Dublin San Ramon Services District

Water, wastewater, recycled water

Standard Procedures, Specifications and Drawings

for Design and Installation of Potable Water, Recycled Water and Wastewater Utilities

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REGISTERED ENGINEER'S STAMP

STANDARD PROCEDURES, SPECIFICATIONS AND DRAWINGS
SEPTEMBER 2022

The technical information of the specifications has been prepared by or under the direction of the following registered engineer.

REGISTERED ENGINEER'S STAMP

STANDARD PROCEDURES, SPECIFICATIONS AND DRAWINGS
September 2022

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REVISIONS

Users of DSRSD's Standard Procedures, Specifications and Drawings and Approved Materials List shall be responsible to confirm they are using the most recent versions. To confirm the most recent versions of the Standard Procedures, Specifications and Drawings and Approved Materials List, please visit www.dsrsd.com, or contact the DSRSD Engineering Department at (925) 828-0515 (press 2 for Departments and then 1 to reach Engineering).

Previous revisions can be found at www.dsrsd.com. Revisions shown in this section are for the most recent version of this document.

0	1/22/2020		Issued for Distribution
3	9/5/2022	Approved Materials List: Manhole Water Stop	Added Christy Manhole Water-Stop Gaskets as acceptable
3	9/5/2022	Approved Materials List: Water Box Schedule	Updated meter box lids to steel checker plate versions for non-traffic areas. Changed meter box size of triple manifold to 24"x36".
3	9/5/2022	I-B6-1. Improvement Plans	Clarified submittal process to include online plan submittal via Citizen Self Service Portal.
3	9/5/2022	I-B6-4. Permits, Licenses and Fees	Added language requiring a Class A Contractor's License
3	9/5/2022	I-D1-7. Construction Water Supply	The applicant shall request for a water meter to be installed at rough plumbing (the tag address on the meter and lot number shall be provided to the Inspector) and an account to be opened after payment of fees and at District inspection
3	9/5/2022	I-D6-2. Class I Embedment	Specified the use of Class I embedment is for water pipes not exclusive to service lines.
3	9/5/2022	I-D7-2. Unimproved Right-of-Way	Added language stating that backfill of pipes within DSRSD easements shall be class 2 aggregate base.

3	9/5/2022	II-A10. BACKFLOW PREVENTION	Paragraph 4, changed distance from 5 feet to 1 foot
3	9/5/2022	II-A13. COMBINED DOMESTIC AND FIRE SPRINKLER SERVICES	Reference to Drawing W-31 removed
3	9/5/2022	II-A13. COMBINED DOMESTIC AND FIRE SPRINKLER SERVICES	Added language: “A ½-inch flow restrictor downstream of the main tee as shown on Drawing W-33 shall be installed.”
3	9/5/2022	II-A2. Location of Mains	Added reference to Standard Drawing G-6.
3	9/5/2022	II-A2-1. Street	Removed language stating water mains shall be no closer than 3 feet away from face of curb and instead added reference to Standard Drawing G-6.
3	9/5/2022	II-A6. Valving	Removed outdated language to Standard Drawings. Removed reference to "temporary" blow offs.
3	9/5/2022	II-A7. Hydrant Placement	Added verbiage that hydrants shall be a minimum of 15 ft away from the entrance or exit of a driveway.
3	9/5/2022	II-B1-1.01.02. Fittings for PVC Pipe	Added AWWA C153 as conforming
3	9/5/2022	II-B1-1.02.03. Lining and Coating for DIP and Fittings	Changed requirement to "The interior and exterior surfaces of all ductile iron fittings shall be coated with 6-8 mil nominal thickness of protective fusion-bonded epoxy in accordance with AWWA C116. DIP shall be cement lined in accordance with AWWA C104 and have an asphaltic coating in conformance with AWWA C151 at the discretion of the District Engineer." This combined language from what

			was previously section II-B1-1.02.04.
3	9/5/2022	II-B1-2.09. Gaskets	Added ring type gaskets as acceptable.
3	9/5/2022	II-B1-2.11. Bolts and Hardware	Text added that bolts shall be stamped or easily identifiable as type 316.
3	9/5/2022	II-B2-3.01. Valves, Valve Boxes, and Valve Box Risers	Clarified that valve operating nut shall be within 24-48 inches of finished grade, consistent with Drawing W-4.
3	9/5/2022	II-B2-5.01. Placement Behind Curbs and Sidewalks	Added sentence: "When a hydrant is located within a high-density area, a check valve may be required at the discretion of the District Engineer."
3	9/5/2022	III-A7. Side Sewers	Changed requirement for tight areas from long radius ninety (90) degree elbows to two (2) forty-five (45) degree elbows.
3	9/5/2022	III-B1-1.05. HDPE Pipe and Fittings	The ASTM D3350 now specifies PE 4710 cell class 445574C/E. Replacing 3408 cell class 345434C.
3	9/5/2022	III-B2-2.06 Drop Manholes	Section replaced entirely with: "Drop Manholes are only allowed in special circumstances and upon the approval of the District Engineer."
3	9/5/2022	Section V	Added new chapter (Chapter V Corrosion Control)
3	9/5/2022	Standard Drawings	Added new Standard drawings related to Corrosion Control Chapter V
3	9/5/2022	Standard Drawings	Added new drawing W-33
3	9/5/2022	Standard Drawings	Drawing G-3, note 1 updated to reflect reference to SWRCB

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GENERAL REQUIREMENTS

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SECTION I-A - INTRODUCTION

I-A1. SCOPE AND PURPOSE

The scope and purpose of these Standard Procedures, Specifications, and Drawings ("Standards") is to provide minimum requirements for the design, materials used, and methods of construction for the Dublin San Ramon Services District's ("District") potable water, recycled water, and sewer systems located within public and private properties. These Standards implement the rules and regulations in the District Code, Titles 3, Application for Services, 4, Water Service Delivery, and 5, Wastewater Service Delivery. Should the language in the District Code and the Standards conflict, the District Code shall prevail. The potable water system includes the installation of mains, service assemblies, hydrants, and valves. The recycled water system includes the installation of mains, service assemblies, and valves. The sewer system includes the installation of mains, service laterals, and manholes. These Standards also cover all other necessary appurtenances and, in general, any repairs, replacements, relocations, or any potable water, recycled water, or sewer work done either for the District or for others by separate contract.

Section I of the specification portion of these Standards covers all topics general to potable water, recycled water, and sewer systems including administrative procedures and policies, design, and construction standards. Section II applies only to potable water systems, and Section III exclusively covers sewerage system requirements. Section IV applies only to recycled water systems.

I-A2. DEFINITIONS

Whenever the following terms, or pronouns used in their place, occur in these documents or in any documents that these Design Criteria and Standards govern, the intent and meaning shall be interpreted as defined below:

"Acceptance": The formal action by the District General Manager accepting the dedication of completed facilities.

"Air-Gap Separation": A physical break between a supply pipe and a receiving vessel. The air gap shall be at least double the diameter of the supply pipe, measured vertically above the top rim of the vessel, and in no case less than one (1) inch.

"Applicant": An individual owner or owner's developer, builder, engineer, or other authorized representative who applies as the owner's official agent to the District for potable water, recycled water, or sewer service.

"Applicant's Engineer": The Engineer licensed by the State of California as a Civil Engineer, retained or employed by the Applicant, under whose direction plans, profiles, and details for the Work are prepared and submitted to the District for review and approval.

"Application Rate": The rate at which water is applied to an irrigation or construction area.

"Approval": Unless specifically otherwise indicated, this shall mean approval of final design documents by the District Engineer and shall be indicated by the District Engineer signing the design documents.

"Approved Use Area": A site with well-defined boundaries that is designated to receive recycled water for an approved use and is in conformance with the regulations of all applicable regulatory agencies.

"Automatic System": Automatic controllers, valves, and associated equipment required for the programming of effective water application rates when using recycled water.

"Board": The Board of Directors of the Dublin San Ramon Services District.

"City": Either the City of Dublin or City of San Ramon, California, whichever applies.

"Color Codes": Colors specified by the District to differentiate various types of facilities (e.g. potable from recycled water systems).

"Contract": The agreement covering the performance of the Work and the furnishing of labor, materials, tools, and equipment in the construction of the Work. The contract may be in the form of the notice to contractors, proposal, plans, specifications, special provisions, contract or performance bonds, purchase orders, standard terms of conditions, work order forms, or a written agreement.

"Contractor": The person or persons, firm, partnership, corporation, or combination thereof, private or municipal, that entered into a contract with the Dublin San Ramon Services District, the Cities of Dublin or San Ramon, or the Counties of Alameda or Contra Costa, or the owner of private property doing his/her own Work on his/her private property only. For purposes of acceptance and guarantee, Contractor refers to the party that has posted the bonds. For purposes of construction, Contractor refers to any contractor licensed by the State of California to enter into contracts for and to perform the Work of installing, repairing, replacing, or relocating potable water, recycled water, or sewer facilities under District jurisdiction.

"County": Either the County of Alameda or County of Contra Costa, California, whichever applies.

"Cross Connection": An unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing non-potable water or other substance. Bypass arrangements, jumper connections, removable sections, swivel or changeover devices, or other devices through which backflow could occur, shall be considered to be cross connections.

"Customer": An owner, developer, builder, engineer, or other authorized representative who accepts responsibility for the customer facilities once they are constructed and accepted by the District.

“Customer Facilities”: Recycled or potable water facilities downstream of the water meter that are owned and operated by the Customer. This also includes sewer facilities upstream of the connection to the District sewer main that are owned and operated by the Customer.

“Day”: A calendar day of 24 hours.

“DIP”: Ductile Iron Pipe

“District”: The Dublin San Ramon Services District, its Board of Directors, authorized employees, and agents, a subdivision of the State of California, located in Alameda and Contra Costa Counties.

“District Engineer”: The District Engineer of the Dublin San Ramon Services District or his/her authorized agent.

“District Facilities”: Recycled or potable water facilities upstream of, and including, the water meter are owned and operated by the District. Sewer mains and appurtenances downstream of the connection to the District’s sewer main are owned and operated by the District.

“Easement”: A recorded document by which the land owner gives the District or the public permanent rights to construct, operate, and maintain a pipeline across private or other property.

“H.L.”: Hydraulic Line

“HDPE”: High Density Polyethylene

“House or Building Sewer”: A sewer pipe on private property connecting a house or a building with the service lateral on public property at the property line.

“Improvement Plans”: Drawings of all potable water, recycled water, and/or sewer mains, services, and appurtenances which are included under District jurisdiction for the proposed project. Prior to construction, the District Engineer must approve Improvement Plans.

“Infiltration Rate”: The rate at which soil will accept water.

“Inspector”: An employee or agent of the District engaged to observe and record field compliance with design criteria, plans, and construction standards.

“Lateral Sewer”: The sewer pipe in a public street or easement connecting a house or building sewer to the District’s main, owned and maintained by the owner of the property which it serves.

“Main”: All potable water, recycled water, and sewer pipelines dedicated for public use in the District’s system, excluding services and laterals.

“Marking Tape”: Tape attached directly to a pipe for the purpose of identifying the pipe as carrying recycled or potable water.

“Offsite Recycled Water Facilities”: Recycled water facilities upstream of, and including, the water meters, which are owned and operated by the District.

“Onsite Recycled Water Facilities”: Recycled water facilities downstream of the water meter, which are owned and operated by the Customer.

“Over Spray”: Recycled water that is transmitted through the air to a location other than for which the direct application of recycled water is intended.

“Owner”: Any holder of legal title, contract purchaser or lessee of property for which service is requested from the District.

“Pantone”: Color standard system.

“Ponding”: Retention of piped recycled water on the surface of the ground or manmade surface for a period of time following the cessation of an approved recycled water use activity such that potential hazard to downstream water courses or the public health may result.

“Potable Water”: Water that conforms to the latest edition of the United States Public Health Service Drinking Water Standards, the California Safe Drinking Water Act, and/or other applicable standards.

“Potable Water Service”: The furnishing of potable water to an owner through a metered connection to customer facilities.

“PVC Pipe”: Polyvinyl Chloride pipe.

“Record Drawings”: Drawings completed under the supervision of the Developer’s Engineer that accurately show all customer and District potable water, recycled water, and sewage facilities as constructed or modified.

“Recycled Water”: Water which, as a result of treatment of wastewater meeting the requirements of Title 22, Division 4, Chapter 3 of the California Code of Regulations, is suitable for outside landscape irrigation or other controlled use as approved by the District.

“Recycled Water Service”: The furnishing of recycled water to an owner through a metered connection to customer facilities.

“Regulatory Agency”: Those public agencies legally constituted by the State of California to protect health and water quality.

“Runoff”: Flow of water along the surface of the ground or other natural or manmade surfaces including, but not limited to, pedestrian walkways, streets, playground surfaces, and grassy slopes or other landscaped areas.

“Sample Station”: Service piping and appurtenances connected to a District potable water or recycled water main used to collect samples for water quality analysis.

“Sealing Water”: Independent water supplies to pump seals, which provide sufficient sealing pressure and priming.

"Service Assembly": Potable and recycled water pipes and fittings between the District's main and the meter.

"Service Connection": The point of connection of the private property owner's water or recycled water piping to the District's meter.

"Service Line": The pipe and fittings between the District's main and the meter.

"Sewer": Sanitary sewer.

"Side Sewer": Includes both the lateral sewer and house or building sewer from the sewer main to the house or building piping; side sewer is owned and maintained by the owner of the property it serves.

"Specifications": The specifications and drawings contained herein and approved addenda, plus any other standard specifications incorporated by reference. In general, the referenced standards or specifications shall be understood as being the latest edition.

"Spray Irrigation": Application of water for irrigation by spraying.

"Standards": The specifications and drawings contained herein and approved addenda, plus any other standard specifications incorporated by reference. In general, the referenced standards or specifications shall be understood as being the latest edition.

"State": The State of California.

"Subcontractor": An individual, firm, or corporation having a direct contract with the Contractor or with any other subcontractor for the performance of a part of the Work at the site.

"Unauthorized Discharge": Any release of recycled water that violates the regulations of the District or any applicable Federal, State, or local statutes, regulations, ordinances, and contracts.

"Water": In general, refers to both potable water and recycled water as defined in these specifications.

"Warning Tape": Tape that is laid a specified distance above a buried pipe, typically one (1) foot, for the purpose of warning that there is a buried pipeline below.

"Windblown Spray": Dispersed, airborne particles of recycled water transmitted through the air to a location other than that for which the direct application of recycled water is approved.

"Work": Any and all obligations, duties, and responsibilities necessary to the successful completion of the project assigned to or undertaken by a Contractor including all labor, materials, equipment, and other incidentals, and the furnishing thereof.

I-A3. ABBREVIATIONS

Whenever in these Standards the following abbreviations are used, they shall be defined as listed below:

AASHTO	American Association of State Highway and Transportation Officials
ABS	Acrylonitrile-Butadiene-Styrene
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CEQA	California Environmental Quality Act
CDF	Controlled Density Fill
CIOD	Cast Iron Outside Diameter
CPVC	Chemical-Resistant Polyvinyl Chloride
DIP	Ductile Iron Pipe
DIPRA	Ductile Iron Pipe Research Association
DOT	Department of Transportation
DR	Dimension Ratio
DSRSD	Dublin San Ramon Services District
DWG	Drawing
e.g.	For example
ES	Extra Strength
fps	feet per second
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
HDPE	High Density Polyethylene
HL	Hub Lateral
NAD	North American Datum
NFPA	National Fire Protection Association
NPT	National Pipe Thread
NSF	National Sanitation Foundation
OD	Outside diameter
OSHA	Occupational Safety and Health Administration
PPI	Plastic Pipe Institute
ppm	parts per million
psi	pounds per square inch
psig	pounds per square inch gauge
PVC	Polyvinyl Chloride
RWQCB	Regional Water Quality Control Board
SC	Slow Cure asphalt
SDR	Standard Dimension Ratio
USA	Underground Services Alert
VCP	Vitrified Clay Pipe
WEF	Water Environment Federation

SECTION I-B - ADMINISTRATIVE REQUIREMENTS FOR APPLICANT-INITIATED PROJECTS

I-B1. RESPONSIBILITIES

The responsibilities of the District, Applicant, Applicant's Engineer, and Contractor with respect to administrative implementation of an applicant-initiated project are defined in the following subsections.

