinforcement to prevent movement during concrete placement.

N. Extend welded wire reinforcement to within 50mm (2") of the edges of slabs. Lap splices at least 1-1/2 courses of the reinforcement and a minimum of 150mm (6"). Tie laps and splices securely at ends and at least every 600mm (24") with 16-gage black annealed steel wire. Pull the welded wire reinforcement into position as the concrete is placed by means of hooks, and work concrete under the reinforcement to ensure that it is at the proper distance above the bottom of the slab.

O. Reinforcing steel as specified herein may be used in place of welded wire reinforcement shown in the Standard Drawings or on the Approved Plans with the approval of the District Engineer.

3.03 EMBEDDED ITEMS

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

3.04 MORTAR MIXING

The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended. Mortar shall be used as soon as possible after mixing and shall show no visible sign of setting prior to use. Re-mixing of mortar by the addition of water after signs of setting are evident shall not be permitted.

3.05 MIXING AND PLACING CONCRETE

A. Hand mixed concrete mixing method shall be in accordance with SSPWC 201-1.4.4.

B. All concrete shall be placed in forms before taking its initial set.

C. No concrete shall be placed in water except with permission of the District Engineer.

D. As the concrete is placed in forms, or in rough excavations (i.e., thrust or anchor blocks), it shall be thoroughly settled and compacted throughout the entire layer by internal vibration and tamping bars.

E. All existing concrete surfaces upon which or against which new concrete is to be placed shall be roughened, thoroughly cleaned, wetted, and grouted before the new concrete is deposited.

3.06 CONCRETE FINISHING

A. Immediately upon the removal of forms, voids shall be neatly filled with cement mortar, non-shrink grout, or epoxy bonding agent and repair mortar as required for the application and as directed by the District Engineer.

B. The surfaces of concrete exposed to view shall be smooth and free from projections or depressions.

C. Exposed surfaces of concrete not poured against forms, such as horizontal or sloping surfaces, shall be screeded to a uniform surface, steel-toweled to densify the surface, and finished to a light broom finish.

3.07 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 by covering them with plastic film wrap and by keeping them damp for at least 7 days after the concrete has been placed, or by using an approved curing process. Exposed surfaces shall be protected from frost by covering with tarps for at least 5 days after pouring.

3.08 REPAIRS TO DAMAGED CONCRETE SURFACES

Minor surface damage to hardened cast-in-place or precast concrete may be repaired, at the discretion of the District Engineer, using the specified materials in accordance with the manufacturer's recommendations and the following procedures:

A. Cast-in-place or precast concrete for manholes and vaults: Remove loose or deteriorated concrete to expose a fractured aggregate surface with an edge cut to a ninety degree angle

to the existing surface. Clean all debris from the area, apply a 0.5 mm (20 mil) coat of epoxy bonding agent to the prepared surface, and place repair mortar while the epoxy is still wet and tacky. On horizontal surfaces, for repair depths greater than 50mm (2"), add aggregate to the repair mortar as recommended by the manufacturer. On vertical or overhead surfaces, for repair depths greater than 50mm (2"), apply the repair mortar in successive lifts, scarifying the lifts, allowing them to harden, and applying a scrub coat of the material prior to proceeding with the next lift. Cure the material as for concrete in accordance with this specification.

B. General Purpose: Remove loose and deteriorated concrete by mechanical means, sandblasting or high-pressure water blasting. Clean all debris from the area and apply non-shrink grout in a 6.35mm (¼") minimum thickness, at the desired consistency, ranging from a dry pack, to a fluid-poured into a formed area, according to the application. Cure the material as for concrete in accordance with this specification.

3.09 EPOXY ADHESIVES FOR ANCHOR BOLT INSTALLATION

Anchor bolts grouted in place with an epoxy adhesive shall be installed using the specified materials in accordance with the manufacturer's recommendations and the following general procedures: Drill the hole with a rotary percussion drill to produce a rough, unpolished hole surface. The hole shall be sized to the manufacturer's recommendations and should be approximately 6.35mm (¼") wider than the diameter of the bolt, with a depth equal to 10 to 15 times the bolt diameter. Remove debris and dust with a stiff bristle brush and clean using compressed air. Utilizing a medium-viscosity epoxy for horizontal surfaces, and a gel-type non-sag epoxy for vertical surfaces, apply the material to fill the hole to approximately half its depth. Insert the bolt, forcing it down until the required embedment depth and projection length are attained and then twist the bolt to establish a bond. Secure the bolt firmly in place in the permanent position until the epoxy sets.

3.10 PROTECTIVE EPOXY COATING

Following core drilling at existing concrete structures, clean the exposed concrete surface and ends of reinforcing steel and apply two coats of protective epoxy coating for a total dry film thickness of 0.254 - 0.381mm (10 –15 mils). Allow the material to cure between coats and prior to continuing the installation through the penetration.

3.11 DAMP-PROOFING FOR THE EXTERIOR OF CONCRETE STRUCTURES

Following completion of the exterior surfaces of manholes and vaults, including necessary repairs and piping penetrations into the structure, apply the specified material to prepared concrete surfaces in accordance with the manufacturer's recommendations. The surfaces to be coated shall be fully cured and free of laitance and contamination. The material shall be applied to all exterior surfaces below a point 300mm (12”) above the water table or indications of seepage or moisture as directed by the District Engineer. Apply two 0.381mm (15 mil) coats, curing between coats, prior to backfill and/or immersion in accordance with the manufacturer's recommendations.

3.12 THRUST AND ANCHOR BLOCKS

The Design Engineer shall be responsible for sizing all thrust blocks and anchor blocks required for the project in accordance with the requirements of the Water Agencies’ Design Guide

A. Thrust Block Placement: Thrust blocks shall be located at all unrestrained pipe fittings and shall bear against firm, undisturbed soil. The thrust blocks shall be centered on the fitting so that the bearing area is exactly opposite the resultant direction of the thrust (refer to the Standard Drawings). Thrust block concrete shall not hinder maintenance access to the valve operators. The shape and location of all thrust block excavations shall be approved by the District Engineer prior to pouring concrete. Prior to filling the pipeline with water,

concrete thrust blocks shall cure for a minimum of three (3) days unless an approved accelerating admixture, as described earlier in this section, is used.

B. Anchor Block Placement: For all vertical bends in pipelines (downward bends) that do not have restrained joints, the fittings shall be retained in place by means of an anchor block. Prior to filling the pipeline with water, concrete anchor blocks shall cure for a minimum of seven (7) days. Accelerating admixtures shall not be used in concrete anchor blocks.

3.13 VALVE SUPPORT BLOCKS

Valve support blocks shall be installed as described below and in accordance with the Standard Drawings:

A. Support blocks below valves shall be cut into the side of the trench a minimum of 300mm (12").

B. Support blocks shall extend up to the height of adjoining pipe and shall have a minimum depth below the valve of 300mm (12").

C. Support blocks shall be installed so that the valves will be accessible for repairs.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 03461 PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of precast concrete manholes for sewers or for access to below grade water mains and appurtenances.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM A 48	-	Gray Iron Castings
ASTM C 478	-	Precast Reinforced Concrete Manhole Sections
ASTM C 478M	-	Precast Reinforced Concrete Manhole Sections [Metric]
ASTM C 923	-	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 03000, 09910, 15000, 15061, and 15065

1.04 ACCESS MANHOLES FOR WATERMAINS AND APPURTENANCES

A. 1500mm (60") diameter manholes shall be used, unless otherwise noted on the approved plans, to access water main appurtenances.

B. A variety of manhole diameters and configurations may be utilized on various water main appurtenances and devices in accordance with the Standard Drawings and as directed by the District Engineer.

1.05 SEWER MANHOLES

1500mm (60") diameter manholes shall be used for sewer applications.

1.06 DROP MANHOLES

1500mm (60") diameter drop manholes shall be used for sewer applications and constructed only at locations shown on the approved plans.

1.07 CORROSION PROTECTION

A corrosion protection lining and/or coating as described in this specification shall be applied to the interior of manholes for sewer mains 450mm (18") or larger, and to all drop manholes regardless of sewer pipe size.

1.08 DAMP-PROOFING

A damp-proofing material shall be applied to the exterior portions of manholes in accordance with Section 03000 and as directed by the District Engineer when located at or below the water table or when moisture or seepage is indicated.

1.09 JOINT SEALING

Joint sealant shall be used to form a continuous watertight seal on the concrete base and between successive precast concrete manhole or vault sections.

1.10 VACUUM TESTING OF MANHOLES

Vacuum testing of manholes is intended for testing precast concrete manhole sections to demonstrate the integrity of the installed materials and construction procedures.

PART 2 MATERIALS

2.01 MANHOLES

A. Precast components and other appurtenant materials shall be selected from the Approved Materials List.

B. Precast concrete manhole components shall be in accordance with ASTM C 478 and the Standard Drawings.

C. Manhole components shall be designed for H-20 highway wheel loading and specific site conditions.

D. Manhole bases may be either precast or cast-in-place, as appropriate for the application, with a formed recess shaped to match the first precast shaft section. The manhole base shall extend 250mm (10") below the bottom of the lowest pipe and 150mm (6") above the top of the largest pipe.

E. Manhole shafts shall be fabricated only from precast shaft sections, eccentric cone sections and grade rings.

F. Pipe penetrations for sewer applications shall incorporate a watertight flexible pipe connector or ring-type seal according to the method of manhole construction as shown in the Standard Drawings. Precast manholes shall utilize either an integrally cast embedded pipe connector, or a boot-type connector installed in a circular block out opening in accordance with ASTM C 923. Connections to existing manholes shall utilize a boot-type connector per ASTM C 923 installed in a cored opening. Cast-in-place bases shall incorporate a ring-type seal on the pipe to be embedded in the concrete.

G. Manholes on sewer mains 450mm (18") or larger, and all drop manholes regardless of the size of the sewer main, shall be PVC lined and polyurethane coated. Precast shaft sections, cone sections and grade rings on PVC-lined manholes shall have an integrally-cast PVC T-shaped liner of 1.65mm (0.065") minimum thickness. A 100% solids elastomeric polyurethane coating shall be applied to exposed concrete at the interior of precast and cast-in-place bases.

2.02 CRUSHED ROCK BASE AND BACKFILL MATERIALS

Crushed rock base and backfill materials shall be in accordance with Section 02223.

2.03 MANHOLE FRAMES AND COVERS

A. Manhole frames shall be 900mm (36") in diameter with two concentric covers, made of cast-iron in accordance with ASTM A 48 Class 30, the Standard Drawings and the Approved Materials List. Covers shall incorporate a “pic-hole” for lifting purposes.

1. Locking frames and covers, in accordance with the Standard Drawings, are required in areas located outside of the public right of way, in remote areas or when determined by the District Engineer.

B. Frames and covers shall be designed for H-20 highway wheel loading.

C. Covers shall be cast with the District’s name and the words “WATER”, “RECYCLED WATER” or “SEWER" as appropriate to the application. No other lettering will be permitted on the top portion of the cover.

D. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Mating surfaces of the frame and cover shall be machined to prevent movement of the lid. Frames and covers shall be match marked in sets before shipping to the site.

E. All castings shall be dipped twice in a preparation of asphalt or coal tar and oil applied at a temperature of not less than 143.3 degrees C (290 degrees F) nor more than 154.4 degrees C (310 degrees F) and in such a manner as to form a firm and tenacious coating.

2.04 CONCRETE

Concrete used for manholes and appurtenances shall be in accordance with Section 03000.

2.05 JOINT SEALING COMPOUND

Joint sealing compound shall be a mastic-type material in a flexible rope or rolled form with removable wrapper sized to fit into the key of manhole or vault sections. Joint sealing compound shall be selected from the Approved Materials List.

2.06 REPAIR MORTAR AND EPOXY BONDING AGENT

Repair mortar and an epoxy bonding agent shall be used to repair minor surface damage to precast sections or cast-in-place manhole bases at the discretion of the District Engineer. Repair products shall be in accordance with Section 03000.

2.07 MORTAR

Mortar for use on joints between precast sections and for setting manhole cover frames shall be in accordance with Section 03000.

2.08 DAMP-PROOFING

Damp-proofing material shall be in accordance with Section 03000.

PART 3 EXECUTION

3.01 WORK WITHIN EXISTING MANHOLES

Contractor shall comply with all Federal and State regulations for confined space entry. Work inside confined spaces, as defined by the applicable regulations, shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159, for confined space entry have been performed and the area is verified as safe to enter. District policy prohibits entry into any confined space with Immediately Dangerous to Life and Health (IDLH) conditions except by trained emergency rescue personnel.

3.02 EARTHWORK

Manhole excavation, foundation stabilization (if necessary), placement of base material, backfill and compaction shall be performed in accordance with Section 02223.

3.03 MANHOLE BASE

A. The invert of precast and cast-in-place bases shall be hand-worked to provide channels conforming in size to the inside diameter of the piping as indicated on the Approved Plans. The channels shall vary uniformly in size and shape from inlet to outlet. The concrete base shall be shaped with a wood float and shall receive a hard steel trowel finish before the concrete sets. A template shall be used to accurately form the level surface that will receive the first precast section.

B. During construction of cast-in-place bases, all sewer mains and stub piping shall be in place, including ring-type seals, before concrete placement. Pipe grade and alignment shall be verified immediately upon placement of concrete to assure that the pipelines are in proper position prior to the concrete taking an initial set. The invert elevation and flow line of piping shall be as shown on the Approved Plans and Standard Drawings. The manhole base shall extend 250mm (10") below the bottom of the lowest pipe and 150mm (6") above the top of the largest pipe.

C. Cast-in-place bases shall set a minimum of 24 hours before the manhole construction is continued. In certain critical situations, the setting time may be reduced upon approval of the District Engineer.

3.04 INSTALLING MANHOLE SECTIONS

A. The concrete manhole base and successive precast sections will receive a mastic joint sealing compound prior to setting the precast sections in place as shown on the Standard Drawings. Following the vacuum testing as described in this section, the joints will be mortared and tooled to a smooth finish, free of voids. Note that sewer manholes are to be vacuum tested following assembly of the concrete sections, but prior to mortaring the joints, or backfilling.

B. Manhole components incorporating a PVC liner and polyurethane coating shall be installed and tested in accordance with these specifications, the manufacturer's recommendations, and the Standard Drawings. Upon assembly of the precast sections and vacuum testing as described in this section, the mortaring and finishing of joints shall be performed. The PVC liner seams at the joints shall then be welded. The PVC liner shall be secured by insertion between the uppermost grade ring and the manhole cover frame. Note that PVC lined sewer manholes are to be vacuum tested following assembly of the concrete sections, but prior to mortaring the joints, welding the seams of the PVC liner, or backfilling. The polyurethane coating of all exposed concrete on the manhole base shall follow completion of the entire installation and all construction activity within the manhole.

C. Assemble the precast sections to the elevation required by the location of the manhole in accordance with the Standard Drawings and as follows:

1. Paved Areas: Top of cover shall be flush with the finished paving surface.

2. Traveled Way: Top of cover shall be flush with the existing surface where it is in a traveled way.

3. Shoulder Areas: Top of cover shall be 25mm (1") above the existing surface where outside the limits of a traveled way. Vaults shall not be placed in roadside ditches without the prior approval of the District Engineer.

4. Unpaved easements: Top of cover shall be 150mm (6") above the ground surface. Guard Posts around the vault may be required in this area as directed by the District Engineer.

D. Secure the manhole frame to the grade ring with mortar in accordance with the Standard Drawings.

1. Locking manholes shall have covers locked to the frame. The frame shall be attached to the top precast section by drilling four (4) 316 stainless steel, all-thread anchor bolts set in epoxy in addition to the mortar collar around the frame in accordance with the Standard Drawings.

E. After the frame is securely set the cover shall be installed. All necessary cleaning of foreign materials from the frames and covers shall be accomplished to ensure a satisfactory fit.

F. Where manholes are to be given a protective coating, they shall be free of seepage and surface moisture.

G. Piping installation adjacent to the manhole and connection to the base or shaft sections shall be performed as shown on the Standard Drawings and Approved Plans. Piping installation into flexible pipe connectors shall be in accordance with the manufacturer's recommendations for assembly, lubricants and limits of deflection.

H. In order to prevent accidental use of the new sewer before completion and acceptance, the new inlet to existing tie-in manhole(s) and the outlet of the first new upstream manhole(s) shall be sealed with expandable plugs. The District Engineer shall approve the specific location of these plugs. Plugs shall be removed at the time of final inspection or as directed by the District Engineer. Removal of all construction debris and water shall be completed prior to removal of plugs.

I. Brick or mortar bulkheads shall be installed by the Contractor at the manhole end of all unused stub channels over 900mm (36") beyond manhole base. The bulkheads are intended to prevent ponding of sewage and debris in the unused channels until such time as the manhole stub is connected and normal sewage flow can occur.

J. New connections to existing manholes, where stubs have not been provided, shall be made by core drilling through the walls or base as directed by the District Engineer. Flexible seals selected from the Approved Materials List and installed in accordance with the Standard Drawings shall be used for the pipe penetration. Apply a protective epoxy coating to the cored concrete and the ends of any reinforcing steel exposed in accordance with Section 03000.

K. A concrete ring shall be cast around manhole frames within paved and traveled areas in accordance with the Standard Drawings.

L. Replacement of asphalt or concrete pavement shall be in accordance with the requirements of the agency having jurisdiction.

3.05 DAMP-PROOFING

At the discretion of the District Engineer, damp-proofing material shall be applied to the exterior surfaces of manholes in accordance with the manufacturer's recommendations and Section 03000. The material shall be applied to all exterior surfaces below a point 300mm (12”) above the water table or indications of seepage or moisture as directed by the District Engineer.

3.06 VACUUM TESTING OF MANHOLES

A. Vacuum testing of manholes for water main appurtenances and sewer manholes is required and shall be performed as directed in the presence of the District Engineer.

B. Vacuum testing equipment shall be as manufactured by P.A. Glazier, Inc. or equal.

C. Manholes shall be tested after assembly and prior to mortaring the joints or backfilling. In the case of manholes incorporating a PVC liner and polyurethane coating, the testing is to take place prior to mortaring the joints, welding the liner seams between sections, applying the coating, or backfilling.

D. All lift holes shall be plugged with an approved grout prior to testing.

E. All pipes entering the manhole shall be plugged, and bracing installed, to prevent the plug from being drawn into the manhole.

F. The test head shall be placed inside the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.

G. A vacuum of 254 mm (10") of mercury shall be drawn. The time shall be measured for the vacuum to drop to 229 mm (9"). The manhole shall pass the test if the time taken for the drop is greater than 60 seconds.

H. If the manhole fails the test, necessary repairs shall be made and the test repeated until acceptable results are obtained. The leak(s) shall be located and repaired according to their nature with material-in-kind.

3.07 PULL TESTING OF PVC-LINED MANHOLES

PVC-lined manholes shall have field-welded joints pull tested. Field welds shall withstand a pull test of at least 45.4 kg per liner cm (100 lbs per liner inch), applied perpendicularly to the concrete surface for a period of one minute, without evidence of cracks or separations. This test shall be conducted at a temperature of 21.1 degrees C to 26.7 degrees C (70 degrees F to 80 degrees F) inclusive.

3.08 HOLIDAY TESTING OF PVC-LINED MANHOLES

PVC-Lined and Polyurethane-coated surfaces shall be holiday tested with an electrical holiday detector as manufactured by Tinker and Rasor (Model AP-W with power pack) with the instrument set at 20,000 volts and used as directed by the District Engineer. All imperfections identified on the PVC lining and polyurethane coating shall be repaired with materials-in-kind and the test shall be repeated until no holidays are evident.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 03462 PRECAST CONCRETE VAULTS

PART 1 GENERAL

1.01 DESCRIPTION

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

1.02 SERVICE APPLICATIONS

Precast concrete vaults shall be used for pressure-reducing stations, turnout structures, valves, pipeline access, or other appurtenances as shown on the Approved Plans or as directed by the District Engineer.

1.03 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ACI 318	-	Building Code Requirements for Reinforced Concrete
ASTM A 48	-	Gray Iron Castings
ASTM A 615A615M		Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Grade 60
ASTM C 478	-	Precast Reinforced Concrete Manhole Sections
ASTM C 478M	-	Precast Reinforced Concrete Manhole Sections [Metric]

1.04 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 03000, 03461, 09910, 11020, 15000, 15056, and 15061

1.05 DESIGN REQUIREMENTS

Precast concrete vaults and access doors shall be designed for H-20 highway wheel loading.

1.06 SUBMITTALS

Submit manufacturer's catalog data on precast items. Provide details and dimensions of the vault including reinforcing steel, the thickness of concrete sections, and locations of the hatch, ladder, sump, and other required items.

Vault accessories such as sump pumps, lighting, ventilation, and SCADA equipment shall be submitted as directed in Section 11020.

1.07 PANEL VAULTS

Panel vaults, consisting of individually cast floor, wall and lid panels assembled on the project site, shall be used only where shown on the Approved Plans or as approved by the District Engineer.

1.08 DAMP-PROOFING

A damp-proofing material shall be applied to the exterior surfaces of precast concrete vaults in accordance with Section 03000 and as directed by the District Engineer when located at or below the water table or when moisture or seepage is indicated.

PART 2 MATERIALS

2.01 PRECAST CONCRETE VAULT

A. Precast components and appurtenant materials shall be obtained from the manufacturers included on the Approved Materials List, shall be designed for H-20 highway loading, and shall comply with applicable portions of ASTM C 478 and the Standard Drawings.

B. Reinforcing steel shall conform to ASTM A 615, Grade 60. Installation of reinforcing steel shall conform to ACI 318. Welding of reinforcing steel is prohibited.

C. Precast vault components shall conform to the shapes and dimensions indicated on the Approved Plans. The minimum wall thickness shall be 150mm (6”).

D. Openings or "knockouts" in precast concrete vaults shall be located as shown on the Approved Plans and shall be sized sufficiently to permit passage of the largest outside dimension of pipe or fittings.

E. The precast vault base or floor slab shall incorporate a sump as shown on the Approved Plans. The sump shall be located on the vault floor so as to avoid conflict with the piping and appurtenances to be installed, and shall not be located directly beneath the access ladder. The vault floor shall be constructed with a 2% slope to the sump.

2.02 CRUSHED ROCK BASE AND BACKFILL MATERIALS

Crushed rock base and backfill materials shall be in accordance with Section 02223.

2.03 CONCRETE

Concrete used for cast-in-place items shall be in accordance with Section 03000.

2.04 JOINT SEALING COMPOUND

Joint sealing material shall be in accordance with Section 03461 and shall be selected from the Approved Materials List for Sewer Facilities.

2.05 MORTAR

Mortar used for finishing the joints between precast sections shall be in accordance with Section 03000.

2.06 PIPE PENETRATIONS

A. Adjustable-linked rubber seal devices shall be used to provide seals around pipe penetrations through precast concrete vaults. Adjustable-linked rubber seal devices shall be selected from the Approved Materials List

B. Non-shrink grout shall be used to provide seals around pipe penetrations through precast concrete vaults instead of, or in addition to, adjustable-linked rubber seal devices when indicated on the Approved Plans or directed by the District Engineer. Non-shrink grout shall be in accordance with Section 03000.

2.07 REPAIR MORTAR AND EPOXY BONDING AGENT

Repair mortar and epoxy bonding agent shall be used to repair minor surface damage to precast concrete vault sections at the discretion of the District Engineer. Repair products shall be in accordance with Section 03000.

2.08 DAMP-PROOFING

Damp-proofing materials shall be in accordance with Section 03000 and shall be selected from the Approved Materials List.

2.09 MANHOLE FRAMES AND COVERS

Manhole frames and covers shall be in accordance with Section 03461 and shall be selected from the Approved Materials List for Sewer Facilities.

2.10 VAULT ACCESS DOORS

A. Vault access doors shall be fabricated aluminum unless otherwise shown on the Approved Plans or directed by the District Engineer.

B. Access doors shall be equipped with stainless steel hardware, compression spring operators, an automatic hold-open arm with release handle, and a locking device. The frame shall incorporate a drain gutter with an outlet routed to the exterior of the precast lid.

C. All vaults shall have H-20 rated traffic doors.

D. Vault access doors shall be selected from the Approved Materials List.

2.11 LADDERS

A. Ladders shall be aluminum, Type 304 stainless steel or fiberglass as shown on the plans or as directed by the District Engineer. Rung diameter shall be 25mm (1") minimum, with 300mm (12") between rungs, and 450mm (18") between ladder rails. Ladders shall have a minimum of three pairs of brackets for wall attachment. Ladders shall meet the requirements of CAL/OSHA and ANSI Standards.

B. Extendable handrails (ladder-ups) shall be 1200mm (48") long when fully extended. The handrail shall have a telescoping tubular section that locks automatically when fully extended and a release lever to allow it to be returned to its lowered position. Handrails shall be 38mm (1½") square aluminum tubing.

C. Material for ladders and extendable handrails shall be high strength 6061-T6 aluminum alloy.

PART 3 EXECUTION

3.01 EARTHWORK

Vault excavation, foundation stabilization, placement of base material, backfill, and compaction shall be performed in accordance with Section 02223. The excavation shall be large enough to accommodate the vault structure and permit grouting of openings and backfilling operations.

3.02 INSTALLATION

A. The vault base section shall be placed on a 150mm (6") thick minimum base of compacted crushed rock over undisturbed soils, and shall be graded level to the elevation shown on the Approved Plans.

B. The concrete vault base section and successive precast sections will receive a joint sealing compound prior to setting the precast sections in place. The joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint, which will remain impermeable throughout the design life of the structure. Following placement of the precast sections, the joints shall be mortared and tooled to a smooth finish, free of voids.

C. Assemble the precast sections to the elevation required by the location of the vault as follows:

1. Paved Areas: Top of cover shall be flush with the finished paving surface.

2. Traveled Way: Top of cover shall be flush with the existing surface where it is in a traveled way.

3. Shoulder Areas: Top of cover shall be 25mm (1") above the existing surface where outside the limits of a traveled way. Vaults shall not be placed in roadside ditches without the prior approval of the District Engineer.

4. Unpaved Easements: Top of cover shall be 150mm (6") above the ground surface. Guard Posts around the vault may be required in this area as directed by the District Engineer.

D. Secure the vault access door in accordance with the manufacturer’s recommendations. Access doors shall be built up so that the hatch is installed as required. The Contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments.

E. Adjustable-linked rubber seal devices providing seals around pipe penetrations through precast concrete vaults shall be assembled and installed in accordance with the manufacturer’s recommendations.

F. Non-shrink grout providing seals around pipe penetrations through precast concrete vaults instead of, or in addition to, adjustable-linked rubber seal devices shall be installed in accordance with Section 03000.

G. Where vaults are to be given a protective coating, they shall be free of seepage and surface moisture.

H. After the vault and all appurtenances are in place and are approved by the District Engineer, backfill shall be placed to the original grade or to the limits shown on the approved plans. 0.03 cubic meters (1.00 cu ft) of crushed rock shall be placed adjacent to the hatch gutter drain outlet.

I. Install ladders using Type 316 stainless steel anchors secured in place using an epoxy adhesive in accordance with Section 03000. Extendable handrails shall be mounted to the outside portion of the ladder railing.

J. Replacement of asphalt or concrete pavement shall be in accordance with the requirements of the agency having jurisdiction.

3.03 DAMP-PROOFING

Damp-proofing material shall be applied to the exterior surface of vaults in accordance with the manufacturer's recommendations and Section 03000.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 06620 FIBERGLASS REINFORCED PLASTIC (FRP) VAULTS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes the materials and installation of Fiberglass Reinforced Plastic (FRP) vaults for metered services.

1.02 SERVICE APPLICATIONS

FRP vaults shall be used for potable water meters and recycled water meters 100mm (4") and larger, or other applications as shown on the Approved Plans or as directed by the District Engineer.

1.03 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AASHTO	-	Association of State Highway and Traffic Officials
ASTM C 109	-	Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C 293	-	Test Method for Flexural Strength of Concrete
ASTM D 256	-	Test Method for Impact Resistance of Plastic and Electrical Insulating Materials
ASTM D 543	-	Test Method for Resistance of Plastics to Chemical Reagents
ASTM D 570	-	Test Method for Water Absorption of Plastics
ASTM D 635	-	Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D 746	-	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 1525	-	Test Method for Vicat Softening Temperature of Plastics
ASTM D 2444	-	Specification for Polyethylene Plastic Pipe
ASTM G 53	-	Practice for Operating Light and Water Exposure Apparatus for Exposure of Non-Metallic Materials
WUC	-	Western Underground Committee, Recommended Guide No. 3.6

1.04 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 03000, 03461, 09910, 11020, 15000, 15056, and 15061

1.05 DESIGN REQUIREMENTS

FRP vaults shall be designed for H-10 parkway wheel loading.

1.06 SUBMITTALS

Submit manufacturer's catalog data. Provide details and dimensions of the vault including location of reinforcing ribs, mouse hole pipe penetration locations, and details of the torsion-assisted cover.

PART 2 MATERIALS

2.01 FRP VAULT

A. FRP vault components and appurtenant materials shall be selected from the Approved Materials List and shall comply with the dimensional requirements of the Standard Drawings.

B. FRP vault components shall be designed for H-10 parkway loading and shall be in accordance with the Standard Drawings. H-20 vaults may be required in certain circumstances as directed by the Engineer or as indicated on the Approved Plans.

C. FRP vaults shall use the highest grade of glass fibers as reinforcement, combined with thermosetting polyester resin binders and fire retardant fillers to attain the following minimum properties:

PROPERTY	ULTIMATE	WORKING
Compressive	53.82 MPa (7,800 psi)	34.5 MPa (5,000 psi)
Flexural	135.9 MPa (19,700 psi)	89.7 MPa (13,000 psi)
Shear	75.4 MPa (10,920 psi)	48.3 MPa (7,000 psi)
Modulus of Elasticity		19,320 MPa (2.8×10^6)

D. Mouse hole openings or "knockouts" in FRP vaults shall be located in accordance with the Standard Drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or flange.

E. The FRP vaults shall incorporate two-piece hinged covers constructed of either Reinforced Polymer Concrete (RPC) or aluminum. Covers shall be load-rated equal to or greater than the vault to which they are attached.

1. RPC covers shall have a two-leaf, non-skid surface with a torsion-assisted heavy-duty galvanized steel frame. The heavy-duty galvanized steel frame shall be attached to the cover and to the FRP vault with 316 stainless steel bolts and nuts. The cover shall have locking cover arms which hold the cover leaves open and release when pushed outward. The cover shall be lockable, either by pentahead bolting or by providing for padlock installation.

2. Aluminum covers shall have a two-leaf, non-skid surface with a torsion-assisted aluminum frame selected from the Approved Materials List. The aluminum cover shall be compatible with the FRP vault and attached to the FRP vault with 316 stainless steel bolts and nuts. The cover shall be lockable, either by pentahead bolting or by providing for padlock installation.

2.02 CRUSHED ROCK BASE AND BACKFILL MATERIALS

Crushed rock base and backfill materials shall be in accordance with Section 02223.

2.03 JOINT SEALING COMPOUND

Joint sealing material shall be a silicone-based caulking material as recommended by the manufacturer.

2.04 PIPE PENETRATIONS

FRP vaults shall be manufactured with the proper mouse hole pipe penetrations in accordance with the Standard Drawings. Field-cutting of the pipe penetrations shall not be permitted.

2.05 REPAIRING FIBERGLASS AND RPM COMPONENTS

A. Minor repairs to the fiberglass portions of the FRP vaults may be made using a marine grade fiberglass repair kit. Apply the fiberglass and bonding agents of the repair in accordance with the manufacturer's recommendations.

B. Minor repairs to the RMP portions of the FRP vault cover with a brick mortar mix repair kit in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 EARTHWORK

Vault excavation, foundation stabilization if necessary, placement of rock base material, backfill and compaction shall be performed in accordance with Section 02223. The excavation shall be large enough to accommodate the vault structure and permit access to the openings and backfilling operations.

3.02 INSTALLATION

A. FRP vaults shall be placed on 150mm (6") thick concrete pads underlain by a 150mm (6") DG base in accordance with the Standard Drawings.

B. FRP vault sections shall receive a silicone joint sealing compound prior to setting the RPC or aluminum cover in place as shown on the Approved Plans. The silicone joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure.

C. Assemble FRP vaults to the elevation required by the location of the vault as shown on the Standard Drawings or as follows:

1. Shoulder Areas: Top of cover shall be 25mm (1") above the existing surface where outside the limits of a traveled way. Vaults shall not be placed in or around roadside or drainage ditches without the prior approval of the District Engineer.

2. Unpaved easements: Top of cover shall be 150mm (6") above the ground surface. Guard Posts around the vault may be required in this area as directed by the District Engineer.

D. Secure vault access doors in accordance with the manufacturer's recommendations. Access doors shall be built up so that the hatch is installed as required. The Contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments.

E. Where vaults are to be given a protective coating, they shall be free of seepage and surface moisture.

F. After the structure and all appurtenances are in place and approved, backfill shall be placed in lifts in accordance with the requirements of Section 02223 to the original grade or to the limits shown on the approved plans. 0.03 cubic meters (1 cu ft) of crushed rock shall be placed adjacent to the hatch gutter drain outlet.

G. Replacement of asphalt or concrete pavement shall be in accordance with the requirements of the agency having jurisdiction.

3.03 FIELD PAINTING AND COATING

Covers and appurtenances shall be field-painted as directed by the District Engineer in accordance with Section 09910.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 09910 FIELD PAINTING AND COATING

PART 1 GENERAL

1.01 DESCRIPTION

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

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA C 210	-	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C 218	-	Liquid Coating Systems for the Exterior of Aboveground Steel Water Pipelines and Fittings
SSPC	-	Steel Structure Painting Council

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 09915, 15000, 15041, 15044, 15056, 15061, 15064, 15065, 15074, 15102, 15108, 15112, and 15300.

1.04 RESTRICTION ON CONTACT WITH POTABLE WATER

A. Under no circumstances shall paint materials specified in this Section be used where they may come in contact with the public water supply or for buried installations. These products are intended for exposed exterior use only.

B. Painting and coating materials in contact with potable and recycled water or for buried installations shall be in accordance with Section 15000.

1.05 QUALITY CONTROL

A. Notify the District 48 hours in advance of field operations involving surface preparation and coating application.

B. The District will inspect shop-and field-prepared surfaces. The Contractor shall not proceed with paint application until the surface preparation has been approved by the District Engineer.

C. The District will inspect application of all prime, intermediate, finish, and touch-up coatings to verify the integrity of the coating and compliance with the specifications. Each coating application will be checked and deficiencies marked. Items exhibiting an improper finish or color, or insufficient surface preparation or dry film thickness shall be prepared as necessary and corrected, utilizing the specified paint materials to obtain compliance.

1.06 SURFACES NOT TO BE FIELD PAINTED

A. Generally, the following items or materials are not to be field painted unless specifically required elsewhere in the specifications:

1. Buried mortar-coated pipe and fittings.

2. Stainless steel.

3. Interior surfaces of valves, fittings and pipe.

4. Nameplates.

5. Grease fittings.

6. Brass, copper, bronze, or galvanized items except as required for recycled water system identification.

7. Buried pipe and appurtenances except as required in the piping specifications.

1.07 COLOR AND PAINT SYSTEM SCHEDULE

The following tables designate the color and paint system that shall be used on the District's various potable water and recycled water facilities.

Potable Water:

ITEM	COLOR	PAINT SYSTEM
Fire Hydrant	Safety Yellow	Acrylic or Epoxy/Urethane
Blow Off Box Lids	Safety Yellow	Acrylic Traffic Paint
Gate Well Lids	Safety Yellow	Acrylic Traffic Paint
Gate Well Lids - Fire Hydrant Valves	White	Acrylic Traffic Paint
Gate Well Lids - Normally Closed Valves	Safety Red	Acrylic Traffic Paint
Air/Vac Assemblies	Safety Yellow	Acrylic or Epoxy/Urethane
Air/Vac Enclosures	Chocolate Brown	Fusion Bonded Polyester (Section 09915)
Water Test Station Enclosures	Chocolate Brown	Fusion Bonded Polyester (Section 09915)
Protector Posts	Safety Yellow	Acrylic or Epoxy/Urethane
Vault Piping	Per Agency	Acrylic or Epoxy
Above Ground Piping	Per Agency	Acrylic or Epoxy/Urethane

Recycled Water:

ITEM	COLOR	PAINT SYSTEM
Gate Well Lids	Safety Purple	Acrylic Traffic Paint
Gate Well Lids – Normally Closed Valves	Safety Red	Acrylic Traffic Paint
Air/Vac Assemblies	Safety Purple	Acrylic or Epoxy/Urethane
Air/Vac Enclosures	Safety Purple	Fusion Bonded Polyester (Section 09915)
Water Test Station Enclosures	Safety Purple	Fusion Bonded Polyester (Section 09915)
Protector Posts	Safety Yellow	Acrylic or Epoxy/Urethane
Vault Piping	Safety Purple	Acrylic or Epoxy
Above Ground Piping	Safety Purple	Acrylic or Epoxy/Urethane

PART 2 MATERIALS

2.01 GENERAL

A. Coating products and colors shall be selected from the tables above and the Approved Materials List.

B. All materials of a specified paint system(s), including prime, intermediate, finish, and touch-up coats shall be provided by the same manufacturer.

C. Thinners, cleaners, driers and other additives shall be as recommended by the coating manufacturer for the specified paint system(s) and shall be approved by the District Engineer.

D. All coating products shall be delivered to the job site in original and unopened containers.

2.02 EPOXY PAINT SYSTEM

Prime, Intermediate, Finish and Touch-Up Coats: VOC-compliant, two-component, chemically cured epoxy.

2.03 EPOXY/URETHANE PAINT SYSTEM

Prime and Intermediate Coats: Field-applied, VOC-compliant, surface tolerant, two-component, chemically cured epoxy.

Finish and Touch-Up Coats: Field-applied, VOC-compliant, two-component, chemically cured aliphatic urethane semi-gloss enamel.

2.04 ACRYLIC PAINT SYSTEM

Acrylic Paint System may be either solventborne or waterborne as described below:

A. Solventborne Acrylic Paint System:

1. Prime, Intermediate, Finish and Touch-Up Coats: Field-applied, VOC-compliant, solventborne acrylic paint.

B. Waterborne Acrylic Paint System:

1. Prime, Intermediate, Finish and Touch-Up Coats: Field-applied, VOC compliant, waterborne acrylic paint.

2.05 ACRYLIC TRAFFIC PAINT SYSTEM

Prime and Finish Coats: Field-applied, VOC-compliant, rapid-drying, weather and abrasion resistant waterborne acrylic paint containing 100% solids by volume.

2.06 PAINT COLORS

A. Safety Yellow, Safety Purple and Safety Red paint colors shall be as specified in Federal OSHA regulations.

B. White paint color shall be as specified by the California Department of Transportation for striping.

C. Chocolate Brown paint color shall be as specified in Section 09915.

D. Successive coats of each paint color shall be of a slightly different shade, as directed by the District Engineer, to facilitate the inspection of surface coverage of each coat. The true colors specified above shall be used for all Finish and Touch-up coats.

PART 3 EXECUTION

3.01 LIMITATIONS TO THE APPLICATION OF COATINGS

A. Apply coatings in accordance with the manufacturer's recommendations. Do not apply coatings under adverse weather conditions. If any of the following minimum conditions are present, the application of coatings shall be delayed or postponed until conditions are favorable.

1. During rain, fog, or mist, or when the relative humidity exceeds 80 percent.

2. When the surface to be coated is wet, moist, or contaminated with any foreign matter.

3. When the surrounding air temperature or the temperature of the surface to be coated is below 13° C (55° F).

4. When the temperature of the surface to be coated is more than 2.8° C (5° F) below the air temperature or when the surface temperature is 49 C (120° F) or above.

5. When the surface temperature is less than 2.8° C (5° F) above the dew point or is expected to be so within twelve hours after application of coating.

B. If a change in weather conditions results in damage to a newly applied coating, restore the affected coatings to their specified condition as directed by the District Engineer.

3.02 PROTECTION OF SURFACES NOT TO BE PAINTED

Remove, mask, or otherwise protect hardware, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, nameplates and other surfaces not intended to be painted. Protect working parts of mechanical and electrical equipment from damage during surface preparation and the painting process. Provide drop cloths or masking to prevent paint materials from dripping or accumulating on adjacent surfaces.