I-B1-1. District Responsibilities

The District shall be responsible for the review and approval of Improvement Plans and the inspection of all mains and services within the public right-of-way and the inspection of recycled water lines outside the public right-of-way for all Work. In addition, the District shall be responsible for the inspection of the house or building sewer to within two (2) feet from the house exterior wall or building face.

I-B1-2. Applicant Responsibilities

The Applicant shall have ultimate responsibility for compliance with all requirements specified in these Standards. The Applicant shall be directly responsible for all administrative requirements including application, submittal of all required Improvement Plans, bonds and insurance, and payment of fees. The Applicant shall also be responsible for performance of the Applicant's Engineer in meeting all design requirements and for the performance of the Contractor in meeting all construction-related requirements. The Applicant shall obtain a District Facilities Construction Permit prior to connection of water and/or sewer services to the District's facilities, or prior to installation of water and sewer facilities to be dedicated to the District for operations and maintenance.

I-B1-3. Applicant's Engineer's Responsibilities

These Standards establish requirements for the design and construction of the District's potable water, recycled water and sewer systems. They are not intended to be a substitute for engineering knowledge, judgment, or experience. The standards presented herein shall be reviewed by the Applicant's Engineer and shall be applied as necessary to the project. Proposed deviations to these Standards shall be submitted, in writing, to the District Engineer.

It is also the Applicant's Engineer's responsibility to be aware of the District's master plans for potable water, recycled water, and sewer systems, and to provide a design that conforms to the District's master plans. Deviations from the District's master plans shall be submitted in writing to the District Engineer. Deviation from the District's master plans will necessitate verification by the Applicant's Engineer of the adequacy of existing potable water, recycled water, and sewer system capacity considering additional project flows.

All development project plans, specifications, reports, or other documents shall be prepared by a State of California registered civil engineer or by a subordinate employee under the direction of the State of California registered civil engineer. All documents shall be signed by a State of California registered civil engineer and stamped with the registered seal to indicate responsibility for them. A "Design Approved" stamp of the District on the Improvement Plans does not in any

way relieve the Applicant's Engineer of the responsibility to adhere to the standards generally prevailing for the performance of expert professional engineering services, exercise the same degree of care, skill, and diligence in the performance of the services as is ordinarily provided by a professional engineer under similar circumstances, and meet all requirements of the District. The Improvement Plans shall be revised or supplemented at any time it is determined that the District's requirements have not been met.

All design changes and change orders shall be submitted to the District for review. Change orders shall be signed and stamped by the Applicant's Engineer. Major changes, as determined by the Inspector, are subject to review and approval by the District Engineer.

In conformance with the California Environmental Quality Act (CEQA), all actions by the District in reviewing, approving, issuing and inspecting Improvement Plans, construction permits and public works for applicant-initiated projects shall be deemed ministerial. It shall be the Applicant's responsibility to conform to the requirements of CEQA and the requirements of the lead agency, which has approved a development project or entitlement, including all mitigation measures that may relate to public improvements under District approval and inspection. The District shall be held harmless from any suit or action arising out of compliance by the Applicant with CEQA, or performance or lack of performance by the Applicant of any mitigation measure adopted or required by any local government.

I-B1-4. Contractor Responsibilities

The Contractor shall be directly responsible for the means, methods, techniques, sequences, and procedures of construction not otherwise required by these Standards and the Improvement Plans. At all times, the Contractor shall be responsible for compliance with all governing federal, state, and local laws, ordinances, codes, orders, and regulations that in any manner affect those engaged or employed on the jobsite, the materials used in the Work, and the safe conduct of the Work. The Contractor shall also be directly responsible for the compliance of all finished work with these Standards and the Improvement Plans.

The inspection by the District Engineer or Inspector, or any approval of the work by the District Engineer or Inspector, does not relieve the contractor of the responsibility to adhere to the standards generally prevailing for the construction, exercise the same degree of care, skill, and diligence in the performance of the work as is ordinarily provided by a licensed contractor under similar circumstances, and adhere to the approved plans and these Standards. Any defective work discovered by the District before the expiration of the period prescribed for latent deficiencies in Section 337.15 of the Code of Civil Procedure shall be removed and replaced, at the applicant's expense, by work that fully conforms to the provisions of the approved plans and these Standards.

I-B2. INTERPRETATION OF SPECIFICATIONS AND DRAWINGS

These Standards are intended to serve as one document. This means that the specifications and drawings contained herein are complementary, and what is called for in one shall be as binding as what is called for in both. In the case of conflict between the specifications and drawings, the specifications shall govern. In case of conflict between the Improvement Plans and Standard Drawings, the Standard Drawings will govern unless the District Engineer has approved a specific variance. In the event of discrepancies, errors, or omissions found in these Standards, or should it

appear there is not sufficient detail to perform the Work, then the Applicant shall promptly submit in writing to the District Engineer a request for clarification or interpretation. The District Engineer will act upon such a request within five (5) working days.

I-B3. VARIANCES

A request for a variance from any requirement contained in these Standards must be submitted in writing to the District Engineer by the Applicant. Such requests shall identify the exact requirement at issue and indicate the proposed variance with supporting factual information. The District Engineer will act upon such requests within ten (10) working days. Any appeal of a decision by the District Engineer must be submitted in writing to the Dublin San Ramon Services District Board of Directors within ten (10) working days of the District Engineer's action. Such appeal will be heard at the next regularly scheduled Board meeting. The written appeal must be received at least ten (10) working days prior to the meeting at which time it will be heard.

I-B4. APPLICATION FOR SERVICE

The first step an Applicant shall take to acquire potable water, recycled water, and/or sewer service for a project shall be the submittal of an application for service to the District office. Once this has been done and the accompanying planning and review fees paid, then all subsequent project design review and approval steps shall be undertaken.

I-B5. PLANNING CONSULTATION SERVICES

To coordinate the best alternative plan for delivery of potable water, recycled water, and/or sewer service for a development project, the District Engineer will review proposed Work in accordance with the District's master plans. The District Engineer shall determine if the proposed Work will require a plan of services in order to comply with the District's master plans. Upon determination that a plan of services is required for Work, the District Engineer shall determine who shall prepare the plan of services.

The Applicant shall be entitled to a limited number of planning consultation sessions with the District Engineer or an appointed representative from District staff not to exceed eight (8) personnel hours unless agreed to by the District.

This shall also include follow-up review by District staff of any required engineering documentation such as Improvement Plans or calculations prepared by the Applicant or Applicant's Engineer, subject to project planning and review fees. In the event that District time for plan review services exceeds two (2) reviews, then the Applicant may be charged for further planning consultation services on an hourly basis in accordance with the District Code. Time spent on formal review of completed Improvement Plans shall be considered as part of the project approval process and not under planning consultation services.

I-B6. PROJECT APPROVAL PROCESS

Project approval is required prior to connection to District water and sewer facilities. A District Facilities Construction Permit shall be obtained prior to connection of water and/or sewer services to the District's facilities, or prior to installation of water and/or sewer facilities to be dedicated to the District for operations and maintenance.

The project approval and permitting process shall basically consist of:

1. The submittal of Improvement Plans and Final Map or Parcel Map, if applicable, for District review.
2. The submittal of Engineer's Cost Estimate.
3. The submittal of application for services and associated project planning and review fees.
4. The submittal of certificates of insurance and endorsement naming the District, each of its officers, employees and agents included as additional insured.
5. The submittal of faithful performance bond directly to the District.
6. The payment of District fees due at the time of construction permit issuance.
7. The submittal of all required easement description offers, legal description of plats, and plat plans. The fee title owner shall sign the easement offer.

I-B6-1. Improvement Plans

Work necessary for the installation of mains, services, and appurtenances to provide potable water, recycled water, and/or sewer service shall be shown on the Improvement Plans. The Improvement Plans shall be prepared under the direction of, and signed by, a currently registered professional engineer in the State of California.

Improvement Plans showing the proposed Work shall be submitted to the District for approval. Included with this submittal shall be all calculations requested by the District Engineer to verify the design of any portion of the potable water, recycled water, or sewer systems. Calculations shall be based on methods generally accepted by the engineering profession and shall be neatly and legibly done in such form as to enable them to be readily checked. Calculations shall be signed and stamped by a State of California registered civil engineer. In addition, literature and technical data concerning any of the materials and equipment to be used shall be furnished to the District Engineer upon request.

Improvement Plans shall comply with the following requirements. Exceptions for small projects may be granted subject to the discretion of the District Engineer.

1. During plan checking, applicant shall submit Improvement Plans through District's Citizen Self Service Portal. Alternatively, 1 set of hard copy plans can be submitted at the District Office if online submittal is not possible.
2. All mains shall be shown in plan and profile with services and laterals in plan.
3. All existing and proposed fire hydrants, valves, and other miscellaneous appurtenances shall be shown for potable and recycled water systems. Commercial and recycled water fire hydrants shall be specifically distinguished.
4. All existing and proposed backflow preventers, valves and other miscellaneous appurtenances shall be shown for potable water systems.
5. All existing and proposed valves and other miscellaneous appurtenances shall be shown for recycled water systems.

6. All existing and proposed manholes, cleanouts, and other miscellaneous appurtenances shall be shown for sewer systems.
7. All existing and proposed potable and recycled water mains, storm and sanitary sewers in the vicinity of any proposed potable water and/or recycled water facilities shall be shown.
8. All existing and proposed buildings and other structures, including light standards and accessory structures, which may affect maintenance, operations, or replacement of water and sewer mains, shall be shown.
9. All required easements shall be shown.
10. Plan and profile drawing scale shall be at least 1 inch equals 40 feet.
11. An overall plan view of the entire proposed potable water, recycled water, and sewer line system shall be provided and shown on one sheet with a drawing key for subsequent plan and profile sheets. In addition, entire single utility should be shown on single sheets.
12. Improvement Plans shall include a location map showing the area to be served relative to established public roads.
13. Improvement Plans shall include a note that states: "Work shall comply with the most current edition of the Standard Procedures, Specifications, and Drawings of Dublin San Ramon Services District."
14. When service utilities and layouts are not presented clearly on Improvement Plans, District may require enlarged details to be provided.
15. Utility poles, fences, street lights and trees shall be specifically identified on Improvement Plans.
16. Improvement Plans shall show all proposed utilities and improvements and shall be substantially complete to the satisfaction of responsible agencies. "Water Only" or "Sewer Only" plans shall not approved by the District Engineer.

The District cost of reviewing the first two (2) Improvement Plan submittals is considered covered by the standard planning and review fees. Additional Improvement Plan submittal reviews will be charged to the Applicant on the basis of District hourly review time.

Once a development project has been approved by the District Engineer, then Portable Document Format (PDF) file and digital vectorized file of the Improvement Plans shall be submitted to the District. Digital raster copies are not acceptable. The digital vectorized files shall be in AutoCAD format. Drawing units shall be decimal with a precision of 0.00. Angles shall be in decimal degrees with a precision of 0.00. All objects and entities in layers shall be colored by layer. All layers shall be named in English. Abbreviations are acceptable. All submitted map drawings shall use the Global Coordinate System of USA, California, NAD 83 California State Planes, Zone III, and U. S. foot.

No changes shall be made to the approved Improvement Plans unless approved and initialed by the District Engineer. In the case of an approved change, all submitted sheets affected by the change shall be replaced.

During construction, one (1) completed set of Improvement Plans shall be kept on site at all times.

I-B6-2. Insurance

An Applicant or Contractor shall procure, carry, and maintain for the duration of the contract the following insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors. Coverage shall at least be as broad as the following:

1. Commercial general liability insurance using Insurance Services Office Form CG 00 01, including products and completed operations, with limits of no less than the amount of $5,000,000 per occurrence for bodily injury, personal injury, or death, and property damage. If a general aggregate limit applies, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be $10,000,000;
2. Automobile Liability: Insurance Services Office Form Number CA 0001 covering Code 1 (any auto), with limits no less than $5,000,000 per accident for bodily injury and property damage;
3. Workers' Compensation insurance as required by the State of California, with Statutory Limits, and Employers' Liability insurance with a limit of no less than $1,000,000 per accident for bodily injury or disease;
4. Builder's Risk (Course of Construction) insurance covering all risks of loss less policy exclusions, with limits equal to the completed value of the project and no coinsurance penalty provisions; and, if the project involves environmental hazards,
5. Contractors' Pollution Legal Liability and/or Asbestos Legal Liability and/or Errors and Omissions with limits no less than $1,000,000 per occurrence or claim, and $2,000,000 policy aggregate.

Any deductibles or self-insured retentions must be declared to and approved by the District. At the option of the District, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the District, its officers, officials, employees, and volunteers; or the Applicant or Contractor shall provide a financial guarantee satisfactory to the District guaranteeing payment of losses and related investigations, claim administration, and defense expenses.

Such insurance shall be primary to any insurance carried by the District, its officers, officials, employees, and volunteers. Any insurance or self-insurance maintained by the District, its officers, officials, employees, or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.

Dublin San Ramon Services District, its Board, each of its officers, employees, and agents shall be named as additional insured on the CGL and auto policies with respect to liability arising out of automobiles owned, leased, hired, or borrowed by or on behalf of the Applicant or Contractor; and with respect to liability arising out of work or operations performed by or on behalf of the Applicant or Contractor including materials, parts, or equipment furnished in connection with such work or operations. General liability coverage can be provided in the form of an endorsement to the Contractor's insurance (at least as broad as ISO Form CG 20 10, 11 85 or both CG 20 10 and CG 20 37 forms if later revisions used).

Cancellation statement on the insurance certificate shall state: "Should any of the above described policies be cancelled before the expiration date thereof, the issuing company will mail 30 days

written notice to the certificate holder named to the left." In addition, each insurance policy required by this clause shall be endorsed to state that coverage shall not be canceled except after thirty (30) days prior written notice (10 days for non-payment) has been provided to the District.

The Applicant or Contractor shall maintain such insurance until the project has been accepted by the District General Manager. The Applicant or Contractor shall submit a copy of the Certificate of Insurance along with endorsement from the issuing insurance company. Renewal of such insurance shall be submitted to the District thirty (30) days prior to the expiration of the insurance.

I-B6-2.01. Waiver of Subrogation

Contractor hereby agrees to waive rights of subrogation which any insurer of Contractor may acquire from Contractor by virtue of the payment of any loss. Contractor agrees to obtain any endorsement that may be necessary to affect this waiver of subrogation. The Workers' Compensation policy shall be endorsed with a waiver of subrogation in favor of the District for all work performed by the Contractor, its employees, agents and subcontractors.

I-B6-2.02. Verification of Coverage

Contractor shall furnish the District with original certificates and amendatory endorsements, or copies of the applicable insurance language, effecting coverage required by this contract. All certificates and endorsements are to be received and approved by the District before work commences. However, failure to obtain the required documents prior to the work beginning shall not waive the Contractor's obligation to provide them. The District reserves the right to require complete, certified copies of all required insurance policies, including endorsements, required by these specifications, at any time.

I-B6-3. Bonds and Other Security

All Applicants and/or Contractors shall obtain a faithful performance bond and warranty bond/maintenance security. The faithful performance bond should be based on 100% of Applicant's Engineer's cost estimate, subject to District Engineer approval. The faithful performance bond shall be submitted to the District prior to issuance of a construction permit and remain in full force and effect until the project is accepted by the District. The warranty bond/maintenance security shall have a minimum amount of 10% of the amount of the District Engineer approved Engineer's cost estimate. The warranty bond/maintenance security shall be submitted to the District prior to acceptance of the project and shall remain in place until authorization of release has been issued by the District.

The warranty bond/maintenance security shall be submitted prior to District General Manager project acceptance and remain in place at least one year after the completion and acceptance of the project, and completion of any repairs required by the District at warranty inspection, unless the District Engineer requires a longer period. If project occupancy is less than ninety (90) percent at project acceptance, the warranty bond/maintenance security shall remain in place until the final residential or commercial unit in the project is granted occupancy.