3.03 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

A. Prior to field touch-up, prepare the surface in accordance with the manufacturer's recommendations and as directed by the District Engineer.

B. Reapply primer as required to cover all scratched, abraded, or deficient areas.

3.04 SURFACE PREPARATION

A. Do not prepare more surface area than can be coated in the same workday.

B. Surface preparation shall conform to the SSPC specifications as follows:

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
Pickling	SP-8
Near-White Blast Cleaning	SP-10
Power Tool Cleaning to Bare Metal	SP-11

C. Wherever the words "solvent cleaning", "hand tool cleaning", "wire brushing", "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 Surface Preparation Specifications listed above.

D. Surface preparation shall be as specified herein, or as directed by the District Engineer.

E. Unless otherwise directed by the District, do not blast-clean items that have previously been factory primed or painted.

3.05 PROCEDURES FOR APPLICATION

A. Conform to the requirements of SSPC-PA 1, Shop, Field, and Maintenance Painting. Follow the recommendations of the coating manufacturer, if more restrictive, including the selection of spray equipment, brushes, rollers, mixing, drying time, temperature and humidity limitations during application, and safety precautions. The Engineer will review procedures for the application of coatings. The Engineer's decision will be final as to interpretation and/or conflict between these Specifications and the recommendations of the coating manufacturer.

B. Stir, strain, and keep coating materials at a uniform consistency during application. Where the Engineer permits thinning, do not reduce the coating material more than is necessary to obtain the proper application characteristics and to obtain the specified dry film thickness. Do not exceed the maximum thinning rate allowed by the manufacturer. Stir coating materials at all times when adding thinner.

C. Apply each layer of coating evenly, free from brush marks, sags, runs, bridges, shiners, laps or other imperfections or other evidence of poor workmanship. Visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges. The areas shall then be primed and finish coated in accordance with the specifications. Finished surfaces shall be free from defects and blemishes prior to final acceptance.

3.06 EPOXY PAINT SYSTEM APPLICATION

A. Surface preparation for the Epoxy Paint System shall be in accordance with SSPC-SP-6, Commercial Blast Cleaning. If Commercial Blast Cleaning is not feasible, prepare surfaces in accordance with SSPC-SP-11, Power Tool Cleaning to Bare Metal.

B. The Epoxy Paint System shall consist of an epoxy prime coat, an epoxy intermediate coat, and epoxy finish coat(s) to provide a total dry film thickness of 9 mils to 15 mils. Apply the coatings in accordance with the manufacturer's recommended film thickness, adding finish coats as necessary to meet the minimum total dry film thickness specified above.

C. Observe minimum and maximum re-coat times and specified by the manufacturer. If these times are exceeded, the surface shall be re-prepared as recommended by the manufacturer and as directed by the District Engineer prior to receiving additional coats.

3.07 EPOXY/URETHANE PAINT SYSTEM APPLICATION

A. Surface preparation for the Epoxy/Urethane Paint System shall be in accordance with SSPC-SP-6, Commercial Blast Cleaning. If Commercial Blast Cleaning is not feasible, prepare surfaces in accordance with SSPC-SP-11, Power Tool Cleaning to Bare Metal.

B. The Epoxy/Urethane Paint System shall consist of an epoxy prime coat, an epoxy intermediate coat, and compatible urethane finish coat(s) to provide a total dry film thickness of 9 mils to 15 mils. Apply the coatings in accordance with the manufacturer's recommended film thickness, adding finish coats as necessary to meet the minimum total dry film thickness specified above.

C. Observe minimum and maximum re-coat times and specified by the manufacturer. If these times are exceeded, the surface shall be re-prepared as recommended by the manufacturer and as directed by the District Engineer prior to receiving additional coats.

3.08 ACRYLIC PAINT SYSTEM

A. Surface preparation for the Acrylic Paint System shall be in accordance with SSPC-SP-6, Commercial Blast Cleaning. If Commercial Blast Cleaning is not feasible, prepare surfaces in accordance with SSPC-SP-11, Power Tool Cleaning to Bare Metal.

B. The Acrylic Paint System shall consist of an acrylic prime coat, an acrylic intermediate coat, and acrylic finish coat(s) to provide a total dry film thickness of 9 mils to 15 mils. Apply the coatings in accordance with the manufacturer's recommended film thickness, adding finish coats as necessary to meet the minimum total dry film thickness specified above.

C. Observe minimum and maximum re-coat times and specified by the manufacturer. If these times are exceeded, the surface shall be re-prepared as recommended by the manufacturer and as directed by the District Engineer prior to receiving additional coats.

3.09 ACRYLIC TRAFFIC PAINT SYSTEM

A. Surface preparation for the Acrylic Traffic Paint System shall be in accordance with SSPC-SP-6. , Commercial Blast Cleaning. If Commercial Blast Cleaning is not feasible, prepare surfaces in accordance with SSPC-SP-11, Power Tool Cleaning to Bare Metal.

B. The Acrylic Traffic Paint System shall consist of a rapid-drying acrylic prime coat and a rapid-drying acrylic finish coat to provide a total dry film thickness of 6 mils to 10 mils.

C. Observe minimum and maximum re-coat times and specified by the manufacturer. If these times are exceeded, the surface shall be re-prepared as recommended by the manufacturer and as directed by the District Engineer prior to receiving additional coats.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 09915 SHOP-APPLIED FUSION-BONDED POLYESTER COATING

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, shop application, and testing of 100% solids polyester powder coatings for air-vacuum and water test station enclosures.

1.02 REFERENCE STANDARDS

The publications listed below form a part of this specification to the extent referenced and are referred to in the by basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA C213	-	Standard for Fusion-Bonded Epoxy for the Interior and Exterior Of Steel Water Pipelines
AWS	-	AWS Thermal Spraying Practice, Theory and Application
Metco	-	Metco Metalizing Handbook, Volumes 1 and 2
SSPC	-	Steel Structures Painting Council Manual, Volume 2, Systems and Specifications
SSPC-PA1	-	Steel Structures Painting Council, SSPC-PA1- Shop, Field, and Maintenance Painting
SSPC-VIS-2	-	Steel Structures Painting Council, SSPC-VIS-2, ASTM 610- Standard Method of Evaluating Degree of Rusting on painted Steel Surfaces
SSPC	-	Steel Structures Painting Council, SSPC-VIS-1, Pictorial Surface Preparation for Painting Steel Surfaces

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 09910, 15000, 15099, and 15108

1.04 COLOR SCHEDULE

The following colors shall be used to designate the potable and recycled water service applications:

A. Potable Water: Chocolate Brown

B. Reclaimed Water: OSHA Safety Purple

PART 2 MATERIALS

2.01 PRIMERS

Approved manufacturers for the coating listed below can be found in the Approved Materials List.

A. Powder Epoxy Primer: Primer shall be a one-part, fusion-bonded, heat-cured, thermosetting 100% solids, zinc-rich, dry powder epoxy resin.

2.02 FINISH COAT

Approved manufacturers for the coating listed below can be found in the Approved Materials List.

A. Polyester Powder: Powder finish coat shall be a high gloss thermosetting fusion-bonded, 100% solid, dry powder TGIC-Polyester resin.

B. Thinners, cleaners, dryers, and other additives shall be as recommended by the coatings manufacturer for the specified system. Any deviation from the manufacturer's recommendations shall be approved in writing by the Engineer prior to starting work.

C. All coatings, thinners, pigments, and other materials to be used on potable water service shall have FDA approval for use with potable water.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Surface preparation shall conform to the SSPC-Specification as follows:

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
Pickling	SP 8
Near White Blast Cleaning	SP 10

B Wherever the words "solvent cleaning", "hand tool cleaning", "blast cleaning" or similar words are used in these specifications, they shall be understood to refer to the applicable SSPC specifications listed above.

C. All oil, grease, and other contaminants shall be removed by steam or solvent (SP-1) cleaning prior to blasting. Remove all sharp edges, burrs, weld splatter, and gouges.

D. Surfaces to be coated shall be blast cleaned to white metal (SSPC-5). The sand or grit used for blasting shall be of proper gradation to import a profile of 2 to 4 mils. The metal shall be cleaned after blasting with clean, dry compressed air. Use of rags to remove residual dust after sandblasting shall not be permitted.

3.02 APPLICATION

A. Coatings shall be applied the same day as the blast cleaning work is performed.

B. Coatings shall be applied in an environment, which provides for adequate control of temperature and humidity.

C. Powder coatings shall be applied by a qualified applicator in accordance with the latest requirements of the manufacturer.

D. Dry film thickness shall be as follows:

Zinc Epoxy Powder:	3 to 5 mils
TGIC Polyester:	3 to 4 mils
Total System:	6 to 9 mils

E. Canisters shall be primed and finish coated over the entire surface, both inside and outside.

F. All coatings shall provide a satisfactory film with a smooth and even surface. Each coating application shall be applied evenly and free of sags, runs, holidays, bridging and with no evidence of poor workmanship. Finished surfaces shall be free from defects and blemishes.

G. All shop-coated items may be subject to field inspection and testing to verify the dry film thickness and absence of holidays. Those items not meeting the criteria of this specification will be subject to rejection.

3.03 FIELD REPAIRS

Field repairs to the polyester coating shall not be permitted. Enclosures requiring repairs to the coating shall be returned to the supplier or coating vendor for repairs or recoating.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 11020 CONCRETE VAULT ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials for and installation of vault accessories.

1.02 REFERENCE STANDARDS

The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise required.

NEC	-	NPFA 70, National Electric Code
UL	-	Underwriters Laboratory
SDG&E	-	San Diego Gas & Electric Service Guide

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 03462, 09910, 15000 and 15057.

1.04 SERVICE APPLICATION

The electrical vault accessories detailed in this Section shall be installed when specified on the Approved Plans, or as directed by the District Engineer.

Vault design, materials of construction, and installation requirements shall be as detailed in Section 03462.

1.05 SUBMITTALS

A. Submit manufacturer's catalog data on electrical items and equipment as specified herein.

B. Submit electrical wiring plan, single line diagram, control panel schematic, and load table.

1.06 DESIGN REQUIREMENTS

A. Design the electrical components and accessories using sound electrical practice and in compliance with the requirements of NPFA 70. The vault electrical system and accessory components shall incorporate a ground fault system.

B. Design and specify moisture-proof electrical components and accessories suitable for wet conditions.

C. Design and specify the electrical supply to the vault. The electrical power supply shall be by means of a dedicated meter and supply conduit. The meter and supply conduit shall be designed and installed to the requirements of SDG & E.

PART 2 MATERIALS

2.01 VAULT ACCESSORIES

The following accessories may be installed in vaults as required. The detailed specifications for each item can be found in the Approved Materials List.

A. Sump Pump

B. Exhaust Fan capable of exchanging the air in the vault six (6) times per hour

C. Exhaust Fan Manual On/Off Switch

D. Vault Access Door Switch (intrusion alarm)

E. Humidistat

F. Load Center

G. Fused Safety Switch

H. Light Switch

I. Overhead or wall-mounted incandescent lights, minimum of two (2) per vault

J. Ground Fault Duplex Receptacle

K. SCADA/Telemetry equipment

PART 3 EXECUTION

3.01 ELECTRICAL COMPONENTS

In general, conduits, switches, breakers, receptacles, and equipment shall be installed in accordance with NPFA 70, National Electrical Code and as shown on the Approved Plans and as directed by the District Engineer.

3.02 EXHAUST FAN

The exhaust fan shall be installed so that it can be energized when:

A. The vault access door is opened.

B. The humidistat registers a rise in the vault humidity above a preset limit.

C. Manually operated.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 13110 CATHODIC PROTECTION AND JOINT BONDING

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing and installation of corrosion protection and monitoring systems for metallic pipes including insulating flange kits, test stations, copper/copper sulfate reference electrodes, sacrificial anodes, wiring, and exothermic welds.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA	C217 -	Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
ASTM	D 1248 -	Standard Specification for Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable
NACE	SP0286 -	The Electrical Isolation of Cathodically Protected Pipelines
NACE	RP0375 -	Application and Handling of Wax-Type Protective Coatings and Wrapper Systems for Underground Pipelines

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 03000, 15000, 15056, 15057, and 15061.

1.04 SUBMITTALS

Submit manufacturer's catalog data on wire and cable, copper sulfate reference electrodes, test stations, conduit, exothermic weld molds and charges, pipe flange insulation kits, pipe flange internal coating, wax tape system, plastic warning tape, sacrificial anodes, and any other required materials.

1.05 MANUFACTURERS

All materials furnished under this specification shall be standard products from manufacturers regularly engaged in the manufacture of such products and shall be the manufacturer's latest design that complies with the specification requirements.

1.06 PIPE JOINT BONDING CABLES

Electrical continuity bonding cables shall be installed across all buried or submerged metallic inline valves, flexible couplings, grooved couplings, pipe joints that are not circumferentially welded, and all other pipe joints except flange joints equipped with insulation gaskets. Where shown on the drawings, bonding cables shall be installed in vaults.

1.07 GALVANIC ISOLATION

All threaded outlets shall incorporate the use of an insulated ball valve for galvanic isolation of stray current.

Threaded outlets may incorporate the use of a nylon isolation bushing for galvanic isolation only with the approval of the District Engineer. Where the use of nylon bushings is required, the threaded outlet shall be increased in size to accept the bushing.

1.08 WARNING/IDENTIFICATION TAPE

All cathodic protection test wires, cables and conduit shall include Warning/Identification Tape in accordance with Section 15000.

PART 2 MATERIALS

2.01 GENERAL

Items in this section shall be selected from the Approved Materials List in accordance with the Standard Drawings.

2.02 TEST STATION BOXES

Cathodic test station boxes shall be circular precast concrete boxes with ductile-iron covers selected from the Approved Materials List

2.03 PREPACKAGED COPPER SULFATE REFERENCE ELECTRODE

A. Copper sulfate reference electrodes shall be constructed with an ion trap to prevent contamination. The reference electrode shall have a design life of 15 years and a stability of +/- 5 millivolts under a 3.0 microampere load.

B. Provide reference electrodes with minimum No. 10 AWG HMW/PE (yellow) insulated wire. Each lead wire shall be long enough to extend to the corrosion monitoring test box plus 450mm (18") of slack without splices.

C. Reference electrodes shall be prepackaged in a permeable cotton cloth bag with low resistivity backfill mixture to protect against the "drying out" type of failure. The backfill mixture shall be composed of 50% Gypsum and 50% Powdered Bentonite.

2.04 PREPACKAGED MAGNESIUM ANODES

Prepackaged magnesium anodes shall be used in low current demand applications. The amount and size of magnesium anodes shall be as shown on the Approved Plans, and shall be installed in accordance with the Standard Drawings.

A. Prepackaged magnesium anodes shall have galvanized steel rod cores encased in magnesium ingots. The ingot portion of anodes shall be of the weight as required on the Approved Plans.

B. Provide magnesium anodes with minimum No. 8 AWG HMW/PE (black) insulated wire. Each lead wire shall be long enough to extend to the corrosion monitoring test box plus 450mm (18") of slack without splices.

C. Magnesium anodes shall be prepackaged in a permeable cloth bag with low resistivity backfill mixture and shall be selected from the Approved Materials List.

2.05 SACRIFICIAL ANODES FOR COPPER TUBING

Prepackaged zinc sacrificial anodes shall be installed and connected to copper tubing where indicated on the Approved Plans. Anodes shall be selected from the Approved Materials List and shall be installed in accordance with the Standard Drawings.

A. Prepackaged zinc sacrificial anodes shall include a zinc-alloy ingot with galvanized steel core weighing not less than 6.8 kg (15 lbs.) and shall be packed in cloth bags filled with a mixture of gypsum and bentonite.

B. Prepackaged zinc sacrificial anodes shall include an integral anode lead connected to the galvanized steel core of the ingot consisting of No. 12 AWG stranded copper wire with (black) THW insulation. Anode lead wires shall be a minimum of 7.62 m (25') long.

2.06 TEST CABLE AND BONDING CABLE

All test cable and bonding cable shall be stranded copper wire with insulation rated at 600 volts. Cable with cut or damaged insulation is not acceptable. All cable shall be of sufficient length to extend from the point of connection to the appropriate corrosion monitoring test box without splices.

The cable shall have a 2.8mm (7/64") thick, high molecular weight polyethylene (HMW/PE) insulation specifically designed for cathodic protection service and suitable for direct burial in corrosive soil or water, conforming to ASTM D 1248, Type I, Class C, Category 5 (HMW/PE Type CP) Grade E-5 or J-1. Test cable shall have at least 450mm (18") of slack in the test box. Testing and/or bonding cable size shall be No. 6 AWG HMW/PE in accordance with the Standard Drawings.

2.07 PIPE FLANGE INSULATING KITS

All pipe flange-insulating materials shall be of the type designated by the manufacturer as suitable for service at the operating temperatures and pressures of the pipeline.

A. Insulating gaskets shall be full-face dielectric neoprene-faced phenolic.

B. Insulating sleeves shall be full-length phenolic

C. Insulating washers shall be phenolic.

D. Steel bolts, nuts, and washers shall be in accordance with Section 15000.

2.08 ADDITIONAL SMOOTH EPOXY LINING AT INSULATED PIPE FLANGES

In addition to the cement mortar lining, the interior of the pipe at all insulated flanges shall be coated with a two-part smooth white liquid epoxy consisting of 100 percent solids.

2.09 TAPE WRAP FOR ABOVEGROUND INSULATED PIPE FLANGES

All aboveground insulated pipe flanges shall be wrapped with minimum 0.36mm (14 mil) thick general utility pipeline tape in accordance with the Approved Materials List.

2.10 WAX TAPE COATING FOR BURIED INSULATED PIPE FLANGES

All buried insulated pipe flanges shall be coated with a three-part, cold-applied wax tape coating system as described by NACE RPO375 and AWWA C217 in accordance with the Approved Materials List. Wax tape is also required where indicated on the Approved Plans.

A. Primer: Primer shall be a blend of petrolatums, plasticizers and corrosion inhibitors having a paste-like consistency. The primer shall have the following properties:

Color	Brown
Pour Point	37.8º C - 43.3º C (100º -110º F)
Flash Point	176.7º C (350º F)
Coverage	0.41 L/M^2 (1 gal/100 sq. ft.)

B. Wax Tape: Wax tape shall consist of a plastic-fiber felt, saturated with a blend of petrolatums, plasticizers, and corrosion inhibitors, forming a tape coating that is easily form-able over irregular surfaces. The tape shall have the following properties:

Color	Brown
Saturant Pour Point	46.1º C - 48.9º C (115º - 120º F)
Thickness	1.27 - 1.78 mm (50 - 70 mils)
Tape Width	150mm (6")
Dielectric Strength	170 volts/mil

C. Tape Outerwrap: Wrapper shall be a polyvinylidene chloride plastic with three 50-gauge plies wound together as a single sheet. The wrapper shall have the following properties:

Color	Clear
Thickness	0.0381 mm (1.5 mils)
Dielectric Strength	2000 volts/mil
Tape Width	150mm (6")
Water Absorption	Negligible

2.11 EXOTHERMIC WELD MOLDS AND WELD CHARGES

Wire-to-pipe connections shall be made using exothermic welds. Weld charges and mold sizes for various surface configurations and materials shall be in accordance with the manufacturer's recommendations.

2.12 REPAIR GROUT FOR EXOTHERMIC WELDS

Repair grout shall be in accordance with cement-mortar grout described in Section 15061.

2.13 BRASS IDENTIFICATION TAGS

All wires terminating in CP Test Boxes shall be identified with brass tags securely attached to the wires with nylon fasteners. The tags shall be 38mm (1½") in diameter, 1.6mm (1/16") thick, and shall be die-stamped with identifying letters and numbers 6.4mm (¼") high.

2.14 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and the Approved Materials List.

2.15 CONCRETE

Concrete shall be in accordance with Section 03000.

PART 3 EXECUTION

3.01 CORROSION MONITORING TEST STATIONS

All test stations shall be installed behind existing or proposed curbs or otherwise out of traffic lanes to allow safe access for personnel during testing in accordance with the Standard Drawings. A utility marker post shall be installed, in accordance with the Standard Drawings, when indicated on the Approved Plans.

3.02 EXOTHERMIC WELDS

All cable-to-pipe connections shall be made using exothermic welds in accordance with the Standard Drawings.

A. Preparation of Cable: Cut cable with a wire cutter to prevent deforming the cable ends. Remove only enough insulation from the cable to allow the weld connection to be made.

B. Preparation of Pipe: The surface of the steel or ductile-iron pipe shall be ground or filed to a bright, shiny, clean and dry surface before welding the cable connection. For cement-mortar coated pipe, a nominal 75mm x 75mm (3" x 3") area of cement mortar shall be chipped off.

C. Attachment of Cable to Structure: The attachment of the cable to the structure shall be made using an exothermic weld. The cable shall be held at a 30º to 45º angle to the surface when welding. Only one cable shall be attached with each weld. All cable-to-pipe welds shall be a minimum of 75mm (3") apart. All weld slag shall be removed from the weldment with a wire brush.

D. Weldment Test: After the exothermic weld has cooled, the weld shall be tested by the Contractor for strength, in the presence of the District Engineer, by striking the weldment a sharp blow with a 0.91 Kg (2 lb.) hammer while pulling firmly on the cable. All unsound welds

shall be re-welded and retested.

E. Repair Grout: The area to be repaired shall be thoroughly clean and dry. Cement-mortar coating shall be repaired or replaced to original condition by hand-placing cement-mortar repair grout as directed by the District Engineer.

3.03 PIPE FLANGE INSULATING KITS

Pipe flange insulating kits shall be installed at the locations shown on the Approved Plans and in accordance with the Standard Drawings and the manufacturer's recommendations. Insulation shall also conform to the National Association of Corrosion Engineers' Recommended Practice RPO286 "Electrical Isolation of Cathodically Protected Pipelines". Particular attention shall be paid to properly align the pipe flanges prior to inserting the bolts with insulating sleeves to prevent cutting of the sleeves and creating an electrical path when the bolts are tightened. Care shall be taken to prevent any moisture, soil, or other foreign matter from contacting any portion of the two mating pipe flanges or gaskets prior to or during installation. If any foreign matter contacts any portion of the insulated pipe flange, the entire pipe joint shall be disassembled, cleaned with a suitable solvent and dried prior to reassembly. Strictly follow the manufacturer's recommendations regarding the torque pattern of the bolts and the amount of torque to be used when installing the pipe flange insulating kit. Conductive grease shall not be used on the flange bolts or any other flange components under any circumstances. Refer to Field Testing below for testing of the flange insulation kits.

3.04 ADDITIONAL SMOOTH EPOXY LINING AT INSULATED PIPE FLANGES

At locations indicated on the Approved Plans or as directed by the District Engineer, an additional two-part smooth epoxy lining shall be applied. The interior of the pipe and flanges shall be coated with the two-part smooth epoxy for a distance of two pipe diameters in each direction away from the insulated pipe flange.

A. Surface Preparation: The surface preparation shall consist of wire brushing to remove all rust and scale and to provide a suitable surface for adhesion of the coating in accordance with the manufacturer's recommendations.

B. Mixing the Coating: The two-part epoxy paint shall be mixed per the manufacturer's recommendations. The two-part epoxy shall be mixed thoroughly for at least two minutes by hand or with a mechanical mixer before being applied by brush.

C. Applying the Coating: The application of the undiluted coating shall be made by brushing until a minimum dry film thickness (DFT) of 0.51mm (20 mil) is achieved. Each subsequent coat shall be applied before the preceding coat cures, which is normally within 3-6 hours. The application of the coating shall be per the guidelines and at the rate recommended by the coating manufacturer.

3.05 WAX-TAPE COATING FOR BURIED INSULATED PIPE FLANGES

After continuity testing, all flange and pipe surfaces shall be clean and free of all dirt, grease, water or other foreign material prior to the application of the primer, wax tape, and tape outerwrap.

A. Apply primer by hand or brush to all surfaces of the flanges. Work the primer into all crevices, around bolts and nuts, and completely cover all exposed metal surfaces. Extend the primer a minimum of 75mm (3") onto adjacent surfaces of the pipe or valve.

B. Apply the wax tape immediately after the primer application. Cut short lengths of tape and

place completely around each bolt head and nut. Work the tape into the crevices around the bolts and nuts. Wrap the wax tape spirally around the pipe and across the flanges to the other pipe or valve. Cover the entire primed area with wax tape using a minimum overlap of 55% of the tape width. Work the tape into the crevices and contours of the irregular shaped surfaces and smooth out so that there is a continuous protective layer with no voids or spaces under the tape.

C. Apply the tape outerwrap to the completed wax tape installation. Wrap spirally around the pipe and across the flanges. Extend the plastic wrap 75mm (3") past the wax tape using a minimum overlap of 55% of the plastic material width to apply two layers of overwrap.

3.06 PREPACKAGED MAGNESIUM ANODES

A. Prepackaged magnesium anodes shall be placed a minimum of 1.5m (5') below the pipe in the trench or an augured hole. Anodes will be a minimum of 12' from finish surface unless otherwise indicated on the approved plans. Soaking of the anode is not required. Installation shall be in accordance with the Standard Drawings.

B. Over-excavated trenches or augured holes in which anodes are placed shall be backfilled with select native material from which rock or other materials larger than 25mm (1") in diameter have been removed. Over-excavated trenches shall be backfilled with native materials up to the bottom of the new water main, which shall then be backfilled with select material in accordance with these Standard Specifications. Anode and native backfill shall be thoroughly wetted after installation.

3.07 SACRIFICIAL ANODES FOR COPPER TUBING

Prepackaged zinc sacrificial anodes shall be installed in accordance with the Standard Drawings.

A. Anode Location:

1. Anodes to be attached to new copper tubing installed by trenching shall be installed horizontally, and shall be located within the paved roadway approximately 1.52m (5') to 3.05m (10') from the edge of the roadway. New copper tubing trench shall be over-excavated at anode location to a depth necessary to provide 600mm (24") minimum vertical separation between new copper tubing and anode.

2. Anodes to be attached to existing copper tubing or to new copper tubing to be installed by boring shall be installed vertically in a 1.22m (4') deep, 200mm (8") minimum diameter augured hole located adjacent to the meter box.

3. Anodes to be attached to existing copper tubing in conjunction with the replacement of existing pipelines shall be installed horizontally, and shall be located within the new water main trench below the new water main. New water main trench shall be over-excavated directly below locations where new water main is to be connected to existing copper tubing to a depth necessary to provide 600mm (24") minimum vertical separation between copper tubing and anode.

B. Anodes shall be hand-placed into over-excavated trenches or augured holes. Anodes shall be handled with care and shall not be carried, suspended or dropped by holding the attached lead wire.

C. Anode Attachment:

1. Anodes to be installed within new copper tubing trenches or within augured holes as described above and intended for the protection of service laterals shall be attached to copper tubing within meter boxes. Anode lead wire shall be securely attached to the copper tubing between anode and meter box, 600mm (24”) of excess wire shall be coiled above ground within the meter box and remaining wire shall be cut. 50mm (2”) of insulation shall be removed from end of anode lead wire and bare wire shall be clamped to the vertical portion of the copper tubing lying immediately below the angle meter stop. Clamp shall be entirely brass or copper, selected from the Approved Materials List. Connection point must be waterproof and shall be securely wrapped with dielectric tape selected from the Approved Materials List.

2. Anodes to be installed within new copper tubing trenches or within augured holes as described above and intended for the protection of copper tubing for air valves shall be attached to copper tubing within air valve enclosures. Anode lead wire shall be installed through concrete air valve slab within 25mm (1”) PVC sleeve, and 600mm (24”) of excess wire shall be coiled and placed within the sleeve. 50mm (2”) of insulation shall be removed from end of anode lead wire and bare wire shall be clamped to copper tubing 75mm (3”) above concrete slab. Clamp shall be entirely brass or copper, selected from the Approved Materials List. Connection point must be waterproof and shall be securely wrapped with dielectric tape selected from the Approved Materials List.

3. Anodes to be installed within new water main trenches as described above and intended for the protection of existing copper tubing shall be clamped to copper tubing at a point approximately 25mm (3”) from the corporation stop. Connection point shall be backfilled along with the new water main, and no excess wire is required. Clamp shall be entirely brass or copper, selected from the Approved Materials List. Connection point must be waterproof and shall be securely wrapped with dielectric tape selected from the Approved Materials List.

D. Over-excavated trenches or augured holes in which anodes are placed shall be backfilled with select native material from which rock or other materials larger than 25mm (1”) in diameter have been removed. Over-excavated trenches shall be backfilled with native materials up to the bottom of the new water main or copper tubing trench, which shall then be backfilled with select material in accordance with these Standard Specifications. Anode and native backfill shall be thoroughly wetted after installation.

3.08 COPPER SULFATE REFERENCE ELECTRODES

Reference electrodes shall be placed 300mm (12”) away from the pipe at spring line. Electrodes shall be placed opposite side of the pipe from anodes. Saturate packaged electrode in 18.9 liters (5 gallons) of water prior to installation. Backfill material around the electrode shall be as specified for the pipeline trench. Installation shall be in accordance with the Standard Drawings.

3.09 TEST CABLE / ANODE LEAD CABLE

All buried lead and test cable requiring trenching to the test station box location shall be installed, without splices, in a conduit in the trench at a minimum depth of 600mm (24"). Trenches shall be backfilled and compacted in accordance with Section 02223. Care shall be taken when installing wire and backfilling trench to prevent damage to the installation. Damaged wire shall be replaced in entirety.

3.10 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be installed in accordance with Section 15000 and the Standard Drawings

3.11 BRASS IDENTIFICATION TAG

Brass identification tags shall be used to identify all cables in all test boxes. Care shall be taken to accurately maintain the wire identities. The tags for all test cables shall be stamped with the District or Agency name, the pipeline size, the contents of the pipeline, and the direction of the connection point along the pipe, in accordance with the Standard Drawings. Copper sulfate reference electrode tags at cathodic test boxes shall be stamped "$CuSO_4$". The tags shall be securely attached to each wire with nylon fasteners prior to pipe backfilling operations.

3.12 FIELD TESTING

The Contractor shall engage the services of a Cathodic Protection firm to test the cathodic protection installations in the presence of the District Engineer. For final acceptance, the official testing of the cathodic protection installations shall be completed by a Certified NACE CP-1 tester or higher, and approved by a Cathodic Protection Engineer and /or a NACE Certified CP Specialist, as deemed necessary by the District Engineer. The Contractor shall notify District Engineer of proposed test dates and times a minimum of 48 hours in advance. As a practical approach, the Contractor may choose to verify pipe continuity and flange isolation (described in Items A and B below) prior to backfilling as an unofficial test. Official testing shall occur after the backfilling and installation of the test boxes.

A. Pipeline Electrical Continuity Testing: Test the electrical continuity of all sections of pipe to be monitored between each pair of adjacent corrosion monitoring test stations or between the ends of pipe sections less than 152.4m (500') apart. Each pipe section shall be considered electrically continuous when the measured longitudinal resistance of each pipe section is no greater than 20% higher than the theoretical resistance of that section of pipe. If testing indicates inadequate electrical continuity, the Contractor shall excavate to investigate and locate improperly bonded pipe joints and make repairs until electrical continuity is accomplished to the satisfaction of the District Engineer.

B. Insulated Pipe Flange Testing: Each insulated pipe flange will be tested for effective electrical isolation of the two mating pipe flanges. The insulated pipe flange shall be judged for effectiveness in accordance with NACE SP0286, Section 9, Field Testing and Maintenance." The Contractor shall replace or repair any insulated pipe flange assembly until electrical discontinuity is accomplished.

C. Initial Reference CP Potential Measurements: The entire metallic piping system shall be tested to establish the base CP Potential measurement readings. The base data will be used for comparative purposes with future monitoring data. The baseline data shall include voltage measurements (+/- 1mV) between any permanent copper sulfate reference electrodes (+ voltmeter correction) and a reliable portable copper sulfate reference electrode (- voltmeter correction) placed directly in the CP test box.

D. Sacrificial Anode Connectivity Testing: After installation of sacrificial anodes for copper tubing, the copper tubing and sacrificial anode lead wire shall be tested for connectivity to insure that the lead wire and the brass or copper clamp has been securely connected to the copper tubing. Test method shall be as directed by the District Engineer.

3.13 CATHODIC TESTING REPORT

At the completion of the testing, a report of the results will be prepared and presented to the District Engineer. The report shall be typed and shall include, at a minimum, test locations, date of tests, name of technician, testing methods, voltage measurements, and theoretical and calculated resistance.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15000 GENERAL PIPING SYSTEM AND APPURTENANCES

PART 1 GENERAL

1.01 DESCRIPTION

This section describes the requirements and procedures for piping systems (pressure pipe and gravity sewer pipe) and appurtenances that apply to a number of other complimentary Specification Sections. The items are listed in this section to avoid repetition in sections elsewhere. This section includes, but is not limited to, temporary pipelines, wet taps, flexible pipe couplings, grooved and shouldered end couplings, joint restraint systems, field touch up, bolts, nuts, polyethylene wrap, warning/identification tape, tracer wire, gate well and extension stems, meter boxes, abandonment and removal of existing facilities, salvage, and disposal.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA C105	-	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C111	-	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C200	-	Steel Water Pipe – 6 In. (150mm) and Larger
AWWA C203	-	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot-Applied
AWWA C213	-	Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines
AWWA C606	-	Grooved and Shouldered Joints
AWWA C900	-	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100mm Through 300mm), for Water Transmission and Distribution
AWWA M11	-	Steel Pipe - A Guide for Design and Installation
AWWA	-	Guidelines for Distribution of Non-Potable Water
ASTM A 36/A 36M	-	Standard Specification for Carbon Structural Steel
ASTM A 47/A 47M	-	Standard Specification for Ferritic Malleable Iron Castings
ASTM A 53	-	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 108	-	Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A 183	-	Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A 283/A 283M	-	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A 307	-	Standard Specification for Carbon Steel Bolts and Studs
ASTM A 325/A 325M	-	Standard Specification for High-Strength Bolts for Structural Steel Joints
ASTM A 510/A 510M	-	Standard Specification for General Requirements for Wire Rods and Course Round Wire, Carbon Steel

ASTM A 512	-	Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing
ASTM A 536	-	Standard Specification for Ductile Iron Castings
ASTM A 568/A 568M	-	Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality and Cold Rolled
ASTM D 2000	-	Standard Classification System for Rubber Products in Automotive Applications
ASTM F 593	-	Specifications for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F 594	-	Specification for Stainless Steel Nuts
ANSI B1.1	-	Unified Inch Screw Threads
ANSI B1.2	-	Gages and Gauging for Unified Inch Screw Threads
NSF	-	National Sanitation Foundation
SSPWC	-	Standard Specifications for Public Works Construction ("Greenbook")

California Administrative Code, Title 22

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 02223, 03000, 13110, and all of Division 15.

1.04 LINING CONTAMINATION PREVENTION

Volatile organic compounds present in the linings of items in contact with potable water or recycled water shall not exceed concentrations allowed by the latest requirements of the State Office of Drinking Water and Department of Health Services. Some products and materials may also require proof of NSF certification on the lining materials to be used.

1.05 TEMPORARY PIPELINES

Temporary pipelines, where shown on the Approved Plans or required by the District Engineer, provide temporary service to customers during construction.

1.06 PIPE TAPPING (WET TAP)

All pipe tap (wet tap) connections to existing pipelines, whether for mainline extension or service laterals, shall be performed by the District. The Contractor shall provide materials and labor to excavate, pour thrust block, backfill, compact, and repair pavement as indicated in this Section. With specific prior approval of the District Engineer or when directed by the District Engineer, the Contractor may perform wet taps in accordance with Appendix D.

1.07 JOINT RESTRAINT SYSTEMS

Joint Restraint Systems may be used for PVC or ductile-iron pipe when shown on the Approved Plans or with prior approval of the District Engineer. Contractor shall submit shop drawings and catalog data for joint restraint systems in accordance with Section 01000.

1.08 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be used for all ferrous metal materials not otherwise protectively coated.

A. Polyethylene wrap or sleeves shall be used for the protection of buried ductile-iron pipe, appurtenances, and valves.

B. Purple-colored polyethylene wrap or sleeves may also be installed around buried pipe for recycled water identification.

1.09 WARNING/IDENTIFICATION TAPE

Warning/identification tape shall be installed to identify location of underground utilities and to act as a warning against accidental excavation of buried utilities. Warning/identification tape shall be used on all underground water and recycled water mains, potable and recycled water irrigation systems, sewer mains, and all related appurtenances. Warning/identification tape shall also be used on cathodic protection wiring systems and tracer wire brought into and out of access ports.

1.10 TRACER WIRE

Tracer wire shall be installed on all buried water and recycled water mains for the purpose of providing a continuous signal path used to determine pipe alignment after installation. Tracer wire is not required in installation of sewer mains.

1.11 GATE WELLS

Gate Wells shall be used for buried valves 50mm (2”) and larger, unless otherwise indicated on the Standard Drawings. Gate well lids shall be used on all gate wells.

1.12 VALVE STEM EXTENSIONS

Valves 100mm (4”) and larger require valve stem extensions to be installed when the valve-operating nut is more than 1.5m (5') below grade or as required by the District Engineer. All valves 50mm (2”) and smaller requiring the installation of a gate well shall include a valve stem extension in accordance with the Standard Drawings.

1.13 METER BOXES

Meter boxes shall be used for 25mm (1”) and 50mm (2”) water meters and other appurtenances as shown on the Standard Drawings.

1.14 RECYCLED WATER IDENTIFICATION

Facilities installed for the use of recycled water shall be identified with purple color coating, identification labels, or signs in accordance with Section 15151.

1.15 CURB IDENTIFICATION MARK FOR SERVICES

The Contractor shall mark the location of all potable water, recycled water and sewer laterals at the curb crossing by stamping the face of the curb in 50mm (2”) high letters as described below:

A. Potable water laterals shall be stamped with a letter “W”.

B. Recycled water laterals shall be stamped with the letters “RW”.

C. Sewer laterals be stamped with a letter “S”.

1.16 FIELD REPAIR OF DAMAGED COATINGS

All surfaces of metallic appurtenances in contact with potable water and not protected from corrosion by another system shall be shop-coated by the manufacturer. Appurtenances with damaged coatings shall be repaired or replaced as directed by the District Engineer. Touch-up of damaged surfaces, when allowed by the District Engineer, shall be performed in accordance with the manufacturer’s recommendations.

PART 2 MATERIALS

2.01 TEMPORARY PIPELINES

Temporary piping layout, materials and appurtenances shall be as indicated on the approved submittal.

2.02 FLEXIBLE PIPE COUPLINGS

Flexible pipe couplings shall be in accordance with the Approved Materials List and as described below:

A. Steel Couplings shall have middle rings made of steel conforming to ASTM A 36/A 36M, A 53 (Type E or S), or A 512 having a minimum yield strength of 207 MPa (30,000 psi). Follower rings shall be ductile-iron per ASTM A 536, or steel per ASTM A 108, Grade 1018 or ASTM A 510, Grade 1018. Minimum middle ring length shall be 175 mm (7") for pipe sized 150 mm (6") through 600 mm (24").

B. Sleeve bolts shall be made of stainless steel per ASTM A193 and shall have a minimum yield strength of 276 MPa (40,000 psi), an ultimate yield strength of 414 MPa (60,000 psi), and shall conform to AWWA C111.

2.03 GROOVED-END OR SHOULDERED COUPLINGS FOR DUCTILE IRON OR STEEL PIPE

Grooved-end or shouldered couplings shall be in accordance with the Approved Materials List and as described below:

A. Use square-cut shouldered or grooved ends per AWWA C606. Grooved-end couplings shall be malleable iron per ASTM A 47, or ductile iron per ASTM A 536. Gaskets shall be per ASTM D 2000.

B. Bolts for exposed service shall conform to ASTM A 183, 69 MPa (10,000 psi) tensile strength.

2.04 JOINT RESTRAINT SYSTEMS

Joint Restraint Systems shall be selected from the Approved Materials List.

A. A minimum pressure rating of 250psi of pipe is required for all engineered restraint systems. All approved restrain system products must meet a 2:1 safety factor.

B. Split ring style joint restraint rods and nuts shall be 304 stainless steel for all applications in accordance with AWWA/ANSI C111/A21.11 and provide a minimum 45,000 psi yield and 60,000 psi tensile strength or as approved by the District Engineer. Unless otherwise approved, all parts and hardware for the joint restraint systems are to be supplied by the restraint manufacturer. Clamping ring shall be manufactured of high strength ductile iron in accordance with ASTM A536, grade 65-45-12.

C. Gland style joint restraint rings and its wedging components shall be constructed of ductile iron conforming to ASTM A 536, Grade 65-45-12. The wedges shall be ductile iron, heat-treated to a minimum hardness of 370 - 470 BHN. Dimensions of the gland shall be such that it can be used with mechanical joint bells conforming to AWWA C111 and AWWA C153. The design shall use torque limiting twist-off nuts to provide actuation of the restraining wedges.

2.05 BOLTS AND NUTS

Bolts and nuts shall be as indicated below and shall be selected from the Approved Materials List.

A. Zinc-plated or fluoropolymer coated bolts and nuts shall be used for the installation of pipelines up to 500mm (20") diameter and shall be carbon steel. Bolts shall conform to ASTM A307, Grade A, and nuts shall conform to ASTM A563, Grade A, unless otherwise indicated on the approved drawings. Bolts and nuts shall have standard ANSI B1.1, Class 2A coarse threads.

B. Stainless steel bolts and nuts shall be used for the installation of pipelines 600mm (24") diameter and larger and for submerged flanges. Bolts and nuts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts, and Grade 8M for nuts.

C. All bolt heads and nuts shall be hexagonal, except where special shapes are required. Bolts shall be of such length that not less than 6.4mm (¼") or more than 12.7mm (½") shall project past the nut in tightened position.

2.06 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be as indicated below and shall be selected from the Approved Materials List. Polyethylene materials shall be kept out of direct sunlight exposure.

A. Polyethylene wrap and sleeves shall be a minimum 0.203mm (0.008” or 8 mil) thick linear low-density polyethylene film in accordance with AWWA C105.

B. Polyethylene wrap and sleeves shall be clear for use with potable water and purple for use with recycled water.

C. Polyethylene encasement shall be secured with 50mm (2”) wide polyethylene or vinyl adhesive tape or with plastic tie straps.

2.07 WARNING/IDENTIFICATION TAPE

Warning/identification tape shall be as indicated below and in accordance with the Approved Materials List.

A. Tape shall be an inert, non-metallic plastic film formulated for prolonged underground use that will not degrade when exposed to alkalis, acids and other destructive substances commonly found in soil.

B. Tape shall be puncture-resistant and shall have an elongation of two times its original length before parting.

C. Tape shall be colored to identify the type of utility intended for identification. Printed message and tape color shall be as follows:

Printed Message	Tape Color
Caution: Waterline Buried Below	Blue
Caution: Recycled Waterline Buried Below	Purple
Caution: Sewerline Buried Below	Green
Caution: Cathodic Protection Cable Buried Below	Red
Caution: Electric Line Buried Below	Red

Ink used to print messages shall be permanently fixed to tape and shall be black in color with message printed continuously throughout.

D. Tape shall be minimum 0.102mm (0.004” or 4 mil) thick x 150mm (6") wide with a printed message on one side. Tape used with the installation of onsite potable and recycled water irrigation systems shall be a minimum of 75mm (3”) wide.

2.09 TRACER WIRE

Tracer wire shall be as indicated below and shall be selected from the Approved Materials List.

A. Tracer wire shall be #14 AWG solid copper UF type wire with cross-linked polyethylene insulation. The insulation shall be white or yellow in color.

B. Wire splices (at pipe tees, crosses and laterals) shall be accomplished using a direct bury silicone-filled capsule tube with standard wire nut or silicone-filled wire nut connectors of the appropriate size selected from the Approved Materials List.

2.10 GATE WELLS

A. Gate wells for valves 50mm (2”) and smaller shall be 100mm (4”) diameter SDR-35 PVC sewer pipe selected from the Approved Materials List.

B. Gate wells for valves larger than 50mm (2”) shall be 200mm (8”) diameter Class 305 C900 PVC pipe selected from the Approved Materials List.

C. Gate wells for use in potable water system applications shall be white or blue. Gate wells for use in recycled water system applications shall be purple or shall otherwise be identified in accordance with Section 15151.

D. Gate well lids shall be circular ductile-iron selected from the Approved Materials List and shall include a skirt for a close fit inside the upper portion of the gate well. Lids shall be cast with the District's name and the word "WATER" for use on potable water systems or the word "RECYCLED" for use on recycled water systems.

1. Gate well lids for valves 50mm (2") and smaller shall be 100mm (4") diameter with 64mm (2-1/2") long skirt.

2. Unless otherwise indicated on the Approved Plans or directed by the District Engineer, gate well lids for valves larger than 50mm (2") shall be Type I in accordance with Standard Drawing WV-01 and selected from the Approved Materials List.

3. When indicated on the Approved Plans or when directed by the District Engineer, gate well lids for valves larger than 50mm (2") shall be Type II in accordance with Standard Drawing WV-02 consisting of a two-piece machined ductile-iron frame and lid selected from the Approved Materials List.

2.11 VALVE STEM EXTENSIONS

Stem extensions shall be complete with operating nut, location ring, and lower socket to fit valve-operating nuts. The configuration of the extension stem socket shall match that of the valve it operates.

A. Valve stem extensions for valves 50mm (2") or smaller shall be in accordance with Standard Drawing WV-05.

B. Valve stem extensions for valves 100mm (4") or larger extensions may be round or square hot-dipped galvanized steel tubing of solid design (no pinned couplings permitted) with guides in accordance with Standard Drawing WV-04.

2.12 METER BOXES

Meter boxes shall be selected from the Approved Materials List.

A. Meter box sizes shall be as follows:

Meter box size	Meter box uses
250mm x 500mm (10" x 20")	25mm (1") water services
325mm x 600mm (13" x 24")	25mm (1") dual domestic/fire water services
425mm x 750mm (17" x 30")	50mm (2") water services and 50mm (2") through 150mm (6") blowoff assemblies

B. Meter box lids for use in potable water system applications shall be gray.

C. Meter box lids for use in recycled water system applications shall be purple.

2.13 RECYCLED WATER IDENTIFICATION

Pipe and appurtenances used for recycled water shall be manufactured in purple color or shall otherwise be identified in accordance with Section 15151.

PART 3 EXECUTION

3.01 TEMPORARY PIPELINES

A. All temporary piping, fittings, and service connections shall be furnished, installed, and maintained by the Contractor, and the Contractor shall make connections to a water source designated by the District Engineer.

B. All pipe, valves, fittings, hose and connections furnished by the Contractor shall be of good quality, clean, and suitable for conveying potable water in the opinion of the District Engineer.

C. The temporary pipe shall be installed in such a manner that it will not present a hazard to traffic and will not interfere with access to homes and driveways along its route.

D. Valves shall be installed at 60m (200') intervals or as directed by the District Engineer. The use of pressure reducing valves (PRV) may be required as directed by the District Engineer.

E. The Contractor shall be responsible for disinfecting all pipe, connections, flushing, and assisting the District in taking water samples for bacteriological testing in accordance with Section 15041.

F. Following disinfection and acceptance of the temporary pipe as a potable water system, the Contractor shall maintain continuous service through the temporary piping to all consumers normally served both directly and indirectly by the pipeline.

G. Upon completion of the work, the Contractor shall remove the temporary piping and appurtenances and shall restore all surfaces to the satisfaction of the District Engineer..

H. If repairs to temporary piping are necessary, Contractor shall make such repairs in a timely manner as directed by the District Engineer. If progress in making repairs is inadequate, or in the event of emergency, the District Engineer may take immediate corrective measures, which may include the performance of repair work by District forces or another contractor. All costs for corrective measures shall be borne by the Contractor.

3.02 CONNECTION TO EXISTING FACILITIES (WET TAPS AND CUT-IN INSTALLATIONS)

Unless otherwise indicated on the Approved Plans or specifically directed by the District Engineer, all connections to existing facilities, including wet taps on active pipelines and cut-in installations, shall be performed by District personnel. When the Approved Plans indicate wet taps or cut-in installations are to be performed by Contractor, or when Contractor has the specific written permission of the District Engineer to perform wet taps or cut-in installations, such work shall be performed in strict accordance with the following procedures. In addition, wet taps shall be performed in accordance with Appendix D. The District Engineer must approve all work performed by Contractor prior to allowing access to the work site by District personnel.

The Contractor shall furnish the tapping sleeve or tee, valves and all other materials as called for in the Standard Specifications in accordance with the Approved Materials List. The Contractor shall provide all equipment and labor required for the excavation and installation of the connection including but not limited to thrust blocks, backfill and pavement replacement. In certain circumstances the Contractor may be required to provide a water truck or temporary piping as part of the equipment for making the connections. In addition, the Contractor shall

assist the District in alleviating any hardship incurred during a shutdown for connections. Emergency standby equipment or materials may be required of the Contractor by the District Engineer.

Wet taps or cut-in tee and valve installations shall be performed as follows:

A. Prior to construction, Contractor shall pothole the existing pipe at the location of the proposed connection. The District Engineer shall inspect the pothole prior to Contractor's repair of trench. Refer to Section 01000 for protection of existing facilities. Contractor shall record the following information on as-built drawings:

1. Pipe size, outside diameter.

2. Pipe type such as ACP, PVC, Ductile-Iron or Steel.

3. Pipe class and/or pressure rating.

4. Elevation, grade, and alignment.

5. Location of collars, pipe bells, fittings or couplings, if found.

6. Potential conflicts with existing utilities.

B. To facilitate the proposed connection and allow for slight adjustments in alignment, the Contractor shall leave a minimum 3.0m (10') gap between the new pipe installation and the proposed connection point at the existing water main. The Contractor shall leave a gap longer than 3.0m (10') if conditions warrant, or if directed by the District Engineer.

C. The new pipeline shall have successfully passed pressure testing in accordance with Section 15044 and disinfection and bacteriological testing in accordance with Section 15041 prior to proceeding with the connection to the existing pipeline.

D. After the District Engineer has given approval to proceed with the connection, the Contractor shall schedule with the District Engineer for the wet tap or cut-in installation.

1. Shutdowns will be scheduled at the convenience of the District. Shutdowns may be scheduled for nights or weekends if required.

2. The Contractor shall give the District Engineer a minimum of five (5) working days notice prior to any proposed excavation or shutdown of existing mains or services. Scheduling shall be subject to approval by the District Engineer.

3. The District Engineer may postpone or reschedule any shutdown operation if, for any reason, the District Engineer believes that the Contractor is improperly prepared with competent personnel, equipment, or materials to proceed with the connection.

4. If progress in completing the connection within the time specified is inadequate, the District Engineer may order necessary corrective measures. Corrective measures may consist of directing District personnel or another contractor to complete the work. All costs for corrective measures shall be borne by the Contractor.

E. Contractor may proceed with excavation only when pothole has been completed, materials have been approved and delivered, wet tap or cut-in installation has been scheduled and a copy of the approved traffic control plan has been supplied to the District Engineer.

1. The Contractor shall saw-cut pavement, excavate and provide and install shoring and steel plating, when necessary, one day prior to the wet tap or cut-in installation.

2. The Contractor shall provide lights, barricades and traffic control in accordance with the agency of jurisdiction and as deemed necessary for the excavation by the District Engineer.

3. The Contractor shall de-water existing mains where cut-in installations are required in the presence of the District Engineer and in accordance with Section 15041 and 02223. The Contractor shall be prepared to deal with leaking valves and water from those valves to complete the shutdown. Only District personnel are authorized to operate existing valves. The Contractor shall be responsible for any and all damage resulting from unauthorized operation of existing District facilities.

4. In areas where cut-ins are to be performed the Contractor shall line the bottom of the trench with 300 to 450mm (12” to 18”) of 19mm (¾”) rock and install a 300 to 400mm (12” to 16”) deep sump for dewatering the trench bottom.

5. The District shall perform the following work for wet taps and cut-in installations:

    a. Wet taps: Disinfect and install the tapping saddle and tapping valve and perform tapping operations in accordance with Appendix D.
    b. Cut-ins: Cut and remove portions of existing mains, and disinfect and install tees, valves, couplings, and appurtenances required to complete the closure. The Contractor shall discard pipe and appurtenances removed from service in accordance with this Section.

6. After the District has performed tapping or cut-in operations, and the District Engineer has given approval to proceed, the Contractor shall complete the installation as shown on the Approved Plans in accordance with the Standard Specifications including, but not limited to:

    a. Disinfecting and installing the pipe section(s) necessary to make the closure to the new system.

    b. Installing and setting the valve gate well(s) in accordance with the Standard Drawings.

    c. Installing thrust and anchor blocks in accordance with Section 03000.

    d. Completing all backfill and compaction of the trench in accordance with Section 02223.

    e. Repairing or replacing pavement as necessary in accordance with agency of jurisdiction requirements.

3.03 FLEXIBLE PIPE COUPLINGS

Flexible pipe couplings shall be installed in accordance with the manufacturers recommendations and as described below:

A. Use plain-end pipe with flexible couplings per AWWA C200. Provide joint harnesses per AWWA M11 for aboveground applications or where indicated on the Approved Plans.

B. Flexible couplings may be used only where indicated on the drawings

C. Clean oil, scale, rust, and dirt from the pipe ends and touch up the epoxy coating and allow time for curing before installing the coupling. Clean the gaskets before installing.

D. Follow the manufacturer's recommendations for installation and bolt torque using a properly calibrated torque wrench.

E. Lubricate the bolt threads with graphite prior to installation.

3.04 GROOVED-END OR SHOULDERED COUPLINGS FOR DUCTILE-IRON OR STEEL PIPE

Grooved-end or shouldered couplings shall be installed in accordance with the manufacturer's recommendations and as described below:

A. Grooved-end or shouldered joint couplings shall be installed per AWWA C606 and the manufacturer's recommendations.

B. Clean loose scale, rust, oil, grease, and dirt from the pipe or fitting groove and touch up the epoxy coating as necessary, allowing time for curing before installing the coupling.

C. Clean the gasket before installation. Apply a lubricant selected from the Approved Materials List to the gasket exterior including lips, pipe ends, and housing interiors.

D. Fasten the coupling alternately and evenly until the coupling halves are seated. Follow the manufacturer's recommendations for bolt torque using a properly calibrated torque wrench.

3.05 JOINT RESTRAINT SYSTEMS

Joint Restraint Systems shall be installed as shown on the Approved Drawings, in accordance with the manufacturers' recommendations and as described below:

A. Split ring joint restraint systems for bell and spigot joints shall be ductile-iron and shall consist of two split-ring restraints with machined (not cast) serrations on the inside diameter and connecting bolts, and shall be selected from the San Diego Water Agency Standards Approved Materials List. One clamping ring shall be installed on the spigot pipe, and with the necessary restraining rods and nuts, connected to a second clamping ring located on the pipe barrel immediately behind the gasket bell. Restraint devices may be installed prior to lowering pipe into the trench only with the approval of the District Engineer. All joint restraint devices shall be installed in accordance with the manufacturers' instructions

B. Split ring joint restraint for mechanical joints shall be ductile-iron and shall consist of two split-ring restraints with machined (not cast) serrations on the inside diameter and connecting bolts, and shall be selected from the San Diego Water Agency Standards Approved Materials List and installed per manufacturer specifications

C. Split ring joint restraint for push-on valves or push by flange adapter shall be ductile-iron and shall consist of two split-ring restraints with machined (not cast) serrations on the inside diameter and connecting bolts, and shall be selected from the San Diego Water Agency Standards Approved Materials List and installed per manufacturer specifications.

Split ring restraints for push-on valve or push by flange adapter shall not be used in applications larger than eight inches (8”) in diameter.

D. Gland style restraining mechanisms for mechanical joints shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets) for the restraining device. Gland style restraints shall be installed at all ductile iron fittings or valves as required by District engineer. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial.

3.06 BOLTS AND NUTS

A. All bolts and nuts shall be new and unused. Bolts shall not be reused once tightened. Used bolts and nuts shall be discarded and removed from the job site.

B. Bolts and nuts shall be cleaned, if needed, by wire brushing and shall be lubricated prior to assembly.

C. Tighten nuts uniformly and progressively in a “star” pattern.

D. Buried bolts and nuts shall receive a heavy coat of protective grease selected from the Approved Materials List prior to being wrapped with polyethylene.

E. All stainless steel bolts shall be coated with an anti-seize compound selected from the Approved Materials List.

3.07 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall completely encase and cover all metal surfaces.

Pipe and pipe-shaped appurtenances: All ductile-iron pipe and pipe-shaped appurtenances such as bends, reducers and offsets shall be encased with polyethylene sleeves in accordance with Method A described in AWWA C105, or with polyethylene wrap in accordance with Method C described in AWWA C105.

Odd-Shaped Appurtenances: Odd-Shaped Appurtenances such as tees and crosses shall be encased with polyethylene wrap in accordance with AWWA C105.

Valves: Valves shall be encased with polyethylene wrap in accordance with AWWA C105 such that only the stem and operating nut are exposed and the wrap shall be attached so that valve operation will not disturb the wrapping or break the seal.

B. Polyethylene sleeves shall be secured with polyethylene or vinyl adhesive tape or plastic tie straps at the ends and quarter points along the sleeve in a manner that will hold the sleeve securely in place during backfill. Polyethylene wrap shall be secured with polyethylene or vinyl adhesive tape or plastic tie straps in a manner that will hold the wrap securely in place during backfill.

3.08 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be installed as described below and in accordance with the Standard Drawings.

A. Tape shall be placed at the top of the pipe zone 300mm (12") above and centered over the utility intended for identification. Tape used with onsite potable and recycled water irrigation systems shall be installed at 150mm (6") above the pipe.

B. Tape shall be installed with the printed side up and run continuously along the entire length of the utility intended for identification. Tape shall be installed on the main piping and all appurtenant laterals, including blowoffs, air valve assemblies, fire hydrants, and services. Tape splices shall overlap a minimum of 600mm (24") for continuous coverage.

C. Tape shall be installed prior to placement of the Trench Zone Backfill.

3.09 TRACER WIRE

Tracer wire shall be installed as described below and in accordance with the Standard Drawings.

A. Tracer wire shall be installed with all water and recycled water mains.

B. Wire shall be placed on the top centerline of the pipeline and shall run continuously along the entire length of pipe prior to placement of trench backfill. Wire shall be mechanically and electrically continuous throughout the pipeline, including within pipe casings.

C. Tracer wire shall be secured to the pipe at 1.8m (6') intervals with plastic adhesive tape, duct tape or plastic tie straps. The wire may alternately be secured to the pipe by looping the tracer wire around itself such that tracer wire remains continuous atop the pipe during backfill operations.

D. Tracer wire access ports shall be installed in accordance with the Standard Drawings within the concrete splash pad of all fire hydrants installed as a part of the work. In addition, tracer wire may terminate within meter boxes, blow off boxes, CP test boxes or air valve enclosures as shown on the Approved Drawings or as directed by the District Engineer at intervals of not more than 305m (1,000'). Locations of all tracer wire access ports installed shall be noted on the field record drawings.

E. Wire shall extend into the access port and shall terminate with a coiled 600mm (24") length of wire. All tracer wire not attached to piping shall be installed, without splices, within a conduit at a minimum depth of 600mm (24") in accordance with the Standard Drawings.

F. Splices shall be installed only when necessary and shall be made using wire connectors selected from the Approved Materials List.

G. The Contractor shall test tracer wire for electrical continuity in the presence of the District Engineer prior to the installation of any paving over atop pipelines or appurtenances. Testing shall be accomplished using a device capable of detecting improper connections or ground fault interruptions.

3.10 GATE WELLS

Gate wells shall be installed as shown on the Standard Drawings and as described below.

A. Gate wells shall be installed with lids flush with the final surface. No more than two 25mm (1") adjustment rings shall be used. Gate wells and adjustment rings shall be accurately cut perpendicular to the length of the piping used.

B. Gate wells shall be color-coded to identify the type and use of the valve installed.

1. The inside portion of the gate well lid and interior portion of PVC gate well shall be identified with a minimum 50mm (2") diameter painted identification marking. Paint color shall be as follows:

Color	Gate Well Lid and PVC Gate Well for:
Red	Normally Closed System Valves (NCV)
White	Resilient Wedge Gate Valves (RWGV)
Green	Butterfly Valves (BFV)

2. The top exterior portion of the gate well lid and ring shall be coated in accordance with Section 09910.

3.11 VALVE STEM EXTENSIONS

A. All valves 50mm (2") and smaller requiring the installation of a gate well shall include a valve stem extension fabricated and installed in accordance with the Standard Drawings. Stem extensions shall be of sufficient length to bring the operating nut to a point approximately 150mm (6") below the gate well lid.

B. Valves 100mm (4") and larger require valve stem extensions to be fabricated and installed in accordance with the Standard Drawings when the valve-operating nut is more than 1.5m (5') below grade. Valve stem extensions shall be of sufficient length to bring the operating nut to a point between 300mm (12") and 450mm (18") below the gate well lid.

3.12 METER BOX INSTALLATIONS

Meter boxes shall be installed at the elevations and locations shown on the Approved Plans and in accordance with the Standard Drawings. Near the completion of the project, a final meter box adjustment to finish grade may be required. Water meters shall not be installed until final adjustments are made to the meter box and are approved by the District Engineer.

3.13 INSTALLATION OF TEMPORARY END CAPS TO MAINTAIN SERVICE

Before excavating for new mains that are to replace existing pipes or services, it may be necessary to install temporary end caps on existing pipes that are later to be abandoned or connected to in order to maintain service to customers or fire protection during construction. When indicated on the Approved Plans or when directed by the District Engineer, Contractor shall install and maintain such temporary end caps as indicated below and in accordance with the Standard Drawings.

A. For existing water mains 350mm (14") or less in diameter, the existing pipe shall be cut cleanly and fitted with a rubber-gasketed ductile-iron solid end cap specifically designed for the size and type of pipe being temporarily capped. The temporary end cap shall be adequately braced with a concrete thrust block poured against undisturbed material or as otherwise required to insure that no movement or leakage occurs.

B. Temporary end caps shall be fitted with 50mm (2") tapped outlets in accordance with the Standard Drawings to provide temporary 50mm (2") blowoffs or connections to temporary water sources if indicated on the Approved Drawings or if directed by the District Engineer.

C. Existing pipes 400mm (16”) or larger shall not be fitted with temporary end caps.

3.14 PERMANENT ABANDONMENT OF PIPELINES AND APPURTENANCES

When indicated on the Approved Plans or when directed by the District Engineer, existing pipelines to be abandoned shall be disconnected from all source pipelines and shall remain in place in accordance with the Standard Drawings and the modifications and instructions listed below:

A. All above-ground appurtenances connected to pipelines to be abandoned shall be removed and disposed of or salvaged in accordance with this Section.

B. All piping and appurtenances buried at a depth of 600mm (24”) or less and connected to pipelines to be abandoned shall be removed and disposed of or salvaged in accordance with this Section. Remaining pipe ends, gate wells and other appurtenances cut at a depth of 600mm (24”) shall be removed entirely or filled with concrete. Excavated areas shall be replaced with compacted backfill and surfaces shall be repaired in accordance with these Standard Specifications.

C. Pipe 100mm (4”) and smaller to be abandoned shall be excavated at intervals of 60m (200’), short sections of pipe shall be removed, and pipe ends shall be encased in concrete.

D. Pipe 150mm (6”) through 350mm (14”) to be abandoned shall be excavated at intervals of 60m (200’), and pipe shall cut and plugged with concrete in accordance with the Standard Drawings or shall be entirely filled by pressure-grouting or with lightweight cellular concrete. The materials and method of filling pipeline(s) to be abandoned shall be submitted for approval by the District Engineer.

E. When existing pipe 350mm (14”) or less is excavated for abandonment, each excavation is considered as a single “cut-and-plug.”

F. Pipe 375mm (15”) and larger to be abandoned shall be entirely filled by pressure-grouting, by blown sand, or with lightweight cellular concrete. The materials and method of filling pipeline(s) to be abandoned shall be submitted for approval by the District Engineer.

G. Ends of all pipe segments to be abandoned shall be filled with concrete in accordance with the Standard Drawings.

H. All valves on pipelines to be abandoned shall be turned to the closed position.

I. Water services to be abandoned that are connected to pipelines that will remain in service shall be abandoned in-place and deactivated at the corp stop in accordance with the Standard Drawings. Water services connected to pipelines to be abandoned shall be abandoned in-place and cut ends shall be crimped.

J. Sewer laterals shall be cut and plugged with concrete at the main as directed by the District Engineer for the specific circumstance and material type identified.

K. Sewer manholes shall have the cover and frame, concrete ring, grade rings and cone section removed. Inlet and outlet piping shall be plugged with concrete, manhole void shall be filled with sand, and a 300mm (12") thick, reinforced concrete slab shall be poured over the top of remaining manhole. The Contractor shall backfill hole to ground surface with compacted select fill.

3.15 REMOVAL OF PIPELINES AND APPURTENANCES

A. Existing pipe and appurtenances shall be completely removed when indicated on the Approved Plans or as directed by the District Engineer. All materials removed during construction operations shall be salvaged or disposed of in accordance with this Section.

B. When fittings, appurtenances, or pipe segments are removed from pipelines that are to remain in service, the removed portions shall be replaced with straight segments of pipe and appropriate couplings selected from the Approved Materials List.

C. Contractor shall provide measures that allow for the removal of existing sewer mains and appurtenances with no leakage of raw sewage. Transportation of sewer mains and appurtenances removed from service shall be in waterproof trucks to prevent raw sewage from leaking on public streets.

D. Removal of asbestos-cement pipe (ACP) and sewer mains and appurtenances shall be in accordance with all applicable State and Federal requirements, and disposal shall be in accordance with the requirements of this Section.

E. Backfill, compaction, and surface repair of all excavations for removal of pipe and appurtenances shall be made in accordance with the Approved Plans, these Standard Specifications, and in accordance with the requirements of the agency of jurisdiction or as directed by the District Engineer.

3.16 RECONNECTIONS

Existing service laterals or appurtenances shall be connected to new pipelines as shown on the Approved Plans or as directed by the District Engineer. Contractor may encounter unused service laterals or piping appurtenant to an existing pipeline being replaced. Laterals and appurtenant piping that will not be connected to new pipelines shall be abandoned in accordance with the requirements of this Section.

3.17 SALVAGE

When the Contractor is required to remove existing pipe and appurtenances, such materials may, when shown on the Approved Plans or directed by the District Engineer, be considered salvage. All materials identified as salvage are considered property of the District. The Contractor shall temporarily stockpile all material identified as salvage in a location that will not disrupt traffic or otherwise create an unsafe condition and shall deliver such materials as directed by the District Engineer.

3.18 DISPOSAL

All materials removed during construction operations and not identified by the District Engineer as salvage shall be legally disposed of in accordance with all applicable Local, State, and Federal requirements.

Disposal of asbestos-cement pipe requires special handling and attention, including but not limited to, encapsulation within airtight packaging, submittal of certification letters and/or waste profile statements, and the use of a Cal-OSHA registered asbestos abatement contractor to transport and dispose of such wastes. The District Engineer shall be provided with copies of all applicable documentation regarding the transportation and disposal of asbestos-cement pipe. Contractor shall comply with all applicable regulations and all requirements of the disposal site. Contractor is responsible for all costs associated with disposal of materials, specifically including

any materials that may contain asbestos.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15041 DISINFESTION OF PIPING

PART 1 GENERAL

1.01 DESCRIPTION

This section describes requirements for disinfection by chlorination of potable and recycled water mains, services, pipe appurtenances and connections.

1.02 REFERENCED STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

- AWWA B300 - Hypochlorites
- AWWA B301 - Liquid Chlorine
- AWWA C651 - Disinfecting Water Mains

1.03 RELATED WORK SPECIFIED ELSEWHERE

- AWWA Standard Methods for the Examination of Water and Wastewater
- WAS Standard Specifications 15000, 15044, 15056, 15057, 15061, and 15064

1.04 SERVICE APPLICATION

A. All water mains and appurtenances taken out of service for inspection, repairs, or other activity that might lead to contamination shall be disinfected before they are returned to service.

B. All new water mains and temporary pipelines shall be disinfected prior to connection to the District's existing system.

C. All components incorporated into a connection to the District's existing system shall be disinfected prior to installation.

1.05 SUBMITTALS

A written disinfection and de-chlorination plan showing the design, equipment, methods, and sequencing intended for use shall be signed by the person responsible for performing the work and submitted to the District Engineer for approval prior to starting disinfection operations.

1.06 DELIVERY, STORAGE AND HANDLING

Chlorination and dechlorination shall be performed by competent individuals knowledgeable and experienced in the operation of the necessary application and safety equipment in accordance with applicable Federal, State and Local laws and regulations. The transport, storage and handling of

these materials shall be performed in accordance with Code of Federal Regulations (CFR) 1910.120 Hazardous Waste Operations and Emergency Response, CFR 49.172 Hazardous Materials Regulations, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5194.

1.07 CONCURRENT DISINFECTION AND HYDROSTATIC TESTING

The specified disinfection of the pipelines may ***not*** be performed concurrently with the hydrostatic testing in accordance with Section 15044.

1.08 CONNECTION TO EXISTING MAINS

Prior to connection to existing mains, disinfection and bacteriological testing shall be performed in accordance with this specification, and hydrostatic testing shall be performed per Section 15044. District authorization for connection to the existing system shall be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results. Connection to existing mains shall be performed in accordance with Section 15000.

PART 2 MATERIALS

2.01 LIQUID CHLORINE (GAS)

A. Liquid chlorine contains 100-percent available chlorine and is packaged in steel containers in net weights of 68.1kg (150 lb.) or 907.2kg (1 ton).

B. Liquid chlorine shall be used with appropriate gas flow chlorinators, heaters, and injectors to provide a controlled, high-concentration solution feed to the water. The chlorinators and injectors shall be the vacuum-operated type.

2.02 SODIUM HYPOCHLORITE (LIQUID)

Sodium hypochlorite is available in liquid form in glass or plastic containers, ranging in size from 0.95 L (1 Qt.) to 18.93 L (5 Gal). The solution contains approximately 10% to 15% available chlorine.

2.03 TABLET OR GRANULAR HYPOCHLORITE

Tablet or granular hypochlorite shall not be used at any time.

PART 3 EXECUTION

3.01 GENERAL

A. Disinfection of pipelines shall not proceed until all appurtenances and any necessary sample ports have been installed and the District Engineer provides authorization.

B. Every effort shall be made to keep the water main and its appurtenances clean and dry during the installation process.

C. All piping, valves, fittings, and appurtenances which become contaminated during installation shall be cleaned, rinsed with potable water, and then sprayed or swabbed with a 5 percent sodium hypochlorite disinfecting solution prior to installation.

D. Water mains under construction that become flooded by storm water, runoff, or ground water shall be cleaned by draining and flushing with metered potable water until clear water is evident. Upon completion, the entire main shall be disinfected using a method approved by the District Engineer.

3.02 METHODS

A. Liquid Chorine (Gas)

1. Only vacuum-operated equipment shall be used. Direct-feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall not be permitted. The equipment shall incorporate a backflow prevention device at the point of connection to the potable water source used to fill the line being tested.

2. The chlorinating agent shall be applied at the beginning of the system to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected.

3. Only a certified, licensed chlorination and testing contractor shall perform gas chlorination work. The chlorination contractor must also possess a Grade II Treatment Plant Operator Certification from the State of California if required by the District Engineer.

B. Sodium Hypochlorite Solution (Liquid)

1. Sodium hypochlorite solution shall be used for cleaning and swabbing piping and appurtenances immediately prior to installation and for disinfecting all components of connections to the District's existing system.

2. Sodium hypochlorite solution may be used for the initial disinfection of newly installed water mains. The solution shall be applied at a terminus of the system to be chlorinated using an injector which can adjust the amount of solution being injected into the piping system. The solution shall be injected in the appropriate concentration to achieve the specified concentration range of chlorine throughout the entire piping system. Where pumping equipment is used in conjunction with an injector, an integral backflow prevention device shall be installed and connected to the potable water supply.

3. Water trucks, pumping equipment, piping, appurtenances and all other equipment in contact with potable water shall be disinfected prior to use.

4. Sodium hypochlorite solution may also be used to increase the total chlorine residual if the concentration from the initial chlorination of the system is found to be low. The solution shall be added to the system in sufficient amounts at appropriate locations to insure that the disinfecting solution is present at a concentration within the specified range throughout the piping system.

3.03 FLUSHING OF WATER MAINS AND APPURTENANCES

Prior to disinfection, new pipelines may be drained as directed by the District Engineer. The pipeline shall then be filled with potable water at a rate not to exceed 300 GPM or a velocity of 1 foot per second, whichever is less, and then flushed per AWWA C651. Flushing will continue until a

minimum of three exchanges of the pipe volume are achieved and the turbidity level of the water in the new pipeline(s) is less than or equal to 0.5 NTU. If the source water turbidity is greater than 0.5 NTU, flushing shall continue until the pipeline turbidity is equal in turbidity to the source water.

Flushing of all pipelines shall be at a maximum of 2,000' in length and flushed as one continuous run of pipe or as directed by the District Engineer.

Temporary end caps shall include a minimum 4" blow off on all pipe 8-12" in diameter and a 6" blow off on all pipe larger than 12" in diameter unless otherwise directed by the District Engineer.

A. Contractor shall provide a complete flushing plan and map including points of discharge to the District prior to the commencement of work.

3.04 HIGH PRESSURE WATER JETTING OF PIPING

Prior to testing and flushing, the Contractor shall be required to perform high pressure jetting to clean all piping prior to chlorination unless otherwise directed by the District Engineer.

A letter of certification is required for all equipment, which shall verify that the equipment has been used only in potable water systems.

An overview map of the piping alignment, identifying pit locations for jetting, shall be provided by the Contractor and approved by the District Engineer prior to commencing jetting activities.

A. Jetting equipment shall consist of the following: a high-pressure water pump with a minimum 80 gallons per minute at 2,500 psi, cleaning nozzle with six rear facing jets at 30 degree angle, and a hydro cleaner tank holding a minimum of 1,000 gallons of minimum concentration of 10 ppm liquid chlorine solution.

B. Contractor shall provide all supplies necessary to perform this work and shall provide documentation that all supplies and equipment are designated for potable water use only. Prior to hydro cleaning, Contractor shall disinfect any equipment in contact with the interior of piping with a liquid chlorine solution in accordance with WAS, AWWA C651, and AWWA C652. All disinfection procedures shall be subject to inspection prior to acceptance and use.

C. Prior to jetting, excavation shall be lined with minimum 8 mil plastic and covered with 12" of ¾" rock to minimize trench erosion and discharging of mud.

D. The hydro cleaner must make a minimum of two (2) complete passes from access point to access point to remove sediment, rust, construction debris, pipe soap residue, and any foreign objects. The hydro cleaner shall make a minimum of two (2) passes from each access point with a minimum 100-foot overlap to ensure that the center of the pipe is cleaned. Contractor shall legally dispose of any debris found within pipe. Contractor shall be responsible for all costs associated with the access points and the physical limitations of jetting.

E. Contractor shall ensure that water and debris that has been removed from the pipeline shall not flow back into the pipeline.

3.05 PROCEDURE FOR DISINFECTING WATER MAINS AND APPURTENANCES

A. Disinfection shall result in an initial free chlorine concentration of 50-mg/l or as otherwise directed by the District Engineer. This concentration shall be evenly distributed throughout the system to be disinfected. Disinfection of all pipelines shall be at a maximum of 2,000' in length and disinfected as one continuous run of pipe or as directed by the District Engineer.

B. All valves shall be operated with the disinfection solution present in the pipeline. All appurtenances such as air-vacuum relief valves, blowoffs, hydrants, backflow prevention devices, and water service laterals shall be flushed with the treated water a sufficient length of time to insure a free chlorine concentration within the specified range in all components of each appurtenance. (Note the limitations for discharge of chlorinated water outlined below.)

C. The District Engineer will verify the presence of the disinfection solution throughout the system by sampling and testing for acceptable free chlorine concentrations at the various appurtenances and/or at the test ports provided by the Contractor. Areas of the system found to be below the specified free chlorine concentration level shall receive additional flushing as noted above and/or additional disinfection solution as necessary. (Note the limitations for discharge of chlorinated water outlined below.) Addition of disinfection solution after the initial charging of the line shall be made by either the liquid chlorine (gas) method, or the sodium hypochlorite method as directed by the District Engineer.

D. The chlorinated water shall be retained in the system for a minimum of 24 hours. The District Engineer will test the free chlorine residual. The system shall contain a free chlorine residual of not less than 80% of the initial free chlorine residual before the 24- hour soaking period began. If the free chlorine residual has decreased more than 20%, the system shall be soaked for an additional 24-hour period. If the free chlorine residual has not decreased after this additional 24-hour period, the system shall be flushed in accordance with the procedure detailed herein. If the free chlorine residual has decreased, the system shall be flushed in accordance with the procedure detailed herein and shall be re-disinfected.

E. Following a successful retention period as determined by the District Engineer, the chlorinated water shall be flushed from the system at its extremities and at each appurtenance, using potable water from a source designated by the District Engineer. The minimum water velocity during flushing shall be 3.0 feet per second (AWWA C651) or as directed by the District Engineer. Flushing shall continue until the replacement water in the new system is equal in chlorine residual to the potable source of supply and the turbidity level is 0.5 NTU's or less or as otherwise directed by the District Engineer. (Note the limitations for discharge of chlorinated water outlined below.)

F. The District Engineer will perform bacteriological sampling and testing as specified herein.

3.06 DISCHARGE OF CHLORINATED WATER

A. Indiscriminate onsite disposal or discharge to sewer systems, storm drains, drainage courses or surface waters is prohibited. It shall be the responsibility of the Developer to file a Notice of Intent and obtain a General Waste Discharge Requirements Permit for Discharges of Hydrostatic Test Water and Potable Water to Surface Waters, Storm Drains or Other Conveyance Systems, San Diego Region (Hydrostatic Test Permit) for any discharge of hydrostatic test water or other potable water. The Contractor shall be solely responsible to evaluate, obtain and comply with the provisions of the Hydrostatic Test Permit, including any monitoring and reporting as may be required. The Contractor shall comply with all requirements of the State Water Resources Control Board and the San Diego Regional Water Quality Control Board. The Contractor shall provide copies of all reports and monitoring information to the District Engineer.

Failure to comply with the Hydrostatic Test Permit is a violation of federal and state law. The Contractor hereby agrees to indemnify and hold harmless the District, its Board members, officers, agents, employees and authorized volunteers from and against any and all claims, demands, losses or liabilities of any kind or nature which District, its Board members, officers, agents, employees and authorized volunteers may sustain or incur for

noncompliance with the Hydrostatic Test Permit arising out of or in connection with the Project.

B. The environment to which the chlorinated water is to be discharged shall be examined by the Developer and the Private Engineer. Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of chlorinated water. Any indication that the discharge of chlorinated water may cause damage to the environment shall require the neutralizing of the chlorine residual by means of a reducing agent in accordance with AWWA C651 and the requirements of this specification.

C. In locations where chlorine neutralization is required, the reducing agent shall be applied to the water as it exits the piping system. The Developer shall monitor the chlorine residual during the discharge operations. Total residual chlorine limits in these locations, and for the discharge of chlorinated water from the testing of pipelines to surface waters of the San Diego Region are as follows:

Total Residual Chlorine Effluent Limitations	
30-Day Average	0.002 mg/l
Average Daily Maximum	0.008 mg/l
Instantaneous Maximum	0.02 mg/l

The various methods of dechlorination available can remove residual chlorine to concentrations below standard analytical methods of detection, 0.02 mg/l, which will assure compliance with the effluent limit. The Developer will perform all necessary tests to ensure that the total residual chlorine effluent limitations listed above are met.

D. In locations where no hazard to the environment is evident based on the joint examination described above, the chlorinated water may be broadcast for dust control on the surface of the immediate site. Care shall be exercised in broadcasting the water to prevent runoff.

3.07 BACTERIOLOGICAL TESTING

After disinfection has been performed as detailed herein, the District Engineer will perform bacteriological sampling and testing of all new system installations. The testing methodology employed by the District Engineer shall be as set forth in "Standard Methods for the Examination of Water and Wastewater" (current edition). Testing requirements are as set forth in the California Domestic Water Quality and Monitoring Regulations and in accordance with current requirements for surface water testing.