I-B6-4. Permits, Licenses and Fees

The Applicant shall obtain all necessary District construction permits, pay all required District fees, and submit a copy of the contractor's license prior to the commencement of any Work. Contractors shall be required to possess a Class A contractor's license in order to perform work on District Facilities. Prior to installation of water meters, and connection of service to the sanitary sewer, Zone 7 water connection fees and District water and sewer capacity reserve fees shall be paid.

I-B6-5. Easements

When conditions require that potable water, recycled water, and sewer mains be located in private property, an easement for the area of pipe alignment shall be secured for the District by the Applicant at no cost to the District. Easement shall provide for restrictions of permanent construction within easement to provide ingress and egress for maintenance.

For subdivision tracts, the owners of land included within the subdivision shall offer to dedicate, for public use, the sewer, recycled water, and potable water easements so designated on the final or parcel map. For other than subdivision tracts, dedication of sewer, recycled water, and potable water rights-of-way shall occur by means of deeds of conveyance to the District for all dedications other than those dedications created by subdivision tract maps on a form and as approved by District Engineer. The Owner of Record shall sign the easement offer.

In addition to easements over the actual pipeline alignment, and where required due to topography or other access limitations, easements shall include adequate ingress and egress for District maintenance vehicles and equipment.

In circumstances where an easement is required across an adjacent property not owned by the Applicant, the Applicant shall be responsible for negotiating and acquiring easements for potable water, recycled water and/or sewer that may be required. The easement documents must be received and approved by the District prior to the issuance of any construction documents.

I-B7. INSPECTIONS AND TESTING

All materials furnished and all Work performed under the contract shall be subject to inspection by the District Engineer. The Contractor shall be held strictly to the true intent of the Standards in regard to quality of materials, workmanship, and diligent execution of the contract. Such inspection may include mill, plant, shop, or field inspection as required. The District Engineer shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated; and shall be furnished with such materials, information, and assistance by the Contractor and subcontractors and suppliers as is required to make a complete and detailed inspection.

The Contractor shall notify the Inspector forty-eight (48) hours in advance of the commencement of any Work. Tie-ins to existing District facilities require seven (7) working days advance notice unless otherwise authorized by the District Engineer.

The District Engineer and the officers, and agents of the District shall have unrestricted access at reasonable hours to all premises to which the District provides services to inspect the potable water,

recycled water, and/or sewer facilities, meter or other measuring apparatus and to see that the rules and regulations of the District regarding the installation of potable water, recycled water, and/or sanitary sewer facilities, and the use of potable and recycled water, and the discharge of wastewater are being observed.

I-B7-1. Work Done in the Absence of Inspection

Work done in the absence of District inspection may be required to be removed and replaced under the proper inspection, and the entire cost of removal and replacement shall be borne by the Contractor, regardless of whether the Work removed is found to be defective or not. Work covered up without the authority of the District Engineer shall, upon order of the District Engineer, be uncovered to the extent required; and the Contractor shall similarly bear the entire cost of performing all the Work and furnishing all the materials necessary for the removal of the covering and its subsequent replacement, as directed and approved by the District Engineer.

I-B7-2. Cost of Inspection and Testing

The cost of initial inspection and testing, with the exception of bacteriological tests, shall be included in the inspection fees per District Code and collected in advance. In the event that any inspection or test reveal non-compliance with approved plans or these specifications, the Applicant shall bear the cost for such corrective measures deemed necessary by the District Engineer, as well as additional re-inspection and re-testing costs incurred by the District.

The Applicant shall be directly responsible for the cost of bacteriological tests. The District shall collect the fees for bacteriological tests separately, after completion of laboratory work for each test.

Overtime construction Work performed at the option of, or for the convenience of, the Contractor will be inspected by the District at the expense of the Applicant and will be billed to and shall be paid for by the Applicant on a monthly basis. Overtime shall be considered beyond the regular eight (8) hour day and for any time on Saturday, Sunday, or holidays. There will be no charge for the inspection of overtime Work ordered by the District Engineer. The Applicant or Contractor shall notify the Inspector not less than forty-eight (48) hours prior to beginning overtime Work and shall be required to complete, and submit to the District, an overtime request form to firmly verify the overtime request. In the event of conflicting schedules or other prior commitments of the Inspector, overtime inspection may not necessarily be provided for the requested period. Fees for overtime inspection shall be in accordance with fees established by ordinance or resolution of the District Board of Directors.

I-B7-3. The Inspector

District Inspectors are authorized to inspect, on behalf of the District Engineer, all Work done and all materials furnished. Such inspection may extend to all or any part of the Work. The Inspector is not authorized to revoke, alter, or waive any requirements of the Standards. The Inspector is authorized to call attention of the Contractor to any failure of the Work or materials to conform to the Standards. The Inspector has the authority to reject materials or suspend the Work until any questions at issue can be referred to and decided by the District Engineer or a duly appointed

representative. The Inspector shall in no case act as a supervisor or perform other duties for the Contractor, nor interfere with the management of the Work by the Contractor. Any advice, which the Inspector may give the Contractor, shall in no way be construed as binding to the District in any way or releasing the Contractor from fulfilling all the Contractor's responsibilities.

If the Contractor refuses to suspend operations on verbal order from the Inspector, the District Engineer shall then issue a written order stopping all Work. After delivery of the order to the Contractor or person in charge, the Inspector will immediately leave the job, and all Work done in the absence of the Inspector shall not be accepted.

I-B7-4. Testing

Except where otherwise specified, the District Engineer or Inspector will make, or have made, such tests determined necessary to ensure that the Work is being accomplished in accordance with the requirements of these Standards and Improvement Plans. The Contractor shall be required to furnish materials and/or do whatever work may be necessary to prepare the facilities for testing. In the event that any tests reveal noncompliance with specified requirements, the Contractor shall bear the cost for such corrective measures deemed necessary by the District Engineer, as well as the cost of subsequent re-testing.

I-B8. SERVICE AND OCCUPANCY

I-B8-1. Beneficial Occupancy

The District may, prior to acceptance of the Work, occupy, or use, any completed part or parts of the Work, providing these areas have been approved for occupancy by the District. The District shall operate and maintain such occupied parts of the work to ensure continued service to its customers. The exercise of this right shall in no way constitute an acceptance of such parts, or any part of the Work. The Work shall be accepted by the District General Manager only when all of the Work has been duly and properly performed in accordance with the requirements of these Standards and Improvement Plans.

District occupancy of part(s) of the Work does not relieve the Applicant or Contractor from completion of follow-on Work associated with those occupied part(s) of the Work. During the beneficial occupancy period, the Applicant and/or Contractor shall perform maintenance repairs on those occupied part(s) of the Work associated with faulty or insufficient materials, workmanship, and/or installation, and any damages associated with the construction of the Project. During construction activities, the Applicant and the Contractor shall protect those occupied part(s) of the Work in accordance with I-D1-5. Care of Existing Property Structures and Utilities.

Operation of facilities during the beneficial occupancy period shall be performed by District personnel, or under the District inspector's supervision and with prior approval. The applicant and the contractor shall be responsible fines and District costs incurred to correct issues caused by unauthorized operation of facilities during beneficial occupancy.

The commencement of the warranty period for these occupied part(s) of the Work shall be upon the acceptance of all of the Work by the District Board of Directors. The warranty bond/maintenance security required by these specifications shall remain in full effect in accordance with I-B6-3. Bonds and Other Security.

I-B8-2. Building Occupancy

Conditions for potable water, recycled water, and/or sewer service and allowance for occupancy of up to ninety (90) percent of dwelling units or ninety (90) percent of the square footage for commercial/industrial of a development project are as follows:

1. All mains, services, and major appurtenances such as fire hydrants and valves for potable and recycled water systems and manholes for sewer systems have been installed to the satisfaction of the Inspector.
2. All connections to existing District systems and facilities have been performed.
3. All testing as required in these Standards has been successfully completed.
4. No further construction Work, such as roadwork, will jeopardize the integrity or quality of potable water, recycled water, or sewer facilities already installed.
5. There is access to all operating facilities such as manholes, vaults, and valves.

Upon meeting all of the above conditions, the Applicant shall submit in writing to the District Engineer a request for occupancy, after which the District Engineer shall respond by recommending occupancy of the home or building to the City following verification that all conditions have been met. The remaining ten (10) percent of the units can be occupied only after formal acceptance of the improvements by the District General Manager.

I-B9. ACCEPTANCE AND GUARANTEE OF WORK

Acceptance of the Applicant's Development Project shall occur only after the following conditions are satisfied:

1. Facilities to be accepted must be adequately protected from on-going construction. Where facilities are to be located in paved areas, the second lift of pavement must be in place.
2. All punchlist work shall be completed.
3. The project warranty bond/maintenance security shall be submitted to the District.
4. The project record drawings shall be submitted to the District.
5. Property dedication requirements over facilities to be accepted shall be completed.
6. All applicable District and Zone 7 fees and charges pertaining to the project shall be paid in full.
7. Special conditions outlined in the construction permit shall be satisfied.
8. Grading plans shall be submitted in AutoCAD digital format with elevation data attached to contour lines and spot elevations.
9. For residential developments, a minimum of fifty (50) percent of the residential units must be occupied. For commercial/industrial developments, a minimum of fifty (50) percent of the commercial square footage must be occupied.

Acceptance of the Applicant's Development Project will be made by action of the General Manager after the Work has been completed in accordance with these Standards, the approved Improvement Plans, all tests have been conducted and successfully completed, any required

property dedications to the District are completed, and a satisfactory final inspection has been completed.

Immediately upon and after acceptance of the Work by the District, the guarantee period on all Work shall be in effect. The standard guarantee period shall be a minimum of one (1) year unless the District Engineer requires a longer period. The warranty bond/maintenance security shall remain in place until the final residential or commercial unit in a development is granted occupancy.

Any faulty workmanship and/or defective materials, which are discovered within the guarantee period, shall be corrected and/or replaced by the Contractor at no expense to the District. Such guarantee period may be extended upon disclosure of a defect until a minimum of one (1) year after the correction of the defect.

All repair Work required during the guarantee period shall be performed within five (5) working days of issuance of written notification to the Contractor. Emergency Work required on work of the Contractor performed by the District and Work performed by the District due to the nonperformance of the Contractor shall be reimbursed to the District within thirty (30) days of invoice.

I-B9-1. Record Drawings

The Applicant or the Applicant's Contractor shall solely dedicate and maintain one (1) set of full size prints as "Record Drawings" and mark thereon the actual work, including any deviations from plan dimensions, elevations or orientations. The Record Drawings shall be submitted in excellent condition to the District upon completion of the job as a condition of acceptance of the Project. Marked prints shall be updated at least once each week and shall be available for District review.

At the completion of all Work, Applicant shall submit Record Drawings as follows:

- one (1) copy in digital vectorized form and one (1) copy in TIF format on CD-ROM. The digital vectorized files shall conform to the format mentioned above.
- one (1) hardcopy set of 11-inch x 17-inch.

I-B10. RECYCLED WATER SERVICE

I-B10-1. Determination When tTo Use Recycled Water Or Potable Water

The District shall determine whether a given service will be furnished with recycled water or potable water. The determination shall be in accordance with the standards of treatment and water quality requirements set forth in Title 22, Chapter 4 of the California Administrative Code, the intent to promote wise and judicious use of water in accordance with State Water Code, Division 7, Chapter 7, parts 13550 through 13580, and the District Code, ordinances, and Board policy. All information necessary to determine the furnishing of recycled water to any given service, including, but not limited to, on-site irrigation and landscape plans, acreage of plantings, booster pumping and special requirements shall be submitted to District, reviewed and approved in accordance with District "Recycled Water Use Guidelines."

SECTION I-C - DESIGN INFORMATION AND CRITERIA

I-C1. SCOPE

This section covers all design information and criteria general to potable water, recycled water, and sewer projects. For design information and criteria specific to potable water, recycled water, or sewer, refer to Sections II, III, and IV, respectively, of these Standards.

I-C2. PIPE DESIGN

The three primary factors of pipe design for which the Applicant's Engineer shall be responsible are pipe sizing, material selection (limited to only approved material), and class or thickness.

I-C2-1. Pipe Sizing

Pipe mains shall be sized according to the particular criteria presented in the potable water, recycled water, and sewer sections of these Standards.

I-C2-2. Pipe Material Selection

The Applicant's Engineer is directed to the materials of construction Sections II-B, III-B, and IV-B under the potable water, recycled water and sewer sections of these Standards. Only the pipe materials specified in those sections shall be allowed. Any other pipe material selected by the Applicant's Engineer shall be cause for not approving the Improvement Plans unless a specific variance in pipe material selection has been approved by the District Engineer for the particular project development.

I-C2-3. Pipe Class or Thickness

The Applicant's Engineer shall be responsible for verification that minimum class or thickness of pipe, as specified in the materials of construction Sections II-B, III-B, and IV-B under the potable water, recycled water and sewer sections of these Standards, is adequate in regard to providing sufficient structural pipe strength for the particular project development. Sufficient structural pipe strength shall be made available to prevent any collapse, excessive deflection, cracking, or other such pipe failure. The Applicant's Engineer shall consider all factors affecting the required pipe class or thickness including, but not limited to, the dead and live loads; the internal pressure; the road surfacing, trench and pipe embedment cross sections design; and the cover over the pipe. The pipe embedment cross sections design and cover over the pipe are specified in Sections II, III, and IV, respectively, in these Standards and cannot be modified unless specific conditions warrant so and specific approval has been given by the District Engineer.

External loads on sewer mains shall be determined using design methods for computing external loads on trench conduits based on Marston's Formula, and described in the "Design and Construction of Sanitary and Storm Sewer," latest Edition, WEF Manual of Practice No. 9.

It shall be the responsibility of the Applicant's Engineer to determine all other pipe thickness design parameters with a reasonable degree of conservatism and factors of safety. The possibility of H-20 truck loading and impact loads as determined from AASHTO Standard Specifications shall be duly considered.

If the Applicant's Engineer's design analysis shows that a pipe class or thickness other than the required minimum is necessary, then that upgraded pipe class or thickness shall be clearly indicated on the Improvement Plans. In addition, such designs shall require the submittal of calculations by the Applicant's Engineer.

I-C2-4. Pipe Corrosion Protection

Corrosion protection for ductile iron pipe, fittings, valves, and appurtenances shall be as recommended and designed by a State of California Registered Corrosion Engineer or AMPP certified Cathodic Protection Specialist (CP-4) or Corrosion Specialist. During the plan review process, the Applicant shall submit a copy of the Corrosion Engineer's report and calculations, complete with recommendations. At a minimum, pipe and appurtenances shall be encased in polyethylene encasement for external corrosion protection. Installation of polyethylene encasement shall be in accordance with the requirements of AWWA C105.

Cathodic protection systems may also be required for direct buried metallic pipe and fittings. Cathodic protection system will require test stations for all reaches of continuous ductile iron or steel pipelines, and for any direct buried ductile valves and fittings installed in arterial roadways (such as Dublin Blvd, Amador Valley Blvd, Dougherty Rd, Village Pkwy, San Ramon Rd, Bollinger Canyon Rd, Hacienda Drive, Tassajara Rd, Fallon Rd, and all freeway crossings) or areas with traffic speed limits posted at 35 MPH or higher. Test station installation requirements shall be coordinated with DSRSD representatives. Test stations shall be verified by independent testing service and a copy of the test results shall be submitted to the District prior to acceptance of the pipeline.

In areas of high traffic or shallow depth fusion bonded epoxy coated ductile iron pipe may be used with the addition of cathodic protection.

Sacrificial anodes may be used under certain circumstances and by the District Engineer's approval.

Depending on soil types, useful life requirements, and casing design specifications, metallic pipe casings may require coatings and cathodic protection or coatings in isolation. Consult DSRSD project representative for casing corrosion control requirements.

I-C3. STRUCTURAL PROTECTION

In addition to upgrading the pipe class or thickness, the Applicant's Engineer may recommend the installation of an arch encasement or total pipe encasement on the Improvement Plans to provide sufficient structural support and protection of a pipe main. Arch encasements and total pipe encasements shall be installed as shown in Drawings G-1 and G-2, respectively, of these Standards, unless the Applicant's Engineer demonstrates that more protection is required for the particular pipe installation. In such a case, the Applicant's Engineer shall be responsible for the determination of adequate protection and the District shall be responsible for review and acceptance of the design.

I-C3-1. Other Pipes and Structures

Mains designed to cross under or over other pipes or structures shall be protected from damage and shall be constructed to prevent endangering the other pipe or structure. To minimize hazards to buildings and other above-ground structures when mains are repaired, a minimum horizontal separation of seven and a half (7-1/2) feet from pipe external wall and structure foundation or footing must be maintained. District water and sewer mains and appurtenances, including water meters, service lines, blowoffs, air relief valves, and mains shall not be installed under the overhanging second floor of buildings. The District Engineer may require greater horizontal separation for pipes larger than twelve (12) inches in diameter.

Particular attention shall be given to the possibility and prevention of settlement-caused damage. As a minimum, structural protection as shown in Drawing G-3 shall be provided. Also where future replacement of any line may be extremely difficult due to the pipe or structure, special design considerations may be required.

I-C3-2. Flexible Joints

Flexible joints that will allow for differential settlements or other movement of pipe, structures, adjacent pipe, and adjacent structures shall be provided where lines enter encasements, manholes, or other structures. Specific flexible joint requirements are provided in the potable water, recycled water, and sewer sections of these Standards.

I-C3-3. Steep Grades

When pipe mains are laid on grades steeper than ten (10) percent and are not under nor intended to be under pavement, then special erosion protection shall be provided over the pipe trench. As a minimum requirement, ground cover shall be planted to match the existing surrounding area. Trench dams, as shown in Drawing G-5, water diversion structure, and other surface improvements shall be required for slopes steeper than 10 percent.

I-C3-4. Utility Clusters

In areas where utility services are clustered, the Applicant’s Engineer shall submit detailed Improvement Plans showing all service lines, lateral pipeline routes, meter box locations, and other related details.

Plans showing the location of the service line from the connection to the District facilities to the building unit shall be submitted. Where required by the District Engineer, service lines from connection to the District's facilities to individual units shall be labeled and tagged at the property line to the building unit, at every 10 feet interval up to connection to plumbing at the building unit.

Alternatively, tracer wire shall be installed on the service line, from the water meter box to the building connection.

I-C3-5. Connection to Existing Facilities

When pipe mains are connected to existing mains and appurtenances that would otherwise remain in good working condition without disturbance, the impacts to the existing facility shall be mitigated. Existing facilities impacted by construction shall be replaced and brought up to current

District standards. The extent of facilities to be replaced shall be determined by the District Engineer.

I-C4. MINIMUM COVER

Minimum cover as specified in the respective potable water, recycled water and sewer sections shall be as measured from the top of pipe to finished grade. In cases where minimum cover cannot be maintained, such as at the crossing of a water main with a sewer main or any other utility line, then either an under crossing or over crossing shall be chosen based upon an evaluation by the Applicant's Engineer and approval by the District Engineer. Evaluation shall include the need for higher class pipe or protection of the pipe, ability to meet the State Water Resources Control Board, Division of Drinking Water (DDW), criteria for the separation of water mains and non-potable pipelines to conform with Title 22 of the California Code of Regulations, Section 64572 (22 CCR § 64572), and the resulting need for either blowoff or air/vacuum release valves. All calculations involved in this evaluation shall be submitted to the District Engineer for review and acceptance.

I-C5. HORIZONTAL AND VERTICAL SEPARATION

All horizontal and vertical separations between potable water mains, recycled water mains, sewer mains, and sewer laterals shall conform to the criteria as contained in the State Water Resources Control Board, Division of Drinking Water (DDW), criteria for the separation of water mains and non-potable pipelines to conform with Title 22 of the California Code of Regulations, Section 64572 (22 CCR § 64572). A copy of this document is included in Appendix C of these Standards. Wherever the State of California separation criteria cannot be maintained, all special construction criteria as outlined in the same document shall be followed.

The separation criteria shall be applied in all cases to: (i) separation of potable water mains from sewer mains; (ii) separation of potable water mains and service lines from recycled water mains and primary customer facility irrigation lines; and, when practical, (iii) separation of recycled water mains from sewer mains. If application of the criteria to separation of recycled water mains from sewer mains is not practical, special approval is required from the District Engineer.

Vertical separation between sewers and all other utilities other than potable water and between potable water and all other utilities other than sewers shall be no less than twelve (12) inches. Under special cases, a separation of less than twelve (12) inches may be allowed providing the structural protection details of Drawing G-3 are used and special approval is obtained from the District Engineer. Horizontal separation between recycled water, sewers and potable water shall be a minimum of ten (10) feet.

Potable water mains, recycled water mains, and sewer mains shall each be placed in a separate trench. Utilities under ownership by other entities shall not be placed in parallel with and in the same trench as potable water mains, recycled water mains, or sewer mains.

I-C6. EASEMENT REQUIREMENTS AND LOCATIONS

Easements shall be avoided where a reasonable alternate solution exists. Unless there are physical limitations, potable water, recycled water, and sanitary sewers facilities shall be installed within public streets. When easements are required, there shall be careful consideration of how the line is to be maintained and/or replaced, if necessary.

All manholes and valves within easements shall be accessible by conventional maintenance vehicles traveling over paved roads or driveways unless otherwise approved. Thus, manholes and valves within private property are discouraged and subject to special approval by the District Engineer.

Service laterals should not be connected to a main line within an easement unless specifically approved by the District Engineer.

I-C6-1. Easement Width and Obstructions

Easements for pipes up to fifteen (15) inches in diameter shall be a minimum of fifteen (15) feet wide, on private roads and parking lots, and twenty-five (25) feet wide for cross country pipelines, or as determined necessary by the District Engineer. However, additional easement width shall be required where the depths of bury exceed ten (10) feet, pipes exceed fifteen (15) inches in diameter, or as deemed necessary by the District Engineer. Pipelines shall not be installed under pavers or decorative pavement or concrete. Furthermore, pipelines shall not be installed within building courtyards or alley ways. The Improvement Plans should clearly indicate any known buildings, block walls, streetlights, trees, pavers, decorative pavement or concrete, or other obstructions within a proposed easement. Such items are contrary to District standards and require special approval from the District Engineer.

I-C6-2. Pipe Location in Easement

Pipelines shall generally be placed in the center of easements and only in unusual circumstances shall a pipeline be approved which is closer than five (5) feet from the easement edge. Unless specifically otherwise approved by the District Engineer, the line shall be straight without horizontal bends or deflections.

I-C6-3. Easement Location

The full easement width shall be on one lot or property in such manner that walls, trees, or permanent improvements will not obstruct access to District facilities. Where this requirement cannot be met without interfering with existing buildings, easements may straddle lot lines providing approval is received from the District Engineer and the sewer or water is not located on the lot lines.

I-C7. CROSS CONNECTIONS

Cross connections, as defined in the California Code of Regulations Title 17, are prohibited. According to California Code of Regulations Title 17, a "Cross-Connection" is an unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water or a substance that is not or cannot be approved as safe, wholesome, and potable. By-pass arrangements, jumper connections, removable sections, swivel or changeover devices, or other devices through which backflow could occur, shall be considered to be cross-connections.

I-C8. MASTER PLAN COMPLIANCE

The primary guide for growth and development of the District's potable water, recycled water, and sewer systems is the master plan. Additionally, a project specific water and/or sewer facilities planning document may have been prepared for the area of development to supplement the master plans. At any one time, the District may have one or more master plans, which may or may not apply to the location of the project development. The Applicant's Engineer is required to be aware of any such applicable master plans and water and/or sewer facilities planning document prepared specifically for the subject development area before proceeding with design. The Applicant's Engineer shall at all times remain in conformance with the applicable master plan(s) and supplemental water and/or sewer facilities plans with respect to layout, sizing and other such design criteria as provided in the master plan(s). Deviation from the master plans shall only be permitted by specific approval of the District Engineer.

I-C9. ABANDONMENT

All existing potable water, recycled water and sewer mains or structures that are to be abandoned shall be indicated on the Improvement Plans by the Applicant's Engineer. In general, abandoned lines that are in service will be replaced with a parallel line of equal or larger size, and the Applicant's Engineer shall indicate on the plans how active water and sewer facilities on or adjacent to the construction area are to be protected. The Applicant's Engineer shall demonstrate in any case that the abandonment does not adversely affect the potable water, recycled water or sewer systems.

I-C10. SEISMIC REQUIREMENTS

New potable water, recycled water, and sewer pipelines and structures that are located within the vicinity of earthquake zones, for example the Calaveras Fault along San Ramon Road and San Ramon Valley Boulevard, may be required to have special seismic design features. Improvement plans shall reflect the location of the earthquake zone and the fault line. The District Engineer shall evaluate the facilities and associated requirements on a case-by-case basis.

SECTION I-D - CONSTRUCTION REQUIREMENTS

I-D1. GENERAL

I-D1-1. Quality Control

Requirements for quality of materials and workmanship are specified in the following subsections.

I-D1-1.01. Quality of Material

Material and equipment to be incorporated into the Work shall be new and unused unless otherwise approved by the District Engineer and shall bear the manufacturer's stamp or marking. In case a reference is not clear as to which of several available grades is desired, the highest quality material shall be used.

The Contractor shall, at any time when requested, submit to the District Engineer, proper authenticated documents or other satisfactory proofs of compliance with the requirements of these specifications. This shall include certified copies of factory or laboratory test reports showing the strength characteristics of any materials used in the Work. For all reinforced concrete work, the Contractor shall furnish, in advance of pouring concrete and if requested, the mix design and calculated concrete strength as prepared by the concrete supplier.

I-D1-1.02. Substitutions

Where articles or materials are specified by brand or trade name, alternate materials or articles equal to those specified may be approved provided the request for approval is in writing to the District Engineer accompanied by supporting data. Sufficient time shall be provided to permit investigations without delaying the Work. No deviation from the Standards will be allowed unless the District Engineer approves substitutions.

I-D1-1.03. Quality of Workmanship

All Work will be done by persons experienced in the specific work, under competent supervision and in a manner to the District's complete satisfaction.

I-D1-1.04. Defective Material and Work

Materials not conforming to the requirements of these specifications shall be considered as defective, and all such materials, whether in place or not, shall be rejected and shall be removed from the site of the Work unless otherwise permitted by the District Engineer. No rejected material, the defects of which have subsequently been corrected, shall be used until inspected and approved by the District Engineer.

I-D1-1.05. Material Test Reports

Upon request, suppliers of material shall furnish a certified statement signed by an authorized representative of the manufacturer that materials furnished under these specifications comply in all respects with these specifications. All physical and chemical tests required must be performed within the United States.

I-D1-1.06. Replacement Parts

Suppliers of material must maintain a complete stock of replacement material and repair parts in the local area. Proof of ability to provide these replacements must be demonstrated upon request of the District Engineer.

I-D1-2. Permits and Bonds

The Contractor shall obtain all permits and bonds necessary for construction of the Work, including any required encroachment permits for construction within city, county, or state rights-of-way. The Contractor shall comply with all requirements imposed by the governing agency as specified in the encroachment permit.

I-D1-3. Safety

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work as required by Labor Code Section 6401.7. The Contractor shall take all necessary precautions for the safety of all Contractor employees on the Work and other persons who may be affected thereby.

The Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons or property to protect them from damage, injury, or loss. This shall include the Construction Safety Orders and rules of the Division of Industrial Safety, State of California, as contained in the California Administrative Code, Title 8, Chapter 4.

I-D1-4. Maintenance of Traffic

The Contractor shall comply with all local ordinances and regulations involving the maintenance of street traffic. The requirements that follow are intended to supplement those governing local ordinances and regulations. Where a conflict arises, the local ordinances and regulations shall prevail.

Contractor shall conduct Work to interfere as little as possible with public travel, whether vehicular or pedestrian. Contractor shall also be responsible for providing traffic control. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from owner and/or tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.

In making open cut street crossings, Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders. No street shall be closed to the public without first obtaining permission of proper governmental authorities and the District.

Toe boards shall be provided to retain excavated materials if required by the District Engineer or the public entity having jurisdiction over the street or highway. Fire hydrants on or adjacent to the Work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by the Contractor to ensure the use of sidewalks and the proper functioning of all gutters, sewer inlets, and other drainage facilities. Local governing agencies may require the submittal and approval of traffic detour plans prior to the commencement of Work.

I-D1-4.01. Temporary Bridges

Contractor shall construct substantial bridges at all points where it is necessary to maintain traffic across excavations for pipeline construction. Bridges in public streets, roads, and highways shall be acceptable to the authority having jurisdiction. Bridges erected in private roads and driveways shall be adequate for the service to which they will be subjected as determined by the Applicant's Engineer. Bridges shall be provided with substantial guardrails and with suitably protected approaches. Footbridges shall be not less than four (4) feet wide, provided with handrails and uprights of dressed lumber. Bridges shall be maintained in place as long as the conditions of the Work require their use for safety of the public, except that when necessary for the proper prosecution of the Work in the immediate vicinity of a bridge, the bridge may be relocated or temporarily removed for such period as District Engineer may permit.

I-D1-4.02. Detours

Where required by the authority having jurisdiction thereover that traffic be maintained over any construction work in a public street, road, or highway, and the traffic cannot be maintained on the alignment of the original roadbed or pavement, Contractor shall, at its own expense, construct and maintain a detour around the construction work. Each detour shall include all necessary barricades, guardrails, approaches, lights, signals, signs, and other devices and precautions necessary for protection of the Work and safety of the public.

I-D1-4.03. Barricades and Lights

All streets, roads, highways, and other public thoroughfares, which are closed to traffic, shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section.

All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights.

All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside public streets and highways shall cause the minimum obstruction and inconvenience to the traveling public.

All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements.

I-D1-5. Care of Existing Property Structures and Utilities

Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by construction operations. All improvements including pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards and parking areas, shall be restored to their original condition if damaged by construction activities, whether within or outside the public right-of-way or easement. All replacements shall be made with new materials.

Where construction disturbs existing water and sewer lines that would otherwise remain in good, working condition without disturbance, the contractor shall replace the existing water and sewer lines in accordance with the District's current standard requirements. The extent of the replacement shall be at the determination of the District Engineer.

No trees shall be removed outside of the permanent easement, except where authorized by the District Engineer. Whenever practicable, Contractor shall tunnel beneath trees in yards and parking areas when on or near the trench line. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage by construction operations.

Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or persons to or from the Work or any part of site thereof, whether by Contractor or subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement, or payment of costs incurred in connection with the damage.

All fire hydrants, meters, manholes and valves shall be kept free from obstruction and available for use at all times.

I-D1-5.01. Existing Utilities

The Improvement Plans for the Work shall show the underground utilities on the site of the construction insofar as they are known or can be inferred by the Applicant’s Engineer. Horizontal and vertical separation between new and existing facilities shall conform to Section I-C5.

In accordance with California Government Code Section 4216.2, the Contractor shall contact all owners of underground facilities known to be in the area of construction and request marking of these facilities at least two (2) full working days in advance of work. The use of Underground Services Alert (USA) is required. USA’s phone number is 811. A request ticket may also be submitted at www.811express.com. If work is proposed within ten (10) feet of an underground facility that is potentially hazardous to workers or the public if damaged, the Contractor shall conduct an on-site meeting with a representative of the owner of the underground facilities to determine actions or activities required to verify the location of the facility prior to start of work. Underground facilities that are potentially hazardous include, but are not limited to, high pressure natural gas lines, petroleum pipelines, pressurized sewer pipelines, high-voltage electric supply

lines, conductors or cables, or hazardous materials pipelines. The Contractor can obtain the underground facility owner's contact information from USA.

When potholing is required to identify and/or locate underground facilities, the Contractor shall replace the pothole area with two-sack slurry mix and allow for 48 hours of cure time prior to any excavation or boring.

If, in the performance of the Work, an existing utility is encountered which is not shown on the Improvement Plans and is not apparent or inferable from visual inspection of the site, the District shall be notified immediately. The District Engineer will determine whether the Improvement Plans shall be modified, the existing utility relocated or if the Contractor shall work around the existing utility.