A. The District Engineer will take samples in accordance with method A or B of AWWA C-651-14. Sample method is at the sole discretion of the District Engineer. No flushing is allowed between samples. The days of the test shall be determined by the District Engineer.

B. Sample locations shall be determined by the District Engineer and shall be taken through the length of the new pipeline(s) at locations not more than 365m (1,200') apart. In addition, samples shall be taken at all branches and dead ends. No More than 2,000' of total system length may be tested at any given cycle or as otherwise directed by the District Engineer.

C. All samples must pass the following tests:

1. Coliform Bacteria Test: No positive samples allowed.

2. Heterotrophic Plate Count (HPC) Test: No more than 500 colony-forming units allowed in any sample. The requirement for HPC testing may be waived at the sole discretion of the District Engineer.

D. Samples with excessive turbidity at time of read may be deemed invalid and new samples taken at the discretion of the District Engineer.

E. Any alterations to already approved systems, I.E. lowering of lateral(s), fire hydrant elevation changes, ETC. may be subject to additional bacteriological testing as directed.

3.08 RE-DISINFECTION

A. If any samples fail the Coliform Bacteria or HPC Tests, the entire pipeline(s) will be re-flushed by the Contractor, as detailed in 3.03 of this section, and re-sampled per the initial sample method (A or B) required by the District Engineer as specified herein.

B. If, after the re-flushing procedures described above are performed, the new pipeline(s) continue to fail either the Coliform Bacteria or HPC Tests, the pipeline(s) shall be re-flushed, re-disinfected, and re-sampled, and may be subject to additional cleaning requirements such as those detailed in 3.04 of this section, at the discretion of the District Engineer. These procedures shall continue until satisfactory results are obtained.

C. All re-flushing, re-disinfection, and re-sampling required shall be at the Contractor's expense.

D. If 4 consecutive test cycles fail to yield passing results, the District Engineer may require the removal of the failed system components.

3.09 CONNECTING NEW PIPELINES TO EXISTING PIPELINES

A. Upon successful completion of Bacteriological Testing, Contractor shall schedule connections to existing pipelines within 10 working days or as otherwise required by the District Engineer. If the Contractor exceeds the 10 working day time frame to schedule connections to existing pipelines, additional sampling and testing may be required at the discretion of the District Engineer.

B. Upon completion of connections to existing pipelines, the District will activate and flush the pipeline and again take samples. If samples fail, the District will re-sample at the failed test location(s). If the re-sample does not produce satisfactory results, the newly- installed pipeline shall be disconnected from the existing pipeline(s) at the discretion of the District Engineer. The new pipeline shall then be re-disinfected, re-flushed and re- sampled as specified herein at the Contractor's expense.

3.10 DISINFECTION AT SHORT-LENGTH TIE-INS

Pipes, fittings, valves and all other components incorporated into connections to the District's existing system with an assembly length of 6m (20') or less shall be spray disinfected or swabbed with a liquid chlorine solution in accordance with AWWA C651 and as specified herein. Upon connection to the main, the line shall be flushed and tested as directed by the District Engineer. Failure to pass Bacteriological Testing will require that new facilities be adequately isolated from existing facilities and re-disinfected and re-tested until the new facilities pass the required tests. Costs for additional disinfection, sampling and testing shall be paid for by Contractor. Alternate methods such as "pre-disinfection" prior to installation in accordance with AWWA C651 may be required at the discretion of the District Engineer.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15043 SEWER LEAKAGE AND INFILTRATION TESTING

PART 1 GENERAL

1.01 DESCRIPTION

This section describes the requirements and procedures for leakage and infiltration testing of gravity sewer systems.

1.02 REFERENCED STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

UNI-B-6	-	Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
SSPWC	-	Standard Specifications for Public Works Construction ("Greenbook")

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02222, 02223, 15045, 15065.

1.04 REQUIREMENTS PRIOR TO TESTING

Trenching for all dry utilities such as electrical, telephone and cable television shall be completed prior to performing any tests on the sewer pipe.

1.05 TESTING

The following tests shall not be conducted until after all other utilities have been installed and trench compaction has been completed. All tests shall be conducted in the presence of the District Engineer.

A. Leakage Test: Each section of sewer pipe between two successive manholes, or between a manhole and its corresponding cleanout or end plug, shall be tested for leakage. The sewer laterals to the property line shall be included in the test.

B. Infiltration Test: In addition to the leakage test, an infiltration test shall be made where groundwater is encountered, or evidence exists that ground water has encroached to the elevation of the sewer, and as directed by the District Engineer.

C. Closed-Circuit Television: A closed-circuit television (CCTV) inspection shall be performed by Contractor on the sewer installation in accordance with Section 15045.

D. Manhole Test: Manholes shall be vacuum-tested in accordance with Section 03461.

E. Testing may be repeated, as directed by the District Engineer, if the subsequent construction operations of the Contractor or others may have damaged or affected the structural integrity of the sewer pipe and/or laterals.

F. All tests must be completed before the street or trench is paved, unless otherwise allowed by the District Engineer.

PART 2 MATERIALS

The Contractor shall furnish all equipment and materials required for testing.

PART 3 EXECUTION

3.01 AIR TEST FOR PVC GRAVITY SEWERS

The testing described in UNI-B-6 shall be followed except as modified below:

A. Each section of sewer pipe, as measured between manholes or manhole and cleanout, shall be tested by plugging all pipe outlets with suitable test plugs.

B. Air shall be slowly added until the internal pressure is raised to 34.5 KPa (5 psi). The compressor used to add air to the pipe shall have a relief valve set to ensure that the internal pressure in the pipe does not exceed 41.4 KPa (6 psi). At no time shall the internal pressure in the pipe exceed 41.4 KPa (6 psi).

C. The internal pressure of 34.5 KPa (5-psi) shall be maintained for at least two minutes to allow the air temperature to stabilize, after which the air supply shall be disconnected.

D. The time in minutes that is required for the internal air pressure to drop from 34.5 KPa (5 psi) to 27.6 KPa (4 psi) shall be measured. The results shall not be less than the minimum permissible duration for air test pressure drop shown in the table below.

Minimum Duration for Air
Test Pressure Drop

Pipe Size mm (inches)	Time (Minutes)
200 mm (8”)	5
250 mm (10”)	6
300 mm (12”)	7
375 mm (15”)	9

E. If the pressure drop from 34.5 KPa (5 psi) to 27.6 KPa (4 psi) occurs in less time than shown above, the pipe shall be examined and repaired, and if necessary, replaced or re-laid including backfill and compaction, and retested.

3.02 AIR PRESSURE ADJUSTMENT FOR GROUNDWATER

A. In areas where groundwater is evident at an elevation above the sewer pipe, or where it can be determined through past physical evidence or known history that groundwater will again achieve an elevation above the sewer pipe, an adjustment shall be made to the leakage test pressure. The highest anticipated groundwater pressure shall be added to the sewer leakage test pressure as compensation.

B. The air pressure correction, which must be added to the 34.5 KPa (5 psi) normal test starting pressure, shall be calculated by dividing the average vertical height of groundwater above the invert of the sewer pipe to be tested, by 704.1mm (2.31').

C. In no case shall the starting test pressure exceed 62.1 KPa (9.0 psi), or the manufacturer's allowable maximum.

3.03 INFILTRATION TEST

A. Prior to testing for infiltration, the ends of the sewer pipe section to be tested shall be capped or plugged to prevent the entrance of water, and pumping of groundwater shall be discontinued for at least three days.

B. Any infiltration discovered before completion and acceptance of the sewer shall be corrected. The sewer shall be examined and the source of infiltration eliminated. Following repairs or replacement as necessary, including backfill and compaction, the subject line shall be retested to assure no infiltration.

3.04 PRESSURE TESTS FOR SEWER FORCE MAINS

Pressure tests for sewer force mains shall be in accordance with Section 15044 except that the allowable leakage shall be zero (0). All leak points shall be located and stopped. All defective pipe, fittings, valves and other appurtenances discovered shall be removed and replaced with sound material and tests repeated until the leakage is zero (0).

3.05 CLOSED-CIRCUIT TELEVISION (CCTV) INSPECTION

In addition to the leakage and infiltration tests, closed-circuit television (CCTV) inspections shall be conducted in accordance with Section 15045.

3.06 VACUUM TESTING OF MANHOLES

Vacuum testing of manholes shall be performed in accordance with Section 03461.

3.07 FINAL ACCEPTANCE

The requirements of this section shall be considered acceptable when each sewer section's air leakage rate is less than the maximum allowed, the television inspection is satisfactory, and the water infiltration rate is zero.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15044 HYDROSTATIC TESTING OF PRESSURE PIPELINES

PART 1 GENERAL

1.01 DESCRIPTION

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

1.02 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 15000, 15041, 15056, 15057, 15061, and 15064

1.03 REQUIREMENTS PRIOR TO TESTING

A. All piping, valves, fire hydrants, services, and related appurtenances shall be installed.

B. The pipe trench shall have trench zone backfill placed and compacted with a minimum of 600mm (24") of material over the pipe.

C. All concrete thrust block and anchor blocks shall be allowed to cure in accordance with Section 03000.

D. Pressure tests on exposed and aboveground piping shall be conducted only after the entire piping system has been installed and attached to pipe supports, hangers or anchors as shown on the Approved Plans.

E. Steel pipelines shall not be tested until factory-applied mortar linings and coatings on all pipe lengths have been in place for a minimum of fourteen (14) days. Steel pipelines with cement mortar field-applied to the interior of the pipeline shall not be filled with water until a minimum of eight (8) hours has elapsed after the final placement of cement mortar, unless otherwise approved by the District Engineer.

F. The Contractor is required to pre-test all pipelines before requesting a hydrostatic testing.

1.04 HYDROSTATIC TESTING AND DISINFECTION OF PIPELINES

Hydrostatic testing of pipelines shall be performed prior to disinfection operations in accordance with Section 15041. In the event repairs are necessary, as indicated by the hydrostatic test, the District Engineer may require additional flushing in accordance with Section 15041.

1.05 CONNECTION TO EXISTING MAINS

Hydrostatic testing shall be performed prior to connections to existing mains. District authorization for connection to the existing system shall be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results. Connection to existing mains shall be performed in accordance with Section 15000.

PART 2 MATERIALS

2.01 WATER

Potable water, supplied by a source approved by the District Engineer, shall be used for all hydrostatic testing of potable and recycled water mains.

2.02 CONNECTIONS

A. Testing water shall be supplied through a metered connection equipped with a backflow prevention device in accordance with Section 15112 at the point of connection to the potable water source used.

B. The Contractor shall provide any temporary piping needed to deliver potable water to the piping that is to be tested. Temporary piping shall be in accordance with Section 15000.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall provide the District Engineer with a minimum of 48 hours' notice prior to the requested date and time for hydrostatic tests.

B. The Contractor shall furnish all labor, materials, tools, and equipment for testing.

C. Temporary blocking during the tests will be permitted only at temporary plugs, caps or where otherwise directed by the District Engineer.

D. All valves and appurtenances shall be operated during the test period. The test shall be conducted with valves in the open position.

E. At the onset of testing, all valves, air vacuum assemblies, blowoffs, and services shall be monitored for possible leakage and repairs made, if necessary, before the test proceeds. The appurtenances shall be monitored through the duration of the testing.

F. Pipelines with cement-mortar lining shall be filled with water and placed under a minimum pressure of 172 KPa (25 psi) for at least forty-eight (48) hours prior to hydrostatic testing.

3.02 FIELD TEST PROCEDURE

A. Before applying the specified test pressure, care shall be taken to release all air within the pipe and appurtenances to be tested. Air shall be released through services, fire hydrants, air release valves, or other approved locations.

B. A five (5) hour hydrostatic pressure test shall be performed after the pipe and all appurtenances have been installed and after any trench backfill compaction with heavy-duty compaction equipment has been completed. The hydrostatic test pressure shall be 345 KPa (50 psi) above the class rating of the pipe, or 1,725 KPa (250 psi), whichever is less, or as otherwise directed by the District Engineer, at the lowest point in the section of pipe being tested. The hydrostatic test pressure at the highest point in the section of pipe being tested shall be within 345 KPa (50 psi) of the hydrostatic test pressure at the lowest point in the section of pipe being tested.

The test pressure shall be applied and continuously maintained by pumping for a period of four (4) hours. During the pumping phase of the test, the test pressure shall be maintained at not less than ninety-five percent (95%) of the specified test pressure at all times.

At the end of the fourth (4th) hour, the pressure shall meet the requirements stated above. Pumping shall then be discontinued for one hour. The pipeline is required to hold the specified test pressure with zero loss for one hour. Any pressure loss from the initial starting pressure will result in a failed test.

If pressure loss exists, the cause of the loss shall be located and repaired as required by the District Engineer. All defective pipe, fittings, valves and other appurtenances discovered shall be removed and replaced with sound material. The hydrostatic test shall be repeated until pressure loss does not occur. All visible leaks shall be similarly repaired.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15045 CLOSED-CIRCUIT TELEVISION (CCTV) INSPECTIONS

PART 1 GENERAL

1.01 DESCRIPTION

This section describes the requirements and procedures for closed-circuit television (CCTV) inspection of newly-constructed and rehabilitated water and sewer mains.

1.02 REFERENCED STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

SSPWC - Standard Specifications for Public Works Construction ("Greenbook")

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Specifications 01000, 15043, and 15061.

1.04 REQUIREMENTS PRIOR TO TESTING

CCTV inspections on newly-constructed water and sewer mains shall be conducted after all utilities have been installed and backfill compaction has been completed, but prior to final paving.

The Contractor shall notify the District Engineer two (2) working days in advance of the anticipated date of televising so that the District Engineer may observe CCTV inspection operations. Schedule shall also include time for pre-cleaning operations, when necessary.

1.05 QUALITY ASSURANCE

A. New Mains: CCTV inspections shall be performed by the Contractor as follows:

1. CCTV inspection of steel water mains 900mm (36") and smaller shall be performed to document the physical condition and cleanliness of the pipe and to inspect mortared joints.

2. CCTV inspection of sewer mains 900mm (36") and smaller shall be performed to document the physical condition and cleanliness of the pipe and to detect reverse slope or low spots in pipe grades.

B. Existing Mains: CCTV inspections shall be performed on existing sewer mains to detect and locate defects and document the current condition of the sewer main, leading to evaluation and selection of repair methodology by the Agency.

PART 2 MATERIALS

2.01 CCTV EQUIPMENT

The Contractor shall furnish all equipment and materials required for inspection. Equipment shall be in accordance with SSPWC Section 500, SSPWC Regional Supplement Amendments Section 306 and as noted below:

A. The video equipment utilized shall be specifically designed and constructed to be operative in one hundred percent (100%) humidity conditions. Lighting for the camera shall minimize reflective glare. Lighting and camera quality shall be suitable to provide a clear, continuously in-focus picture of the entire inside periphery of the pipe for all conditions encountered during the inspection. A reflector in front of the camera may be required to enhance lighting in large diameter pipe.

B. Video equipment utilized for inspection of potable water mains shall be certified for potable water main inspection only, and shall also be certified to never have been utilized in non-potable systems.

C. CCTV inspections shall be recorded onto digital media.

2.02 TEMPORARY BYPASS PUMPING

If temporary bypass piping is required, the Contractor shall provide pumps, piping, hoses, and accessories suitable for continuous pumping of raw sewage. Backup equipment of equal size and power shall be provided to ensure continuous pumping in the event of equipment or power failure.

2.03 PRE-CLEANING

The Contractor shall coordinate with the District Engineer for determination of equipment required and its use. Equipment selection and method for cleaning may be based on the age, pipe material, and the probable condition of the sewer pipe.

PART 3 EXECUTION

3.01 TEMPORARY BYPASS PUMPING

If temporary bypass pumping is required during the duration of the CCTV inspection, the existing sewer main shall be plugged at the nearest manhole and sewage effluent shall be bypassed around the areas of inspection. Bypass piping shall be located out of the traveled way and shall be protected during use.

3.02 PRE-CLEANING

The Contractor shall coordinate closely with the District Engineer during the cleaning operations. Cleaning operations shall not damage the sewer or any manhole during cleaning. Cleaning operations shall remove dirt, sand, rocks, solids, debris, grease or grit from the entire circumference of the sewer between manholes or access points.

3.03 CCTV PROCEDURES

Procedures for CCTV inspections shall be in accordance with SSPWC Section 500, SSPWC Regional Supplement Amendments Section 306 and as noted below:

A. The camera operator shall slow or stop the camera at potential or actual imperfections in the new main to obtain a high-quality video image. Each location where a potential obstruction or structural deficiency exists shall be identified with accurate distance measurements above ground from the manhole or access hole.

B. For CCTV inspections on water mains the Contractor shall examine the main to insure the passage of the camera through all valves and fittings prior to any televising. Mains with fittings that would obstruct the camera, such as butterfly valves, shall be televised either prior to the installation of those fittings or from access holes immediately adjacent to the obstructing fitting, if available.

3.04 CCTV INSPECTION

Structural cracking, excessively deflected joints, protruding joint sealing material, corrosion, evidence of reverse slope by ponding of water or low spots in sewer pipe grades and any other defect revealed by the CCTV inspection shall be repaired to the satisfaction of the District Engineer at the Contractor's expense.

After defects in the pipe lining or joints are repaired, another video shall be taken of the repaired section and submitted for approval by the District Engineer.

3.05 DOCUMENTATION

Documentation of CCTV inspections shall be in accordance with SSPWC Section 500, except as otherwise modified herein.

A. If voice recording is used on the digital media, the recording shall have brief informative comments on unusual conditions, type and size of connections and fittings, collapsed sections, the presence of scale or corrosion, the location and description of each defect and any other unusual or significant conditions noted.

B. The Contractor shall prepare an inspection report which shall be a complete written log of pipe conditions, indexed to the footage counter. The Contractor shall provide a minimum of two (2) copies of the inspection report, together with digital media, to the District Engineer at the completion of the inspection.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15055 DUCTILE-IRON PIPE

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation procedures for ductile-iron pipe for potable and recycled water systems.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM C 150 - Standard Specification for Portland Cement
AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
AWWA C110 - Ductile-Iron and Gray-Iron Fittings
AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C150 - Thickness Design of Ductile-Iron Pipe
AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast
AWWA C153 - Ductile-Iron Compact Fittings
AWWA C207 - Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In. (100mm
Through 3,600 mm)
AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances
AWWA C606 - Grooved and Shouldered Joints

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 03000, 09910, 13110, 15000, 15041, 15044, 15056, 15057, 15061, 15064, 15108, 15112, and 15151.

1.04 SERVICE APPLICATION

Ductile-iron pipe shall be used to transport and distribute potable water or recycled water as indicated on the Approved Plans.

If ductile-iron pipe is to be used in the place of PVC pipe, a cathodic protection system may be required.

1.05 DESIGN REQUIREMENTS

A. General:

1. Ductile-iron pipe shall be manufactured per AWWA C111, C115, C150, and C151.

2. Ductile-iron pipe shall be provided in standard 5.49m (18') or 6.10m (20') lengths unless otherwise detailed or required on the Approved Plans. When deep trenches or shoring restrictions hinder the use of the standard length sections, shorter lengths shall be allowed with the concurrence of the District Engineer. Random lengths are not allowed.

3. The minimum length of ductile-iron pipe sections used for tie-ins and stub-outs shall be three (3) times the nominal pipe diameter or 1200mm (48"), whichever is longer, unless otherwise approved by the District Engineer.

4. Joints for ductile-iron pipe shall be mechanical, flanged, or push-on in accordance with AWWA C110, C111, and C153, unless otherwise indicated on the Approved Plans. Joints that are aboveground, within structures, or submerged shall be flanged unless otherwise shown on the Approved Plans.

5. Except as amended herein, or otherwise shown on the Approved Plans, joints for ductile-iron pipe shall have a pressure rating equal to or greater than the adjacent piping.

6. Horizontal Radius and Pipe Deflections: In locations where it is required to lay ductile-iron pipe along curves or install pipe deflections, ductile-iron pipe shall be deflected at joints in accordance with the requirements of AWWA C600. Pipe segments shall not be bent to form arcs.

B. Unless otherwise specified, ductile-iron pipe flanges shall be shop-threaded in accordance with AWWA C115, rated at a working pressure of 1,724 KPa (250 psi). Where required in order to connect to the flanges of 1,724 KPa (250 psi) butterfly valves, or as otherwise shown on the approved plans, ductile-iron flanges shall be compatible with AWWA C207, Class "F". Gray-iron, cast-iron, or hollow-back flanges are not permitted. Threading of flanges in the field is not permitted.

Pipe segments with threaded flanges shall be hydrostatically tested in the presence of the District Engineer prior to installation. The pipe section or spool piece shall be hydrostatically tested for 15 minutes at the pressure rating of the flanges. No leaks are permitted.

C. Plain ends of ductile-iron pipe shall conform to the requirements of AWWA C151 to accept mechanical or push-on joints, flanged coupling adaptors, flexible couplings, or grooved couplings.

D. All ductile-iron pipe shall be cement-mortar lined in accordance with AWWA C104. Cement-mortar shall be in accordance with ASTM C 150, Type II or Type V.

1.06 QUALITY ASSURANCE

A. The manufacturer of each shipment of pipe shall be required to supply a statement certifying that each lot or load of pipe has been subjected to and meets the tests specified for ductile-iron pipe required per AWWA C111, C115, C150, and C151, as applicable.

B. All ductile-iron pipe shall bear indelible identification markings as required by AWWA C151 and shall bear a “home” mark on the spigot end to indicate proper penetration when the joint is made.

1.07 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling of ductile-iron pipe shall follow the recommendations of AWWA C600 and as specified herein:

A. Handling of pipe shall be performed with lifts, cranes, or other suitable equipment and devices. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the pipe, linings, and coatings. Pipe shall not be dropped or dragged.

B. During transport, the pipe shall be supported and secured against movement using padded devices in such a manner to prevent damage.

C. Stored pipe shall be protected from damage and kept free from dirt and foreign materials by closing the ends of the pipe. Other pipeline materials shall be protected by appropriate packaging or wrapping. Gaskets shall be stored in a cool location out of direct sunlight. Bolts, nuts, and washers shall be handled and stored in a dry location.

D. Maintain plastic end caps on all pipe and fittings in good condition until the pipe is ready to be installed in the trench. Periodically open the plastic end caps and spray clean potable water inside the pipe for moisture control.

E. Under no circumstances shall ropes or other handling devices be attached through the interior of pipe or fittings.

1.08 SERVICE SADDLES FOR DUCTILE-IRON PIPE

Service saddles shall be used for the installation of pipe appurtenances 50mm (2”) and smaller in accordance with Section 15057.

1.09 FITTINGS

Ductile-iron fittings shall be used for the installation of pipe appurtenances 100mm (4”) and larger in accordance with Section 15056.

1.10 JOINT RESTRAINT

Joint restraint systems in accordance with Section 15000 shall be used where indicated on the Approved Plans or where concrete thrust blocks are not practical, with the prior approval of the District Engineer.

1.11 CATHODIC PROTECTION

Cathodic protection for ductile-iron pipe shall be installed as indicated on the Approved Plans.

1.12 POLYETHYLENE ENCASEMENT

All ductile-iron pipe shall be encased with polyethylene sleeves or polyethylene wrap in accordance with Section 15000.

1.13 TRACER WIRE

Tracer wire shall be installed for ductile-iron pipe in accordance with Section 15000.

1.14 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for ductile-iron pipe in accordance with Section 15000.

1.15 RECYCLED WATER IDENTIFICATION

Ductile-iron pipe for recycled water shall be identified with purple-colored coating, purple polyethylene sleeves, identification labels or signs in accordance with Section 15151.

PART 2 MATERIALS

2.01 DUCTILE-IRON PIPE

Ductile-iron pipe and appurtenant components and materials shall be selected from the Approved Materials List and in accordance with the Standard Drawings.

A. Minimum pressure class of ductile-iron pipe with push-on, mechanical joint or plain end connections shall be as shown in the following table unless otherwise shown on the Approved Plans:

Pipe Diameter	Pressure Class
Under 500mm (20”)	350
500mm to 600mm (20” to 24”)	300
750mm to 900mm (30” to 36”)	250
Over 900mm (36”)	200

B. Minimum thickness of ductile-iron pipe with threaded flanges or threaded shoulders shall be Special Thickness Class 53 unless otherwise shown on the Approved Plans.

C. Minimum thickness of ductile-iron pipe with grooved ends shall be as shown in the following table unless otherwise shown on the Approved Plans:

Pipe Diameter	Special Thickness Class
Under 500mm (20”)	53
500mm (20”)	54
Over 500mm (20”)	56

2.02 GASKETS

A. Mechanical joint rubber gasket configuration and materials shall comply with AWWA C111 and shall be in accordance with the applicable joint type and pressure rating of the piping system.

B. Flange gaskets shall be 3.2mm (1/8") thick aramid fibers bound with nitrile for all sizes of pipe. Gaskets shall be full-face type with pre-punched holes or ring-type extending to the inner edge of the bolt circumference of the flange. Ring-type gaskets may only be used as directed by the District Engineer.

C. Push-on joint rubber gaskets shall be per AWWA C111.

D. If soil contaminated with organic solvents or petroleum products is encountered during the course of the work, alternate gasket materials or joint treatment may be required by the District Engineer.

2.03 BOLTS AND NUTS FOR FLANGES

Bolts and nuts shall be in accordance with Section 15000 and shall be selected from the Approved Materials List.

2.04 JOINT BONDING AND CATHODIC PROTECTION

Joint bonding, flange insulation kits, internal epoxy linings, and cathodic protection materials shall be provided as indicated on the Approved Plans and in accordance with Section 13110.

2.05 PAINTING AND COATING

A. Buried ductile-iron pipe shall receive a shop-applied asphaltic coating in accordance with AWWA C151.

B. The District may require alternative coatings based on special conditions and the Corrosion Engineer’s recommendations. Additional coating requirements, if any, shall be shown on the drawings.

C. Materials for coating of pipe and fittings located above ground and in structures shall be in accordance with Section 09910.

D. Materials for coating buried mechanical joints and hardware shall be in accordance Section 15000.

2.06 IMPORTED GRANULAR MATERIAL FOR PIPE AND TRENCH ZONES

Imported granular material for use in pipe and trench zones shall be in accordance with Section 02223.

2.07 CONCRETE

Concrete for thrust, anchor, and support blocks shall be in accordance with Section 03000.

2.08 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.09 TRACER WIRE

Tracer wire materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.10 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

PART 3 EXECUTION

3.01 GENERAL

A. At all times when the work of installing pipe is not in progress, including worker break times, ends of the pipe shall be closed with tight-fitting, vermin-proof and child-proof caps or plugs. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The Contractor shall maintain the interior of the pipe in a sanitary condition free from foreign materials at all times.

B. Proper care shall be used to prevent damage in handling, moving and placing the pipe. All pipe, fittings, valves, and other pipeline materials shall be lowered into the trench in a manner that prevents damage. The pipe shall not be dropped, dragged or handled in a manner that will cause bruises, cracks, or other damage. Ductile-iron pipe that has been gouged, scratched, or otherwise damaged shall be subject to rejection at the discretion of the District Engineer.

C. Where pipe lengths less than the standard 5.49m (18') or 6.10m (20') are required, the pipe sections shall be installed in accordance with the manufacturer's installation guide and shall only be used as specified herein or with the approval of the District Engineer. The minimum pipe length permitted is 1.52m (5'), except at tie-ins or stub-outs, where the minimum pipe length permitted is three (3) times the pipe diameter or 1.22m (4'), whichever is longer, unless otherwise approved by the District Engineer.

3.02 TRENCHING, BACKFILLING AND COMPACTING

Trenching, backfilling and compacting shall be performed in accordance with Section 02223.

3.03 DEWATERING

Dewatering of trench excavations shall be performed in accordance with Section 02223. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipelines, appurtenances or trench materials shall be repaired or replaced as directed by the District Engineer.

3.04 PIPE INSTALLATION

When the work requires entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159 for confined space entry have been performed and the area is verified as safe to enter.

The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation. Install pipe in the trench as follows:

A. Lay pipe out for installation on earth berms or timber cradles adjacent to the trench in sequential order of installation.

B. Inspect each pipe segment and appurtenance before lowering the pipe segment or appurtenance into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material recommended by the protective coating manufacturer. Thoroughly clean the ends of the pipe. Remove foreign matter and dirt from inside of the pipe and keep pipe clean during and after installation.

C. Install pipe according to the manufacturer's approved order of installation. Install pipes uphill if the grade exceeds 10%. Lower the pipe onto the bedding at the proper lines and grades.

D. The manufacturer's printed installation guide outlining the radius of curvature that can be negotiated with pipe sections of various lengths shall be followed, except they shall not exceed the deflections allowed in AWWA C600 according to joint type. Combined deflections at rubber gasket or flexible coupling joints shall not exceed that recommended by the manufacturer.

E. The pipe shall have firm bearing along its full length, and bell holes shall be provided at each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.

F. Pipe Assembly:

1. Push-On Type: Assemble the pipe joint using a lubricant selected from the Approved Materials List. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive spigot ends of the pipe into bell ends in accordance with the manufacturer’s recommendations. Stabbing shall not be permitted.

2. Mechanical Joint Type: Assembly of mechanical joint fittings shall be in accordance with the manufacturer's recommendations regarding installation.

3.05 FLANGED PIPE AND FITTINGS

Flanged connections shall be installed where indicated on the Approved Drawings.

A. Bolt holes shall straddle the vertical centerline.

B. The bolts, nuts and flange faces shall be thoroughly cleaned by wire brush prior to assembly.

C. Bolts and nuts shall be lubricated with a District-approved anti-seize compound.

D. Nuts shall be tightened in an alternating "star" pattern to the manufacturer's recommended torque.

E. Coat the exterior of exposed flanges, bolts and nuts located aboveground or within vaults in accordance with Section 09910.

3.06 MECHANICAL JOINT CONNECTIONS

A. Install mechanical joint connections per AWWA C600 and the manufacturer's recommendations.

B. Prior to installation of the mechanical joint, clean the socket and plain end of the pipe. Lubricate both the gasket and plain end of the pipe with an approved lubricant per AWWA C111 immediately prior to slipping the gasket onto the plain end of the pipe.

C. Tighten the bolts to the normal range of bolt torque per the manufacturer's recommendations and AWWA C600, Table 3, as follows:

Pipe Diameter	Bolt Size	Range of Torque
75 mm (3")	16 mm (5/8")	61-81 N-M (45-60 ft.-lb.)
100-600 mm (4” - 24")	19 mm (3/4")	102-122 N-M (75-90 ft.-lb.)
750-900 mm (30” - 36")	25 mm (1")	136-163 N-M (100-120 ft.-lb.)

3.07 JOINT BONDING AND CATHODIC PROTECTION

Joint bonding to provide continuity, flange insulation kits, internal epoxy linings, and other cathodic protection items and materials shall be installed where shown on the Approved Plans in accordance with the Standard Drawings and Section 13110.

3.08 COUPLINGS FOR DUCTILE-IRON PIPE

A. Grooved-joint couplings shall be used within vaults, above ground, or where indicated on the Approved Plans and shall be installed in accordance with AWWA C606 and Section 15000.

B. Flanged coupling adapters shall be used where indicated on the Approved Plans and shall be installed per the manufacturer's recommendations.

C. Flexible couplings shall be used below ground or where indicated on the Approved Plans and shall be installed per Section 15000 and the manufacturer's recommendations.

3.09 CONCRETE

Concrete thrust and anchor blocks shall be installed in accordance with Section 03000 and the Standards Drawings. Prior to filling the pipeline with water, refer to Section 03000 for the minimum concrete curing time required.

3.10 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be used for the buried installation of ductile-iron pipe and shall be installed in accordance with Section 15000.

3.11 THRUST AND ANCHOR BLOCKS

Concrete thrust and anchor blocks shall be installed in accordance with Section 03000 and the Standard Drawings.

3.12 JOINT RESTRAINT SYSTEMS

Joint restraint systems shall be installed in accordance with Section 15000. Joint restraint lengths along new pipelines shall be as shown on the Approved Plans. If the installation of concrete thrust blocks is not practical and use of joint restraint systems are approved by the District Engineer, calculations indicating joint restraint lengths along new pipelines shall be submitted to the District Engineer for approval.

3.13 TRACER WIRE

Tracer Wire shall be installed in accordance with Section 15000 and the Standard Drawings.

3.14 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.15 DISINFECTION AND BACTERIOLOGICAL TESTING

Disinfection, bacteriological testing, and flushing shall be performed in accordance with Section 15041.

3.16 HYDROSTATIC TESTING

Field hydrostatic testing shall be performed in accordance with Section 15044.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15056 DUCTILE-IRON FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation procedures for ductile-iron fittings for potable and recycled water systems.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM C 150	-	Standard Specification for Portland Cement
AWWA C104	-	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
AWWA C110	-	Ductile-Iron and Gray-Iron Fittings
AWWA C111	-	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	-	Ductile-Iron Pipe, Centrifugally Cast
AWWA C153	-	Ductile-Iron Compact Fittings
AWWA C600	-	Installation of Ductile-Iron Mains and Their Appurtenances

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 03000, 09910, 13110, 15000, 15041, 15044, 15055, 15061, 15064, 15108, 15112, and 15151.

1.04 SERVICE APPLICATION

Ductile-iron fittings shall be used as needed in conjunction with the installation of PVC pipe and ductile-iron pipe in locations shown on the Approved Plans.

1.05 DESIGN REQUIREMENTS

A. General:

1. Ductile-iron fittings shall be manufactured per AWWA C110 and C153. Gray-iron or cast-iron fittings shall not be used. Gray iron or cast-iron flanges shall not be used.

2. Ductile-iron fittings shall be mechanical, flanged, or push-on joints in accordance with AWWA C110, and C153.

3. Except as amended herein, or otherwise shown on the Approved Plans, joints for ductile-iron fittings shall have a pressure rating equal to or greater than the adjacent piping.

B. Unless otherwise specified, ductile-iron flanged fittings shall be integrally cast in accordance with AWWA C110, rated at a working pressure of 1,724 KPa (250 psi). Gray-iron or cast-iron flanged fittings are not permitted.

C. The exterior surfaces of all ductile-iron fittings shall be factory-coated with a minimum one (1) mil thick petroleum asphaltic material per AWWA C110 and C153.

D. All ductile-iron fittings shall be cement-mortar lined and seal-coated in accordance with AWWA C104. Cement-mortar shall be in accordance with ASTM C 150, Type II or Type V.

1.06 QUALITY ASSURANCE

The manufacturer of each shipment of ductile-iron fittings shall be required to supply a statement certifying that each lot or load of fittings has been subjected to and met the tests specified for ductile-iron fittings per AWWA C110 and C153, as applicable.

1.07 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling of ductile-iron fittings shall follow the recommendations of AWWA C600 and shall also be as specified herein:

A. Handling of fittings shall be performed with lifts, cranes, or other suitable equipment and devices. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the fittings, linings, and coatings. The fittings shall not be dropped or dragged.

B. During transport, fittings shall be supported and secured against movement using padded devices in such a manner to prevent damage.

C. Stored fittings shall be protected from damage and kept free from dirt and foreign materials by closing the ends of the pipe. Other pipeline materials shall be protected by appropriate packaging or wrapping. Gaskets shall be stored in a cool location out of direct sunlight. Bolts, nuts, and washers shall be handled and stored in a dry location.

D. Maintain plastic end caps on all fittings in good condition until the pipe is ready to be installed in the trench. Periodically open the plastic end caps and spray clean potable water inside fittings for moisture control.

E. Under no circumstances shall ropes or other handling devices be attached through the interior of fittings.

1.08 POLYETHYLENE WRAP

Polyethylene wrap shall be installed for buried ductile-iron fittings in accordance with Section 15000.

1.09 TRACER WIRE

Tracer wire shall be installed for ductile-iron fittings in accordance with Section 15000.

1.10 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for ductile-iron fittings in accordance with Section 15000.

1.11 RECYCLED WATER IDENTIFICATION

Ductile-iron fittings for recycled water shall be identified with purple-colored coating, purple polyethylene sleeves, identification labels or signs in accordance with Section 15151.

PART 2 MATERIALS

2.01 DUCTILE-IRON FITTINGS

Ductile-iron fittings and appurtenant components and materials shall be selected from the Approved Materials List and in accordance with the Standard Drawings.

2.02 GASKETS

A. Mechanical-joint rubber gasket configuration and materials shall comply with AWWA C111 and shall be in accordance with the applicable joint type and pressure rating of the piping system.

B. Flange gaskets shall be 3.2mm (1/8") thick aramid fiber bound with nitrile for all sizes of pipe. Gaskets shall be full-face type with pre-punched holes or ring-type extending to the inner edge of the bolt circumference of the flange. Ring-type gaskets may only be used as directed by the District Engineer.

C. Push-on joint rubber gaskets shall be per AWWA C111.

D. If soil contaminated with organic solvents or petroleum products are encountered during the course of the work, alternate gasket materials or joint treatment may be required by the District Engineer.

2.03 BOLTS AND NUTS FOR FLANGES

Bolts and nuts shall be in accordance with Section 15000 and shall be selected from the Approved Materials List.

2.04 PAINTING AND COATING

A. Buried ductile-iron fittings shall receive a shop-applied asphaltic coating in accordance with AWWA C151.

B. The District may require alternative coatings based on special conditions and the Corrosion Engineer's recommendations. Additional coating requirements shall be shown on the drawings.

C. Materials for coating of ductile-iron fittings located above ground and in structures shall be in accordance with Section 09910.

D. Materials for coating buried mechanical joints and hardware shall be in accordance Section 15000.

2.05 IMPORTED GRANULAR MATERIAL FOR PIPE AND TRENCH ZONES

Imported granular material for use in pipe and trench zones shall be in accordance with Section 02223.

2.06 CONCRETE

Concrete for thrust, anchor, and support blocks shall be in accordance with Section 03000.

2.07 POLYETHYLENE WRAP

Polyethylene wrap shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.08 TRACER WIRE

Tracer wire materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.09 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

PART 3 EXECUTION

3.01 GENERAL

Ductile-iron fittings shall be installed in accordance with Section 01500 and the manufacturer's recommendations.

3.02 TRENCHING, BACKFILLING AND COMPACTING

Trenching, backfilling and compacting shall be performed in accordance with Section 02223.

3.03 POLYETHYLENE WRAP

Polyethylene wrap shall be used for the buried installation of ductile iron fittings and shall be installed in accordance with Section 15000.

3.04 FLANGED FITTINGS

Flanged fittings shall be installed where indicated on the Approved Drawings.

A. Bolt holes shall straddle the vertical centerline.

B. The bolts, nuts and flange faces shall be thoroughly cleaned by wire brush prior to assembly.

C. Bolts and nuts shall be lubricated with a District-approved anti-seize compound.

D. Nuts shall be tightened in an alternating "star" pattern to the manufacturer's recommended torque.

E. Coat the exterior of exposed flanges, bolts and nuts located aboveground or within vaults in accordance with Section 09910.

3.05 FLANGED CROSSES AND TEES

A. Flanged ductile-iron crosses shall be installed with flanged ductile-iron pipe spools between the crosses and adjacent gate valves or butterfly valves.

B. Flanged tees shall be installed with flanged ductile-iron pipe spools between the tees and adjacent butterfly valves.

C. Spools are required to position valves a sufficient distance from crosses and tees to allow for the installation of thrust blocks without conflicting with valve actuators. Spools shall be 450mm (18”) long for pipe sizes 200mm (8”) through 300mm (12”), and 600mm (24”) long for pipe sizes 350mm (14”) and larger.

D. The pressure class of the spools shall be equal to or greater than that of adjacent piping.

3.06 MECHANICAL-JOINT FITTINGS

A. Install mechanical-joint fittings per AWWA C600 and the manufacturer's recommendations.

B. Prior to installation of the mechanical joint, clean the socket and plain end of the pipe. Lubricate both the gasket and plain end of the pipe with an approved lubricant per AWWA C111 immediately prior to slipping the gasket onto the plain end of the pipe.

C. Tighten the bolts to the normal range of bolt torque per the manufacturer's recommendations and AWWA C600, Table 3, as follows:

Pipe Diameter	Bolt Size	Range of Torque
75 mm (3")	16 mm (5/8")	61-81 N-M (45-60 ft.-lb.)
100-600 mm (4-24")	19 mm (3/4")	102-122 N-M (75-90 ft.-lb.)
750-900 mm (30-36")	25 mm (1")	136-163 N-M (100-120 ft.-lb.)