I-D1-6. Security

The Applicant's Contractor shall be responsible for the protection of the site and all Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.

I-D1-7. Construction Water Supply

The Applicant shall obtain a construction meter from the District and provide an appropriate billing address for water use during construction. No construction water will be allowed from an unmetered source, unless specifically approved by the District Engineer, construction water supply may be from the District's recycled water system.

Construction water for residential development projects shall be available in accordance with the fees and conditions in the District Code. Water meter jumpers will not be installed in place of water meters for lots in single-family developments. The applicant shall request for a water meter to be installed at rough plumbing (the tag address on the meter and lot number shall be provided to the Inspector) and an account to be opened after payment of fees and at District inspection. The applicant must provide an appropriate billing address. Water use through the residential meters is limited to:

1. Testing the structure's interior plumbing prior to the construction of walls.
2. Incidental earthwork on the property including presoak of foundation forms prior to concrete pour and finish grade work within the property.
3. House construction needs, such as painting, plaster work, and plumbing work.

Water services may be shut down should any District personnel observe unauthorized use of water.

The Applicant and its Contractor are jointly and severally responsible for payment of water consumption for construction purposes within its project site, including, but not limited to, water for grading, pipeline flushing, and testing. The project shall not be accepted until such account is paid in full.

I-D1-8. Control of Site Conditions

Contractor shall be responsible for controlling all site conditions including noise, dust, drainage, erosion, and pollution.

I-D1-8.01. Noise

Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

During construction activities on or adjacent to occupied buildings, and when appropriate, Contractor shall erect screens or barriers effective in reducing noise in the building and shall conduct construction operations to avoid unnecessary noise which might interfere with the activities of building occupants.

I-D1-8.02. Dust Control

Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. Dusty materials in piles or in transit shall be covered whenever possible to prevent blowing.

Buildings or operating facilities, which may be affected adversely by dust, shall be adequately protected from dust. Suitable dust screens shall protect existing or new machinery, motors, instrument panels or similar equipment. Proper ventilation shall be included with dust screens.

I-D1-8.03. Drainage Maintenance

The Contractor shall provide and maintain temporary drainage of ground water from all excavations, drains, sewers, ditches, trenches, and structures in compliance with State Water Resources Control Board (SWRCB) Order No. 99-08 DWQ. The Contractor shall keep the excavations dry throughout the construction operations. The laying of pipe or the placing of concrete will not be allowed under circumstances where there is standing water in the excavation. Failure by the Contractor to dewater the excavation area may result in an order to halt progress of the Work until compliance has been achieved.

The Contractor shall dispose of the water from the Work in accordance with their NPDES Permitting issued under SWRCB Order No. 99-08 DWQ.

Contractor shall also provide for the drainage of storm water as may be applied or discharged on the site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the site, and adjacent property.

I-D1-8.04. Erosion Control

Contractor shall prevent erosion of soil on the site and adjacent property resulting from construction activities. Effective measures, as required in their Storm Water Pollution Prevention Plan (SWPPP), shall be initiated prior to the commencement of clearing, grading, excavation or other operation that will disturb the natural protection. The protective measures shall be in

accordance with Regional Water Quality Control Board, Alameda County or Contra Costa County best management practices.
Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast growing vegetation, suitable ground cover, or other acceptable methods shall be implemented as necessary to control runoff.

I-D1-8.05. Pollution Control

Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities as outlined in their Storm Water Pollution Prevention Plan (SWPPP). No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance will be permitted to enter sanitary sewers and reasonable measures will be taken to prevent such materials from entering any drain or watercourse.

I-D1-9. Clean Up

Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the site, and shall promptly empty the containers when filled.

Construction materials, such as concrete forms and scaffolding, shall be neatly stacked by Contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

Volatile wastes shall be properly stored in covered metal containers and removed daily.

Wastes shall not be buried or burned on the site or disposed of into storm drains, sewers, streams, or waterways. All wastes shall be removed from the site and disposed of in a manner complying with local ordinances and antipollution laws.

I-D1-10. Coordination of Work with Street Development

Street development work such as grading and laying of base rock and asphalt shall be coordinated with water and sewer facilities installation such that the integrity of installed pipe and connecting joints is not adversely affected. Pressure testing of water and sewer mains shall be performed after road base rock has been installed and compacted. In the opinion of the Inspector, if any street development work following a passing test has adversely affected the water or sewer Work, then the Contractor shall be required to conduct additional pressure tests. If damage has occurred, then the Contractor will be responsible to repair the damage and pay the District for the cost of additional tests.

I-D1-11. Lines and Grades

All Work shall be done in accordance with the lines, grades, and elevations shown on the Improvement Plans.

Basic horizontal and vertical control points will be established or designated by Applicant's Engineer. These points shall be used as datum for the Work. As a part of the Work, the Applicant's Engineer or Contractor shall perform all additional survey, layout, and measurement work.

Applicant's Engineer or Contractor shall provide experienced instrument personnel, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, Applicant's Engineer or Contractor shall furnish, without charge, competent personnel and such tools, stakes, and other materials as may be required in establishing or designating control points, in establishing construction easement boundaries, or in checking survey, layout, and measurement of work performed by Contractor.

Contractor shall keep the Applicant's Engineer informed, a reasonable time in advance, of the times and places at which the Contractor wishes to do Work, so that horizontal and vertical control points may be established, and any checking deemed necessary by Applicant's Engineer may be done with minimum inconvenience to the Applicant's Engineer and minimum delay to the Contractor. Contractor must supply cut sheets to the District Inspector prior to commencement of any work.

Prior to extension of water and sewer services, fire hydrants, and other appurtenances to be located behind the curb, Contractor shall provide all construction staking necessary to adequately locate the curb, gutter, fire hydrants, and water and sewer pipes, services, and appurtenances. Contractor shall remove and reconstruct Work that is improperly located.

I-D2. CLEARING AND GRUBBING

Clearing and grubbing, which consists of removal of objectionable material from the right-of-way, shall be done with caution such that existing improvements and trees and shrubbery that are not to be removed are protected from injury or damage.

Within easements or rights-of-way, trees, shrubs, fences, and all other improvements that have to be removed to permit construction, shall be replaced in kind and size (excluding native trees under two (2) inch diameter or native brush) or with approved substitutes, unless permission to exclude such replacement is obtained from the property owner.

I-D3. EXISTING PAVEMENT REMOVAL

Removal of existing pavement shall be done in a manner prescribed by the city or county having jurisdiction, or the governing state agency. In addition to the pavement removed for the trench, an additional six (6) inches on each side of the trench shall be removed prior to repaving. The pavement shall be cut on neat lines prior to excavation, parallel to the trench at the width required. Any pavement damaged outside these lines shall be restored at the Contractor's expense.

I-D4. EXCAVATION AND TRENCHING

I-D4-1. General

Trench excavation shall consist of all excavation involved in the grading and construction of the sewer or water line as shown on Improvement Plans. The Contractor shall perform all excavation of every description and of whatever substances encountered, to depths indicated on the

Improvement Plans or as otherwise specified or required. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the District, the pipe or duct can be safely and properly installed and backfill can be properly compacted in such tunnel sections.

If blasting is necessary, the Contractor shall notify the District and the City of the blasting schedule and procedures, and obtain a blasting permit. All reasonable precautions in protecting life and property shall be observed.

Trench excavation shall only be conducted after pipe and other necessary materials are delivered to the work site.

Holes and depressions for bells or couplings shall be excavated after the trench bottom has been graded and embedment material placed, and shall be only of such length, depth, and width as required for properly making the particular type of joint. Over excavations shall be backfilled with the same material as the bedding zone.

The trench bottom shall be of even grade such that it will provide uniform bearing and support for each section of pipe and shall be free of clods, rocks, and excess spoil material. Grades shall be transferred from ground surface to the bottom of the trench by experienced workers using not less than three (3) consecutive grade points in common so that variations from a straight grade can be readily detected.

I-D4-2. Trench Width

The width of unsheathed trenches shall be limited to a width that will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. Where shoring is required, the width of trench shall be increased only sufficiently to accommodate the sheeting or shoring.

I-D4-3. Trench Depth

Unless specifically authorized by the District Engineer, trench depth shall always allow a four (4) foot minimum cover over all water mains and five (5) foot cover for sewer mains. For cases where minimum cover cannot be maintained, the Applicant's Engineer shall follow design requirements of Section I-C4.

I-D4-4. Maximum Length of Open Trench

Unless otherwise specified or directed by the District Engineer, the maximum length of open trench shall be one (1) block, four-hundred (400) feet, or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is shorter. The distance is the collective length of any location, including open excavation, pipe laying and appurtenant construction and backfill, that has not been temporarily resurfaced. Failure by the Contractor to comply with the limitations specified herein may result in an order to halt progress of the Work until compliance has been achieved. No trenches shall remain open overnight unless covered by steel plates capable of sustaining expected wheel loads.

I-D4-5. Unsuitable Material on Bottom of Trench

Where, in the opinion of the District Engineer, the bottom of the excavation will not afford the pipe a firm and uniform bearing because of rock, hardpan, shale, or any other material which cannot be readily excavated, the Contractor shall excavate a minimum of six (6) inches below the bottom surface grade of the pipe, refill the trench with pipe embedment material specified herein in Section I-D6-1, and consolidate and reshape the trench bottom to the required section and grade.

Where the material at the bottom of the excavation is of soft or unstable material, or is otherwise considered unsuitable for the support of the pipe, the Contractor shall overexcavate to an additional depth as required by the District Engineer. Backfill to the required grade with 1-1/2 inch crushed drain rock wrapped in geotextile filter fabric per Caltrans Section 88, with twelve (12) inch overlaps, to afford the pipe a firm and uniform bearing. The Contractor shall consolidate and reshape trench to required section and grade.

I-D4-6. Overexcavation or Inaccurate Trimming

Wherever, due to overexcavation or inaccurate trimming caused by carelessness in operation of the Contractor's equipment or workers or other reasons, the shaping of the trench is inadequate to afford the pipe a firm and uniform bearing, the Contractor shall, at its own expense, refill the trench with backfill material, specified herein, and consolidate and reshape the trench bottom to the required section and grade.

I-D4-7. Shoring

The Contractor shall furnish, put in place, and maintain such sheeting or shoring, etc., both in open cut and tunneling, as may be required to support the sides of the excavation and prevent any movements which could in any way injure any structure.

All excavations shall be supported in the manner set forth in the rules, orders, and regulations prescribed by the California Division of Occupational Safety and Health (Cal/OSHA). All shoring of trenches shall comply with the Cal/OSHA standards.

The Contractor shall be responsible for any injury which may result to any person(s), structure(s), or to any interests whatsoever that is due directly or indirectly to the insufficiency of said sheeting or shoring, or to the replacing or removal of said sheeting or shoring.

I-D4-8. Control of Water

The Contractor shall remove all water that may accumulate in the excavation during the progress of the Work so that all Work can be done under dry conditions. Trenches or other excavations shall be kept free from water while the pipe or structures are installed, while concrete is setting, and until backfill has progressed to a sufficient height to anchor the Work against possible flotation or leakage. Failure by the Contractor to dewater the excavation area may result in an order to halt progress of the Work until compliance has been achieved. Water shall be disposed of in such a manner as to cause no injury to public or private property or to be a nuisance or menace to the public health and in accordance with any State of California Regional Water Quality Control Board ("RWQCB") permits.

To prevent soil migration in the pipe zone, installation of geotextile fabric shall be used in the trench in addition to Class II AB around the pipe.

I-D4-9. Excavated Material

Excavated materials shall be stored so as to offer minimum obstruction to traffic and the normal use of adjacent properties. Material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides and cave-ins. Gutters shall be kept clear, or other provisions shall be made for handling drainage. Free access must be provided to all fire hydrants, water valves, meters, manholes, and private drives. Material shall be removed from the site when determined to be excess or unfit for use. The Contractor shall not dump material on any private or public property without the permission of the owner thereof.

I-D4-10. Excavation in Public Rights-of-Way

Excavation and trenching in the public streets and highways shall conform to the requirements of the agency having jurisdiction, e.g., Cities of Dublin and/or San Ramon or Counties of Alameda and/or Contra Costa.

I-D5. PIPE LAYING

Contractor shall properly assemble all pipe and provide an installation true to line and grade and free from leaks, cracks, and obstructions. Minimum length of pipe that can be used for mains shall be five feet (5').

Each length of pipe shall be laid on compacted, approved bedding material as specified in I-D6-1 and shall have full bearing for its entire length between bell holes excavated in said bedding material to allow for unobstructed assembly of all joints. Adjustments of pipe to line and grade shall be made by scraping away or filling in and tamping approved material under the body of the pipe. No wedging or blocking with wood or soil to support the pipe will be permitted. Under no circumstances will Contractor be allowed to dump backfill materials on top of a pipe that is not continuously supported in its final grade position.

Each section of pipe and each fitting shall be thoroughly cleaned before it is installed. Pipes should be installed such that manufacturer pipe markings shall be on top of the pipe. All pipe, fittings, valves, etc., shall be carefully lowered into the trench by suitable tools or equipment, in such manner as to prevent damage to the pipe, lining, coating, fitting, or other appurtenances. Damage to lining or coating shall be repaired to the satisfaction of the District Engineer before the pipe or fitting is installed or backfilled.

The pipe shall be laid true to line, with no visible change in alignment at any joint, unless curved alignment is shown on the Improvement Plans.

When curved alignment is shown on the Improvement Plans, the maximum deflection at any joint shall not exceed the manufacturer's recommendation for the type of pipe and joint being used.

Pipe joints shall be made only with the couplings and rubber rings furnished with the pipe, and aligned and constructed in the trench in accordance with the manufacturer's instruction manual. "Stabbing," "Swinging In," or "Popping On" spigot ends of pipe into bell ends will not be permitted.

Pipe shall not be laid when the District Engineer or Inspector determines that the condition of the trench or weather is unsuitable. As Work progresses, the interior of the pipe shall be cleared of all dirt and extraneous materials.

At the close of each day's work, and at such other times when pipe is not being laid, the end of the pipe shall be protected with a close-fitting stopper. Whenever the Work ceases for any reason or when the pipe is constructed with end not joined to an existing pipe or structure, it shall be closed by a cap or plug, tightly sealed in place.

All piping must be installed with piping identifications facing up on top of pipes.

I-D6. PIPE EMBEDMENT

Pipe embedment material shall be free of organic material, recycled material, including recycled aggregate base, and other deleterious substances. Pipe embedment material shall be of such nature that it can be compacted to form a firm, stable base.

There shall be two (2) standard main pipe embedment classes: A and B as shown on Drawing G-l. Class A pipe embedment is characterized by use of arch encasement and imported aggregate, and shall be required under special circumstances of shallow cover and excessive loads. The required reach of Class A pipe embedment shall be indicated on the Improvement Plans. Class B pipe embedment shall be used for all plastic pipes and ductile iron pipe, and is characterized by use of Class 1 Embedment conforming to Section I-D6-2 of these Standards extending from four (4) inches below the bottom surface of the pipe to twelve (12) inches above the top surface of the pipe as shown in the Drawings. Outside of vehicular traffic areas, the remaining backfill more than twelve (12) inches above top surface of the pipe shall be select material from excavation. Select material shall be free of organic or other unsuitable materials and shall not include rocks, boulders, or unbroken masses of soil larger than four (4) inches in greatest dimension. Within vehicular traffic areas or public right of ways, backfill materials and compaction shall be in accordance with the City or County of jurisdiction.

The concrete encasement section as shown in Drawing G-2 shall be used when pipe cover is three (3) feet or less, or when pipes are installed under a concrete slab, footing, or foundation.

These definitions shall apply to the entire length of the pipe including the barrel and bell. As the pipe surface varies at the bell section, the pipe embedment zone shall accordingly vary to maintain the above required pipe embedment material thickness surrounding the surface of the pipe.

I-D6-1. Class 2 Aggregate Base

Pipe embedment material for sewer pipes shall be 3/4-inch maximum aggregate and shall conform to the grading and quality requirements of Class 2 aggregate base as specified in Sections 25 and 26 of the State of California Department of Transportation ("DOT") Standard Specifications, latest edition shown in the following tables.