3.07 SUPPORT FOR DUCTIRE–IRON FITTINGS

All ductile-iron fittings require concrete support blocks in accordance with Section 15000 to prevent the fitting's weight from being carried by the adjacent pipe.

3.08 THRUST AND ANCHOR BLOCKS

Concrete thrust and anchor blocks shall be installed in accordance with the Approved Plans, Section 03000 and the Standard Drawings.

3.09 JOINT RESTRAINT SYSTEMS

Joint restraint systems shall be installed on ductile-iron fittings in accordance with Section 15000. Joint restraint lengths along new pipelines shall be as shown on the Approved Plans. If the installation of concrete thrust blocks is not practical and the use of joint restraint systems are approved by the District Engineer, calculations indicating joint restraint lengths along new pipelines shall be submitted to the District Engineer for approval.

3.10 TRACER WIRE

Tracer Wire shall be installed in accordance with Section 15000 and the Standard Drawings.

3.11 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.12 DISINFECTION AND BACTERIOLOGICAL TESTING

Disinfection, bacteriological testing, and flushing shall be performed in accordance with Section 15041.

3.13 HYDROSTATIC TESTING

Field hydrostatic testing shall be performed in accordance with Section 15044.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15057 COPPER TUBING, BRASS AND BRONZE PIPE FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

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

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ANSI B1.1	-	Unified Inch Screw Threads
ANSI B1.2	-	Gages and Gaging for Unified Inch Screw Threads
ANSI B1.20.1	-	Pipe Threads, General Purpose (Inch)
ASTM B 43	-	Seamless Red Brass Pipe, Standard Sizes
ASTM B 62	-	Composition Bronze or Ounce Metal Castings
ASTM B 88	-	Seamless Copper Water Tube
ASTM B 88M	-	Seamless Copper Water Tube [Metric]

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02222, 02223, 09910, 13110, 15000, 15041, 15044, 15056, 15061, 15064, and 15151.

1.04 SERVICE SADDLES

All connections to new PVC and ductile-iron pipelines for services and other appurtenances sized 50mm (2") or smaller require the installation of service saddles.

1.05 RECYCLED WATER IDENTIFICATION

Copper Tubing, Brass, and Bronze Pipe Fittings for recycled water shall be identified with purple color coating, purple polyethylene sleeves, identification labels and/or signs in accordance with Section 15151.

1.06 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape in accordance with Section 15000 shall be used for all copper tubing,

except that which is bored or jacked.

1.07 SACRIFICIAL ANODES FOR COPPER TUBING

Sacrificial anodes shall be connected to copper tubing where indicated on the Approved Plans in accordance with Section 13110.

PART 2 MATERIALS

2.01 COPPER TUBING

Copper tubing shall conform to the requirements of ASTM B88 Type K or ASTM B88 M (Metric) Type A seamless copper water tube. Copper tubing shall be soft and shall be selected from the Approved Materials List.

2.02 BRASS PIPE, NIPPLES, AND FITTINGS

Brass pipe, nipples, and fittings shall conform to ASTM B 43, regular wall thickness. Threads shall conform to ANSI B1.20.1.

2.03 BRONZE APPURTENANCES

A. All bronze appurtenances specified herein shall conform to ASTM B 62.

B. Corporation stops, curb stops, meter and angle meter stops, and meter flange adapters shall be selected from the Approved Materials List.

C. Bronze appurtenances shall be threaded or compression-type in accordance with the Standard Drawings.

2.04 SERVICE SADDLES

Service saddles shall be compatible with the size and type of pipe receiving the saddle in accordance with the manufacturer's recommendations and shall be selected from the Approved Materials List.

2.05 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape materials shall be in accordance with Section 15000 and shall be selected from the Approved Materials List.

2.06 SACRIFICIAL ANODES FOR COPPER TUBING

Sacrificial anodes shall be in accordance with Section 13110 and shall be selected from the Approved Materials List.

PART 3 EXECUTION

3.01 COPPER TUBING AND FITTINGS

A. Trenching, bedding, backfilling and compacting shall be performed in accordance with Section 02223 and the Standard Drawings. Provide a minimum cover of 750mm (30") below finished street grade.

B. Cut tubing true and square and remove burrs.

C. Copper tubing shall be installed perpendicular to water mains. Horizontal bends or curves in copper tubing are not allowed. Vertical bends shall be in accordance with the Standard Drawings. Shape vertical bends with shaping tools and form bends without flattening, buckling, or thinning the tubing wall at any point.

D. Assemble copper tubing and fittings per the manufacturer's recommendations.

3.02 SERVICE SADDLES

A. Service saddles shall be located a minimum of 600mm (24”) from any pipe joint, fitting, or other service saddle(s).

B. Multiple service saddles installed on the same side of a single pipe spool shall be alternated at 10° and 30° above horizontal to prevent a weak plane in the pipe.

C. Prior to installation of service saddles, the surface of the pipe shall be cleaned to remove all dirt and debris.

D. Service saddles shall be tightened in accordance with the manufacturer's recommendations to ensure a tight seal, using care to prevent damage or distortion of the service saddle or corporation stop due to over-tightening.

E. Pipe taps shall be made in accordance with the pipe manufacturer's recommendations. Tapping tools and shell cutters with internal teeth or double slots that will retain the coupon shall be used.

3.03 WARNING/IDENTIFICATION TAPE

Install warning/identification tape in accordance with Section 15000 and the Standard Drawings.

3.04 SACRIFICIAL ANODES FOR COPPER TUBING

Install sacrificial anodes where indicated on the Approved Plans in accordance with Section 13110.

3.05 DISINFECTION AND BACTERIOLOGICAL TESTING

Disinfection, bacteriological testing, and flushing shall be performed in accordance with Section 15041.

3.06 HYDROSTATIC TESTING

Field hydrostatic testing shall be performed in accordance with Section 15044.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15061 CEMENT-MORTAR LINED AND COATED STEEL PIPE AND SPECIALS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, design, fabrication, and installation of cement-mortar lined and coated steel pipe and specials.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA C200	-	Steel Water Pipe – 6 In. (150mm) and Larger
AWWA C205	-	Cement-Mortar Protective Lining and Coating for Steel Water Pipe 4 In. (100mm) and Larger - Shop Applied
AWWA C206	-	Field Welding of Steel Water Pipe
AWWA C207	-	Steel Pipe Flanges For Waterworks Service – Sizes 4 In. Through 144 In. (100mm Through 3,600mm)
AWWA C208	-	Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C217	-	Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
AWWA C606	-	Grooved and Shouldered Joints
AWWA M11	-	Steel Pipe - A Guide for Design and Installation
ASTM A 47/A 47M	-	Standard Specification for Ferric Malleable Iron Castings
ASTM A 36/A 36M	-	Standard Specification for Carbon Structural Steel
ASTM A 53	-	Standard Specification for Pipe, Steel, Black & Hot Dipped, Zinc-Coated, Welded, and Seamless
ASTM A 105	-	Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A 183	-	Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A 216	-	Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding for High Temperature Service
ASTM A 307	-	Standard Specification for Carbon Steel Bolts and Studs
ASTM A 536	-	Standard Specification for Ductile Iron Castings
ASTM A 568/A 568M	-	Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality and Cold Rolled
ASTM A 1011/A 1011M	-	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM A 1018/A 1018M	-	Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM D 2000	-	Standard Classification System for Rubber Products

ANSI B1.1	-	Unified Inch Screw Threads
ANSI B1.2	-	Gages and Gaging for Unified Inch Screw Threads
ANSI B1.20.1	-	Pipe Threads, General Purpose (Inch)

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 03000, 09910, 13110, 15000, 15041, 15044, 15045, 15074, 15100, 15102, 15108, 15112, and 15300.

1.04 SERVICE APPLICATION

Cement-mortar lined and coated steel pipe and specials shall be used only for specific purposes as shown on the Approved Plans. Generally, cement-mortar lined and coated steel pipe shall be used for transmission mains of 16” or larger.

1.05 SPECIALS

A special is defined as any piece of pipe other than a normal full length of straight pipe. This includes, but is not limited to, elbows, short pieces, reducers, tees, crosses, spools, sections with outlets, beveled sections and manholes.

1.06 DESIGN REQUIREMENTS

A. All steel used for pipe or specials shall have a 248 MPa (36,000psi) minimum yield point unless otherwise directed by the District Engineer. See material information concerning steel designation below.

B. Design stress in steel cylinders shall not exceed 50% of the specified minimum yield strength of the steel used. The internal operating pressure used for design shall be a minimum of 1.03 Pa (150psi) or as called for on the Approved Plans, whichever is greater. If no specific surge analysis has been performed, the internal operating pressure used in circumferential stress calculations shall include at least a 10% increase for surge conditions. No allowance shall be made for the tensile strength of the cement mortar lining and coating.

C. Specials shall be designed per AWWA M11 and as a minimum shall conform to the pressure rating, grade of steel and cylinder thickness of the adjoining standard pipe sections. Fitting dimensions shall conform to AWWA C208. Reinforcing collars, wrappers, crotch plates, and anchor rings shall be designed and fabricated per AWWA M11.

1. Outlets may be built into the wall of the pipe or may be fabricated as steel plate specials. Outlets of size 50mm (2") and smaller in piping 100mm (4") and larger shall be of the threadolet type or shall be extra-heavy half couplings to fit the pipe in accordance with AWWA M11. Outlets shall be 1360kg (3,000 lb.) WOG forged steel per ASTM A105. Threads shall comply with ANSI B1.20.1. Outlets larger than 50mm (2") shall use a tee or nozzle with a flanged outlet. All outlets larger than 50mm (2") in diameter shall be provided with steel reinforcing collars, wrapper plates, or crotch plates per AWWA M11. At the option of the manufacturer, wrappers may be used in place of collars, and crotch plates may be used in place of collars or wrappers.

2. On 50mm (2") and smaller outlets where nylon insulation bushings are to be used, the outlet shall be increased in size to accept the bushing.

3. Tees, wyes, and crosses shall be dimensioned in accordance with AWWA C208, Table 1, or as modified on the Approved Plans.

4. Bends shall have a minimum radius of not less than 2½ times the pipe diameter unless otherwise approved by the District Engineer. The maximum deflection at mitered girth seams shall be 22½E. At the option of the Contractor, a bend may be welded to the adjacent pipe section.

5. All specials shall be marked at both ends of the fitting with “Field Top” indicators.

D. Minimum cylinder thickness for pipe and specials shall be 6.35mm (0.250" or ¼”) or as directed by the District Engineer.

The wall thickness tolerances for steel pipe 300mm (12”) diameter and larger shall be governed by the requirements of the ASTM specifications to which the plates or sheets are ordered, but in no case shall the thickness be less than 6.35mm (0.250" or ¼”) or as directed by the District Engineer.

E. Standard pipe sections shall not be less than 6m (20') nor more than 12m (40') in length, except where shorter lengths are required to fit horizontal and vertical alignment or are otherwise shown on the Approved Plans.

F. Pipe ends shall be as follows:

1. Bell and Spigot with Rubber Gasket: In accordance with AWWA C200 and AWWA M11. Bell ends that are pressed or rolled shall be limited to maximum pipe diameter of 525mm (21") nominal.

2. Lap Welded Joints: Use expanded bell with matching spigot end.

3. Flanges: Flanges for use in construction of Steel Pipe shall be as described below.

a. AWWA C207, Class D flanges (matching ANSI/ASME B16.1, Class 125 flanges for bolt hole size and drilling) shall be used for pressures up to 1.03 Pa (150 psi).

b. AWWA C207, Class E flanges (matching ANSI/ASME B16.1, Class 125 flanges for bolt hole size and drilling) shall be used for pressures between 1.03 MPa and 1.72 MPa (150 psi and 250 psi).

c. AWWA C207, Class F flanges (matching ANSI/ASME B16.1, Class 250 flanges for bolt hole size and drilling) shall be used for pressures between 1.72 MPa and 2.07 MPa (250 psi and 300 psi) or when Class 250 butterfly valves or other appurtenances using flanges corresponding to AWWA C207 Class F are required.

d. Flanges shall be flat-faced type only. Segmented flanges shall not be used.

4. Butt Straps: Use two-piece rolled steel straps with a minimum thickness of 6.35mm (¼"), and a minimum width of 250mm (10"). Straps shall be fabricated to snugly fit over the plain pipe ends, and shall be centered over the ends of the pipe sections to be joined. Weld one standard 125mm (5”), 1361kg (3000 lb.) threaded half-coupling to the butt strap section for butt straps up to and including 500mm (20”) in nominal diameter. Weld two standard 125mm (5”), 1361 kg (3000 lb.) threaded half-couplings to the butt strap section for butt straps greater than 500mm (20”) in nominal diameter. Provide a threaded steel plug for each half-coupling.

5. Grooved-End or Shouldered Couplings: Use square-cut shouldered or grooved ends per AWWA C606. Grooved-end couplings shall be malleable iron per ASTM A 47, or ductile-iron per ASTM A 536. Gaskets shall be per ASTM D 2000. Nuts and bolts in exposed service shall conform to ASTM A 183, 758.43 MPa (110,000 psi) tensile strength.

6. Flexible Pipe Couplings: Use plain-end pipe with flexible pipe couplings per AWWA C200. Provide joint harnesses per AWWA M11 where indicated on the Approved Plans.

G. Angles or Curves in Alignment:

Minor changes of direction in the grade or alignment may be made by a deflection in the joint up to a maximum of 19mm (¾“) on one side of the joint. For greater angular deflections, pipe with ends beveled up to a maximum of 5 degrees measured from a plane perpendicular to the pipe’s axis may be used. The short point on the bevel shall be so marked on the pipe. Pipe length shorter than 6m (20’) may be used on curves. Where curves that have a shorter radius than can be accommodated by beveled pipe are required, or where indicated on the Approved Plans, special short-radius bends shall be provided.

H. Mortar Coating and Lining:

Use coatings and linings conforming to AWWA C205, except as noted below. All exterior metal surfaces intended for direct buried service shall be coated.

1. Mortar coating thickness shall be 31.8mm (1¼").

2. Mortar lining thickness shall be as follows:

a. Pipelines 400mm (16”) and smaller:

Lining Thickness	Tolerance
7.94mm (5/16”)	-1.59mm, +3.18mm (-1/16”, +1/8”)

b. Pipelines 450mm (18”) through 900mm (36”):

Lining Thickness	Tolerance
19.05mm (3/4”)	-1.59mm, + 3.18mm (-1/16”, +1/8”)

c. Pipelines larger than 900mm (36”):

Lining Thickness	Tolerance
19.05mm (3/4”)	-1.59mm, + 4.77mm (-1/16”, +3/16”)

I. The exterior surfaces of areas of pipes and fittings that are not mortar coated, such as flanges, grooved ends, or plain ends for butt-straps or flexible couplings, shall be sandblasted in accordance with SSPC-SP10 - Near White Blast Cleaning, and coated in accordance with Section 15000.

J. The term "diameter of pipe" as used in these specifications or as shown on the Approved Plans shall mean the net inside diameter of the mortar lining.

K. Where indicated on the approved plans polyethylene tape wrap pipe coating shall be applied per the District's supplemental specifications, AWWA C-209, and AWWA C-214 with a ¾" thick reinforced cement-mortar overcoat (rockshield) in accordance with AWWA C205 for steel pipe sizes 4" and larger.

1.07 QUALITY ASSURANCE

A. Cement-mortar lined and coated steel pipe shall be inspected at the supplier's manufacturing plant by the District Engineer. Contractor shall be responsible for District Engineer's expenses, including travel, time, meals and overnight accommodations. Overnight accommodations and air travel may be required if the manufacturing plant is more than 200 miles from the District Engineer's office.

B. In addition to the shop hydrostatic testing performed on pipe cylinders required per AWWA C200, all welds of specials and attachments (i.e. joint rings and nozzles) shall be tested by a dye penetrant process. Certification of such testing shall be submitted to the District.

C. Field welders shall be certified under Section IX, Part A of the ASME Boiler and Pressure Vessel Code or in accordance with AWWA C206, Section 4.4. Welders shall present a copy of their certification to the District prior to performing any field welding. Certifications shall be dated within three (3) years of the job to be performed.

D. Plainly mark each length of straight pipe and each special at the bell end to identify the proper location of the pipe item by reference to the layout schedule.

E. The top of all pipe and specials shall be clearly identified by marking the top with "T.O.P." for easy identification in the field.

F. Closed-Circuit Television Inspection: A closed-circuit television (CCTV) inspection shall be performed by Contractor on all steel pipe 36" and smaller in accordance with Section 15045.

1.08 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling of the pipe and specials shall be as follows:

A. Pipe and fittings shall be carefully handled and shall be protected against damage to linings and coatings due to impact shocks Pipe shall not be placed directly on rough ground but shall be supported in a manner which will protect the pipe against injury whenever stored at the site or elsewhere. Pipe shall be handled and stored per these requirements and in accordance with the Manufacturer's recommendations.

B. Temporary internal bracing shall be installed in all pipe 400mm (16") and larger prior to shipment to the job site. Temporary internal bracing shall be 100mm x 100mm (4" x 4") wooden struts installed in both the horizontal and vertical directions. Each set of struts shall be nailed together as a unit. Wooden wedges may be used to maintain the proper tight fit of the internal bracing. The bracing shall be located 300mm (12") in from each end of the pipe section for all pipe, and additionally at the mid-point for piping600mm (24") and larger. Maintain internal bracing as specified under Pipe Installation.

C. Transport pipe to the job site on padded bunks with nylon tie-down straps or padded bonding to protect the pipe.

D. Pipes and specials shall only be handled with appropriate spreader bars and wide nylon slings. Chains or wire rope slings shall not be used. Under no circumstances shall pipe or specials be pushed or dragged along the ground. All pipe sections over 6m (20') in length shall be lifted at the quarter points from each end.

E. Store pipe on earth berms or padded timber cradles adjacent to the trench in the numerical order of installation. Place the supports at about the one-quarter point from the pipe ends.

F. Maintain plastic end caps on all pipe and specials in good condition until the pipe is ready to be installed in the trench. Periodically open the plastic end caps and spray potable water inside the pipe to moisten the mortar lining as directed by the District Engineer.

1.09 SUBMITTALS

The following items shall be submitted to the District for review and approval prior to fabrication of steel pipe and specials:

A. An affidavit of compliance with AWWA C200 and C205.

B. Tabulated layout schedule including:

1. Order of installation and closures.

2. Pipe station and bottom of pipe (BOP) elevation at each change of grade and alignment.

3. Elements of curves and bends, both in horizontal and vertical alignment.

4. Pipe internal diameter, wall thickness, and internal design pressure.

5. Locations of bulkheads for field hydrostatic testing. (Testing against valves shall not be permitted).

6. Locations of closures, including cut-to-fit allowances, for length adjustment and for construction convenience.

7. Locations of valves, flanges, appurtenances and other mechanical equipment.

C. Details of all specials, and of the lining and coating.

D. Calculations supporting the sizing of reinforcing collar plates, wrapper plates or crotch plates.

E. Calculations supporting selected wall thickness of pipe and specials.

F. Calculations supporting welded joint design and joint welding details.

G. Current shop welder and field welder certifications.

H. Mill test reports on each heat from which steel is rolled, at the discretion of the District Engineer.

I. Certification of dye penetrant shop-weld testing.

J. Cathodic Protection design and installation details.

1.10 RECYCLED WATER IDENTIFICATION

Cement-mortar lined and coated steel pipe and specials for recycled water shall be identified with purple colored coating, purple polyethylene sleeves, identification labels, or signs in accordance with Section 15151.

1.11 WAX TAPE

Wax tape shall be installed in accordance with Section 13100 as shown on the Approved Plans or as directed by the District Engineer.

1.12 TRACER WIRE

Tracer wire shall be installed on all cement-mortar lined and coated steel potable and recycled water mains in accordance with Section 15000.

1.13 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be installed on all cement-mortar lined and coated steel potable and recycled water mains in accordance with Section 15000.

PART 2 MATERIALS

2.01 STEEL PIPE AND SPECIALS

Steel pipe and specials shall conform to the requirements of the AWWA C200 and C205, and AWWA M11, except as modified herein.

Steel for fabricated cylinders shall conform to ASTM A 36/A 36M, ASTM A 1011/A 1011M, Grade 36, or ASTM A1018/A 1018M, Grade 36. Other steel grades may be used only upon approval of the District Engineer.

2.02 MORTAR LINING AND COATING

A. Cement used in mortar lining and coating shall be Portland Cement per ASTM C 150, Type V for coating and Type II or Type V for lining.

B. Cement-mortar coating shall be reinforced in accordance with AWWA C205.

C. Cement mortar grout for field joints shall consist of a mixture of 1½ to 2 parts sand to 1 part Type II or Type V Portland Cement with enough clean, potable water to permit packing and troweling without crumbling. The sand shall be washed, well-graded sand such that all will pass a No. 8 sieve. The quantity of water to be used in the preparation of grout shall be the minimum required to produce a mixture sufficiently workable for the purpose intended. Grout shall attain a minimum compressive strength of 12.4 MPa (1,800 psi) in 28 days.

D. In certain circumstances, rapid-setting mortar may be required. Acceleration admixtures may be used in the mix as permitted by the District Engineer. Calcium chloride shall not be used in the mix.

2.03 PAINTING AND COATING

A. Paint and coating products for exterior surfaces of all pipe and appurtenances not otherwise mortar-coated shall be in accordance with Section 09910 and the Approved Materials List.

B. Paint and coating products for areas in contact with potable water such plain ends of pipe, grooved and shouldered ends of pipe and exposed inside surfaces of threaded outlets and blind flanges shall be in accordance with Section 09910 and selected from the Approved Materials List.

2.04 BOLTS AND NUTS FOR FLANGES

Bolts and nuts shall be in accordance with Section 15000 and the Approved Materials List.

2.05 GASKETS

A. Rubber-ring gaskets shall comply with AWWA C200 according to the applicable joint type and pressure rating of the piping system.

B. Flange gaskets shall comply with AWWA C207. Flange gaskets shall be 3.18mm (⅛") thick aramid fibers bound with nitrile for all sizes of pipe. Gaskets shall be full-face type with pre-punched holes or ring-type extending to the inner edge of the bolt circumference of the flange. Ring-type gaskets may only be used as directed by the District Engineer.

C. In the event of encountering organic solvents or petroleum products during the course of the work, alternate gasket materials or joint treatment will be required as directed by the District Engineer.

2.06 JOINT BONDING AND CATHODIC PROTECTION

Joint bonding, flange insulation kits, internal epoxy linings, and cathodic protection materials shall be provided as indicated on the Approved Plans and in accordance with Section 13110 and the Approved Materials List.

2.07 IMPORTED GRANULAR MATERIAL FOR PIPE AND TRENCH ZONES

The imported granular material for use in pipe and trench zones shall be in accordance with Section 02223.

2.08 CONCRETE

Concrete used for thrust and anchor blocks shall be in accordance with Section 03000.

2.09 WAX TAPE

Wax tape materials shall be in accordance with Section 13110 and the Approved Materials List.

2.10 CLOSED-CIRCUIT TELEVISION INSPECTIONS

The Contractor shall furnish all equipment and materials required for CCTV inspections in accordance with Section 15045.

2.11 TRACER WIRE

Tracer wire materials shall be in accordance with Section 15000 and the Approved Materials List.

2.12 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape materials shall be in accordance with Section 15000 and the Approved Materials List.

PART 3 EXECUTION

3.01 GENERAL

At all times when the work of installing pipe is not in progress, including worker break times, the ends of the pipe shall be closed with tight-fitting, vermin-proof and child-proof caps or plugs. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The Contractor shall maintain the interior of the pipe in a sanitary condition free from foreign materials at all times.

3.02 TRENCH EXCAVATION, BACKFILL AND COMPACTION

Trenching, backfilling and compaction shall be performed in accordance with Section 02223.

3.03 DEWATERING

Dewatering of trench excavations shall be performed in accordance with Section 02223. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipelines, appurtenances, or trench materials shall be repaired or replaced as directed by the District Engineer.

3.04 PIPE INSTALLATION

When the work requires and the size of the pipe allows entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159 for confined space entry have been performed and the area is verified as safe to enter. Generally, the aforementioned safety provisions apply to pipe 600mm (24") and larger. Note that for pipe less than 600mm (24") diameter, more stringent safety procedures apply.

The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation.

Pipe installation shall be as shown on the Approved Plans and Shop Drawings in accordance with the following:

A. No pipe shall be installed where the linings or coatings show cracks that may be harmful as determined by the District Engineer. Such damaged linings and coatings shall be repaired or new, undamaged pipe sections shall be provided.

B. Pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.

C. The Contractor shall inspect each pipe and fitting to insure that there are no damaged portions of the pipe. The Contractor shall remove or smooth out any burrs, gouges, weld splatter, or other small defects prior to laying the pipe.

D. Before placement of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the work as noted above.

E. Pipe shall be laid directly on the bedding material. No blocking will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Excavations shall be made as needed to facilitate removal of handling devices after the pipe is laid. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings and to permit visual inspection of the joint. Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations and for application of coatings on field joints.

F. Installation Tolerances: Each section of pipe shall be laid in the order and position shown on the approved layout schedule to the proper lines and grades in accordance with the following:

1. Each section of pipe having a nominal diameter less than 1200mm (48”) shall be

laid not to vary more than 50mm (2”) horizontally or 25mm (1”) vertically from the alignment and elevations shown on the Approved Plans.

2. Each section of pipe having nominal diameter 1200mm (48”) and larger shall be laid not to vary more than five percent (5%) of the pipe diameter horizontally or two and one half percent (2.5%) of the pipe diameter vertically.

3. In addition to the horizontal and vertical tolerances above, lay the pipe so that no high or low points occur along the pipeline other than those shown on the approved layout schedule.

G. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the District Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed seventy five percent (75%) of the maximum deflection recommended by the pipe manufacturer. No joint shall be deflected any amount that will be detrimental to the strength and water tightness of the finished joint. In all cases the joint opening, before finishing with the protective mortar inside the pipe, shall be the controlling factor.

H. Pipes shall be laid uphill on grades exceeding 10 percent. Pipe that is laid on a downhill grade shall be blocked and held in place until the following pipe section has been installed to provide sufficient support to prevent movement.

I. Temporary internal pipe bracing shall be left in place in pipe sizes larger than 600mm (24”) until pipe zone compaction has have been completed. Bracing in pipe smaller than 600mm (24”) may be removed immediately after the pipe has been laid into the trench. The Contractor shall employ a laboratory to monitor pipe deflection by measuring pipe inside diameter before bracing is removed and 24 hours after struts are removed. Pipe deflection shall not exceed 2 percent in 24 hours after the bracing has been removed. After the backfill has been placed, the struts shall be removed.

J. Cold Weather Protection: No pipe shall be installed upon a foundation onto which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be laid unless it can be established that the trench will be backfilled prior to formation of ice and frost.

K. Pipe and Specials Protection: The openings of all pipe and specials where the pipe and specials have been 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 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.

3.05 FIELD WELDED JOINTS

A. Welded joints shall be completed in the trench per AWWA C206.

B. Both the bell and spigot ends shall be cleaned of foreign matter prior to welding.

C. For pipe diameters less than 600mm (24") the exterior of the joint shall be welded. For pipe diameter 600mm (24") and larger, the joint shall be welded in accordance with the approved submittal. All welded joints shall remain exposed until inspection has been performed.

D. Welding electrodes shall be as recommended by the pipe manufacturer. Typically, electrodes shall be E6010 for root passes and E7018 for additional passes. Do not deposit more than 3.2mm (1/8") of throat thickness per pass.

E. Weld material shall be deposited in successive layers. Complete and clean each pass around the entire circumference of the pipe before commencing the next pass.

F. The minimum number of passes in the completed weld shall be as follows:

Steel Cylinder Thickness		Fillet Weld Minimum
mm	(inches)	Number of Passes
6.35 or less	(0.2500 or 1/4”)	2
Greater than 6.35	(0.2500 or 1/4”)	3

G. To minimize longitudinal stresses due to temperature variations, it is necessary to leave unwelded one joint per each 120m (400’) of pipeline. This joint shall be left unwelded until all the joints on both sides of it are welded, and it shall be welded at the coolest time of the working day. The District Engineer shall decide if and when this procedure is warranted.

H. Tack-welding the joint may be permitted to hold the pipe in place. If the joint is to be circumferentially welded, sufficient time shall elapse to allow for an initial set of interior joint lining prior to proceeding with joint welding. Rapid-setting mortar may be used in accordance with this Section. In some cases, the District Engineer may require hand holes.

I. Field welders shall be certified in accordance with ASME Section IX (pipe welders) or AWS D1.1 (plate welders). Welders shall present a copy of their certification to the District Engineer prior to performing any field welding.

J. Prior to butt-strap welding, the pipe and pipe joint shall be properly positioned in the trench using line-up damps so that, in the finished joint, the abutting pipe sections shall not be misaligned by more than 1.59mm (1/16”).

K. 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.

L. Inspection of Field Welded Joints:

1. The District or the Developer (as required by the District) shall arrange for the welds to be inspected. Inspection of welds shall take place during welding operations or as soon as possible following the completion of the welds.

2. Visual inspections of welds shall be performed by an AWS QC1 Certified inspector. Nondestructive testing, such as liquid dye penetrate testing shall only be performed by individuals qualified per AWS D1.1 as a NDT Level II or greater.

3. The Contractor shall coordinate and supply ventilation, lighting, and other equipment deemed necessary for inspection. The Contractor shall be responsible for providing safe entry into and out of the trench, safety of inspection personal, traffic control and other safety precautions deemed

necessary for the inspections.

3.06 INTERIOR JOINT FINISH - PIPE LESS THAN 600mm (24")

Complete interior mortar joints for pipe sizes less than 600mm (24") by drawing through a tight-fitting swab or squeegee. Coat the face of the cement mortar lining at the bell with a sufficient amount of stiff cement mortar to fill the gap. Immediately after joining the pipes, draw the swab through the pipe to remove all excess mortar and expel it from the open pipe end. Do not move the pipe after the swab has been pulled past the joint. See requirements under "Field Welded Joints" for these joints requiring welding.

3.07 INTERIOR JOINT FINISH - PIPE 600mm (24") AND LARGER

A. Complete interior mortar joints for pipe sizes 600mm (24") and larger by the trowel method. Prior to applying interior mortar at the joints all backfill in the area shall be completed. After cleaning the interior joint, pack cement mortar into each joint. Finish the surface with a steel trowel to a smooth finish and equal thickness to match the adjoining pipe mortar.

B. Where more than a 100mm (4") joint strip of mortar is required, place galvanized welded wire mesh reinforcement in 50mm x 100mm (2" x 4”) pattern of No. 13 gauge over the exposed steel. Install the mesh so that the wires on the 50mm (2") spacing direction run circumferentially around the pipe. Crimp the wires on the 100mm (4") spacing to support the mesh 9.5mm (3/8") from the metal surface. Steel-trowel finish the interior mortar to match adjoining mortar-lined pipe sections.

3.08 CLOSED-CIRCUIT TELEVISION INSPECTIONS

Closed-circuit television inspections shall be performed by the Contractor in accordance with Section 15045.

3.09 EXTERIOR JOINT FINISH

A. The outside annular space between pipe sections shall be completely filled with grout formed by the use of polyethylene foam-lined fabric bands. The grout space shall be flushed with water prior to filling so that the surfaces of the joint to be in contact with the grout will be thoroughly moistened when the grout is poured. The joint shall be filled with grout by pouring from one side only. Grout 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. Care shall be taken to leave no unfilled space. 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 three joints of the pipe being laid.

B. 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 nodding of the mortar, and allow excess water to escape. The foam plastic shall be 100 percent closed cell, chemically inert, insoluble in water and resistant to acids, alkalis and solvents. Foam Plastic shall be Dow Chemical Company, Ethafoam 222, or equal.

The fabric backing shall be cut and sewn into 224mm (9”) wide strips with slots for the steel strapping on the outer edges. The polyethylene foam shall be cut into strips 150mm (6”) wide and slit to a thickness of 6.35mm (¼”) that will expose a hollow or open-cell surface on one side. The foam liner shall be attached to the fabric backing with the open or hollow cells facing towards the pipe. The foam strip shall cover the full interior circumference of the grout band with sufficient length to permit a 200mm (8”) overlap of the foam at or near the top of the pipe joint. Splices to provide continuity of the material will be permitted. The polyethylene foam material shall be protected from direct sunlight.

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 the steel straps. After filling the exterior joint space with 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.

C. Following grouting, the joint shall be wrapped with two layers of polyethylene encasement in accordance with per Section 15000.

3.10 BUTT STRAP JOINTS

Butt strap closure joints shall be installed where shown on the Approved Plans in accordance with AWWA C206.

A. Butt straps shall be field welded to the outside plain end of the pipe along both edges with a full circumferential weld. A minimum of two weld passes shall be used.

B. The interior of the joints shall be filled with a rapid-set mortar and finished off smoothly to match the pipe interior diameter.

C. Clean the butt strap with a wire brush and apply a cement and water wash coat prior to applying cement mortar.

D. Galvanized wire mesh, 50mm x 100mm (2" x 4”) x No. 13 gauge shall be installed to the exterior of the joint prior to applying the mortar coating.

E. Coat the exterior of the closure assemblies with mortar to cover all steel with a minimum of 32mm (1¼”).

F. Seal weld the steel plug to the hand hole after the interior of the joint has been inspected and approved by the District Engineer.

G. Following grouting, the joint shall then be wrapped with two layers of polyethylene encasement in accordance with Section 15000.

3.11 FLANGED CONNECTIONS

Flanged connections shall be installed where indicated on the Approved Plans.

A. Bolt holes shall straddle the vertical centerline.

B. The bolts, nuts and flange faces shall be thoroughly cleaned by wire brush prior to assembly.

C. Bolts and nuts shall be lubricated with a District-approved anti-seize compound.

D. Nuts shall be tightened in an alternating "star" pattern to the manufacturer's recommended torque.

E. Slip-on type flanges intended for field fit-up and welding shall be welded inside and outside in accordance with AWWA C207.

F. Coat the exterior of exposed flanges, bolts and nuts in accordance with Section 09910.

3.12 FLANGED COUPLING ADAPTERS

Flanged coupling adapters shall be installed in accordance with the manufacturer's recommendations. Bolts shall be tightened with a torque wrench in the presence of the District Engineer to the torque recommended by the manufacturer.

3.13 JOINT BONDING/CATHODIC PROTECTION INSULATION

Bonding of joints to provide continuity, flange insulation kits, internal epoxy linings, and other cathodic protection items and materials shall be installed where shown on the Approved Plans in accordance with the Standard Drawings and Section 13110.

3.14 WAX TAPE

Wax tape shall be installed as shown on the Approved Plans or as directed by the District Engineer in accordance with Section 13110 and the Standard Drawings.

3.15 CONCRETE

Where required, concrete thrust and anchor blocks shall be installed in accordance with Section 03000 and as shown on the Approved Plans. Prior to filling the pipeline with water, refer to Section 03000 for the minimum concrete curing time required.

3.16 TRACER WIRE

Tracer Wire shall be installed in accordance with Section 15000 and the Standard Drawings.

3.17 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.18 DISINFECTION AND BACTERIOLOGICAL TESTING

Disinfection, bacteriological testing, and flushing shall be performed in accordance with Section 15041.

3.19 HYDROSTATIC TESTING

Field hydrostatic testing shall be performed in accordance with Section 15044.

3.20 FIELD PAINTING AND COATING

A. Exterior surfaces of all pipe and appurtenances not otherwise mortar-coated shall be field painted in accordance with Section 09910.

B. Areas in contact with potable water such plain ends of pipe, grooved and shouldered ends of pipe and exposed inside surfaces of threaded outlets and blind flanges shall be coated in accordance with Section 09910.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15064 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation procedures for polyvinyl chloride (PVC) pressure pipe. Generally, this section refers to the materials and procedures for installing pipe and appurtenances for potable and recycled water systems.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

- AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings for Water Transmission and Distribution
- AWWA M23 - PVC Pipe - Design and Installation
- Uni-Bell - Handbook of PVC Pipe Design and Construction

1.03 RELATED WORK SPECIFIED ELSEWHERE

- WAS Standard Drawings
- WAS Standard Specifications 02223, 03000, 09910, 15000, 15041, 15044, 15056, 15057, 15074, 15100, 15102, 15108, and 15300

1.04 SERVICE APPLICATION

A. PVC pipe will be used to transport and distribute potable water or recycled water as indicated on the Approved Plans.

B. In accordance with their AWWA designations PVC pipe shall be used for pipe sizes as follows:

1. 100mm (4") C900 PVC pipe shall be used for the installation of appurtenances such as air valves, blowoffs and fire services.

2. C900 PVC pipe shall be used for mains and related appurtenances.

1.05 DESIGN REQUIREMENTS

A. PVC pipe shall be provided in standard 6.10m (20') lengths, unless otherwise detailed or required on the Approved Plans. When deep trenches or shoring restrictions hinder the use of the standard length sections, the use of 3.05m (10') and 4.57m (15') lengths shall be allowed. Random lengths are not allowed.

B. The minimum length of PVC pipe sections used for tie-ins and stub-outs shall be three (3) times the pipe diameter or 1200mm (48”), whichever is longer, unless otherwise approved by the District Engineer.

C. Horizontal Radius: In areas where it is required to lay the pipe along a curve, the use of deflection couplings will be used to form the arc. The pipe shall not be bent to form the arc, nor shall the pipe be deflected within integral bells or ductile-iron fittings. Unless otherwise approved by the District Engineer, PVC pipe shall be installed using 5°□deflection couplings (2½° at each bell) to form arcs with radii no less than the minimums noted below:

Pipe Length Used	Minimum Radius
6.10m (20')	69.80m (229')
3.05m (10')	35.05m (115')
Combination (refer to Section 3)	23.16m (76')

1.06 QUALITY ASSURANCE

A. The manufacturer of each shipment of pipe shall be required to supply a statement certifying that each lot or load of pipe has been subjected to the tests specified for PVC pipe, and has been found to meet all the requirements of AWWA C900.

B. PVC pipe shall carry a current certification of the National Sanitation Foundation (NSF) as acceptable to use in the transport of potable water.

C. PVC pipe and couplings shall bear indelible identification markings as required by AWWA C900. In addition, all pipe shall bear a “home” mark on the spigot end to indicate proper penetration when the joint is made. The pipe markings for PVC pipe for recycled water systems shall include the designation “RECYCLED WATER” in addition to the identification markings required by AWWA.

1.07 DELIVERY, STORAGE, AND HANDLING

A. PVC pipe shall be stored in suppliers' yards and on the job site in accordance with AWWA M23 and the manufacturer's recommendations. Store PVC pipe in the field by supporting the pipe uniformly in accordance with AWWA M23. Pipe shall not be stacked higher that 1.22m (4’) or with weight on the bell ends.

B. Cover stored PVC pipe with an opaque material to protect it from the sun's ultraviolet radiation. PVC pipe that has been subjected to excess ultraviolet radiation as identified by color fading or chalking shall not be used. The determination as to the acceptability of PVC pipe shall rest solely with the District Engineer.

C. PVC pipe that has been contaminated in any way with petroleum products (on the inside or outside of the pipe) shall not be used.

1.08 SERVICE SADDLES FOR PVC PIPE

Service saddles shall be used for the installation of pipe appurtenances 50mm (2”) and smaller in accordance with Section 15057.

1.09 FITTINGS

Ductile-iron fittings shall be used for the installation of pipe appurtenances 100mm (4”) and larger in accordance with Section 15056.

1.10 JOINT RESTRAINT

Joint restraint systems in accordance with Section 15000 shall be used where indicated on the Approved Plans or where concrete thrust blocks are not practical, with the prior approval of the District Engineer.

1.11 TRACER WIRE

Tracer wire shall be installed for all PVC water mains, whether potable or recycled, in accordance with Section 15000.

1.12 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for all PVC water mains, whether potable or recycled, in accordance with Section 15000.

1.13 RECYCLED WATER IDENTIFICATION

PVC pipe for recycled water system applications shall be purple. Fittings and pipe appurtenances installed with PVC mains for recycled water shall be identified with purple-colored coating, purple polyethylene sleeves, identification labels, or signs in accordance with Section 15151.

PART 2 MATERIALS

2.01 POLYVINYL CHLORIDE PIPE

A. PVC pressure pipe and appurtenant components and materials shall be selected from the Approved Materials List. Provide pipe with cast-iron equivalent outside diameter, and integral wall-thickened bell and spigot ends.

B. PVC pipe in sizes 100mm (4") through 300mm (12") shall comply with the requirements of AWWA C900, Class 305 (DR14).

C. PVC pipe in sizes 350mm (14”) through 900mm (36”) shall comply with the requirements of AWWA C900, Class 165 (DR 25) or Class 235 (DR18), as shown on the Approved Plans.

2.02 DEFLECTION COUPLINGS

PVC deflection couplings that allow for 2½° deflection at each bell for a maximum of 5° total deflection shall be selected from the Approved Materials List.

2.03 FITTINGS

Ductile-iron fittings shall be in accordance with Section 15056 and selected from the Approved Materials List. The fittings shall have mechanical joint type or push-on type joints manufactured specifically for PVC pipe.

2.04 CONCRETE

Concrete used for thrust, anchor, and support blocks shall be in accordance with Section 03000.

2.05 JOINT RESTRAINT

Joint restraint systems shall be in accordance with Section 15000 and shall be selected from the Approved Materials List.

2.06 IMPORTED GRANULAR MATERIAL FOR PIPE AND TRENCH ZONES

Imported granular material for use in pipe and trench zones shall be in accordance with Section 02223.

2.07 TRACER WIRE

Tracer wire materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.08 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

PART 3 EXECUTION

3.01 3.01 GENERAL

A. At all times when the work of installing pipe is not in progress, including worker break times, the ends of the pipe shall be closed with tight-fitting, vermin-proof and child-proof caps or plugs. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The Contractor shall maintain the interior of the pipe in a sanitary condition free from foreign materials at all times.

B. Proper care shall be used to prevent damage in handling, moving and placing the pipe. All pipe, fittings, valves, and other pipeline materials shall be lowered into the trench in a manner that prevents damage. The pipe shall not be dropped, dragged or handled in a manner that will cause bruises, cracks, or other damage. PVC pipe that has been gouged, scratched, or otherwise damaged shall be subject to rejection at the discretion of the District Engineer.

C. Where pipe lengths less than the standard 6.10m (20’) are required, the pipe sections shall be installed in accordance with the manufacturer's installation guide (with the exception of deflection at the bell and spigot, which is not allowed) and shall only be used as specified herein or with the approval of the District Engineer. The minimum pipe length permitted is 1.52m (5'), except at tie-ins and stub-outs, where the minimum pipe length permitted is three (3) times the pipe diameter or 1.22m (4’), whichever is longer, unless otherwise approved by the District Engineer.

3.02 TRENCHING, BACKFILLING AND COMPACTION

Trenching, bedding, backfilling and compaction operations shall be performed in accordance with Section 02223.

3.03 DEWATERING

Dewatering of trench excavations shall be performed in accordance with Section 02223. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipelines, appurtenances, or trench materials shall be repaired or replaced as directed by the District Engineer.

3.04 PIPE INSTALLATION

When the work requires and the size of the pipe allows entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159 for confined space entry have been performed and the area is verified as safe to enter.

The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation. Install pipe in the trench as follows:

A. Inspect each section of pipe prior to lowering the pipe into the trench. Thoroughly clean the ends of the pipe. Remove foreign matter and dirt from inside of the pipe and keep clean during and after installation.

B. Install pipe according to the manufacturer's approved order of installation to the proper lines and grades in accordance with the Approved Plans and as follows:

   1. Install pipe uphill if the grade exceeds ten percent (10%).

   2. Installation tolerances for the pipe shall not vary more than 50mm (2”) horizontally or 25mm (1”) vertically from the alignment and elevations shown on the Approved Plans.

   3. Install the pipe such that the identification markings on each pipe section are continuously aligned for the total length of the pipeline alignment. Orient the strip marking upward to the 12 o’clock position (top) of the trench opening.

C. The pipe shall have firm bearing along its full length, and bell holes shall be provided at each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.

D. The beveled end of the pipe shall be removed prior to insertion into a mechanical joint fitting.

E. Field cutting and milling shall be performed in accordance with the manufacturer’s written instructions to equal the quality of shop-fabricated ends.

F. Pipe Assembly:

   1. Push-On Type: Assemble the pipe joint using a lubricant selected from the Approved Materials List. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive spigot ends of the pipe into bell ends in accordance with the manufacturer’s recommendations. Stabbing shall not be permitted.

2. Mechanical-Joint Type: Assembly of mechanical joint fittings shall be in accordance with the manufacturer's recommendations regarding installation.

G. PVC pipe shall not be bent, nor shall PVC pipe be deflected at pipe connections other than deflection couplings. Install deflection couplings selected from the Approved Materials List for horizontal and vertical changes in direction not greater than 5°, and for installation of pipe through curves. Pipe sections of differing lengths may be used as follows to facilitate the installation of pipelines through curves:

1. Allowable lengths of pipe sections through curves are 6.10m (20'), 3.05m (10'), or 1.52m (5') only.

2. No more than two 1.52m (5') pipe sections may be used in succession without being separated by a 6.10m (20') or 3.05m (10') section. Pipe layout through curves is subject to approval by the District Engineer. In no case shall the minimum radius be less than 23.16m (76').

3.05 SUPPORT FOR DUCTILE-IRON FITTINGS AND VALVES

All ductile-iron fittings and valves require concrete support blocks in accordance with Sections 15056, 15100 and 15102 to prevent the fitting or valve weight from being carried by the PVC pipe.

3.06 THRUST AND ANCHOR BLOCKS

Concrete thrust and anchor blocks shall be installed in accordance with Section 03000 and the Standard Drawings.

3.07 JOINT RESTRAINT SYSTEMS

Joint restraint systems shall be installed in accordance with Section 15000. Joint restraint lengths along new pipelines shall be as shown on the Approved Plans. If the installation of concrete thrust blocks is not practical and use of joint restraint systems are approved by the District Engineer, calculations indicating joint restraint lengths along new pipelines shall be submitted to the District Engineer for approval.

3.08 TRACER WIRE

Tracer wire shall be installed in accordance with Section 15000 and the Standard Drawings.

3.09 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.10 DISINFECTION AND BACTERIOLOGICAL TESTING

Disinfection, bacteriological testing and flushing shall be performed in accordance with Section 15041.

3.11 HYDROSTATIC TESTING

Field hydrostatic testing shall be performed in accordance with Section 15044.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15065 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of polyvinyl chloride (PVC) gravity sewer pipe and fittings.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM D 3034	-	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F 679	-	PVC Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 794	-	Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
AWWA M23	-	PVC Pipe – Design and Installation
SSPWC	-	Standard Specifications for Public Works Construction (Green Book)
UNI-B-5	-	Recommended Practice for the Installation of PVC Sewer Pipe
Uni-Bell	-	Handbook of PVC Pipe Design and Construction

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 01000, 02223, 03000, 03461, 15000, 15043, 15045

1.04 SERVICE APPLICATION

A. PVC gravity sewer pipe will be used to convey sewage as indicated on the Approved Plans.

B. In accordance with their ASTM designations PVC gravity sewer pipe shall be used for pipe sizes as follows:

1. ASTM D 3034, SDR-35 pipe shall be used for the installation of gate wells and access ports in water applications as shown on the Standard Drawings.

2. ASTM D 3034, SDR-35 pipe shall be used for the installation of sewer laterals with a minimum size of 100mm (4") as shown on the Approved Plans.

3. ASTM D 3034, SDR-35 pipe shall be used for mains, fittings, couplings, and joints sized 100mm (4") through 375mm (15").

4. ASTM F 679, SDR-35 (T-1) pipe shall be used for mains, fittings, couplings, and joints sized 450mm (18”) through 675mm (27”) as shown on the Approved Plans.

5. ASTM F 794, Closed Profile pipe shall be used for mains, fittings, couplings, and joints sized 530mm (21”) through 1200mm (48”) as shown on the Approved Plans.

1.05 DESIGN REQUIREMENTS

A. Sewer pipe shall be furnished in standard 3.96m (13’) or 6.10m (20’) lengths unless otherwise detailed or required on the Approved Plans. Random lengths may be furnished but shall not exceed 15% of the total footage.

B. Minimum length of PVC pipe sections used for tie-ins and stub-outs shall be 900mm (36”), unless otherwise approved by the District Engineer.

C. Horizontal curves in sewer mains shall be as shown on the Approved Plans.

1.06 QUALITY ASSURANCE

A. The manufacturer of each shipment of pipe shall be required to supply a statement certifying that each lot or load of pipe has been subjected to the tests specified for PVC gravity sewer pipe. Tests shall show that the pipe has been found to meet all the requirements of ASTM D 3034, F 679, and/or F 794 as applicable.

B. PVC pipe and couplings shall bear indelible identification markings as required by ASTM D 3034, F 679, and/or F 794 and as follows:

1. All pipe, fittings, and couplings shall be clearly marked with the following information at an interval not to exceed 1.52m (5’):

a. Nominal pipe diameter.

b. PVC cell classification.

c. Company, plant, date of manufacture, and ASTM and SDR designation. Fittings and couplings do not require the SDR designation.

d. Service designation or legend.

2. All pipe shall bear a “home” mark on the spigot end to indicate proper penetration when the joint is made.

C. The bell and spigot configuration for the fittings and couplings shall be compatible with those used for the pipe.

1.07 DELIVERY, STORAGE, AND HANDLING

A. PVC pipe shall be stored in suppliers' yards and on the job site by supporting the pipe uniformly in accordance with AWWA M23 and the manufacturer's recommendations. Pipe shall not be stacked higher than 1.22m (4’) or with weight on the bell ends.

B. Cover stored PVC pipe with an opaque material to protect it from the sun's ultraviolet

radiation. PVC pipe that has been subjected to excess ultraviolet radiation as identified by color fading or chalking shall not be used. The determination as to the acceptability of PVC pipe shall rest solely with the District Engineer.

C. PVC pipe that has been contaminated in any way with petroleum products (on the inside or outside of the pipe) shall not be used.

1.08 SADDLE CONNECTIONS TO EXISTING SEWER MAINS

Saddle-type connections are used for connecting new sewer laterals to existing sewer mains. The District shall perform all saddle connections to the existing system in accordance with this Section and the Standard Drawings.

1.09 WARNING/IDENTIFICATION TAPE

All PVC pipe sewer mains shall include the installation of Warning/Identification Tape in accordance with Section 15000.

1.10 CURB IDENTIFICATION MARK FOR SERVICES

The Contractor shall mark the location of each sewer lateral at the curb crossing as described in Section 15000.

1.11 MANHOLES

Manholes shall be installed in accordance with Section 03461 when shown on the Approved Plans.

1.12 CLEANOUTS

Size-on-size cleanouts are permissible at the end of mains 200mm (8”) and smaller that extend no more than 61m (200’) and have no more than three (3) laterals installed at or near the end of the main. Cleanouts shall be installed at ends of mains and on sewer laterals in accordance with the Standard Drawings when shown on the Approved Plans.

1.13 SEWER FORCE MAINS

Sewer force mains shall be constructed of PVC pressure pipe in accordance with Section 15064 and the Approved Plans.

PART 2 MATERIALS

2.01 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. PVC gravity sewer pipe and appurtenant components and materials shall be selected from the Approved Materials List.

B. PVC pipe in sizes 100mm (4") through 375mm (15") shall comply with the requirements of ASTM D 3034, SDR-35.

C. PVC pipe in sizes 450mm (18") through 675mm (27"), when shown on the Approved Plans, shall comply with the requirements of ASTM F 679, SDR-35 (T-1).

D. PVC pipe in sizes 525mm (21") through 1,200mm (48"), when shown on the Approved Plans, shall comply with the requirements ASTM F 794, Closed Profile.

2.02 CRUSHED ROCK FOR PIPE ZONES

Crushed rock material for use in the pipe zone shall be in accordance with Section 02223.

2.03 IMPORTED GRANULAR MATERIAL FOR TRENCH ZONES

Imported granular material for use in trench zones shall be in accordance with Section 02223.

2.04 CONCRETE

Concrete used for anchor blocks, lugs and other uses as required shall be in accordance with Section 03000.

2.05 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.06 MANHOLES

Materials used for the installation of manholes shall be in accordance with Section 03461 and shall be selected from the Approved Materials List.

2.07 CLEANOUTS

Materials used for the installation of cleanouts shall be selected from the Approved Materials List.

PART 3 EXECUTION

3.01 GENERAL

A. At all times when the work of installing pipe is not in progress, including worker break times, the ends of the pipe shall be closed with tight-fitting, vermin-proof and child-proof caps or plugs. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The Contractor shall maintain the interior of the pipe in a sanitary condition free from foreign materials at all times.

B. Proper care shall be used to prevent damage in handling, moving and placing the pipe. All pipe, fittings, and other pipeline materials shall be lowered into the trench in a manner

that prevents damage. The pipe shall not be dropped, dragged, or handled in a manner that will cause bruises, cracks, or other damage. PVC pipe that has been gouged, scratched, or otherwise damaged shall be subject to rejection at the discretion of the District Engineer.

C. Where pipe lengths less than the standard 3.96m (13') or 6.10m (20') are required, the pipe sections shall be installed in accordance with the manufacturer's installation guide (with the exception of deflection at the bell and spigot, which is not allowed) and shall only be used as specified herein or with the approval of the District Engineer. The minimum pipe length permitted is 1.52m (5') when used to connect to manholes and cleanouts. The minimum pipe length permitted for stub outs is 900mm (36").

3.02 TRENCHING, BACKFILLING AND COMPACTION

Trenching, bedding, backfilling and compaction operations shall be performed in accordance with Section 02223.

3.03 DEWATERING

Dewatering of trench excavations shall be performed in accordance with Section 02223. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipelines, appurtenances, or trench materials shall be repaired or replaced as directed by the District Engineer.

3.04 PIPE INSTALLATION

When the work requires and the size of the pipe allows entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159 for confined space entry have been performed and the area is verified as safe to enter.

The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, supports, gaskets, jointing materials, and all other appurtenances as shown and as required to provide a complete and workable installation. Pipe installation shall be as recommended in UNI-B-5 except as modified below and as shown on the Approved Plans.

A. Inspect each section of pipe prior to lowering the pipe into the trench. Thoroughly clean the ends of the pipe. Remove foreign matter and dirt from inside of the pipe and keep pipe clean during and after installation.

B. Install pipe according to the manufacturer's approved order of installation to the proper lines and grades as shown on the Approved Plans and as follows:

1. Pipe shall be installed with pipe bells up-grade. Lay pipes uphill if the grade exceeds ten percent (10%).

2. Installation tolerances for the pipe shall not vary more than 50mm (2") horizontally or 25mm (1") vertically from the alignment and elevations shown on the Approved Plans.
3. Install the pipe such that the identification markings on each pipe section are continuously aligned for the total length of the pipeline alignment. Orient the strip

marking upward to the 12 o'clock position (top) of the trench opening.

4. Avoidance of reverse slope: Any pipeline installed with reversed slope, as evidenced by ponding of water or sag, is not allowed. Any such pipeline shall be removed and replaced (at proper line and grade) to the nearest upstream and downstream sewer structure as directed by the District Engineer.

C. The pipe shall have firm bearing along its full length, and bell holes shall be provided at each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.

D. Field cutting and milling shall be performed in accordance with the manufacturer's written instructions to equal the quality of shop-fabricated ends.

E. Pipe Assembly: Assemble the pipe joint using the lubricant supplied by the pipe manufacturer. Insert the spigot end into the bell to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive the spigot end into the bell in accordance with the manufacturer's recommendations. Stabbing shall not be permitted.

F. Horizontal or vertical curve alignments shall be accomplished as required, in accordance with the manufacturer's recommendations. A combination of random pipe lengths, bending, and joint deflection shall be utilized to create smooth radius curves in accordance with the manufacturer's recommendations and as directed by the District Engineer.

G. Wyes shall not be placed closer than 1.52m (5') from the exterior of any structure such as manholes.

3.06 SEWER LATERALS

A. The Contractor shall install sewer laterals where shown on the Approved Plans in accordance with the Standard Drawings.

B. All sewer laterals shall run perpendicular from the sewer main to the property line. Sewer laterals shall be bedded, backfilled and compacted the same as the sewer main into which they connect in accordance with Section 02223.

C. All sewer laterals shall be plugged or capped at the end of the last joint to withstand the internal pressure during leakage and infiltration testing.

D. All sewer laterals that are to be left unconnected to a building lateral extension shall be capped and identified as shown on the Standard Drawings.

3.07 SADDLE CONNECTIONS TO EXISTING SEWER MAINS

The Contractor shall furnish saddle fittings, appurtenances and all other materials as called for in the Standard Specifications in accordance with the Approved Materials List. The Contractor shall provide all equipment and labor required for the excavation and installation of connections including but not limited to backfill and pavement replacement. In certain circumstances the Contractor may be required to provide a water truck, bypass pump, and fittings as part of the equipment for making the connections. Emergency standby equipment or materials may be required of the Contractor by the District Engineer.

Saddle connections to existing sewer mains for the tie-in of new sewer laterals shall be as follows:

A. Prior to construction, Contractor shall pothole the existing pipe at the location of the proposed connection. The District shall inspect the pothole prior to Contractor's repair of trench. Refer to Section 01000 for protection of existing facilities. Contractor shall record the following information on Record Drawings:

2. Pipe size, outside diameter.

3. Pipe type such as PVC or VCP.

4. Elevation, grade, and alignment.

5. Location of any collars, pipe bells, fittings or couplings in the area of the connection that prohibit installation of laterals.

6. Potential conflicts with existing utilities.

B. To facilitate the proposed connection and allow for slight adjustments in alignment, the Contractor shall leave a minimum 3.0m (10') gap between the new pipe installation and the proposed connection point at the existing main. The Contractor shall leave a gap longer than 3.0m (10') if conditions warrant, or if directed by the District Engineer.

C. After the District Engineer has given approval to proceed with the connection, the Contractor shall schedule with the District Engineer for the connection.

1. Tie-ins will be scheduled at the convenience of the District. Work may be scheduled for nights and weekends if required.

2. The Contractor shall give the District Engineer a minimum notice of five (5) working days prior to any proposed excavation. Scheduling shall be subject to approval of the District Engineer.

3. The District Engineer may postpone or reschedule the connection operation if, for any reason, the District Engineer believes that the Contractor is improperly prepared with competent personnel, equipment, or materials to proceed with the connection.

4. If progress in completing the connection within the time specified is inadequate, the District Engineer may order necessary corrective measures. Corrective measures may consist of directing District personnel or another contractor to complete the work. All costs for corrective measures shall be borne by the Contractor.

D. Contractor may proceed with the excavation and connection only when approved materials are onsite, when connection operations have been scheduled, and when a copy of the approved traffic control plan has been supplied to the District Engineer.

1. When directed to do so by the District Engineer, the Contractor shall saw-cut pavement, excavate, and provide and install shoring and steel plating one day prior to the cut-in installation.

2. The Contractor shall provide lights, barricades and traffic control in accordance with the requirements of the Agency of Jurisdiction and as deemed necessary for the excavation by the District Engineer.

3. After the District has performed connection operations and the District Engineer has given approval to proceed, the Contractor shall complete the installation as shown on the Approved Plans in accordance with Standard Specifications and as follows:

   a. Install the pipe section(s) necessary to make the closure to the new system.

   b. Complete all backfill and compaction of the trench in accordance with Section 02223.

   c. Repair or replace all pavement as necessary in accordance with the requirements of the Agency of Jurisdiction.

   d. Discard pipe and appurtenances removed from service as specified in this Section.

3.08 CONNECTION TO EXISTING SEWER SYSTEM

A. Connection to the existing sewer system at an existing manhole or dead end shall be made as shown on the Approved Plans and in accordance with Section 03461. All work shall be performed in the presence of the District Engineer.

B. In order to prevent unauthorized or accidental use of the new sewer before completion and acceptance, the new inlet to the existing tie-in manhole and the outlet of the first new upstream manhole shall be sealed with expandable plugs. Installation of plugs shall be in accordance with the manufacturer's recommendations and as approved by the District Engineer. Plugs shall be removed at the time of final inspection or as directed by the District Engineer.

3.09 CONCRETE

Concrete for anchor blocks, lugs and other uses shall be installed as called for in Section 03000 and in accordance with the Standard Drawings.

3.10 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.11 MANHOLES

Manholes shall be installed in accordance with Section 03461 at the locations shown on the Approved Plans.

3.12 CLEANOUTS

Cleanouts shall be installed at the locations shown on the Approved Plans in accordance with the Standard Drawings.

3.13 CLEANING

A. Before testing, each pipe shall be thoroughly flushed with clean water from manhole to manhole with an appropriately-sized inflatable ball.
B. All construction debris and water shall be removed from each manhole prior to removal of the plugs.
C. Water used in flushing out the new sewer mains, laterals, or house plumbing shall not be discharged into the existing sewer system.

3.14 MANDREL TEST

A. Following backfill and compaction, installation of all utilities, and prior to permanent pavement replacement, all main line sewer pipe shall be mandrelled to check for obstructions. A rigid mandrel, circular in cross section, having a diameter of 95% of the pipe inside diameter, and equal in length to the pipe diameter, shall be pulled through the pipe by hand.

B. Obstructions encountered by the mandrel shall be corrected by the Contractor. If an obstruction is encountered, the District Engineer shall approve corrective measures prior to implementation.

3.15 LEAKAGE AND INFILTRATION TESTING

Field leakage and infiltration testing of sewer mains shall be performed in accordance with Section 15043.

3.16 CLOSED-CIRCUIT TELEVISION INSPECTION

Closed-circuit television (CCTV) inspections of sewer mains shall be performed in accordance with Section 15045.

3.17 FINAL INSPECTION

A final visual inspection shall be made after paving has been completed and all manhole frames have been raised to grade. The Contractor shall have a responsible person present and shall furnish the necessary labor to assist the District Engineer in making the final inspection. Final acceptance of the system will be withheld pending completion or correction of items identified during this inspection.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15074 BLOWOFF ASSEMBLIES

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of blowoff assemblies.

1.02 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 02223, 03000, 09910, 15000, 15041, 15044, 15056, 15057, 15061, 15064, and 15100

1.03 SERVICE APPLICATION

A. Blowoff assemblies shall be installed on potable and recycled water mains.

B. Blowoff assemblies shall be sized and located as shown on the Approved Plans. In general, blowoff assemblies will be installed at the ends and at low points of pipelines as shown below:

1. 50mm (2") blowoff assemblies will be required on pipelines for temporary use, when shown on the Approved Plans, or as otherwise directed by the District Engineer.

2. 100mm (4") blowoff assemblies will be required on pipeline sizes 400mm (16") and smaller.

3. 150mm (6") blowoff assembly will be required on pipeline sizes 450mm (18") and larger.

1.04 RECYCLED WATER IDENTIFICATION

Blowoff assemblies for recycled water shall be identified with purple-colored coating, identification labels or signs in accordance with Section 15151.

1.05 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for blowoff assemblies in accordance with Section 15000.

PART 2 MATERIALS

2.01 GENERAL

Blowoff assemblies and appurtenant components and materials shall be selected from the Approved Materials List.

2.02 CONCRETE

Concrete used for thrust or anchor blocks shall be in accordance with Section 03000.

2.03 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and the Approved Materials List.

2.04 FIELD PAINTING AND COATING

Field painting and coating materials shall be in accordance with Section 09910 and the Approved Materials List.

PART 3 EXECUTION

3.01 INSTALLATION

A. Blowoff assemblies shall be installed at locations shown on the Approved Plans or as directed by the District Engineer in accordance with the Standard Drawings.

B. Blowoff assemblies shall be connected to water mains no closer than 600mm (24”) to a bell, coupling, joint or fitting.

C. Locations of blowoff assembly meter boxes or valve boxes shall be in accordance with the Standard Drawings.

3.02 CONCRETE

Concrete thrust and anchor blocks shall be installed in accordance with Section 03000 and the Standard Drawings. Refer to Section 03000 for the minimum concrete curing time required.

3.03 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.04 DISINFECTION OF BLOWOFF ASSEMBLIES

Blowoff assemblies shall be disinfected in accordance with Section 15041 in conjunction with disinfecting the main to which it is connected. Blowoff assembly valves shall be operated and the assembly shall be flushed to completely disinfect all internal parts.

3.05 HYDROSTATIC TESTING

Blowoff assemblies shall be hydrostatically tested in accordance with Section 15044 in conjunction with hydrostatically testing the pipeline to which it is connected.

3.06 FIELD PAINTING AND COATING

Blowoff assembly appurtenances shall be field-painted in accordance with Section 09910.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15099 PROCESS VALVES AND MISCELLANEOUS VALVES

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing and installation of manually operated process valves such as check valves, corporation stops, meter stops and ball valves.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM A126	-	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A536	-	Specification for Ductile Iron Castings
ASTM B61	-	Specification for Steam or Valve Bronze Castings
ASTM B62	-	Specification for Composition Bronze or Ounce Metal Castings
ASTM B584	-	Specification for Copper Alloy Sand Castings for General Applications
NSF	-	National Sanitation Foundation

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Specification Sections 02223, 03000, 09910, 15000, 15041, 15044, 15057, 15074, 15108, 15112 and 15152.

1.04 SERVICE APPLICATIONS

Check valves, bronze gate valves and ball valves are primarily used in the installation of potable and recycled water main appurtenances and where called for on the Approved Plans and indicated on the Standard Drawings.

1.05 SUBMITTALS

If required by the District Engineer, the following items shall be submitted to the District for review and approval prior to ordering or delivery of valves.

A. The valve manufacturers catalog data showing the size to be used, valve dimensions, pressure rating and materials of construction.

B. Manufacturers catalog data and proof of NSF certification on the lining materials to be used.

C. Installation procedures including field adjustments as required.

1.06 SIZING OF VALVES

Valves shall be the same size as the appurtenance in which they are to be installed with unless otherwise called for on the Approved Plans or indicated on the Standard Drawings.

1.07 VALVE ENDS

Valve ends shall be compatible with the piping system or appurtenance in which they are to be installed or as called for on the Approved Plans or indicated on the Standard Drawings.

1.08 DELIVERY, STORAGE AND HANDLING

Valves shall be delivered and stored in accordance with the manufactures recommendations. Valves shall remain in factory packaging until ready for installation. Valves shall not be stored in contact with bare ground.

1.09 RECYCLED WATER IDENTIFICATION

Valves for recycled water shall be identified with purple-colored coating, identification labels or signs in accordance with Section 15151.

1.10 POLYETHYLENE WRAP

Polyethylene wrap shall be used for the buried installation of valves in accordance with Section 15000.

1.11 GATE WELLS AND EXTENSION STEMS

Valve boxes and extension stems shall be installed in accordance with Section 15000 and the Standard Drawings.

PART 2 MATERIALS

2.01 RUBBER-FLAPPER SWING CHECK VALVE

A. Swing check valves shall be selected from the Approved Materials List. A submittal will be required as described in this Section.

B. Rubber-flapper swing check valves shall have a heavily constructed ductile-iron body and cover. The body shall be long pattern design (not wafer), with integrally cast-on end flanges. The flapper shall be Buna-N having an "O" ring seating edge and be internally reinforced with steel.

C. Flapper shall be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position during flow through the valve. Flapper shall be easily removed without need to remove valve from line. Check valves shall have full pipe size flow area. Seating surface shall be on a 45° angle requiring the flapper to travel only 35° from closed to full open position, for minimum head loss and non-slam closure.

D. Buna-N flapper shall be high-strength coated fabric, coated both sides with 70 DURO, which creates an elastic spring effect, molded internally, to assist the flapper to close against a

slight head to prevent slamming. When essential to create backflow through the check valve, as directed by the District Engineer, an external backflow device shall be furnished.

E. Valve ends shall be flanged ductile-iron in accordance with Section 15056 unless otherwise called for on the Approved Plans or directed by the District Engineer.

F. Check valves shall be tested by the manufacturer and the test results shall be approved by the District Engineer prior to shipment to the project. Check valves must unseat at a head no greater than 600mm (24").

2.02 SMALL DIAMETER ISOLATING VALVES

Provide all small diameter valves and cocks for shut-off process connections, instrumentation and other miscellaneous uses in accordance with the Approved Plans. These valves shall be of the same material and pressure rating as the adjacent process piping. Shutoff valves shall be compatible with instrumentation and other equipment in accordance with the manufacturer's recommendations.

2.03 CORPORATION STOPS

Corporation stops shall be the ball type with a bronze body and T-Head operator. Valve ends shall be compatible with the piping system in which they are being installed or as called for on the Approved Plans or indicated on the Standard Drawings. Corporation stops shall be rated for a minimum pressure of 1,379 KPa (200 psi). Corporation stops shall be selected from the Approved Materials List.

2.04 ANGLE METER STOPS

Angle meter stops shall be the ball type with a bronze body and 90° lock wing. Valve ends shall be 110-style compression inlet and swivel meter nut for 25mm (1") and meter flange for 50mm (2") outlets. Angle meter stops shall be rated for a minimum pressure of 1,379 KPa (200 psi). Angle meter stops shall be selected from the Approved Materials List.

2.05 CUSTOMER METER SHUT-OFF VALVE

Customer meter shut-off valves shall be the ball type with a bronze body and lever handle operator. Valve ends shall be swivel meter nut for 19mm (¾") and 25mm (1") inlets and meter flange for 38mm (1½") and 50mm (2") inlets. Outlets shall be female iron pipe thread (FIP) or compression. Customer meter shut-off valves shall be rated for a minimum pressure of 1,379 KPa (200 psi). Angle meter stops shall be selected from the Approved Materials List. The District Engineer may require the use of a customer meter shut-off valve equipped with a 90° lock wing.

2.06 BALL VALVES

Ball valves 50mm (2") and smaller shall be of bronze construction conforming to ASTM B62 and equipped with a T-Head or lever handle operator as required. Valve ends shall be compatible with the piping system in which they are being installed or as indicated on the Approved Plans or Standard Drawings. Ball valves shall be rated for a minimum pressure of 1,379 KPa (200 psi). Ball valves shall be selected from the Approved Materials List.

2.07 BACKFLOW PREVENTERS

Backflow preventers shall be in accordance with Section 15112 and selected from the Approved Materials List.

2.08 POLYETHYLENE WRAP

Polyethylene wrap shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.09 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be in accordance with Section 15000 and selected from the Approved Materials List.

PART 3 EXECUTION

3.01 INSTALLATION

A. Valves shall be set in true alignment straddling the centerline of pipe with the valve operator in the vertical position unless otherwise noted on the Approved Plans or shown on the Standard Drawings.

B. Valves shall be installed in accordance with the manufacturer's recommendations and the applicable section of these specifications for the piping material and joint type being used.

C. Aboveground valves shall be rigidly held in place using supports and hangers in accordance with the Approved Plans and Standard Drawings. The stem orientation of valves in elevated piping shall be as approved by the District Engineer for accessibility, except that no valves shall be installed with stems aligned below horizontal. Saddle type valve supports shall be provided. Supports shall be of rugged construction providing at least one hundred twenty degrees (120°) under support for the valve body. Valve supports shall be constructed of steel, and shall be anchored to the foundations using stainless steel anchor bolts.

3.02 POLYETHYLENE WRAP

Installation of polyethylene wrap for buried valves shall be in accordance with Section 15000.

3.03 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be in accordance with Section 15000 and the Standard Drawings.

3.04 DISINFECTION OF THE VALVES

Disinfection and flushing shall be in accordance with Section 15041, as part of the process of disinfecting the main pipeline. The valves shall be operated during the disinfection period to completely disinfect all internal parts.

3.05 HYDROSTATIC TESTING

Valves shall be hydrostatically tested in conjunction with the pipelines in which they are installed in accordance with Section 15044.

3.06 FIELD PAINTING AND COATING

The exterior of valves installed above ground or exposed in vaults or enclosures shall be field painted in accordance with Section 09910.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15100 RESILIENT WEDGE GATE VALVES (RWGVs)

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of manually operated Resilient Wedge Gate Valves (RWGVs).

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

- ASTM G62-22 - Standard Test Methods for Holiday Detection in Pipeline Coatings
- AWWA C210 - Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
- AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
- AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
- AWWA C550 - Protective Interior Coatings for Valves and Hydrants
- SSPC - Steel Structures Painting Council

1.03 RELATED WORK SPECIFIED ELSEWHERE

- WAS Standard Drawings
- WAS Standard Specifications 02223, 03000, 09910, 15000, 15041, 15044, 15056, 15057, 15061, 15064, 15074, 15108, 15112, and 15300

1.04 SERVICE APPLICATION

A. RWGVs shall be installed on potable and recycled water mains and appurtenances in accordance with the Approved Plans and the Standard Drawings.

B. RWGVs shall be used to isolate and depressurize pipeline segments for repairs, modifications, inspections, or maintenance.

C. In general, RWGVs shall be used when valves are required on pipelines and appurtenances sized 100mm (4") through 300mm (12").

D. Valves for pipelines sized 350mm (14") and larger generally require the use of butterfly valves (BFV's) in accordance with Section 15102.

1.05 SUBMITTALS

A. RWGVs 300mm (12”) and smaller shall be selected from the Approved Materials List.

B. RWGVs 350mm (14”) and larger require District Approval. Submittals shall include catalog data showing conformance to AWWA C509, size(s) proposed for use, valve dimensions, pressure rating, and materials of construction, and such valves shall also conform to all other requirements specified herein.

1.06 SIZING OF VALVES

Valves shall be the same size as the line in which they are installed unless otherwise noted on the Approved Plans.

1.07 VALVE ENDS

Valve ends shall be compatible with the piping system in which they are being installed in accordance with the Approved Plans or directed by the District Engineer.

Ductile-iron flanges shall be in accordance with Section 15056.

1.08 VALVE TESTING

RWGVs shall be hydrostatically tested, and valve coatings shall be holiday detected prior to shipment to the field in accordance with the testing procedures shown in Appendix A. Valves delivered to the site prior to successful hydrostatic testing and holiday detection shall be rejected.

1.09 DELIVERY, STORAGE AND HANDLING

Valves shall be delivered and stored in accordance with AWWA C550. The port openings shall be covered with plastic, cardboard, or wood while in transit and during storage in the field. These covers shall remain in place until valves are ready to be installed. Valves shall not be stored in contact with bare ground. Valves shall not be stacked.

1.10 RECYCLED WATER IDENTIFICATION

RWGVs used for recycled water shall be identified with purple-colored coating, identification labels and/or signs in accordance with Section 15151.

1.11 POLYETHYLENE ENCASEMENT

Polyethylene wrap shall be used for the buried installation of resilient wedge gate valves in accordance with Section 15000.

PART 2 MATERIALS

2.01 RESILIENT WEDGE GATE VALVES (RWGVs)

A. RWGVs shall be ductile iron in accordance with AWWA C509 and C515 except as modified herein.

B. RWGVs shall have smooth unobstructed waterways free from any sediment pockets.

C. RWGVs shall be leak-tight at their rated pressure.

D. RWGVs shall have a non-rising low-zinc bronze or stainless steel stem, opened by turning left (counterclockwise).

E. Stem seals shall be the O-ring type incorporating a minimum of two rings as required by AWWA C509.

F. Low-friction torque-reduction thrust washers or bearings shall be provided on the stem collar.

G. Wedge (gate) shall be fully encapsulated with a bonded-in-place Ethylene Propylene Diene Monomer (EPDM) elastomeric covering. Minimum thickness of the rubber seating area shall be 6.35mm (¼").

H. Valves for buried applications shall be provided with a 50mm (2") square operating nut, and valves located above ground or in structures shall be equipped with a minimum 300mm (12”) diameter hand wheel in accordance with AWWA C509 unless otherwise indicated on the Approved Plans or required by the District Engineer.

I. RWGV interior and exterior surfaces (except for the encapsulated disc) shall be coated as described below.

J. All bolts and nuts used in the construction of RWGVs shall be Type 316 stainless steel.

2.02 EPOXY LINING AND COATING

Epoxy linings and coatings for valves shall be provided in accordance with AWWA C210, C213 and C550, with the following modifications:

A. Epoxy lining and coating of valve surfaces shall be performed by the valve manufacturer by qualified personnel in a facility where the environment can be controlled. Epoxy lining and coating of valves in the field is prohibited.

1. Surface preparation shall be as detailed in SSPC-SP10, Near White Blast Cleaning.

2. Liquid epoxy lining materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, certified for use in contact for potable water.

3. The minimum dry film thickness for epoxy linings shall be 0.15mm (0.006 inches or 6 mils). Liquid epoxy lining shall be applied in two (2) coats in accordance with AWWA C210 and application shall conform to the coating manufacturer’s recommendations.

B. Powder epoxy lining and coating materials shall contain one hundred percent (100%) solids in accordance with AWWA C213, shall be applied in one or more coats, and shall conform to the coating manufacturer’s recommendations.

C. Repairs made to manufacturer’s applied linings shall be performed by a company approved by the valve manufacturer, by qualified personnel, and in a facility where the environment can be controlled.

2.03 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.04 CONCRETE

Concrete used for thrust, anchor, and support blocks shall be in accordance with Section 03000.

2.05 POLYETHYLENE ENCASEMENT

Polyethylene wrap shall be in accordance with Section 15000 and shall be selected from the Approved Materials List.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install valves with the bolt holes straddling the vertical centerline of pipe and the operating nut in the vertical position unless otherwise noted on the Approved Plans.

B. Valves shall be installed in accordance with the manufacturer's recommendations and the applicable section of these specifications for the piping material and joint type being used.

C. Joints shall be prepared for installation in accordance with Section 15056.

3.02 POLYETHYLENE ENCASEMENT

Install polyethylene wrap for buried valves in accordance with Section 15000.

3.03 CONCRETE

Concrete thrust, anchor, and support blocks shall be installed in accordance with Section 03000 and the Standard Drawings. The concrete shall be placed so that valves and valve operators will be accessible for repairs or replacement. Prior to filling the pipeline with water, refer to Section 03000 for the minimum concrete curing time required.

3.04 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be installed in accordance with Section 15000 and the Standard Drawings.

3.05 DISINFECTION OF VALVES

Disinfection and flushing of valves shall be in accordance with Section 15041, as part of the process of disinfecting the main pipeline. Valves shall be operated during the disinfection period to completely disinfect all internal parts.

3.06 HYDROSTATIC TESTING

Valves shall be hydrostatically tested in conjunction with the pipeline in which they are installed in accordance with Section 15044.

3.07 FIELD PAINTING AND COATING

The exterior of valves installed above ground or exposed in vaults or enclosures shall be field painted in accordance with Section 09910.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15102 BUTTERFLY VALVES (BFVs)

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of manually operated butterfly valves (BFVs).

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

- ASTM G62-22 - Standard Test Methods for Holiday Detection in Pipeline Coatings
- AWWA C210 - Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
- AWWA C504 - Rubber-Seated Butterfly Valves
- AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants
- SSPC - Steel Structures Painting Council

1.03 RELATED WORK SPECIFIED ELSEWHERE

- WAS Standard Drawings
- WAS Standard Specifications 02223, 03000, 09910, 15000, 15041, 15044, 15056, 15061 and 15064

1.04 SERVICE APPLICATION

A. Butterfly valves (BFV) shall be installed on potable and recycled water mains and appurtenances where shown on the Approved Plans and in accordance with the Standard Drawings.

B. Butterfly valves shall be used for open/closed operations and throttling service and frequent operation after long periods of inactivity.

C. In general butterfly valves shall be used when valves are required on pipelines 350mm (14") and larger and where the use of a motor-operated valve is required as shown on the Approved Plans. Butterfly valves smaller than 350mm (14") shall only be used as indicated on the Approved Plans or with the prior approval of the District Engineer.

D. Valves for pipelines sized 300mm (12") and smaller generally require resilient wedge gate valves (RWGVs) in accordance with Section 15100.

1.05 SUBMITTALS

The following items shall be submitted for review and approval by the District Engineer prior to ordering or delivery of butterfly valves.

A. An affidavit from the valve manufacturer showing the following:

1. Actuators used were furnished and installed by the valve manufacturer.

2. Valves have successfully passed hydrostatic testing per AWWA C504 and coatings testing by the valve manufacturer.

B. The valve manufacturer's catalog data showing the size to be used, valve dimensions, pressure rating and materials of construction.