Table 1. Aggregate Grading Requirements For 3/4-inch, Class 2 Aggregate Base

Sieve Sizes	Percentage Passing	
	Individual Test Results	Moving Average
2 inch	--	--
1-1/2 inch	--	--
1 inch	100	100
3/4 inch	87-100	90-100
No. 4	30-65	35-60
No. 30	5-35	10-30
No. 200	0-12	2-9

Table 2. Quality Requirements For 3/4-inch, Class 2 Aggregate Base

Tests	Individual Test Results	Moving Average
Resistance (R value)	78 min.	--
Sand equivalent	22 min.	25 min.
Durability index	35 min.	--

Evaluation of test results, with moving averages specified, shall conform to the applicable provisions of "Statistical Testing" of DOT Standard Specifications, latest edition.

Coarse aggregate (material retained on the No. 4 sieve) shall consist of material of which at least 25 percent by weight shall be crushed particles as determined by California Test 205.

The aggregate shall not be treated with lime, cement, or other chemical material before the durability index is performed.

I-D6-2. Class 1 Embedment

Pipe embedment material for PVC and ductile iron water pipes shall be Class 1 backfill. Class 1 backfill shall be clean, sound and durable natural or crushed sand, with qualities conforming to Table 3A below. Class 1 backfill shall also conform to the grading requirements in Table 3B below.

Table 3A. Quality Requirements - Class 1 Backfill

Qualities	Tests	Test Results
Organic Impurities	ASTM C-40.	Supernatant shall not be darker than Plate 3 when compared to standard Gardiner Color Series.
Sand Equivalent	ASTM D-2419	Equal to or greater than 20

Qualities	Tests	Test Results
pH value	ASTM G-51-77	Equal to or greater than 4.5 and less than 9
Resistivity R	ASTM G-57	Equal to or greater than 5,000 Ohms-cm (See Note 1)
Compaction	ASTM D-1557	Equal to or greater than 95%. Material should not slough when cross trenched.
Coefficient of Uniformity	See gradation	$C_u \geq 2.5$, where; $C_u = D_{60} / D_{10}$ D_n = Diameter of grain size for which n % of the total sample is passing

Note 1 - If Resistivity R is smaller than 5,000 Ohms-cm, the following chemical contents limits shall apply:

- Total chloride content shall be equal to or less than 500 parts per million as determined by EPA Method 300.0 prepared by Parr O Subscript 2 bomb combustion.
- Total sulfate content shall be equal to or less than 150 parts per million as determined by EPA Method 300.0 prepared by Parr O Subscript 2 bomb combustion.

Table 3B. Grading Requirements - Class 1 Backfill

Sieve Sizes	Percentage Passing
1/2 inch	100
No. 4	75-100 [2]
No. 50	0-70
No. 100	0-30
No. 200	0-15

Note 2 - For grains retained on No. 4 sieve, the grain shape shall be rounded or sub-rounded as defined by ASTM D-2488.

Supplier shall submit samples of Class 1 Embedment from each source for testing at an independent lab in accordance with all listed specifications. The lab results must be signed by a Registered Civil Engineer. Supplier shall provide certified test reports to the District upon request. Supplier shall obtain and provide new test results when there is a change in the original approved source.

Sand sampling shall follow ASTM D-75:

- The minimum sample size that will be accepted for testing is 100 pounds.
- Each sample shall be representative of the material from a single source.
- Each sample shall be marked with a unique identifier and the location where it was procured.
- New test results shall be obtained when there is a change in the original approved source.

I-D6-3. Controlled Density Fill

At the discretion of the District Engineer, controlled density fill ("CDF") may be substituted for Class 2 aggregate base above the invert of the pipe. The controlled density fill shall conform to the following:

CDF shall be manufactured in accordance with the following reference standards. It shall be a hand-excavatable mixture of aggregate, cement, Pozzolan, water and admixtures to be used as fill material where indicated in this Specification and on the Improvement Plans.

CDF material shall have the following properties:

1. Cement shall be Type II in accordance with ASTM C150.
2. Pozzolan shall be Type F in accordance with ASTM C618.
3. Coarse aggregate shall consist of a well-graded mixture of crushed rock, soil, or sand with a maximum size aggregate of three-eighths (3/8) inch. One hundred (100) percent shall pass the half (1/2) inch sieve. Not more than thirty (30) percent shall be retained by the three-eighths (3/8) inch sieve and not more than twelve (12) percent shall pass the No. 200 sieve. All material shall be free from organic matter and not contain more alkali, sulfates, or salts than the native soils at the site of the Work.
4. Air entraining shall be used to improve the workability of the mixture in accordance with ASTM C260. Entrained air content shall be between eight (8) and twenty (20) percent.
5. A water reducing agent shall be added to improve the workability and shall be in accordance with ASTM C494.
6. Water shall be potable, clean and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities.
7. CDF shall be flowable engineered fill material similar in all respects to CDF products listed in the Approved Materials List, or an approved equal. The 28-day compressive strength shall be between fifty (50) and one hundred fifty (150) psi.

I-D6-4. Placement and Compaction

Before placement of embedment material, the trench shall be cleared of all timber and debris, leveled and checked for specified cut. Bottom embedment material shall be placed in the trench to the full width of excavation, leveled and compacted to the specified compaction. After the pipe has been properly laid and inspected to the satisfaction of the District, embedment material shall be hand shoveled and uniformly distributed on both sides of the pipe. Sufficient material shall be hand shoveled to securely anchor the pipe so that no change in alignment or grade will occur when the next section of pipe is installed. Embedment material shall not be dropped directly upon the pipe

With the exception of jetting or flooding, which shall not be allowed unless specifically approved by the District Engineer, the Contractor shall choose the compaction device to obtain a relative compaction of ninety (90) percent in the pipe zone as defined by AASHTO Test No. T180 (Standard Proctor). All compaction testing within the pipe zone shall be performed by a District approved, certified soils inspector. The compaction device may either be manually, mechanically, or pneumatically driven; however, the compaction device used shall in no manner cause displacement, instability or damage to the pipe. In such an event, the Contractor shall be responsible for all necessary repairs.

Except for directly above the pipe, compaction lifts shall be limited to six (6) inches within the pipe zone. For embedment material placed directly above the pipe, the compaction lift shall be of

sufficient depth to achieve required compaction and protect the pipe. All compaction layers shall be compacted as required before the next layer is deposited.

The Inspector shall examine the embedment material to assure that it has been uniformly compacted throughout the entire pipe zone and that no voids exist. A minimum of one compaction test per five hundred (500) feet of pipeline shall be performed at Contractor's expense by an independent testing laboratory. If there is any indication that the required compaction has not been achieved the trench shall be recompacted and retested. The Applicant or Contractor shall pay for recompaction and retesting.

During the process of backfilling embedment material, any timbering, sheeting, shoring, and sheet piling used to shore the excavation shall be carefully removed by the Contractor in such a manner as will result in a minimum of caving, lateral movement, or flowing of the soil. On approval of the District Engineer, the Contractor may leave in place sheet piling, sheeting, and bracing.

I-D7. BACKFILL AND COMPACTION

I-D7-1. Public Streets and Highways

Where trench backfill and compaction above the pipe embedment zone is performed in public streets and highways, the Contractor shall comply with all requirements of the governing city or agency. The pipe embedment zone to one (1) foot over the top of the pipe is under the jurisdiction of the District.

I-D7-2. Unimproved Rights-of-Way

Trench backfill above the pipe embedment zone shall be select material from the excavation approved by the District Engineer. Select material shall be free of organic or other unsuitable materials and shall not include rocks, boulders, or unbroken masses of soil larger than four (4) inches in greatest dimension.

Trench backfill shall be compacted to ninety (90) percent relative compaction using AASHTO Test No. T180 (Standard Proctor). If for any reason this degree of compaction cannot be achieved, then imported backfill material meeting the above requirements shall be used. All costs of providing and placing the imported material shall be the responsibility of the Applicant or Contractor.

Trench backfill within District Easements shall be Class 2 aggregate base.

I-D8. BORING AND JACKING OPERATIONS

Placement of pipe by boring or jacking methods requires special District approval for each instance. However, as a general guideline, the following shall pertain:

1. Except for the use of air or water, the methods and equipment used in boring and jacking operations shall be at the option of the Contractor, provided that the District reviews them prior to any work.
2. The placement of pipe shall be to the lines and grades shown on the Improvement Plans.

3. Voids remaining outside the pipe (or carrier pipe if applicable) shall be backfilled with grout.
4. Where a casing pipe is used, it shall be no less than eight (8) inches greater in diameter than the sewer pipe or water pipe to be installed.
5. The placement of pipe in casings shall be supported with redwood skids, shims, or wedges to the lines and grades shown on the Improvement Plans. Skids shall be notched so strapping will not scrape off interior coating.
6. Pipe installed in casings shall have restrained joints. See water system requirements for acceptable joint types. Pipe shall be pulled through casings unless otherwise approved by the District Engineer.

I-D8-1. Bores

The boring machine shall cut a true circular bore to the required line and grade. The bored tunnel shall be no more than two (2) inches larger in diameter than the maximum outside diameter of the casing or pipe to be installed.

I-D8-2. Jacked Steel Crossings

1. In addition to applicable portions above, the following shall pertain:
2. Where casings are used, the size and wall thickness of the casing shall be at the Contractor's option, except that the minimum casing thickness shall be not less than three-eighths (3/8) inch.
3. Field joints of steel casings shall be welded with a continuous circumferential weld.
4. The placement of pipe in casings shall be supported with redwood skids, shims, or wedges to the lines and grades shown on the Improvement Plans.
5. Prior to backfilling the annular space between the pipe and casing, the pipeline shall be tested in accordance with Section II-B3, III-B4 or IV-B3 Testing.
6. The annular space shall be backfilled with washed concrete sand blown or rammed into place until the entire cavity is filled. Concrete bulkheads shall be placed at each end of the cased section to retain the backfill material.

I-D9. RESURFACING AND RESTORATION

I-D9-1. General

Where an unimproved surface is encountered, the trench shall be restored to its original surface, unless otherwise indicated on the Improvement Plans.

If the Work has disturbed or damaged existing private streets, alleys, driveways, or other improved surfaces, the damaged portions shall be removed and restored, including the provision of adequate subgrade where these operations have disturbed the original materials.

Any temporary paving, barricades, or special provisions required by public agencies shall be furnished by the Contractor as required.

I-D9-2. City or Other Governing Agency Requirements

If the Work is within existing city or county streets or other public roadways, any required resurfacing shall be in accordance with the city, county or other governing agency requirements.

If the Work shall occur in streets where no paving exists, the Contractor shall, in accordance with city and other governing agency requirements, leave the completed trenches in a suitably compacted condition for future finish grading, placement of base material, and paving.

I-D9-3. District Requirements

The requirements in this section shall apply to the extent that there are no city or other governing agency requirements which take precedence.

Aggregate base, paving materials, and methods of placement shall be in accordance with the most recent edition of State of California Department of Transportation Standard Specifications.

Where a gravel surface is encountered, it shall be replaced over the width of the trench with Class 2 aggregate base eighteen (18) inches in depth if within eight (8) feet from the edge of a paved road. If greater than eight (8) feet from the edge of a paved road, the surface shall be restored with six (6) inches of Class 2 aggregate base.

Where existing surface is some type of asphalt concrete, it shall be restored with a temporary surface followed by a permanent surface as specified herein.

I-D9-3.01. Temporary Paving

Temporary surfacing shall be Class 2 aggregate base, equal in depth to the existing pavement structural section but in any case, not less than eighteen (18) inches in depth, plus one and one half (1-1/2) inches of premixed asphaltic paving material.

In areas used by public traffic, the temporary paving must be placed at the end of each workday. All other areas shall be surfaced within two (2) days after backfilling.

Before street is opened for traffic, all excess dirt, rock, and debris shall be removed and the street surface shall be swept clean. Temporary surfacing shall be maintained constantly so that at no time will there be any mud holes, nor shall the surface settle below one (1) inch, nor be raised more than one (1) inch from the existing pavement.

I-D9-3.02. Permanent Paving

Permanent paving shall not be constructed until the compaction requirements of these Standards are satisfied.

The existing pavement shall be neatly cut to a depth of two (2) inches and removed to at least six (6) inches outside each edge of the pipe trench to permit proper keying in the restored pavement. The existing pavement cut shall be straight, vertical, and with no ragged edges.

The base course for permanent surfacing shall be Class 2 aggregate base as specified in the above State of California Department of Transportation ("DOT") Standard Specifications. The aggregate

base shall be equal to the existing pavement structural section less three (3) inches but in any case, not less than sixteen (16) inches in depth.

The aggregate base shall be given a penetration treatment as specified in Section 37 of the State of California DOT Standard Specifications. Liquid asphalt used for the treatment shall be grade SC-70. The rate of application of the liquid asphalt shall be the maximum that will, under favorable weather conditions, be completely absorbed by the base material within twenty-four (24) hours from the time of application. A sufficient amount of liquid asphalt shall be applied to bind the aggregate base and prevent raveling. Care shall be taken so that liquid asphalt is applied to the adjoining pavement surface.

The wearing surface for permanent surfacing shall be asphalt concrete. The depth of the asphalt concrete shall be as required by the local agency having jurisdiction or match existing, with a minimum depth of three (3) inches. The asphalt concrete shall be "Type B-Asphalt Concrete" conforming to the requirements of Section 39 of the State of California DOT Standard Specifications.

I-D10. CONCRETE AND MORTAR WORK

I-D10-1. Concrete

I-D10-10.01. Material

Concrete used for thrust blocks, manholes, encasements, filling, blocking, piers, and other typical construction applications shall be transit-mixed concrete from a supervised batch plant which issues a certified delivery ticket with each load, showing the mix proportions, mixing time, true departure time and water added. Such certified tickets will be handed to the Inspector at the time of delivery. Ready-mixed concrete shall be batched and handled in accordance with ASTM C94. Job-mixed concrete shall be limited to that needed for patching and minor nonstructural uses requiring one sack of cement or less. In these cases, the materials and workmanship shall be the same as if transit-mixed concrete had been used.

Approved concrete material shall be Portland Cement concrete as specified in Section 90 of the DOT Standard Specifications and shall be chosen according to the following chart showing its intended use:

Class	Application	Min. Weight of Portland Cement, lbs/cy	Maximum Aggregate Size, Inches	Slump Inches	
				Min	Max
A	Walls, drop structures, slabs, and reinforced structural encasement	564 (6 sack)	1-1/2"	3"	6"
B	Manhole bottoms, thrust blocks, drop pipe encasement, pipe bedding, nonstructural use	470 (5 sack)	1-1/2"	2"	6"
C	Pump mix for abandoning lines	376 (4 sack)	3/8"	--	--

Type V cement shall be used for concrete material used in any structure subject to sulfide deterioration.

The 28-day compressive design strength of concrete shall be chosen according to its intended use as outlined above.

When concrete is being hauled in truck mixers or agitators, ensure the discharge is completed within 1-1/2 hours or 250 revolutions after introducing the cementitious material to the aggregates. If the concrete temperature is 85 degrees F or above, determine the time (less than 1-1/2 hours) that will be allowed. Advise the contractor accordingly.

I-D10-10.02. Placement

Concrete shall be placed in clean forms before its initial set begins, using the minimum amount of mixing water required for good workability. Concrete shall be worked into forms by rodding or vibrating to secure a dense homogeneous mass, free from voids and rock pockets. All concrete shall be vibrated unless the Inspector approves solely rodding to avoid having the concrete run out of the forms or trench.

I-D10-10.03. Finish

Concrete surfaces to be in contact with sewage shall be steel trowelled to a smooth hard surface, free from ridges, holes, and surface roughness. Exposed walls shall be left with a surface finish comparable to that obtained with new plywood forms. Slabs and walkways shall be finished with a wood float unless otherwise specified on the Improvement Plans. Corners and edges shall be neatly beveled. Surface defects shall be repaired to match the surrounding concrete.

I-D10-10.04. Accelerated Curing

Calcium chloride not in excess of two (2) percent volume will be permitted when, in the District Engineer's opinion, circumstances warrant its use. Use of calcium chloride admixture may be restricted, at District discretion.

I-D10-2. Mortar

Mortar shall consist of commercial grade non-shrink grout.

I-D11. REINFORCING STEEL

Bar reinforcement shall be Grade 40 minimum deformed bars conforming to ASTM A615, accurately placed and secured in position to accomplish the intent of the design plans. Where bars are spliced they shall be lapped at least twenty (20) diameters or butt welded, except where otherwise shown on the Improvement Plans.

Mesh reinforcement shall conform to the requirements of ASTM A185; wire gauge and mesh dimensions will be as shown on the Improvement Plans.

I-D12. ABANDONMENT

In absence of more stringent encroachment permit requirements administered by the local governing agency; all water and sewer main abandonments shall be in accordance with the below requirements, and these specifications.

Pipe mains greater than six (6) inches and indicated on the Improvement Plans to be abandoned shall be filled with a sand or sand and cement slurry mixture.

Sewer mains of all sizes to be abandoned shall be capped at each end. Sewer mains constructed of PVC or ductile pipe shall be abandoned in accordance with abandonment of water mains below. Existing sewer service lines that are attached to an active sewer main shall be abandoned by excavating the service connection at the main and disconnecting the service pipe at the main. The sewer main shall be capped or plugged with like material at the wye or tee connection.

Water mains of all sizes indicated on the Improvement Plans to be abandoned shall be cut and capped, or plugged, at each end as indicated on the drawings.

Existing water service lines that are attached to an active water main shall be abandoned by excavating the service connection at the main; removing the corporation stop and disconnecting the service pipe at the main; and installing a full circle stainless steel repair band.

Water main valves shall not be abandoned in place. All water main valves indicated on the Improvement Plans to be abandoned shall be physically removed from service, and replaced with a blind flange, cap or plug as indicated on the plans.

Manholes, valve boxes, and other underground appurtenances to be abandoned shall be removed to at least three (3) feet below finished grade. All remaining cavities shall be filled with sand to the cut elevation and the excavation backfilled and restored to finish grade as required.

Pipes to be abandoned underneath proposed structures shall be removed.

I-D13. LOCATION MARKINGS

All water service assemblies, valves, blowoffs, side sewers, and manhole locations shall be clearly indicated on the street curb at the time of the street curb installation as per the legends in Drawing G-4. Size of lettering shall be at least two (2) inches high. If there is no curb marker, posts per Drawing G-4 shall be constructed.

SECTION II
POTABLE WATER SYSTEM REQUIREMENTS

SECTION II
POTABLE WATER SYSTEM REQUIREMENTS

SECTION II-A - DESIGN CRITERIA

II-A1. POTABLE WATER MAIN SIZING

Potable water mains shall be sized using the Hazen-Williams or Darcy-Weisbach formula. The design criteria to be used to determine the sizes of the mains in the distribution system shall be the values for the following parameters, which are given in the following sections:

1. Design water demand.
2. Pipe friction factor of pipe material.
3. Maximum velocity.
4. Minimum and maximum residual pressure in the main.

Each potable water main reach shall be sized to provide sufficient flow and pressure to meet at all times domestic, commercial demand, and fire flow. Potable water mains designed to serve future development shall also include capacity for future demands. Capacity for future demands shall be as determined by the District Engineer in accordance with the Water Master Plan.

II-A1-1. Design Water Demand

Potable water demand for the development shall be based on the maximum daily demand. Each pipe main reach shall be sized to supply maximum daily water demand of all the service connections being served by the reach based on the following criteria:

Table 1. Flow per Service for each Lot

Service	Maximum Daily Demand
Single family dwelling, residential	0.53 gpm/connection
Multi-family, residential	4.00 gpm/acre
Institutional areas	2.00 gpm/acre
Commercial areas	2.92 gpm/acre
Parks	2.11 gpm/acre

Table 2. Commercial and Institutional Buildings

Type of Business	Maximum Daily Demand
Hair care establishment	3.0 gpm/chair
Dental office	4.0 gpm/chair
Department store	2.0 gpm/employee
Groceries	3.0 gpm/employee
Drug store	5.0 gpm/establishment
Laundry	30 gpm/1,000 lbs clothes
Laundromat	8 gpm/washer
Meat market, supermarket	6 gpm/1,000 sq ft floor area
Motel, hotel	4.0 gpm/unit
Medical office	3.0 gpm/exam room
Restaurant: Seating service	2.0 gpm/table
Restaurant: Drive-in	0.2 gpm/car space
Theaters, movie houses	0.2 gpm/seat
Hospitals	4.0 gpm/bed
Nursing homes	2.0 gpm/bed

Table 1 shall be used when lot dimensions of establishments are determined and size of building design is not known.

Table 2 shall be used to determine flows when the type and size of business establishment or building design is known.

II-A1-2. Fire Flow Requirements

Fire flow requirements for the potable water distribution system shall be set forth by the local fire agency. For preliminary designs, fire flow requirement shall be in accordance with the criteria for fire flows quoted below:

Potable Water Distribution System Criteria for Fire Protection

Analysis and design of potable water distribution systems shall be based upon the following criteria:

1. Fire flow rates and duration

		Flow (gpm)	Duration (hours)
a.	Single family residential (non-sprinklered)	2,000	2
b.	Single family residential (sprinklered)	1,000	2
c.	Multiple family residential (sprinklered)	2,500	2

d.	Business and small commercial (sprinklered)	2,500	2
e.	Major commercial (sprinklered)	2,500	2

Industrial, institutional, and medium-to-large commercial developments shall require special evaluation on a case-by-case basis by fire department personnel using procedures as outlined in the Insurance Services Office publication, "Fire Suppression Rating Schedule," latest edition.

2. Pressure

A minimum of twenty (20) psi residual pressure shall be maintained at the hydrant outlet under conditions of the required fire flow rate plus maximum daily demand.

II-A1-3. Combined Conditions

Potable water mains and transmission mains shall be designed for the combined total demand as tabulated below:

Water Mains without Fire Hydrants	**Design Combined Flow**
Residential Area	100 percent of maximum daily residential demand.
Commercial Area	100 percent of maximum daily commercial demand.

Water Mains with Fire Hydrant	**Design Combined Flow (or as directed by the local Fire District)**
Residential Area	100 percent of maximum daily residential demand plus 2000 gpm flow from each of the two (2) nearest fire hydrants.
Commercial Area	100 percent of maximum daily commercial demand plus 4000 gpm flow from each of the nearest three (3) fire hydrants.
Transmission Main	Conveyance flow plus maximum daily residential, commercial demand, and fire flow. Flows to be determined by District Engineer from Water Master Plan.

II-A1-4. Pipe Friction Factor

There are many factors and conditions affecting pipe friction factors and much research has been conducted to determine the amount of friction losses in pipe. Pipe friction factors vary over a wide range and designers and engineers will select different values based on individual judgment of the design conditions. For uniformity of design in the District, the values to be used in the calculation for the pipe friction factor are the following:

Pipe Type	Hazen Williams 'C' Factor
Ductile Iron Pipe (DIP), cement-lined	120
Polyvinyl Chloride (PVC) Pipe	130
High Density Polyethylene (HDPE) Pipe	150

II-A1-5. Maximum Velocity

Flow of water in the main is not constant and will continually vary from no flow to a maximum flow depending on the demand and other conditions. Due to the varying flow conditions, the pipe will be subjected to cyclic surging. Its magnitude shall be minimized to keep the stress of the pipe due to water hammer effects within the design strength of the pipe by limiting the allowable operating velocity of the main. The design criteria for the water velocity in the main shall not exceed the following:

Pipe Size / Flow Condition	Maximum Velocity, fps
14-inch and greater, Normal Operating Conditions	5
12-inch and smaller, Normal Operating Conditions	8
All sizes, Fire Flow Conditions	10

Higher velocities up to a maximum of ten (10) fps may be allowed for PVC pipes by the District Engineer, in which case specific consideration shall be given to the design and operation of control valves, relief valves, and pumps when included in the potable water system.

II-A1-6. Potable Water Main Pressures

The mains shall be designed to have a minimum static pressure of fifty (50) psi at the highest point of the line. Under fire flow conditions, the main shall be designed to have at least twenty (20) psi measured at the hydrant outlet with the required fire flow.

II-A1-7. Minimum Size

Minimum size of potable water mains shall be eight (8) inches. Upon review and approval, the District Engineer may allow the use of a 6” main in small cul-de-sacs or dead ends with no fire flow requirements or hydrants.

II-A1-8. Service Connections and Water Meters

Each house or building on an individual lot or parcel shall have a separate service connection and water meter. If more than one house or building is located on a parcel of land that cannot be subdivided and is under one ownership, the house or buildings may be served by a common service and meter upon the approval of the District Engineer.

Each unit in a condominium, apartment, or multifamily unit shall be provided with a District owned and maintained water meter if project configuration allows, as determined by the District Engineer. If project configuration does not allow for individual meters per unit, a master meter shall be installed and each unit shall be submetered. The meters shall be installed between the onsite domestic water mains and the individual living units in a location consistent with Section II-A16 of these Standards. Separate meters shall be installed for common area landscaping and/or community buildings. Where condominiums, apartments, or multifamily units are divided among multiple buildings, separate manifolds and clusters shall be provided for each building. Where

possible, meters shall be clustered in a readily accessible location adjacent to public right of way. The locations of the meters will be subject to approval of the District Engineer. Each individual meter shall be installed with permanent identification tags clearly identifying the address of the unit served by the meter in conformance with Standard Drawing W-29. Access rights shall be granted to the District to enter upon the property to operate, read and maintain the meters.

Water Meters for single-family home shall be a minimum size of one inch, or as required by the local fire agency.

Landscape irrigation water service for non-single family homes shall be metered separately.

II-A1-9. Minimum Length

Water main layouts shall be designed with no segment less than five feet (5') in length.

II-A2. LOCATION OF MAIN

Potable water mains and their appurtenances shall be located in areas accessible to District personnel and maintenance vehicles and equipment for maintenance, repair, and servicing at all times. Mains shall be located within public right-of-way and easements. Potable water mains shall be located with the required horizontal and vertical separations from sewer lines in conformance with Section I-C5 and Standard Drawing G-6.

II-A2-1. Street

Potable water mains laid in streets shall be located about ten (10) feet from the street centerline. Refer to Standard Drawing G-6 for other separation requirements. In any case, mains shall be located so that excavation and repair of the main or its appurtenances will not encroach on private property.

II-A2-2. Building and Other Above-ground Structure Set Back from Mains

To minimize hazards to buildings and other above-ground structures when pressure mains are repaired, foundations or footings of buildings and other above-ground structures shall be set back a minimum of seven and one half (7.5) feet from the surface of the potable water main or recycled water main.

The installation of mains less than seven and one half (7.5) feet from the building or above-ground structure shall be subject to the approval of the District Engineer. In such cases, polyethylene wrapped DIP shall be used. No service connection to the water main is allowed within five (5) feet of the building foundation.

II-A3. LOOPING

Looping of potable water mains provides a grid layout or network of piping that provides increased reliability of a potable water supply system. Looping allows reaches to be supplied from each end of the reach, allows confining loss of service due to pipe breaks to small sections by valving, and allows repair and expansion of the system with minimum service disruption to customers. At loop connections, tee or cross fittings shall be used and valves installed at the main or branches. Cross fittings shall have four (4) valves; tee fittings shall have (3) three valves. To

maintain water quality and assure water service reliability, especially in events of fire, the applicant will be required, at minimum, to install a water loop when there is another existing or proposed water main within 200 ft of a dead-end line. Potable water mains shall be interconnected or loop-connected so that no reach shall exceed the following length:

Pipe Size, inch	Maximum Unconnected Reach	
	Residential Area	Commercial Area
8-10	1,200 feet	800 feet
12 and larger	1,500 feet or as required by Water Master Plan	1,200 feet

II-A4. DEPTH AND MINIMUM COVER

Potable water mains installed below ground shall be provided with a minimum four (4) foot cover.

II-A5. HORIZONTAL AND VERTICAL CURVES

In curved streets, the main shall follow the street curvature, and the alignment shall be planned to minimize crossing the street centerline. In general, horizontal and vertical curves shall be formed by pulling the joints, by bending the pipes, or by the use of fittings.

II-A5-1. Curves for PVC Pipe

PVC pipe shall not be deflected or bent into a curve without the approval of the District Engineer. Deflection shall not occur at the joint of the pipe.

If approved, PVC pipe may be bent in a true arc throughout its length. The maximum allowable bending offset for PVC pipe AWWA C900 shall be in accordance with AWWA C605, except Table 2 of AWWA C605 shall be superseded by the following:

Pipe Size, inch	Maximum Bending Offset per 20 ft Pipe Length, Inches	Minimum Bending Radius, feet
4	17	140
6	12	200
8	9	260
10	7	310

PVC pipe greater than 10-inch in diameter shall not be bent.

II-A5-2. Curves for Ductile Iron Pipe

If approved, curves for DIP shall be in accordance with the following:

Pipe Size	Maximum Angle of Deflections in Degrees-Minutes		Minimum Bending Radius, feet	
	Push-on Joint	Mechanical Joint	Push-on Joint	Mechanical Joint
6	5-0	5-40	206	185
8	5-0	4-15	206	245
10	5-0	4-15	206	245
12	5-0	4-15	206	245
14	5-0	2-50	206	365
16	5-0	2-50	206	365
18	5-0	2-25	206	430
20	5-0	2-25	206	430
24	5-0	1-55	206	540

II-A5-3. Curves for HDPE Pipe

Heat fused HDPE pipe may be cold bent during installation. Allowable bend radius shall be as specified below:

HDPE DR	Minimum Allowable Bend Radius
DR 7.3-9.0	Greater than 25 Times Pipe O. D.

If heat fused tees, ells, or flanges are located in the bend zone, the minimum bend radius shall be increased to one hundred (100) times the outside diameter of the pipe.

II-A6. VALVING

Valves are located in the distribution system to facilitate repair, maintenance, servicing, and extension of the system. Valves are also used to isolate sections where serious leakage or line breakage may occur that may cause property damage and loss of a large volume of water, if not repaired promptly.

Valves shall be located on all branches of the main and between feeder pipes. In addition, on long distribution mains, valves shall be installed at a maximum of eight hundred (800) feet at residential areas and a maximum of one thousand (1,000) feet at commercial areas. Dead ends for future expansion shall be provided with a valve and blowoff. The size of the blowoff shall be as prescribed in Section II-A9. All taps to existing mains shall be provided with tapping valves. Each fire hydrant shall be provided with an isolating valve.

All valves are to be raised to grade within 48 hours of final paving.

II-A7. HYDRANT PLACEMENT

Generally, hydrants shall be located to provide adequate fire stream flow to all structures and areas in the development and at the dead end of each main. The local Fire Authority has ultimate

authority for the location of hydrant placement. In single-family residential areas, hydrants shall be located every four hundred (400) feet and every three hundred (300) feet in commercial and multi-family areas, with distances measured along street curbs. Hydrants may be located on the mains by other methods provided such methods will give full or total fire flow coverage of the development.

Hydrants shall be installed near the street curb, shall be accessible to fire trucks, and protected from traffic. Hydrants shall be located four (4) feet or more from a utility pole, traffic control box, or fixed object or structure in conformance with Drawing W-6. Hydrants shall be located a minimum of fifteen (15) feet away from the entrance or exit of a driveway. Bollards around fire hydrants shall be installed as determined by the District Engineer.

II-A8. COMBINATION AIR RELEASE AND VACUUM RELIEF VALVES

The potable water distribution system shall be designed to minimize high points where air can accumulate. All high points in the distribution system shall be provided with combination air release and vacuum relief valves. The air release valves shall not allow the accumulation of entrapped air at the high point, which will restrict water flow. The vacuum valves shall allow air to enter the pipe and prevent its potential collapse due to the formation of a vacuum condition caused by rapid withdrawal of water. Combination air release and vacuum relief valves shall be provided in accordance with the following:

1. Mains that are 6-inches to 10-inches in diameter shall have 1-inch combination air-vacuum valves.
2. Mains that are 12-inches to 16-inches shall have 2-inch combination air-vacuum valves.
3. Mains that are greater than 16-inches must be engineered to compensate for the size of pipe and the length of run.