C. Actuator manufacturer's catalog data and detail construction sheets showing the dimensions, materials, number of turns, and required torque input of the actuator to be used.

D. Manufacturer's catalog data and proof of NSF certification on the lining materials to be used.

1.06 SIZING OF VALVES

Valves shall be the same size as the line in which they are installed unless otherwise shown on the Approved Plans.

1.07 VALVE ENDS

Valve ends shall be flanged ductile iron unless otherwise called for on the Approved Plans or as directed by the District Engineer.

Ductile-iron flanges shall generally be in accordance with AWWA C115, rated at a working pressure of 1,724 KPa (250 psi). When Class 250 butterfly valves are shown on the Approved Plans or are otherwise required, ductile-iron flanges shall be compatible with AWWA C207, Class "F".

Maximum working pressure of the flange shall as specified in AWWA or ASME/ANSI. Flanges shall be integrally cast per AWWA C110.

1.08 VALVE TESTING

Butterfly valves shall be hydrostatically tested, and coatings shall be holiday detected prior to shipment to the field per testing procedures shown in Appendix A. Valves delivered to the site prior to successful hydrostatic testing and holiday detection will be subject to rejection.

1.09 DELIVERY, STORAGE AND HANDLING

Valves shall be delivered and stored in accordance with AWWA C504 and AWWA C550. The port openings shall be covered with plastic, cardboard, or wood while in transit and during storage in the field. These covers shall remain in place until the valve is ready to be installed. Valves shall not be stored in contact with bare ground. Valves shall not be stacked.

1.10 RECYCLED WATER IDENTIFICATION

Butterfly valves for recycled water shall be identified with purple-colored coating, identification labels or signs in accordance with Section 15151.

1.11 POLYETHYLENE WRAP

Polyethylene wrap shall be used for buried installation of butterfly valves in accordance with Section 15000.

PART 2 MATERIALS

2.01 BUTTERFLY VALVES (BFV)

A. Butterfly valves and appurtenant components and materials shall be selected from the Approved Materials List.

B. Butterfly valves shall be short body, leak-tight closing, and rubber-seated in accordance with AWWA C504 except as modified herein.

C. Butterfly valve bodies shall be ductile iron as defined within AWWA C504.

D. Except as modified below, BFVs shall be Class 150B in accordance with AWWA C504, rated for a flow velocity of 4.9m/s (16ft/s).

E. Where the static pressure of the pipeline in which the BFV is to be installed exceeds 1.03 Pa (150psi), a Class 250B butterfly valve in general conformance with AWWA C504 shall be required. Class 250B butterfly valves shall be submitted to the Engineer for approval prior to ordering or delivery.

F. Butterfly valves shall open by turning left (counterclockwise). Valve disc shall rotate ninety degrees (90°) from the fully open position to the tight shut position.

G. Butterfly valve interior and exterior surfaces shall be coated as described below.

2.02 MANUAL VALVE ACTUATORS

A. General:

1. All valve actuators shall be watertight, designed for buried or submerged uses. Actuators shall be fully gasketed, sealed, and factory-packed with grease.

2. As directed by the District Engineer, actuators for valves located above ground or in vaults and structures may have hand wheels or chain wheels. Minimum hand wheel diameter shall be 300mm (12"). The actuator shall be equipped with a dial indicator, which shows the position of the valve disc. The District Engineer may require the use of a 50mm (2”) square operating nut in some cases.

3. Actuators for valves shall be provided with a 50mm (2") square operating nut when buried or when indicated on the Approved Plans.

4. Actuators shall have travel stops, which can be adjusted in the field without having to remove the actuator from the valve.

5. Actuators shall be sized for opening and closing the valve at the valve's full rated working pressure and at a flow velocity of 4.9m/s (16 ft/s).

6. Actuators shall accept a minimum of 407Nm (300 foot-pounds) of input torque at the full open and full closed positions without damage to the actuator or the valve.

7. Actuators equipped with 50mm (2”) operator nuts shall require a maximum input torque of 203Nm (150 foot-pounds) to operate the valve. A maximum input torque of 108Nm (80 foot-pounds) shall be required to operate valves with hand wheels.

8. Actuators shall be of the same manufacturer as the valve where possible or as directed by the District Engineer.

9. Actuators shall be installed, adjusted, tested and certified by the valve manufacture prior to shipping.

10. Actuators shall require a maximum of one hundred (100) input turns for the complete ninety-degree (90°) movement of the disc.

11. Actuators shall receive an epoxy coating on the exterior surface as described below.

B. Traveling Nut Actuators:

1. Actuators for butterfly valves sizes 350mm (14") through 600mm (24") may be the manual traveling nut type. Traveling nut actuators shall not be used on valves requiring motor driven actuators or where the District has specified a worm gear type actuator.

2. Actuators shall be capable of producing the below listed output torque at the closed position:

Valve Size in mm (inches)	Output Torque Nm (foot-pounds)
350 (14”)	2779 (2050)
400 (16”)	2779 (2050)
450 (18”)	3729 (2750)
500 (20”)	3729 (2750)
600 (24”)	6372 (4700)

C. Worm Gear Type Actuators:

1. Actuators for butterfly valves 750mm (30") or larger shall be the worm gear type. In addition, worm gear type actuators shall be used on butterfly valves requiring motor driven actuators or where the District has specified a worm gear actuator.

2. Worm gear actuators shall be totally enclosed and self-locking.

2.03 EPOXY LINING AND COATING

Epoxy linings and coatings for valves and actuators shall be provided in accordance with AWWA C210, C213 and C550, with the following modifications:

A. Epoxy lining and coating of valve surfaces shall be performed by the manufacturer in a facility with qualified personnel, where the environment can be controlled. Epoxy lining and coating of valves in the field is prohibited.

B. Repairs made to shop-applied coatings shall be performed in a facility with qualified personnel, where the environment can be controlled. The facility shall be one that is approved by the valve manufacturer.

C. Surface preparation shall be as detailed in SSPC-SP10 Near White Blast Cleaning.

D. Liquid epoxy lining and coating materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, certified for use in contact with potable water.

E. The minimum dry film thickness for epoxy linings shall be 0.15mm (0.006 inches or 6 mils). Liquid epoxy lining shall be applied in two (2) coats in accordance with AWWA C210 and application shall conform to the coating manufacturer's recommendations.

2.04 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be in accordance with Section 15000 and the Approved Materials List.

2.05 CONCRETE

Concrete used for anchor, thrust, or support blocks shall be in accordance with Section 03000.

2.06 POLYETHYLENE WRAP

Polyethylene wrap shall be in accordance with Section 15000 and the Approved Materials List.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install valves with the bolt holes straddling the vertical and horizontal centerlines of pipe, with the operating nut in the vertical position, unless otherwise noted on the Approved Plans.

B. Valves shall be installed per the manufacturer's recommendation in accordance with the applicable specification for the piping material and joint type being used for the valve and the water main.

C. Joints shall be cleaned and installed in accordance with Section 15056.

3.02 FLANGE INSULATING KITS

Flange insulating kits shall be installed only where shown on the Approved Plans in accordance with Section 13110.

3.03 WAX TAPE COATINGS

Wax tape coatings shall be installed only where shown on the Approved Plans or as directed by the District Engineer in accordance with Section 13110.

3.04 POLYETHYLENE WRAP

Installation of polyethylene wrap for buried valves shall be performed in accordance with Section 15000.

3.05 CONCRETE

Concrete thrust, anchor, and support blocks shall be installed as called for in Section 03000 in accordance with the Standard Drawings. The concrete shall be placed so that valves and valve operators will be accessible for repairs or replacement. Prior to filling the pipeline with water, refer to Section 03000 for minimum concrete curing time required.

3.06 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be installed in accordance with Section 15000 and the Standard Drawings.

3.07 3.07 DISINFECTION OF THE VALVES

Disinfection and flushing shall be performed in accordance with Section 15041, as part of the process of disinfecting the main pipeline. The valves shall be operated during the disinfection period to completely disinfect all internal parts.

3.08 HYDROSTATIC TESTING

Valves shall be hydrostatically tested in conjunction with the pipeline in which it is connected in accordance with Section 15044 and Appendix “A”.

3.09 FIELD PAINTING AND COATING

The exterior of valves installed above ground or exposed in vaults or enclosures shall be field painted in accordance with Section 09910.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15108 AIR RELEASE VALVE, AIR AND VACUUM VALVE, COMBINATION AIR VALVE AND MANUAL AIR VALVE ASSEMBLIES

PART 1 GENERAL

1.01 DESCRIPTION

This section includes the materials and installation instructions for above ground air release valves, air and vacuum valves, and combination air valve assemblies and for below ground manual air valves.

The term "air valve" is used generically in this specification to refer to requirements common to all of the specified air release valves, air and vacuum valves, and combination air valves. Otherwise, the various types of air valves are addressed by the individual designations commonly used in AWWA and industry standards.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA C512	-	Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
AWWA C550	-	Protective Interior Coatings for Valves and Hydrants

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 02223, 03000, 09910, 15000, 15041, 15044, 15056, 15057, 15061, 15064, 15100, 16640

1.04 SERVICE APPLICATION

A. Combination air valves are generally installed on all potable and recycled water mains where shown on the Approved Plans and in accordance with the Standard Drawings.

B. Unless otherwise directed by the District Engineer, combination air valves will be required as indicated below:

1. 50mm (2") combination air valve assemblies shall be installed on pipeline sizes 150mm (6") through 350mm (14").

2. 100mm (4") combination air valve assemblies shall be installed on pipeline sizes 400mm (16") and 500mm (20").

3. 150mm (6”) combination air valve assemblies shall be installed on pipeline sizes 600mm (24”) through 900mm (36”).

C. Air release valves, air and vacuum valves, and manual air valves shall be installed in accordance with the Approved Plans or as directed by the District Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

Valves shall be delivered and stored in accordance with AWWA C550. The port openings shall be covered with plastic, cardboard, or wood while in transit and during storage in the field. These covers shall remain in place until the valve is ready to be installed. Valves shall not be stored in contact with bare ground. Valves shall not be stacked.

1.06 RECYCLED WATER IDENTIFICATION

Air valve assemblies and enclosures used for recycled water shall be identified with purple-colored coating, identification labels or signs in accordance with Section 15151.

1.07 TRACER WIRE

Tracer wire shall be installed for air valve assemblies in accordance with Section 15000 and the Standard Drawings.

1.08 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for air valve assemblies in accordance with Section 15000.

PART 2 MATERIALS

2.01 COMBINATION AIR VALVES

A. Combination air valves and appurtenant components and materials suitable for the system pressure shall be selected from the Approved Materials List.

B. Combination air valves shall comply with AWWA C512 except as modified herein.

C. 50mm (2”) combination air valves shall be the single-body type incorporating stainless steel internal components and suction screen. National Pipe Threaded (NPT) inlet and outlet configurations.

D. 100mm (4”) and 150mm (6”) combination air valves shall be the single-body type incorporating stainless steel internal components, protective hood, suction screen and flanged inlet.

E. Internal protective epoxy coatings shall be provided in accordance with AWWA C550.

2.02 AIR RELEASE VALVES AND AIR AND VACUUM VALVES

A. Air release valves and air and vacuum valves shall be provided only as specifically shown on the Approved Plans. Air release valves, air and vacuum valves and appurtenant components and materials suitable for the system pressure, shall be selected from the Approved Materials List.

B. Air release valves and air and vacuum valves shall comply with AWWA C512 except as modified herein.

C. 50mm (2") air release valves and air and vacuum valves shall be the single-body type incorporating stainless steel internal components and suction screen. National Pipe Threaded (NPT) inlet and outlet configurations.

D. 100mm (4") and 150mm (6") air release valves and air and vacuum valves shall be the single-body style. Valves shall incorporate stainless steel internal components, suction screen, protective hood and flanged inlet.

E. Epoxy linings and coatings for valves shall be provided in accordance with AWWA C550.

1. Liquid epoxy lining and coating materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, certified for use in contact with potable water.

2. The minimum dry film thickness for epoxy linings shall be 0.203mm (0.008" or 8 mils). Liquid epoxy lining shall be applied in two (2) coats in accordance with AWWA C210.

2.03 MANUAL AIR VALVES

Manual air valves shall be provided only as specifically shown on the Approved Plans. Materials shall be in accordance with the Standard Drawings and selected from the Approved Materials List.

2.04 ENCLOSURES

Air Valve Enclosures shall be selected from the Approved Materials List.

2.05 CONCRETE

Concrete used for anchor or thrust blocks and equipment pads shall be in accordance with Section 03000.

2.06 BOLTS AND NUTS

A. Combination air valves, air release valves and air and vacuum valves sized 100mm (4") and larger shall be installed with bolts and nuts in accordance with the Standard Drawings and selected from the Approved Materials List.

B. Bolts and nuts shall be zinc-plated A307 carbon steel in accordance with section 15000.

2.07 TRACER WIRE

Tracer wire materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.08 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.09 FIELD PAINTING AND COATING

Field painting and coating materials shall be in accordance with Section 09910 and 09915 and selected from the Approved Materials List.

PART 3 EXECUTION

3.01 INSTALLATION

A. Air valve assemblies shall be provided as shown on the Approved Plans. Additional air valve assemblies may be required in areas of potential air entrapment, at the discretion of the District Engineer.

B. Air valve assemblies shall be installed relative to street improvements in accordance with the Standard Drawings.

C. Connections for the air valve assemblies shall be made within a section of the main line no closer than 600mm (24”) to a bell, coupling, joint or fitting.

3.02 CONCRETE

Concrete thrust or anchor blocks and equipment pads shall be installed in accordance with Section 03000 and the Standard Drawings. Refer to Section 03000 for the minimum concrete curing time required.

3.03 TRACER WIRE

Tracer Wire shall be installed in accordance with Section 15000 and the Standard Drawings.

3.04 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.05 DISINFECTION

Air valve assemblies shall be disinfected in accordance with Section 15041 in conjunction with disinfecting the main to which it is connected. The assembly valves shall be operated and the assembly flushed to completely disinfect all internal parts.

3.06 HYDROSTATIC TESTING

Air valve assemblies shall be hydrostatically tested in accordance with Section 15044 in conjunction with the pipeline to which they are connected.

3.07 FIELD PAINTING AND COATINGS

A. Air valve assemblies shall be color coded, if required, in accordance with Section 09910.

B. Field repairs to the enclosure shall not be permitted. Enclosures requiring repairs to the coating shall be returned to the supplier or coating vendor for repairs or recoating in accordance with Section 09915.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15112 BACKFLOW PREVENTERS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of reduced-pressure backflow prevention devices and check valve and double check valve assemblies.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

- State of California Department of Health Services Division of Drinking Water and Environmental Management, Approved Backflow Prevention Assemblies for Service Isolation
- AWWA C510 - Double Check Valve Backflow-Prevention Assembly
- AWWA C511 - Reduced-Pressure Principle Backflow-Prevention Assembly
- AWWA M14 - Recommended Practice for Backflow Prevention and Cross-Connection Control
- AWWA Publication - Cross-Connection and Backflow Prevention

1.03 RELATED WORK SPECIFIED ELSEWHERE

- Agencies of Jurisdiction Rules and regulations regarding "Cross Connection Control and Backflow Prevention"
- WAS Standard Drawings
- WAS Standard Specifications 02223, 03000, 09910, 15000, 15041, 15044, 15056, 15057, 15061, 15064 and 15100.

1.04 SERVICE APPLICATION

A. Reduced-pressure principle backflow prevention assemblies shall be provided on all commercial and industrial water services. Depending on degree of hazard, a double check valve assembly may be required in place of a reduced-pressure backflow assembly where approved by the District Engineer.

B. Reduced-pressure principle backflow prevention assemblies shall be provided on irrigation services where served by potable water.

C. Reduced-pressure principle backflow prevention assemblies shall be provided on potable water services where recycled water, well water or any other water supply is served to the same property.

D. Reduced-pressure principle backflow assemblies shall be provided at all points of connections to District sources at construction sites.

E. Reduced-pressure principle detector assemblies shall be provided on all fire services. Backflow prevention on fire services shall be as required by the Water District of jurisdiction.

F. The District shall be the final authority as to the location, installation, and type of backflow prevention device required.

1.05 GENERAL DESIGN CONSIDERATIONS

A. The design and construction of backflow prevention assemblies shall meet the requirements called for in this specification except that any modifications specifically shown on the Approved Plans shall take precedence over these general standards.

B. The nominal size of the backflow prevention device shall be equal to or greater than the size of the purchased meter. For example, a 25mm (1") meter shall have a 25mm (1") or larger backflow device.

C. The assembly shall include same size valves located on either side of the backflow prevention assemblies. Four test cocks shall be appropriately located on the assembly for testing and certification.

D. The nominal size of reduced-pressure principle detector assemblies shall be as shown on the Approved Plans or as directed by the Fire Department of jurisdiction.

E. Enclosures and concrete slabs shall be provided only as shown on the Approved Plans or as required by the agency of jurisdiction.

1.06 DELIVERY, STORAGE AND HANDLING

Backflow prevention assemblies shall be delivered and stored in accordance with AWWA C210, AWWA C213, and AWWA C550. The port openings shall be covered with plastic, cardboard, or wood while in transit and during storage in the field. These covers shall remain in place until the backflow assembly is ready to be installed. Backflow assemblies shall not be stored in contact with bare ground. Backflow assemblies shall not be stacked.

1.07 RECYCLED WATER IDENTIFICATION

Backflow prevention assemblies and enclosures, if required, for recycled water shall be identified with purple-colored coating, identification labels, or signs in accordance with Section 15151.

1.08 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for backflow prevention assemblies in accordance with Section 15000.

PART 2 MATERIALS

2.01 BACKFLOW PREVENTION ASSEMBLIES

A. Reduced-pressure principle backflow prevention assemblies and reduced-pressure principle detector assemblies shall be among those listed as “Approved Backflow Prevention Assemblies for Service Containment” as issued by the State of California Department of Health Services, Division of Drinking Water and Environmental Management. Assemblies shall be listed on the Foundation for Cross-Connection Control and Hydraulic Research, a Division of the University of Southern California. Backflow prevention assemblies shall meet the requirements of this specification Section 1.05.

B. Reduced-pressure principle detector assemblies shall include a completely independent bypass assembly consisting of a water meter, displaying cubic feet as the unit of measurement, and a reduced-pressure principle backflow prevention assembly consisting of two isolation valves, two spring-loaded check valves, and a pressure differential discharge.

2.02 CONCRETE

Concrete used for slabs and anchor or thrust blocks shall be in accordance with Section 03000.

2.03 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be in accordance with Section 15000 and the Approved Materials List.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall comply with the latest edition of the Uniform Plumbing Code, applicable local agency, and District requirements.

B. Backflow prevention assemblies shall be installed in accordance with the Standard Drawings.

C. Water service and fire service shut-off valves will be secured closed during installation until an approved backflow prevention device is installed and tested in compliance with this specification.

D. When static pressure exceeds 1.03MPa (150psi), when recommended by the backflow device manufacturer, or when required by the District Engineer, a pressure-reducing valve shall be installed as shown on the Standard Drawings.

3.02 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.03 CONCRETE

Concrete thrust or anchor blocks and slabs shall be installed in accordance with Section 03000 and the Standard Drawings. Refer to Section 03000 for the minimum concrete curing time required.

3.04 ENCLOSURES

Enclosures shall be installed where shown on the Approved Plans or as directed by the Agency of jurisdiction in accordance with the Standard Drawings.

3.05 DISINFECTION

Disinfection and flushing shall be performed in accordance with Section 15041, as part of the process of disinfecting the main pipeline. The backflow assemblies shall be operated during the disinfection period to completely disinfect all internal parts.

3.06 HYDROSTATIC TESTING

Backflow assemblies shall not be hydrostatically tested as part of or in conjunction with the pipeline to which they are connected.

3.07 TESTING

Backflow assemblies shall be tested and certified by a District-approved backflow tester after installation inspection by District is complete.

Required maintenance of the backflow prevention device and appurtenances and annual testing of the device shall be the owner's responsibility.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15121 OPEN TRENCH PIPE CASING

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials for and installation of open trench pipe casings. Jacked casings or specially installed pipe casings shall be installed as detailed in Section 15125.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. References shall be made to the latest edition of said standards unless otherwise called for.

- ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel
- ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
- ASTM A 568/A 568M - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, and Structural Quality Cold Rolled
- AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe

1.03 RELATED WORK SPECIFIED ELSEWHERE

- WAS Standard Drawings
- WAS Standard Specifications 15000, 15056, 15061, and 15064

1.04 SERVICE APPLICATION

Generally, pipe casings are used for protection of utilities (carrier pipes) and may be installed for future utility installations. Pipe casings shall be used for the installation of potable water, reclaimed water, and sewer mains where shown on the Approved Drawings or as required by the District.

1.05 DESIGN REQUIREMENTS

A. Pipe casings shall be provided for carrier piping where shown on the Approved Drawings or as required by the District. The sizes and material type for pipe casing shall be as detailed in Part 2 of this Section.

B. The District Engineer may select a greater steel thickness and diameter as appropriate for the intended application.

1.06 SUBMITTALS

The following items shall be submitted for review and approval by the District Engineer prior to the start of the casing work:

A. Casing pipe.

B. Casing spacers and end seals.

C. Installation procedure.

D. Method of restraint to be used for the casing and carrier pipes.

E. Welding procedure.

F. Cathodic Protection.

1.07 DELIVERY, STORAGE AND HANDLING

A. PVC pipe casing shall be stored in suppliers' yards and on the job site in accordance with AWWA M23 and the manufacturer's recommendations. PVC pipe casing which has been subjected to excessive ultraviolet radiation from the sun shall not be used. The determination as to the acceptability of PVC pipe casing faded by the sun's radiation shall rest solely with the District.

B. Store PVC pipe casing in the field by the supporting the pipe uniformly per AWWA M23. Do not stack pipe higher than 1.22m (4') high or stack the pipe with weight on the bell ends. Cover stored PVC pipe casing to protect it from the sun's ultraviolet radiation. Pipe which has been contaminated with any petroleum products (inside or outside) shall not be installed.

C. Proper care shall be used to prevent damage in handling, moving, and placing the pipe casing. All pipe casing materials shall be lowered into the trench in a manner that prevents damage. The pipe casing shall not be dropped, dragged, or handled in a manner that will cause bruises, cracks, or other damage.

1.08 CASING SPACERS AND END SEALS

Casing spacers and end seals shall be used for all carrier pipe installations within casings.

1.09 TRACER WIRE

Tracer wire shall be installed atop all potable and recycled water carrier pipe in accordance with Section 15000.

1.10 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be installed in accordance with Section 15000.

1.11 RECYCLED WATER IDENTIFICATION

A. PVC pipe casing for recycled water system applications shall be purple. The pipe markings shall include the designation "RECYCLED WATER" in addition to the standard factory labels required by AWWA.

B. Fittings and pipe appurtenances installed with PVC mains for recycled water shall be identified with purple-colored coating, purple polyethylene sleeve, identification labels or signs in accordance with Section 15151.

PART 2 MATERIALS

2.01 PIPE CASING

Pipe casing materials shall be as indicated below and shall be selected from the Approved Materials List. The size of the pipe casings required for the various sizes of carrier pipe is as follows:

Carrier Pipe Size	Minimum Casing Size
150mm (6”)	350mm (14”)
200mm (8”)	400mm (16”)
250mm (10”)	450mm (18”)
300mm (12”)	500mm (20”)
400mm (16”)	750mm (30”)
500mm (20”)	900mm (36”)
600mm (24”)	1,050mm (42”)

Pipe Casing for Carrier Pipe larger than 600mm (24”) shall be as determined by the District Engineer.

A. Polyvinyl Chloride Pipe (PVC) casings shall be as follows:

1. Casing pipe shall be in accordance with AWWA C900, minimum pressure rating of 235 (DR18).

2. The color for PVC casing pipe shall be blue or white for potable water carrier pipe and purple for recycled water carrier pipe.

B. Steel Pipe casings shall be as follows:

1. Steel pipe casings, unless otherwise approved by the District, shall be butt-welded sheets (spiral welding of pipe not allowed) conforming to ASTM A 36/A 36M, ASTM A 283/ A 283M, Grade D, or ASTM A 568/A 568M, Grade 33. Other steel grades may be used upon approval of the District. Steel casings sized 500mm (20”) or smaller shall have a minimum wall thickness of 9.53mm (3/8”). Steel casings sized larger than 500mm (20”) shall have a minimum wall thickness of 12.70mm (1/2”).

2. Steel pipe casings shall not be lined or coated with any material unless otherwise directed by the District Engineer.

   If required, steel pipe casing shall be lined and coated with liquid epoxy paint per AWWA C210. Liquid epoxy shall be applied in three coats to a minimum thickness of 0.305mm (0.012” or 12 mils). The final coat of the liquid epoxy shall be blue for potable water and purple for recycled water steel casing pipe.

3. Steel pipe casings shall include the installation of an anode in accordance with the Standard Drawings, unless otherwise directed by the District Engineer.

2.02 CASING SPACERS

Casing spacers shall be stainless steel, centered-position type with PVC liner and non-metallic anti-friction runners selected from the Approved Materials List.

2.03 CASING END SEALS

Casing end seals, selected from the Approved Materials List, shall wrap around the casing and carrier pipe to provide a barrier to backfill material and seepage. The casing end seal shall be a minimum 6.25mm (¼") thick styrene butadiene rubber sheet attached to the carrier pipe and casing with 25mm (1") wide stainless steel bands. Zippered casing end seals with stainless steel bands may also be used.

2.04 TRACER WIRE

Tracer wire materials shall be in accordance with Section 15000 and the Approved Materials List.

2.05 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and the Approved Materials List.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION, BACKFILL AND COMPACTION

Trenching, bedding, backfilling and compaction operations shall be performed in accordance with Section 02223.

3.02 DEWATERING

The Contractor shall provide, and maintain at all times during construction, ample means and devices to promptly remove and dispose all water from any source entering trench excavations or other parts of the work in accordance with Section 02223. Any damage caused by flooding of the trench shall be the Contractor's responsibility.

Dewatering shall be performed by methods that will maintain a dry excavation, preservation of the final lines and grades and protection of all utilities. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipeline appurtenances or trench materials shall be repaired or replaced as directed by the Engineer.

3.03 PIPE CASING INSTALLATION

Installation of pipe casing and carrier pipe shall be as described below and in accordance with the Standard Drawings.

A. Pipe casing shall be installed in an open trench type excavation.

B. Pipe casings shall be lowered onto the bedding of the proper lines and grades called for on the Approved Plans.

C. Pipe casings shall have firm bearing along their full length.

D. Pipe casing sections shall be bell and spigot joint connection for PVC. PVC casing sections shall be restrained by mechanical means or by the use of splined gaskets. Steel casing sections shall be jointed by full-circumference butt welding in the field. Steel casing shall have all areas of damaged coating repaired.

E. Carrier pipe shall be pushed into the casing incorporating the use of casing spacers as described below.

F. PVC or ductile-iron carrier pipe joints shall be restrained either by mechanical means or by use of splined gaskets.

G. Steel carrier pipe sections shall be lap joint welded per Section 15061.

H. Upstream and downstream elevations of the carrier pipe shall be verified prior to installing the end seals.

I. The portion of carrier pipes installed within casings shall have pressure, leakage, and infiltration testing completed in accordance with Sections 15043 and 15044 prior to installation of the end seals.

J. The annular space between the carrier pipe and casing shall not be filled with any material unless otherwise noted on the Approved Plans.

3.04 CASING SPACERS

Casing spacers shall be used to prevent the carrier pipe bell from touching the casing and to maintain a uniform space between the carrier pipe and casing interior. A minimum of three casing spacers shall be installed, equally spaced, on each pipe section at intervals recommended by the manufacturer.

3.05 CASING END SEALS

Casing end seals shall be installed in accordance with the manufacturer's recommendations.

Carrier pipe shall pass hydrostatic or leakage tests in accordance with Sections 15044 or Section 15043 prior to the installation of casing end seals or backfilling operations.

3.06 TRACER WIRE

Tracer wire shall be installed on the carrier pipe in accordance with Section 15000 and the Standard Drawings.

3.07 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed above the casing pipe in accordance with Section 15000 and the Standard Drawings.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15125 JACKED PIPE CASING

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of jacked pipe casings. Where the contractor proposes to install pipelines using directional drilling or boring, a complete submittal of the methods and materials shall be made to the District prior to the initiation of the work.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. References shall be made to the latest edition of said standards unless otherwise called for.

ASTM A 36/A 36M	-	Standard Specification for Carbon Structural Steel
ASTM A 283/A 283M	-	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 568/A 568M	-	Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, and Structural Quality Cold Rolled

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 15000, 15056, 15061, 15064, and 15065

1.04 SERVICE APPLICATION

Generally, pipe casings are used for protection of utilities (carrier pipes) and may be installed for future utility installations. Pipe casings shall be used in conjunction with the installation of potable water, recycled water, and sewer mains in areas shown on the Approved Plans or as directed by the District Engineer.

1.05 PROTECTION OF EXISTING UTILITES AND FACILITIES

The contractor shall be responsible for the care and protection of all existing utilities, facilities, and structures that may be encountered in or near the area of the work per Section 01000.

1.06 SAFETY AND PERMITTING REQUIREMENTS

A. Pipe jacking and boring projects 750mm (30") in diameter or larger are required to be classified by the State of California, Department of Industrial Relations, Division of Occupational Safety and Health.

B. Protection of workers in trench excavation shall be as required by the State of California Construction Safety Orders, the State of California State Health and Safety Code, the requirements of CAL-OSHA and in accordance with Section 01000.

C. All excavations shall be performed, protected, and supported as required for safety and in the manner set forth in the operation regulations prescribed by CAL-OSHA.

D. It shall be the Contractor's responsibility to obtain excavation permits, traffic control permits, or other applicable permits from the local agency which has jurisdiction

E. A pre-job safety conference with representatives of the Division of Occupational Safety, CAL-OSHA, the District, the Contractor and Contractor's employees shall be held before the work begins.

F. Contractors performing this type of work are required to hold a current C-34 or General Engineering Contracting License from the State of California.

1.07 DESIGN REQUIREMENTS

A. Pipe casing shall be provided for the carrier piping where shown on the Approved Plans or as required by the District Engineer. The sizes and material type for pipe casing shall be as detailed in Part 2 of this Section.

B. The District Engineer may select a greater steel thickness and diameter as appropriate for the intended application.

1.08 SUBMITTALS

The contractor shall provide to the District and the agency, or agencies, of jurisdiction a drilling, boring, and jacking plan prior to commencing boring operations. The submittal shall include:

A. Configuration of the jacking pits and jacking pit bracing or shoring. Pit excavations deeper than 6.1m (20') require the shoring system to certified by a Registered Civil Engineer.

B. The pipe casing material to be used. Include pipe material type, wall thickness, and welding details.

C. Casing spacers and end seals.

D. Jacking plan and profile drawing detailing the placement of the jacked casing.

E. Installation procedure.

F. Manufacturer and type of liquid epoxy paint, including proposed steel preparation and application methods to be used.

G. The jacking machinery and jacking head proposed to be used.

H. Summary of the backfilling method to be used.

I. Worker Protection and Safety Plan.

J. Cathodic Protection.

1.09 DELIVERY AND HANDLING

Proper care shall be used to prevent damage in handling, moving and placing the pipe casing. All pipe-casing materials shall be lowered into the trench in a manner that prevents damage. The pipe casing shall not be dropped, dragged or handled in a manner that will cause dents, cracks, or other damage to the pipe casing.

1.10 CASING SPACERS AND END SEALS

Casing spacers and end seals shall be used for all pipe installations within casings.

If the carrier pipe is not installed within the casing, as a continuous operation, following completion of jacking, then bulkhead the portals and backfill the approach trenches. Bulkheads will be removed at a later time to allow for the installation of the carrier pipe.

1.11 TRACER WIRE

Tracer wire shall be installed atop all potable and recycled water carrier pipe in accordance with Section 15000.

1.12 RECYCLED WATER IDENTIFICATION

Fittings and pipe appurtenances installed for recycled water shall be identified with purple color coating, purple polyethylene sleeve, identification labels or signs in accordance with Section 15151.

PART 2 MATERIALS

2.01 PIPE CASINGS

Jacked pipe casings shall be steel.

A. The minimum size and wall thickness of jacked steel pipe casings shall be as follows, unless otherwise required by the agency having jurisdiction over the road, utilities, or improvements.

Carrier Pipe Size	Minimum Casing Size	Min. Steel Casing Wall Thickness
150mm (6”)	350mm (14”)	9.53mm (3/8”)
200mm (8”)	400mm (16”)	9.53mm (3/8”)
250mm (10”)	450mm (18”)	9.53mm (3/8”)
300mm (12”)	500mm(20”)	9.53mm (3/8”)
400mm (16”)	750mm (30”)	12.7mm (1/2”)
500mm (20”)	900mm (36”)	12.7mm (1/2”)
600mm (24”)	1,050mm (42”)	12.7mm (1/2”)

B. Pipe casing for carrier pipe sizes larger than 600mm (24”) shall be determined by the District Engineer.

C. The Contractor may submit a greater steel thickness and diameter as appropriate for the method of work and loadings involved, as suitable for the site and as limited by possible interferences. The Contractor shall submit any deviations in the approved design to the District fourteen (14) working days in advance of jacking operations, and may not proceed with any work until the District Engineer has approved the alternate methods proposed.

D. It is the Contractor's responsibility to choose a size of casing at or above the minimum specified, and to insure that the jacking is done with a high degree of accuracy to permit installation of the carrier pipe to the lines and grades shown on the approved plans.

E. Steel pipe casings, unless otherwise approved by the District, shall be butt-welded sheets (spiral welding of pipe not allowed) conforming to ASTM A 36/A 36M, ASTM A 283/ A 283M, Grade D, or ASTM A 570/A 570M, Grade 33. Other steel grades may be used upon approval of the District Engineer.

F. Steel pipe casings shall include the installation of an anode in accordance with the Standard Drawings, unless otherwise directed by the District Engineer.

2.02 CASING SPACERS

Casing spacers shall be stainless steel, centered-position type with PVC liner and non-metallic anti-friction runners in accordance with the Approved Materials List.

2.03 CASING END SEALS

Casing end seals, in accordance with the Approved Materials List, shall wrap around the casing and carrier pipe to provide a barrier to backfill material and seepage. The casing end seal shall be a minimum 6.25mm (¼") thick styrene butadiene rubber sheet attached to the carrier pipe and casing with 25mm (1") wide stainless steel bands. Zippered casing end seals with stainless steel bands may also be used.

2.04 TRACER WIRE (CARRIER PIPE)

Tracer wire materials shall be in accordance with Section and the Approved Materials List.

2.05 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and the Approved Materials List.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION, BACKFILL AND COMPACTION

Trenching, bedding, backfilling and compaction operations shall be performed in accordance with Section 02223.

3.02 JACKING PIT

A. 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.

B. Placement of equipment in the approach trench of the jacking pit shall be firmly bedded on the required line and grade using heavy timbers, structural steel, or concrete cradles of sufficient length to provide accurate control of jacking alignment. Provide 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. After jacking equipment and debris 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 materials below pipe grade to undisturbed earth and re-compact the material in accordance with Section 02223.

3.03 PIPE CASING INSTALLATION

Installation of pipe casings shall be as described below and in accordance with the Standard Drawings. Only workers experienced in jacking operations shall be used in performing the work of jacking and boring.

A. The Contractor's attention is called to the fact that extreme care is required in placing the casing so as to permit the installation of the carrier pipe to the lines and grades shown on the Approved Plans.

B. Gravity flow pipelines are designed at grades that do not permit variance from the lines and grade as shown on the Approved Plans.

C. 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 450mm (18") beyond the driving end of the casing. It shall not protrude more than 13mm (½") beyond the outer casing surface.

D. The leading section of casing shall be equipped with a jacking head securely anchored thereto to prevent any wobble or variation in alignment during the jacking operation.

E. 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 materials shall be removed from the casing as jacking progresses and no accumulation of excavated material within the casing will be permitted.

F. A jacking band to reinforce the end of the pipe receiving the jacking thrust will be required.

G. 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. Do not encroach upon the minimum annular space detailed. Restrict the excavation of material to the least clearance to prevent binding in order to avoid settlement or possible damage to overlying structures or utilities.

H. Steel casing sections shall be full-circumference butt-welded in the field. It shall be the Contractors responsibility to provide stress transfer across the joints capable of resisting the jacking forces involved.

3.04 CARRIER PIPE INSTALLATION

A. Carrier pipe shall be pushed into the casing incorporating the use of casing spacers as described below.

B. PVC or ductile-iron carrier pipe joints shall be restrained either by mechanical means or by use of splined gaskets.

C. Steel carrier pipe sections shall be lap joint welded in accordance with Section 15061.

D. Upstream and downstream elevations of the carrier pipe shall be verified prior to installing the end seals.

E. The portion of carrier pipe installed within a casing shall have pressure, leakage, and infiltration testing completed in accordance with Section 15043 and 15044 prior to installation of the end seals.

F. The annular space between the carrier pipe and casing shall not be filled with any material unless otherwise noted on the Approved Plans.

3.05 CASING SPACERS

Casing spacers shall be used to prevent the carrier pipe bell from touching the casing and to maintain a uniform space between the carrier pipe and casing interior. Casing spacers shall be installed on the carrier pipe at intervals per the manufacturer's recommendations with a minimum of three spacers per pipe section equally spaced.

3.06 CASING END SEALS

Casing end seals shall be installed in accordance with the manufacturer's recommendations.

Carrier pipe shall pass hydrostatic or leakage tests in accordance with Sections 15044 or 15043 prior to the installation of casing end seals or backfilling operations.

3.07 TRACER WIRE

Tracer wire shall be installed on the carrier pipe as required in Section 15000 in accordance with the Standard Drawings.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15151 RECYCLED WATER FACILITIES (OFFSITE)

PART 1 GENERAL

1.01 DESCRIPTION

This section includes special provisions, materials, and identification of offsite recycled water systems.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA Guidelines for Distribution of Nonpotable Water
California Code of Regulations (CCR), Title 22 and Title 17
County of San Diego, Department of Environmental Health Recycled Water Plan Check and Inspection Manual

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 02202, 02223, 03000, 09910, 15000, 15041, 15044, 15056, 15057, 15061, 15064, 15074, 15100, 15102, 15108, and 15112.

1.04 APPROVED USE

All potential applications of recycled water shall be reviewed and approved by the District prior to installation of facilities. The facilities shall be constructed in accordance with the procedures and requirements of the District. No connections to recycled water main(s) shall be installed unless shown on the Approved Plans or permission has otherwise been granted in writing by the District.

1.05 OFFSITE AND ONSITE CRITERIA

Recycled water facilities are separated into two categories:

A. "Offsite" (pre-meter, public) recycled water facilities consist of those facilities which are on the upstream side of the meter. These facilities are, or will be, owned, operated and maintained by the District. This Specification Section will detail the requirements for construction of Offsite Recycled Water Facilities.

B. "Onsite" (post-meter, private) recycled water facilities consist of those facilities which are on the downstream side of the water meter. These are facilities which will be owned,

operated and maintained by the customer. Refer to Section 15152 for the detailed requirements of onsite irrigation and plumbing systems.

1.06 DESIGN CRITERIA

A. A licensed Civil Engineer registered in the State of California shall be responsible for the design of offsite recycled water facilities, including the preparation of plans and specifications.

B. Plans for offsite potable and recycled water systems in the same street or easement shall show both potable and recycled water mains on the same sheets of plans.

C. The minimum depth of cover for recycled water mains shall be in accordance with Section 02223 or as shown on the Approved Plans. In general, where both recycled and potable water mains are to be installed in the same street or easement, the top of pipe of the recycled water main shall be 300mm (12”) below the top of the potable water main.

D. A horizontal separation of 3.05m (10'), and a vertical separation of 300mm (12") shall be maintained between recycled water lines and potable water lines, and between recycled lines and sanitary sewers. Recycled water lines shall be designed to cross under potable water mains and above sanitary sewers.

E. In the event that it is not possible to maintain the required separation and relative positions between recycled water lines, potable water lines, and sanitary sewers, special construction shall be required in accordance with the Standard Drawings and as directed by the District Engineer.

F. The minimum size distribution main shall be 100mm (4”). The District shall be the final authority concerning the size and pressure rating of the distribution main.

G. Offsite recycled water mains shall typically be located on the opposite side of the street or easement from the potable water main.

H. Offsite recycled water mains shall be designed with service laterals perpendicular to the main. Service laterals shall be a minimum of 25mm (1”) in size. Larger sized laterals may be required. A service lateral shall be designed for each lot or area to be served with recycled water. A service lateral shall not be designed to serve opposite sides of a street or easement and shall not be located in street medians or center islands..

I. Offsite recycled water systems shall not be designed with fire hydrants, wharf heads, or other appurtenances which would allow recycled water to be used for other than the approved uses unless the appurtenances are expressly approved by the District.

J. Offsite recycled water mains shall not be designed with temporary connections unless expressly approved by the District. When permitted, temporary connections shall be located, sized, and designed according to the requirements of the District.

1.07 PROVISIONS FOR FUTURE USE OF RECYCLED WATER

In those areas where the District has determined that recycled water will be supplied to the subject area in the future but is not currently available, recycled facilities shall be installed as detailed in this Section. Provisions for future connection to the permanent recycled water system shall be included in the initial installation of the system as directed by the District. In the interim, the new recycled system will be supplied with potable water via a temporary connection performed by the

Contractor as directed by the District. This temporary service connection shall be provided in accordance with the Standard Drawings and shall incorporate a master backflow prevention device located and installed in accordance with Section 15112. Connections between offsite recycled water mains and potable water mains shall only be permitted when the recycled water main is to temporarily convey potable water. No connection of any other kind shall be permitted between the potable water and recycled water mains. In the future, the Owner shall be responsible to remove the temporary service and transfer the main to a permanent connection to the recycled system when it becomes available.

PART 2 MATERIALS

2.01 OFFSITE RECYCLED WATER FACILITIES

A. Materials for offsite recycled water systems shall generally consist of those specified for potable water systems as detailed within these Standard Specifications, the Standard Drawings, the Approved Materials List, and as modified herein.

B. Recycled water mains sized 150mm (6") and larger shall be PVC in accordance with Section 15064. PVC pipe for recycled water system applications and related gate well casings shall be manufactured in the purple color. Pipe markings shall include the designation "RECYCLED WATER" in addition to the standard factory labeling required by AWWA.

C. Devices and appurtenances such as air valve assemblies, backflow preventers, blowoff assemblies, butterfly valves, gate valves, services and other items shall be provided in accordance with the various applicable Sections of these Standard Specifications, the Standard Drawings and the Approved Materials List. Color coding and other identification shall be provided as indicated below.

D. Miscellaneous materials such as gate wells, meter boxes, warning tape, tracer wire, copper tubing, ductile iron fittings, brass and bronze fittings and devices, and all related items shall be provided in accordance with the various applicable Sections of these Standard Specifications, the Standard Drawings and the Approved Materials List. Color coding and other identification shall be provided as indicated below.

E. Warning/Identification Tape shall be as specified in Section 15000 in accordance with the Approved Materials List.

F. Paint products for protection and identification shall be provided as specified below and in accordance with Sections 09910, 09915 and the Approved Materials List.

G. Warning signs and labels shall be post mounted aluminum or vinyl, self adhesive with peel off paper backing, bearing the warning "RECYCLED WATER - DO NOT DRINK" or the equivalent, in English and Spanish, along with the international "Do Not Drink" symbol. Warning labels and signs shall have a purple background with contrasting lettering and markings.

H. Utility identification tape shall be 0.102mm (0.004” or 4 mils) PVC, pressure-sensitive adhesive-backed tape in rolls of various widths. The tape shall be colored-coded purple and shall bear the designation "RECYCLED WATER" or the equivalent, in contrasting permanent lettering at approximately 300mm (12") intervals. Identification tape will generally be used in the 50mm (2") width to identify buried materials and components as detailed below.

PART 3 EXECUTION

3.01 OFFSITE RECYCLED WATER FACILITIES

In general, offsite recycled water facilities shall be installed in accordance with the requirements for potable water materials and facilities within these Specifications, the Standard Drawings and the Approved Plans.

3.02 FIELD IDENTIFICATION - PIPING AND APPURTENANCES

Recycled water mains and appurtenances shall be identified with purple-colored coding and identification labels and signs as specified herein.

A. PVC pipe and related gate well casings shall be colored purple as manufactured. If purple-colored PVC pipe in the specified size or class is not readily available from suppliers, standard colored PVC pipe may be used and sleeved with a 0.203mm (0.008" or 8 mils) purple-colored, high-density polyethylene encasement sleeve which totally encloses the pipe.

B. Buried items that are not available from the manufacturer in the purple color shall be identified in the field by means of utility identification tape applied to the surface of the items. Valves, ductile iron fittings and similar items shall receive a band of the tape applied circumferentially at the ends of the fittings adjacent to connections to the adjoining piping sections, and to the operator portions of gate and butterfly valves. The identification tape shall also be used to secure the polyethylene wrap specified for the various piping materials and appurtenances. Copper tubing and appurtenant bronze fittings shall be identified by means of utility identification tape applied continuously along the upper surface of the entire length of the line.

C. Meter and blowoff boxes shall be colored purple as manufactured.

D. Accessible items that are not available from the manufacturer in the purple color, such as those located at grade, above ground and within meter boxes and vaults shall be identified in the field by means of a paint coating in the purple color. Meters, blowoff piping and blowoff box covers or blowoff manhole covers, valve box lids, air valves and enclosures, piping, valves, backflow devices and all other items either accessible or exposed to view, shall be identified by means of the purple coating or integral purple color. The coating system shall be suitable for the substrate material and the degree of protection required for the various items, in accordance with Section 09910 and the Approved Materials List.

E. Tracer wire shall be installed in accordance with Section 15000 and the Standard Drawings.

F. Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.03 LABELS AND SIGNAGE

Labels shall be installed on recycled facilities exposed to view including above ground piping and appurtenances, meter and blowoff box covers, and where indicated on the Standard Drawings and the Approved Plans. Signs shall be installed where necessary and as indicated on the Approved Plans.

3.04 DISINFECTION AND BACTERIOLOGICAL TESTING

In the event the recycled water mains are installed with provisions for future use for transporting recycled water, but, will initially transport potable water, (see item above), disinfection, flushing and bacteriological testing shall be performed in accordance with Section 15041.

3.05 HYDROSTATIC TESTING

Potable water shall be used for filling, flushing, and hydrostatic testing. Field hydrostatic testing shall be performed in accordance with Section 15044.

3.06 BACKFLOW PREVENTION

During the course of flushing and disinfection and hydrostatic testing of the recycled water mains, an appropriate backflow prevention device shall be installed on the potable source piping to isolate the potable from the non-potable system in accordance with Section 15044 and 15112.

END OF SECTION

WATER AGENCIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15152 RECYCLED WATER FACILITIES (ONSITE)

PART 1 GENERAL

1.01 DESCRIPTION

This section includes special provisions, materials, and identification of onsite (post meter, private) recycled water irrigation or plumbing systems. The purpose of this section is to provide Rules and Regulations and establish procedures and specifications for the development and operation of recycled water systems in the District's service area.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

- AWWA - American Waterworks Association Guidelines for Distribution of Non-potable Water
- CCR - California Code of Regulations Title 22 and Title 17.
- DOHS - Department of Health Services
- Recycled Water Plan Check and Inspection Manual, County of San Diego, Department of Environmental Health

1.03 RELATED WORK SPECIFIED ELSEWHERE

- WAS Standard Drawings
- WAS Standard Specification 01000

1.04 OFFSITE AND ONSITE CRITERIA

Recycled water facilities are separated into two categories:

A. "Offsite" (pre-meter, public) recycled water facilities consist of those facilities which are on the upstream side of the meter. These facilities are, or will be, owned, operated and maintained by the District. Specification Section 15151 details the requirements for construction of Offsite Recycled Water Facilities.

B. "Onsite" (post-meter, private) recycled water facilities consist of those facilities which are on the downstream side of the water meter. These are facilities which will be owned, operated and maintained by the customer. This specification will detail the requirements for the design, installation and testing of onsite recycled irrigation and plumbing systems.

1.05 POLICY

The District operates and maintains a recycled water distribution system within its service area enabling it to provide disinfected tertiary treated recycled water for a variety of beneficial uses.

Recycled Water usage as an alternate will conserve an equal amount of potable water for domestic use.

The beneficial use of recycled water is regulated by the California State Water Resources Control Board (CWRCB). California Water Code Section 13551 establishes a State policy to encourage the use of recycled water. Permission to use recycled water is based on the ability to adequately treat wastewater to the point that the recycled water (effluent) meets or exceeds the requirements of existing Title 22, Chapter 3, regulations of the California Code of Regulations. Title 22 was promulgated by the State of California Department of Health Services (DOHS) to ensure proper health protection and specify the treatment degree to match the intended applications.

In accordance with waste discharge requirements for water reclamation projects, the Regional Water Quality Control Board, San Diego Region, (RWQCB) requires that Rules and Regulations for facilities using recycled water be established.

1.06 APPROVED USE

These Rules and Regulations pertain to recycled water service to lands and/or improvements lying within the legal boundaries of the District unless otherwise stated. It is the intent of the District to provide recycled water service in accordance with these Rules and Regulations to all areas identified in the District's Water Reclamation Master Plan, including all subsequent revisions for the use of recycled water. Recycled water service shall be provided to the service area when related transmission distribution facilities are completed and service becomes available.

In accordance with the goals of the District, the uses of recycled water include only those uses approved by the State of California Department of Health Services (DOHS), the County of San Diego Department of Environmental Health (DEH) and for which Title 22 of the California Code of Regulations provides treatment requirements. All potential applications of recycled water shall be reviewed and approved by the District prior to installation of facilities. Prior to approval and at its discretion, the District may set forth specific requirements as conditions for providing service and/or require specific prior approval from the appropriate regulatory agencies.

The facilities shall be constructed in accordance with the procedures and requirements of the District. No recycled water mains or connections to the recycled water mains shall be installed unless shown on the Approved Plans.

1.07 CONDITIONS OF SERVICE

Recycled water service shall be provided by the District only if such service is obtained in the manner provided in these Rules and Regulations. Recycled water service shall be available, provided, and used in accordance with other codes, rules, and regulations referenced in this specification.

If any of the following conditions of service are not satisfied at all times recycled water service may be revoked by the District.

A. Financial: Conditions relating to service rates, fees and billing shall be established by the Board of Directors.

B. Operational:

1. Liability: The District shall not be liable for any water-related damage resulting from, but not limited to:

a. defective plumbing

b. broken or faulty services

c. onsite facilities failures

d. high or low pressure conditions

e. interruptions of service

f. unauthorized connections

2. Service: All recycled water will be provided to the user as specified in the Application/Permit For Recycled Water Service. Recycled water use will be subject to the same restrictions as stated in these specifications and the regulatory requirements of DOHS and DEH.

C. Regulatory: Recycled water service may be suspended whenever the quality of the recycled water does not comply with the requirements of the regulatory agencies or at any time these Rules and Regulations For Recycled Water Service are violated.

1.08 DESIGN CRITERIA - ONSITE RECYCLED SYSTEMS

A. The design of onsite recycled water facilities, including the preparation of plans and specifications, shall be under the responsibility of a licensed Landscape Architect or Civil Engineer registered with the State of California. A Declaration of Responsible Charge shall appear on the title sheet of the plans.

B. The design of onsite recycled facilities shall conform to the most current provisions set forth herein and to any other conditions, standards, and requirements set forth by the District.

C. In those areas where recycled water is not immediately available, and the District has determined that recycled water will be supplied in the future, the onsite facilities shall be designed to use recycled water. Provisions shall be made, as directed by the District, to allow for connection to the recycled distribution main when it becomes available. In the interim, potable water shall be supplied through a temporary potable water connection using a master reduced pressure principal backflow device installed per these Standard Specifications. When recycled water becomes available, the Owner shall remove the backflow prevention device in the presence of, and as directed by, the District Engineer. The onsite system will be connected to the recycled water distribution main per the requirements of the Standard Specifications at the time the connection is made.

D. Onsite recycled water systems shall be designed to include backflow prevention per the requirements of the Standard Specifications. In some cases, more stringent backflow protection may be required.

E. The recycled water system shall be separate and independent of any potable water system. Cross connections between potable water facilities and recycled water facilities are prohibited.

F. Hose bibs on recycled water facilities are prohibited.

G. Fire hydrants, wharf heads, or other appurtenances shall only be included in the design when these appurtenances are expressly approved by the District and DOHS.

H. Drinking fountains shall be protected from the spray of recycled water. There shall be no direct contact of recycled water with a drinking fountain. Protection of drinking fountains can be accomplished either by maintaining a horizontal separation of at least 9m (30') between the drinking fountain and the nearest spray type emitter, spray head modification,

or by the use of a covered fountain. The manner used to protect drinking fountains from the spray of recycled water shall be approved by the District and DOHS.

I. Potable and recycled lines shall not to be installed in the same trench. Recycled lines shall be designed to be installed below the potable lines where the two pipelines run parallel to each other. Where this is not possible, the recycled line shall be installed in a casing/sleeve. Details of this installation shall be clearly drawn on the plans.

J. Recycled mainlines and lateral lines crossing under hardscape shall be installed in a casing/sleeve at a size of two times the diameter of the pipe being installed. There shall be one pipe per casing/sleeve. Hardscape may be any sidewalk, street, driveway, or pathway.

K. Onsite recycled water irrigation systems shall be designed to meet the peak moisture demand of the plant material to be irrigated. The use of moisture sensors is encouraged, but not mandatory.

L. Onsite recycled water irrigation systems shall be designed to apply irrigation water in a manner compatible with the infiltration rates of the soil types within the approved use area. Evidence that infiltration rates have been assessed shall be included with the design. Where varying soil types are present, the system design shall be compatible with the lowest infiltration rate present.

M. Onsite recycled water systems shall be designed to prevent discharge onto areas not under control of the Owner. Appropriate sprinklers, bubblers, emitters, rotors, etc., shall be employed in the design to confine the discharge to the approved use area. The design shall avoid spray patterns which discharge onto obstructions that tend to concentrate water which results in ponding and/or runoff.

N. Onsite recycled irrigation systems shall be designed to provide a physical separation between adjacent areas irrigated with potable water. The means of separation shall be provided by either a distance of 3m (10’), concrete mow strips, approved fence or other approved means. Where concrete mow strips or other means are used, they shall be shown on the plans.

O. Onsite recycled water systems shall be designed to operate during periods of minimal public use of the area. The total time required to irrigate the design area shall not exceed nine (9) hours in any twenty-four (24) hour period. The system shall be designed to operate between the hours of 9 PM and 6 AM.

P. Onsite recycled water system designs shall include automatic system control devices which can be easily adjusted to minimize ponding and runoff.

Q. Onsite recycled water system design plans shall contain the following information for each meter requested:

1. Meter location and size

2. Gross and net irrigation area served by each meter (sq ft or acres)

3. Peak flow through the meter in liters/minute (gpm)

4. Estimate of the yearly demand (acre-feet)

5. Design operating pressure at the meter in Kpa (psi)

R. Onsite recycled water system design plans shall contain a legend showing the pertinent data for the materials to be used in the system construction. Included shall be a pipe schedule (listing pipe sizes and materials of construction), valve types (including quick-coupling type valves), and the following information for each type of sprinkler device:

1. Manufacturer and model number
2. Sprinkler radius in meters (feet)
3. Operating pressure in Kpa (psi)
4. Flow in liters/minute (gpm)
5. Sprinkler pattern

S. Onsite recycled water design plans shall contain the following detailed information:

1. Points of connection
2. Routing of all pipes
3. Gate valves
4. Control valves
5. Quick-coupling valves
6. Routing of control wires
7. Control stations
8. The area controlled by each control station
9. Signage plan and sign detail
10. Cross connection test station locations and detail
11. Location of mow strips, fences, walls, or other barriers
12. Adjacent parcels, lots or home sites irrigated with potable water

T. Onsite recycled water design plans shall clearly detail backflow prevention devices, all potable water lines, buildings, walls, exterior drinking, and decorative fountains, swimming pools, playgrounds, or any other permanent facilities in the design area. If none of the items listed in this paragraph are present in the design area, it shall be specifically stated on the plans that none exist.

U. Onsite recycled water design plans shall clearly indicate the following minimum top of pipe depth requirements:

1. Intermittent pressure lines 50mm (2”) in diameter and smaller: 300mm (12”) deep.
2. Constant pressure lines less than 150mm (6”) in diameter: 450mm (18”) deep.
3. Constant pressure lines 150mm (6”) in diameter and larger: 750mm (30”) deep.

V. The District's Recycled Water Use Notes are to be included on all onsite recycled water system design plans. These notes, as appended, may be expanded or otherwise modified as directed by the District.

W. The name(s) and 24-hour contact telephone number for the party responsible for operation and maintenance of the system shall appear on the cover sheet of the design plans.

X. An Inspection Note shall be shown on each page of the design plans. The note shall be as follows: The District Inspection Division shall be notified 48 hours (2 working days) prior to the start of construction. All work performed without benefit of inspection shall be subject to rejection and removal.

1.09 WARNING/IDENTIFICATION TAPE

All irrigation pipe, both potable and recycled, shall include the installation of Warning/Identification Tape.

PART 2 MATERIALS

2.01 ONSITE RECYCLED WATER FACILITIES

A. Pipe shall be solid purple-colored PVC material conforming to the following:

1. 75mm (3") or smaller pipe shall conform to ASTM-D1784, Type 1, Grade 1, PVC-1120 for schedule 40 or 80, or ASTM-D2241, Type 1, Grade 1, PVC-1120 for SDR rated pipe. Ends shall be solvent welded joints conforming to ASTM-D2672.

2. 100mm (4") and larger pipe shall conform to AWWA C900 with elastomeric ring bell-type pipe ends, conforming to ASTM-D3139. Where purple pipe is unavailable, 0.203mm (0.008" or 8 mils) purple plastic sleeve material may be used in accordance with Section 15151.

3. Identification markings shall be continuous on two sides of the pipe. Markings shall include the nominal pipe size, PVC type, ASTM or AWWA designation, pressure rating and the words "CAUTION-RECYCLED WATER".

B. Fittings for PVC pipe shall conform to the following:

1. 75mm (3") and smaller pipe shall use solvent weld joint type fittings, minimum Schedule 40, with a working pressure rating no lower than that of the pipe. Schedule 40 fittings shall conform to ASTM-D2466 and Schedule 80 fittings to ASTM-D2464 and D-2467. PVC solvent cement shall conform to ASTM-D2564.

2. 100mm (4") and larger pipe shall use either mechanical joint ductile-iron Class 350 fittings conforming to AWWA C153; or grip tite fittings conforming to AWWA C110 and C111.

C. Warning tape shall be an inert plastic film formulated for prolonged underground conditions. The minimum thickness shall be 0.102mm (0.004" or 4 mils) and the overall width shall be a minimum of 75mm (3"). The tape shall have purple printing on a silver background or black printing on a purple background with the words "CAUTION: RECYCLED WATERLINE BELOW".

D. Quick-coupling valves shall be acme thread type for operation with a special coupler key. They shall be constructed of brass with a solid purple-colored locking rubber or vinyl cover. The locking cover shall have the warning "NON-POTABLE-DO NOT DRINK" in English and Spanish, and the International "DO NOT DRINK" symbol. The warnings shall be permanently molded into the cover.

E. Sprinklers, rotor heads and other types of dispersion heads shall have the exposed surface colored purple. The exposed surface shall be colored through the use of integrally molded purple plastic or permanently attached purple plastic ring or disc.

F. Valve boxes shall be per industry standards with solid purple-colored lids as a minimum. The entire box may be molded from purple-colored PVC. The lids shall have the warning "NON-POTABLE- DO NOT DRINK" in English and Spanish and the International "DO NOT Drink" symbol. The warnings shall be permanently molded into the lid.

G. Valves shall have their exterior surface painted purple and be tagged with identification tags. The purple paint shall be as listed on the Approved Materials List. Identification tags shall be 75mm x 100mm (3” x 4”) weatherproof purple plastic. The plastic tags shall be imprinted in black permanent markings with the words “Caution: Recycled Water- Do Not Drink” on one side and “Peligro: Agua Impura- No Beber” on the opposite side.

H. Warning labels and signs shall be required and installed per the approved signage plans. Labels and signs shall be submitted to the District Engineer for approval prior to installation. The labels and signs shall notify that the system contains recycled water that is unsafe to drink. They shall be in English and Spanish with the international “Do Not Drink” symbol. As a minimum, signs shall be installed at impoundments, ingress and egress points, and on the exterior front panel of irrigation controllers.

I. Strainers shall be the same nominal size as the service meter and shall have a ball valve on the strainer leg for flushing. 50mm (2”) and smaller wye pattern strainers shall be bronze body, in-line type with stainless steel screens. Strainers shall have a 13mm (1/2”) bronze ball valve installed on the strainer’s wye leg. 75mm (3”) and larger wye pattern strainers shall be cast-or ductile-iron and have the size ball valve recommended by the manufacturer installed on the strainer’s wye leg

J. Check valves shall be in-line, spring-loaded, bronze-body construction. Check valves shall be globe, wafer, or dual check type valves with stainless steel springs. Check valves shall be the same size as the service meter.

K. A more stringent method of backflow prevention may be required when a fertilizer or pesticide injection system is shown on the Approved Plans.

2.02 ONSITE POTABLE WATER FACILITIES

A. Pipe shall be white-or blue-colored PVC material conforming to this specification.

B. Quick-coupling valves shall not be acme thread type. They shall have a cover made of brass, yellow rubber or vinyl.

C. Onsite systems distributing potable water shall not have purple markings.

2.03 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape materials shall conform to Section 15000.

PART 3 EXECUTION

3.01 ONSITE RECYCLED WATER FACILITIES

A. Onsite recycled water facilities shall not be installed until the plans have been approved by the District Engineer and the San Diego County, Department of Environmental Health Services (DOHS), and a pre-construction meeting has been held with the District Inspection Division. If any portion of the onsite recycled system is installed prior to plan approval and/or inspection, all or any portion of the system shall be exposed and corrected as directed by the District Engineer.

B. Onsite recycled water facilities shall be installed as shown on the approved plans. Deviations from these plans by the installer shall not be permitted until the revised plans have been submitted to, and approved by, the governing regulatory agencies.

C. Installation of onsite recycled water facilities shall conform to the following:

1. The recycled water system shall be separate and independent of any potable water system. Cross connections between potable water facilities and onsite recycled water facilities are prohibited.

2. Hose bibs on recycled water facilities are prohibited.

3. Drinking fountains shall be protected from the spray of recycled water in a manner approved by the governing regulatory agencies and as directed by the District Engineer.

4. Conditions that cause overspray, ponding and runoff shall be limited or prevented.

D. Onsite recycled water and potable water facilities shall be installed in accordance with the following criteria:

1. The horizontal separation between onsite recycled and potable lines shall be a minimum of 1200mm (48”), measured between outside diameters.

2. In general, onsite recycled water lines shall be installed below potable water lines, with a minimum vertical separation of 300mm (12”), measured between outside diameters. Exceptions to this general requirement are as follows:

a. Recycled water lines may be installed above potable water lines where the recycled lines (laterals) are intermittently pressurized. No special construction requirements are necessary, provided the 300mm (12”) vertical separation is maintained.

b. Constantly pressurized recycled water lines may be installed above potable water lines providing the recycled pressured line has an automatic flow control/shut-off device installed, or the recycled line is sleeved. An automatic flow control/shut-off device shall terminate all flow to a lateral automatically should the flow exceed a preset maximum Kpa (gpm). Sleeving shall extend 1.5m (5’) each side from the centerline of the potable line, for a total length of 3m (10’). The sleeve shall be purple PVC. In all cases, the 300mm (12”) vertical separation shall be maintained.

E. Onsite recycled water systems shall be installed to prevent discharge onto areas not under control of the Owner. Appropriate irrigation components shall be employed in the installation to confine the discharge to the approved use area. The installation shall avoid spray patterns which discharge onto obstructions that tend to concentrate water to produce ponding and/or runoff.

F. Onsite recycled water systems shall be installed to operate during periods of minimal public use of the area. The total time required to irrigate the design area shall not exceed nine (9) hours in any 24-hour period. The system shall be installed to operate between the hours of 9 PM and 6 AM.

G. Onsite recycled water systems shall be installed to the following minimum top of pipe depth requirements:

1. Intermittent pressure lines 50mm (2”) and smaller – 300mm (12”).

2. Constant pressure lines smaller than 150mm (6”) – 450mm (18”).

3. Constant pressure lines 150mm (6”) and larger – 750mm (30”).

H. Warning/Identification Tape shall be installed on all onsite potable and recycled lines as called for in Section 15000.

I. Hydrotesting shall be performed on all constant pressure lines in the presence of the District Engineer. The test pressure shall be a minimum of 345 Kpa (50 psi) above the rating of the pipe. The two-hour pressure test will consist of a one hour pump up period and a one hour hold period. No leakage (drop in pressure) shall be allowed. If leakage exceeds this rate, the leak points shall be located and repaired, and the hydrotest repeated until there is zero leakage.

J. Only potable water shall be used for hydrotesting, flushing, the operational test and the cross connection test (if required). Potable water shall be supplied through a separate temporary water meter obtained from the District and located at a District-approved potable water source. A reduced pressure principal backflow device shall be installed at ground level immediately downstream of the temporary potable water meter. A temporary high line shall be installed to supply the proposed recycled irrigation system during the construction and testing period.

K. A wye strainer and check valve shall be installed in accordance with Standard Drawing WR-03 selected from the Approved Materials List.

1. For meter sizes 19mm (¾”) through 50mm (2”), the strainer and check valve shall be installed in a separate 25mm (1”) meter box abutted to the service meter box.

2. For meter sizes larger than 50mm (2”), the strainer and check valve shall be installed in a separate vault adjacent to meter vault. The vault shall be of sufficient size to provide adequate room for maintenance and removal of the strainer and check valve.

3. The strainer and check valve shall be installed and inspected prior to service being established.

L. Cross connection test stations shall be installed at the locations shown on the Approved Plans and detailed on the Standard Drawings. In general, one test station shall be installed directly downstream of each point of connection, downstream of any pressure reducing

valves. Additional cross connection station(s) may be required as indicated on the Approved Plans.

M. A controller recycled irrigation map shall be prepared and submitted to the District prior to commencing service. The map shall be prepared as follows:

1. Provide one map for each automatic controller showing the area covered. The map shall be 275mm x 425mm (11” x 17”) in size.

2. The map is to be a reduced drawing of the actual system. The line weights and lettering on the original controller map drawing shall be so drawn that, when reduced, it is clearly legible.

3. The map shall be a blackline print with a different color used to show area of coverage for each station and subsystem.

4. When completed and approved, the maps shall be hermetically sealed between two pieces of clear, colorless plastic, each piece being a minimum of 0.254mm (0.010” or 10 mils) thick.

N. The owner or owner's representative shall contact the District's Inspection Division and arrange for a coverage test inspection. The owner or owner's representative must be in attendance along with persons capable of making system adjustments. If modifications to the system are required, other than minor adjustments, the owner will be notified in writing of the changes required. To avoid suspension of service, the modifications must be made in a timely manner. All modifications to the system are the responsibility of the owner, applicant, or customer and said owner, applicant or customer shall pay all costs associated with such modifications.

O. Either prior to or at the time of the coverage test, a Final Inspection shall also be performed. The following items must be completed to the satisfaction of the District Engineer before permanent service will be established:

1. Application for recycled service has been made to the District.

2. Warning signs and labels are installed.

3. Quick coupling valves, valve boxes, controllers and other system components are clearly identified with the proper markings indicating distribution of either recycled or potable water.

4. Windblown spray, runoff and ponding have been limited or prevented.

5. Controller clocks are set to operate during the approved hours.

6. Controller maps have been submitted to the District.

7. Site supervisor and twenty-four (24) hour contact phone number identified.

P. In those areas where recycled water is not immediately available, but the District has determined that recycled water will be supplied in the future, the onsite facilities shall be installed to use recycled water. Provisions shall be made, as directed by the District, to allow for connection to the recycled distribution main when it becomes available. In the interim, potable water shall be supplied through a temporary potable water connection installed in accordance with the District’s Standard Specifications. When recycled water

becomes available, the Owner shall remove the backflow prevention device in the presence of and as directed by the District Engineer and shall connect the onsite system to the recycled water service lateral.

3.02 OPERATION AND MAINTENANCE

A. General:

1. The operation, surveillance, maintenance, and repair of all onsite recycled water facilities are the responsibility of the customer. The customer's designated "On-Site Recycled Water Supervisor" shall bear the responsibility for the distribution of recycled water in accordance with the District Rules and Regulations. The District shall receive the following information regarding the individual designated as "On-Site Supervisor": their name, address and telephone number of their location during normal working hours, and a telephone number at which they can be reached during off hours.

2. The District must be notified in writing of any change in the information in Section 15152.3.02.A.1 within ten (10) working days.

B. The customer shall have the following responsibilities pertaining to operation of onsite facilities:

1. To ensure that all operations and maintenance personnel are trained and familiarized with the use of recycled water.

2. To ensure precautionary measures be taken to minimize direct contact with recycled water. For work involving more than a casual contact with recycled water, employees must be provided with proper protective equipment. Adequate first aid supplies should be available on the premises. All cuts and abrasions should be promptly treated to prevent infection.

3. To furnish their operations and maintenance personnel with maintenance instructions, irrigation schedules, controller charts, and as-built plans to ensure proper operation in accordance with these Rules and Regulations.

4. To ensure all recycled water facilities are operated and maintained in accordance with these Rules and Regulations and other documents governing recycled water systems within the District.

C. The customer shall be responsible for any and all subsequent uses of the recycled water. Operation, maintenance and control measures to be utilized in this regard, where appropriate, shall include but are not limited to the following:

1. Operation of onsite recycled water facilities shall be operated to prevent or minimize discharge onto areas not under control of the customer to minimize public contact.

2. Operation of the onsite recycled water facilities shall be during periods of minimal human use of the service area. Consideration shall be given to allow a maximum dry-out time before the irrigated area will be used by the public.

3. Utilization of automatic controller systems to minimize ponding and runoff of recycled water. Total sprinkler run times shall not be greater than the time needed to supply the landscape's water requirement. If runoff occurs before the

landscape's water requirements are met, the automatic controllers shall be reprogrammed with a greater number of water cycles of shorter duration to meet the requirements. This method of operation is intended to minimize ponding and runoff.

4. The customer reporting to the District any and all failures in the recycled water system that cause an unauthorized discharge of recycled water.

5. Protection of all drinking fountains located within the approved use area from contact with windblown recycled water spray, direct application through irrigation or other approved uses by location and/or a protecting structure. Protection shall be by design, construction practice and system operation.

6. Protection of facilities that may be used by the public. They include but are not limited to, eating surfaces and playground equipment located within the approved use areas. These shall be protected by siting and/or shelter from contact with recycled water to the maximum extent possible. Windblown spray, direct contact through wash down or by irrigation application, or other approved uses are considered sources of recycled water. Protection shall be by design, construction practice and system operation.

7. Notification of the District of all updates and proposed changes. Approval by the District and DOHS shall be obtained prior to construction in accordance with District procedures. All updates and proposed changes shall comply with these Rules and Regulations and the governing documents of all other regulatory agencies.

D. The customer shall enforce the following prohibitions:

1. Cross-connections: Cross-connections, as defined by the California Code of Regulations, Title 17, resulting from the use of recycled water or from the physical presence of a recycled water service, whether by design, construction practice or system operation, are strictly prohibited.

2. Hose Bibs: Use or installation of permanent hose bibs on any customer water system that presently operates or is designed to operate with recycled water, regardless of the hose bib construction or identification, is prohibited.

3. Runoff: Conditions that directly or indirectly cause runoff of recycled water either within or outside of the approved use area, whether by design, construction practice or system operation, are prohibited.

4. Ponding: Conditions that directly or indirectly cause recycled water to pond either within or outside of the approved use area, whether by design, construction practice, or system operation, are prohibited.

5. Windblown Spray: Conditions that directly or indirectly permit windblown spray to pass outside of the approved use area, whether by design, construction practice, or system operation, are prohibited.

6. Disposal in Unapproved Areas: Disposal of recycled water for any purposes, including approved uses, in areas other than those specifically approved by the District and without the prior knowledge and approval of the governing regulatory agencies, is prohibited.

7. Unapproved Uses: Use of recycled water for any purposes other than those specifically approved by the District, is prohibited.

3.03 MONITORING AND INSPECTION

The District shall monitor and inspect the entire recycled distribution facility, including both offsite and onsite facilities. The District shall conduct monitoring programs, maintain records as deemed necessary, inspect onsite facilities for compliance with these Rules and Regulations, and provide reports as requested by other regulating agencies. For these purposes, the District shall have the right to enter upon the customer's premises during reasonable hours to inspect onsite recycled water facilities and approved use areas. Reasonable hours shall include hours when irrigation is occurring. The District, Regional Water Quality Control Board, DOHS and DEH shall have the right to enter upon the customer's premises during reasonable hours, from time to time, to verify that the customer's irrigation practices conform with these Rules and Regulations. Where necessary, keys and/or lock combinations shall be issued upon request to the District to provide such access.

3.04 VIOLATION AND NOTIFICATION

A. The District reserves the right to determine whether a violation of the Rules and Regulations has resulted from any action or occurrence that is the responsibility of a customer. Insofar as the violation of these Standards Specifications constitutes a violation of any regulatory agency requirement, the District shall make its determination with consultation on behalf of the concerned agency.

B. Specific violations shall include those that directly cause noncompliance with any one of the specific prohibitions as listed in these Rules and Regulations. However, by definition, noncompliance with any condition or conditions of these Rules and Regulations, whether willfully or by accident, shall constitute a violation.

C. It is the responsibility of the customer to notify the District of any and all failures in the onsite recycled water system whether or not in the customer's opinion the failures resulted in violations. Failures may occur as a result of the customer's action, an action by unauthorized personnel or any non-designated use of the recycled water service. If there are any doubts regarding whether a violation has occurred, the customer should notify the District so that a determination can be made.

D. Notification of failures and violations should be made by telephone, as soon as possible, to the District. If the failure occurs after normal business hours, notification should be made no later than 9:00 a.m. on the next regular business day following the occurrence.

3.05 CORRECTIVE ACTION

A. If the District’s investigation results in the determination that a violation has occurred, then it shall be the responsibility of the customer to initiate corrective action. Pertinent violations will be documented, and a copy of this notice will be hand-delivered or mailed to the customer.

B. A timetable for completing the corrective action should be negotiated with the District by the customer. Such corrections can involve human factors, such as additional training or procedures modifications, as well as physical alterations to the system. Corrections not made in accordance with the timetable shall result in the termination of service by shutting off and locking the meter.

C. If, in the opinion of the District, the violation constitutes an immediate danger to the public health, then service shall be terminated immediately by shutting off the meter or service

and locking it. Service shall be resumed only after the violation has been corrected to the satisfaction of the District.

D. The customer is to maintain a written log of all system failures and violations, including corrective action taken. The log will be reviewed by the District regularly.

3.06 ADMINISTRATIVE REVIEW

A mandatory administrative review will be conducted to examine customer's irrigation practice if three written violations are issued within a 30-day period. The District and customer or agent is required to present reasons for non-compliance with these Rules and Regulations. The customer shall present a plan for corrective action acceptable to the District and the regulatory agencies. The accepted plan and implementation schedule shall be adhered to, or service may be suspended.

END OF SECTION

WATER AGENGIES' STANDARDS

STANDARD SPECIFICATIONS

SECTION 15300 FIRE HYDRANTS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes the materials for and installation of fire hydrant assemblies.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA C502 - Dry-Barrel Fire Hydrants
AWWA C503 - Wet-Barrel Fire Hydrants
AWWA C550 - Protective Epoxy Interior Coatings For Valves and Hydrants

1.03 RELATED WORK SPECIFIED ELSEWHERE

WAS Standard Drawings
WAS Standard Specifications 02223, 03000, 09910, 15000, 15041, 15044, 15056, 15061, 15064, and 15100

1.04 SYSTEM DESCRIPTION

A. Hydrant outlet sizes and configuration shall be as shown on the Approved Plans or as directed by the fire department of jurisdiction.

B. Hydrants shall generally have the following number and size of outlets as directed by the fire department of jurisdiction:

1. Residential: One 64mm (2½") outlet and one 100mm (4") outlet

2. Commercial: Two 64mm (2½") outlets and one 100mm (4") outlet.

3. Industrial: One 64mm (2½") outlet and two 100mm (4") outlets.

1.05 SERVICE APPLICATION

A. Fire hydrants shall be installed on potable water mains only. Fire hydrants shall not be installed on recycled water mains.

B. Wet-barrel hydrants shall generally be used for pressures up to 1.38MPa (200 PSI). System pressures up to and including 1.03MPa (150 PSI) require standard wet-barrel hydrants, and pressures up to 1.38MPa (200 PSI) require high-pressure wet-barrel hydrants in accordance with the Approved Materials List.

C. Dry-barrel hydrants shall generally be used for pressure ranges in excess of 1.38MPa (200 PSI), up to 1.72MPa (250 PSI) as specifically shown on the approved drawings.

1.06 DELIVERY, STORAGE AND HANDLING

Fire hydrants shall be delivered and stored in accordance with AWWA C210, AWWA C213, and AWWA C550. The port openings shall be covered with plastic, cardboard or wood while in transit and during storage in the field. These covers shall remain in place until the valve is ready to be installed. Fire hydrants shall not be stored in contact with bare ground. Fire hydrants shall not be stacked.

1.07 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for fire hydrant assemblies in accordance with Section 15000.

PART 2 MATERIALS

2.01 HYDRANTS

A. Fire hydrants and appurtenances shall be selected from the Approved Materials List.

B. Dry-barrel fire hydrants shall comply with AWWA C502 and these specifications unless otherwise indicated on the Approved Drawings.

C. Wet-barrel fire hydrants shall comply with AWWA C503 and these specifications unless otherwise indicated on the Approved Drawings.

D. The interior of ductile-iron hydrants shall be fusion-epoxy lined per AWWA C550.

E. All outlets shall be provided with National Standard Fire-Hose Threads. Outlets shall be equipped with brass or ductile iron caps with chains.

F. Wet-barrel fire hydrant flanges and appurtenant bury ells and spools shall incorporate a six-hole bolt pattern.

G. Fire hydrant break-off check valves shall be in accordance with the Approved Materials List.

2.02 BOLTS AND NUTS

A. Fire Hydrants shall be installed with bolts and nuts in accordance with the Standard Drawings and selected from the Approved Materials List.

B. Bolts and nuts shall be zinc-plated A307 carbon steel in accordance with Section 15000.

2.03 CONCRETE

Concrete used for splash pads, thrust or anchor blocks shall be in accordance with Section 03000.

2.04 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and the Approved Materials List.

2.05 FIELD PAINTING AND COATING

Field painting and coating materials shall be in accordance with Section 09910 in accordance with the Approved Materials List.

PART 3 EXECUTION

3.01 GENERAL

A. Fire hydrant assemblies shall be installed at locations shown on the Approved Plans or as directed by the fire department of jurisdiction in accordance with the Standard Drawings.

B. The location and port orientation of the Fire Hydrant shall be in accordance with the Standard Drawings.

C. Fire hydrant flange bolts shall be set with nuts on top. Torque nuts uniformly and progressively in accordance with the manufacturer's recommendations.. Fill the hollow bolt shafts of break-away bolts with silicone sealant.

D. Depending on location, fire hydrant assemblies may require protection posts or concrete retaining walls. When required by the District Engineer, or when shown on the Approved Plans, protection posts or retaining walls shall be installed in accordance with the Standard Drawings.

3.02 CONCRETE

Concrete thrust and anchor blocks shall be installed in accordance with Section 03000 and the Standard Drawings. Refer to Section 03000 for the minimum concrete curing time required.

3.03 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.04 DISINFECTION OF FIRE HYDRANT

The fire hydrant assembly shall be disinfected in accordance with Section 15041, as part of the process of disinfecting the main pipeline. The assembly valves shall be operated and the assembly flushed to completely disinfect all internal parts.

3.05 HYDROSTATIC TESTING

Fire hydrant assemblies shall be hydrostatically tested in accordance with Section 15044 in conjunction with the pipeline to which it is connected.

3.06 FIELD PAINTING AND COATING

The fire hydrant exterior shall be field painted in accordance with Section 09910.

END OF SECTION