Vent lines from air release and vacuum relief valves shall be the same size as the valve outlet and shall run from valve to discharge without traps. The vent line shall be as short as possible and with not more than four (4) elbows. The vent shall terminate with the opening covered by a stainless steel bug screen. The base of the vent shall be provided with concrete support in accordance with Drawings W-15 and W-16.

The need for the installation of air relief valves should be minimized. Where required, a box shall be provided in accordance with Drawings W-15 and W-16. Air relief valves shall, when possible, be located behind curbs, outside traffic areas, within public right-of-ways or easements. Air relief valves shall be accessible to District personnel or agents at all times.

II-A9. BLOWOFFS

Blowoffs shall be installed at all low points and dead ends. Blowoffs shall be designed to empty sections of the main to periodically remove silt and to repair or maintain appurtenances that cannot be serviced under pressure. Dead end blowoffs shall be designed to be located a minimum of five (5) feet away from service saddles.

The blowoff assembly shall be designed to discharge into a sewer using a temporary connection or a sump from which water can be pumped to waste. Blowoffs shall not be directly connected to sewers.

Blowoff standard sizing shall be 4 inches. For any pipe larger than 16-inch, blowoff shall be designed by an engineer to allow for proper velocity and flow.

II-A10. BACKFLOW PREVENTION

Backflow prevention devices shall be installed in the branch or service line supplying potable water to residential, commercial, or institutional customers where a potential exists for back-siphonage of water into the distribution main. Backflow preventers shall be installed downstream of the customer's water meter. Backflow preventers shall be installed in accordance with the following schedule:

Application	Type of Device
Car wash	Reduced pressure
Car wash w/reclamation	Reduced pressure
Cement, concrete, sand, and gravel plants	Reduced pressure
Chemical storage or processing facilities	Reduced pressure
Construction water supply	Reduced pressure
Dairy or cold storage	Reduced pressure
Film processing or printing	Reduced pressure
Fire systems	Double check/detector check
Fire systems w/sprinkler in hazardous location	Reduced pressure w/detector
Heating and air conditioning (using water)	Reduced pressure
Hospital or medical facility (1-1/2" or larger)	Reduced pressure
Irrigation system	Reduced pressure
Irrigation system w/chemical feed	Reduced pressure
Laboratories (commercial or research)	Reduced pressure
Laundry or dry cleaner	Reduced pressure
Manufacturing or processing (w/toxic chemicals)	Reduced pressure
Medical or dental facility (smaller than 1-1/2")	Reduced pressure
Mobile home park	Reduced pressure
Multi-family dwellings	Reduced pressure
Ornamental pools, ponds or fountains	Reduced pressure
Radioactive or hazardous material handling	Reduced pressure
Recycled water irrigation sites	Reduced pressure
Residential with recycled water service	Reduced pressure
Residential with sewage ejectors	Reduced pressure
Restaurant	Reduced pressure
Restricted or classified facilities	Reduced pressure
Schools and other services larger than 2"	Reduced pressure
Sewage or storm drain facilities	Reduced pressure
Steam generation	Reduced pressure
Swimming pools	Reduced pressure
Systems looped with 2 or more services	Reduced pressure

Application	Type of Device
Tank trucks or chemical spray rigs	Air gap (externally mounted)
Veterinary clinics	Reduced pressure
Warehousing and storage	Reduced pressure

In a case where more than one of the above applications applies to the same service, the most protective device shall apply.

Approved backflow prevention devices as required by Title 22 of the California Code of Regulations (CCR) shall also be installed downstream of the customer's potable water meter for all customers with both potable and recycled water systems at the same site or parcel.

Backflow preventors shall be installed within 1 foot of service point. If not within 1 foot of service point, then service line shall be encased in concrete from service point to backflow assembly.

If the potable water system is used to supplement the recycled water system, an air gap separation is required between the two systems, in accordance with Title 22 of the CCR.

Any potable water used as seal water for recycled water pump seals shall be adequately protected from backflow.

II-A11. CONNECTIONS TO EXISTING POTABLE MAINS

The minimum potable water service and curb stop shall be one (1) inch for residential developments. The service for homes requiring residential fire service shall be one (1) inch minimum, or as required by the local fire agency. Service connections, up to two (2) inches on existing mains, except on High Density Polyethylene (HDPE) mains, shall be made by wet taps using service saddles. Service connections up to two (2) inches on HDPE mains shall be made with a sidewall fused hot tapping tee or an electrofusion hot tapping tee. All fusion procedures shall follow the manufacturer's recommendations. Each service connection shall have a corporation stop. Tapping on existing mains, including HDPE, to connect a branch, feeder, or service line two and one half (2-1/2) inch and larger shall also be made with a wet tap.

Wet taps for service lines are allowed on mains equal to or greater than eight (8) inches in diameter. Wet tapping shall be made with a tapping sleeve when the branch is greater than two (2) inches. The tapping sleeve shall be provided with a tapping valve. Drilling and tapping machines shall be compatible or designed to attach to the tapping sleeve and tapping valve assembly. Tapping sleeves for connecting to HDPE mains must be approved for use on HDPE pipe by the saddle/sleeve manufacturer. Mechanical saddles/sleeves manufactured for use on PVC or ductile iron pipe are not acceptable for use on HDPE pipe.

The District Engineer may allow a dry tap, if dry tapping will not cause long and undue disruption to other customers. Dry tapping shall be made with a tee fitting with the appropriate couplings to connect to the mains. The tee branch shall be provided with an isolating gate valve.

Tapping of potable mains shall be made using materials and equipment especially designed for tapping water mains for potable water supply.

All dry and wet taps for potable mains shall be provided with thrust blocking as specified in Section II-A13.

II-A12. FIRE LINES

All commercial fire lines in excess of 2-inches in diameter shall have an accessible and clearly marked valve at the main and an approved double detector check installed in accordance with Drawing W-23. The detector meter shall be supplied with a radio read Neptune or Sensus meter. The meter interface units shall be "Datamatic" Firefly meter interface units for AMR systems using encoded registers with Profile PLUS load profiling capability. Fire lines shall connect to the main separate from the domestic supply line serving the same building. Fire lines shall be provided for buildings and establishments as required by the local Fire Authority.

Water meters on double check/detector check backflow preventors shall be set to read water flow in hundreds of cubic feet (ccf). All new double check/detector check backflow preventors shall be tested by a District-approved, certified tester within thirty (30) days of installation and a backflow test report shall be submitted to the District prior to request for occupancy. If the backflow test report is not received within 30 days, water service may be discontinued.

All multifamily fire lines 1-1/2 inches or less in diameter that are not equipped with pumper connections shall connect to the main separate from the domestic supply line serving the same building. They shall be provided with a rubber-faced detector check valve assembly installed in accordance with manufacturer's specifications. All systems must be supplied with a rubber-faced check valve on the sprinkler riser as required by NFPA and local Fire Authority specifications. Piping must be connected with CPVC piping. In cases where iron piping is used, refer to commercial fire line application.

All single-unit residential fire lines shall connect to the main service to the property downstream of the water meter. Piping systems shall be constructed of CPVC or other fire department approved piping, except ferrous metals. All systems must be supplied with a rubber-faced check valve on the sprinkler riser as required by NFPA and local Fire Authority specifications.

II-A13. COMBINED DOMESTIC AND FIRE SPRINKLER SERVICES

Water services which supply both domestic and fire sprinkler systems may be allowed for individual residential units, only as permitted by the local Fire Authority. The District Engineer shall determine the type of water meter to be installed to allow for measurement of low domestic flows. Water service lines and meters shall be sized to allow for fire sprinkler flows as required by the local Fire Authority. A ½-inch flow restrictor downstream of the main tee as shown on Drawing W-33 shall be installed. A plastic tag shall be affixed to the service line downstream of the water meter, with the words engraved on the tag "WATER TO DOMESTIC AND FIRE SPRINKLER SYSTEM. NOTIFY FIRE DEPARTMENT PRIOR TO SHUT OFF."

II-A14. THRUST BLOCKS

Thrust blocks shall be provided for all unrestrained bends, tees, crosses, reducers, dead ends, fire hydrants, and where pipe changes in directions of more than 11-1/4 degrees occurring on any plane, and where indicated on the Improvement Plans or as required by the District Engineer.

Buried, heat-fused HDPE pipe and fittings do not require thrust blocks, except at mechanical connections to other pipe materials and unfused fittings, and at termination points.

Thrust blocks shall be designed to resist the thrust reaction forces at the bends or fittings whose magnitude will depend on the pipe diameter and internal pressures, and allowance for water hammer. Thrust blocks shall be designed to transfer and distribute the thrust forces to the undisturbed soil surface. Surface bearing capacity of soil shall be as determined and recommended by a soil investigation or report. In the absence of a soil investigation or report, the soil bearing capacity shall be as determined by the District Engineer. Thrust block shall be designed with a minimum factor of safety of 1.25, and shall be provided in accordance with Drawings W-2 and W-3.

Where thrust blocks are not feasible, restrained joints, tie rods, or other methods of anchoring the pipes shall be provided, and such alternate methods shall be subject to the approval of the District Engineer. If used, all tie rods shall be Type 316 stainless steel.

II-A15. SAMPLING STATIONS

Sample stations shall be installed at locations where required by the District Engineer in accordance with Drawing W-26. At a minimum, a sample station shall be installed in the middle of a subdivision of approximately 100 to 250 homes. Sample stations shall be located behind curbs, outside traffic areas, within public right-of-ways or easements. Sample stations shall be accessible to District personnel or agents at all times.

II-A16. WATER METERS AND METER BOXES

Water meters and meter boxes shall be installed in accordance with W-19, W-20, and W20A. A maximum of three meters may be manifolded from one service line. Water meters and meter boxes shall be located behind curbs, outside traffic areas, within public right-of-ways or easements. Water meters and meter boxes shall be accessible to District personnel or agents at all times.

SECTION II-B - CONSTRUCTION STANDARDS

II-B1. MATERIAL OF CONSTRUCTION

This section covers materials for the potable water mains, fittings, and appurtenances in the distribution system. All materials shall be manufactured and approved for potable water systems and comply with NSF 61 potable water regulations and must be in compliance with State of California Assembly Bill (AB) 1953 and contain less than 0.25 percent (0.25%) lead by average weight.

II-B1-1. Pipe Materials

II-B1-1.01. Polyvinyl Chloride Pressure Pipe

All PVC water pipes shall conform to the requirements as specified in AWWA C900. 4-inch through 16-inch pipe shall be DR 14, Pressure Class 305. PVC pipes 18-inch and larger shall be DR 18, Pressure Class 235.

The standard length of the PVC pipe shall be twenty (20) foot laying lengths and shall have cast iron outside diameters (CIODs).

II-B1-1.01.01. Joints for PVC Pipe

Joining of PVC pipe shall be with elastomeric-gasket bell ends.

The bell ends shall be integral thickened bell end conforming to AWWA C900.

Elastomeric gaskets shall conform to the requirements of ASTM F477.

Manufactured restraint systems for mechanical joints shall be wedge type or wedge collar and rod type. Wedge-type restraint systems shall use twist-off bolts to ensure proper gripping pressure. Systems that rely on set screws only will not be acceptable. Mechanical restrained joints used on PVC pipe shall be designed and rated for PVC pipe and shall be on the District Approved Materials List, or an approved equal.

II-B1-1.01.02. Fittings for PVC Pipe

All fittings for use with PVC pipe shall be ductile iron conforming to AWWA C110 or C153 with flanged and/or mechanical joints.

Flange gaskets shall be 1/8-inch, either ring-type or full face, conforming to AWWA C115.

The interior and exterior surfaces of all ductile iron and steel fittings shall be coated with 6-8 mil nominal thickness of protective fusion-bonded epoxy. The fusion-bonded epoxy coating shall be applied in accordance with and shall meet all applicable terms and provisions of AWWA C116.

II-B1-1.01.03. Lining and Coating

No lining or coating is required for PVC pipe.

II-B1-1.02. Ductile Iron Pipe (DIP)

DIP shall conform to the requirements as specified in AWWA C151. Pipes shall be lined and coated as specified herein.

The minimum pressure class for DIP shall be 350.

II-B1-1.02.01. Joints for DIP

Joints for DIP shall be selected to suit the installation condition in the field. Gaskets for push-on joints, mechanical joints, and flanged joints shall be standard styrene butadiene rubber (SBR) in accordance with AWWA C111 and AWWA C115. Joints shall be in accordance with the AWWA C111 for push-on and mechanical joints, and AWWA C115 for flanged joints. Minimum rating of all joints shall be 250 psi. Flange gaskets shall be 1/8-inch, either ring-type or full face, in accordance with AWWA C115.

Push-on restrained joint pipe and fittings for ductile iron shall be boltless and capable of deflection after assembly. Restrained joints shall be rated for 350 psi working pressure for sizes 4" through 24" and 250 psi working pressure for sizes 30" and 36". Restrained joint pipe and fittings shall be of the same manufacturer. Push-on restrained joints shall be on the Approved Materials List, or an approved equal.

Manufactured restraint systems for mechanical joints shall be wedge type or wedge collar and rod type. Wedge-type restraint systems shall use twist-off bolts to ensure proper gripping pressure. Systems that rely on set screws only will not be acceptable. Mechanical restrained joints for DIP shall be on the Approved Materials List, or an approved equal.

II-B1-1.02.02. Fittings for DIP

All fittings for use with DIP shall be in accordance with Section II-B1-1.01.02 of these Standards.

II-B1-1.02.03. Lining and Coating for DIP and Fittings

The interior and exterior surfaces of all ductile iron fittings shall be coated with 6-8 mil nominal thickness of protective fusion-bonded epoxy in accordance with AWWA C116.

DIP may be cement lined in accordance with AWWA C104 and have an asphaltic coating in conformance with AWWA C151 at the discretion of the District Engineer.

II-B1-1.02.04. Polyethylene Encasement

All buried ductile iron pipe shall be encased in eight-mil polyethylene wrap. All buried fittings and appurtenances shall be double encased in an eight-mil polyethylene wrap. Polyethylene wrap shall be manufactured and installed in conformance with AWWA C105.

II-B1-1.03. Steel Pipe

Steel may be used only for special installation where PVC or ductile iron pipe would not be suitable. Steel pipe for special piping installation such as offsets, transition pieces, reducers, tees, wyes, crosses, special heads, and fittings shall be rated for minimum 200 psi and shall be fabricated

in accordance with AWWA C208 specifications. All steel pipe shall be cement mortar lined and coated in accordance with AWWA C205.

II-B1-1.04. Service Line Piping and Tubing

Service lines shall be continuous polyethylene tubing or piping per Section II-B1-1.05, no joints shall be allowed. Polybutylene piping is not acceptable. Tracer Wire TW #10 shall be twined around the polyethylene line, and extend into the meter box. Polyethylene piping for potable water service shall have blue exterior color.

II-B1-1.05. High Density Polyethylene Pressure Pipe ("HDPE")

HDPE pressure pipe shall conform to the requirements as specified in AWWA C901 for 1/2-inch to 3-inch diameter tubing or piping, or AWWA C906 for 4-inch or larger diameter piping. HDPE Pipe shall have a minimum working pressure rating (Pressure Class) of 200 psi or greater (SDR 9.0 or 11.0). A higher class may be required to meet design conditions as determined by calculations and as indicated on the Improvement Plans. System pressure calculations shall be provided with Improvement Plans and sealed by a California Registered Professional Engineer, when required.

Tubing of 2-inch diameter or smaller shall be provided in Copper Tubing Sizes (CTS). Piping of 3-inch diameter shall be provided in Iron Pipe Sizes (IPS). The standard length of the HDPE pipe of 4-inch diameter and larger shall be forty (40) or fifty (50) feet and shall have cast iron outside diameters (CIODs).

II-B1-1.05.01. Joints for HDPE Pipe

All joints of HDPE pipe shall be heat fused in strict accordance with the pipe manufacturer's recommendations. Heat fusion shall only be performed by technicians who have been certified by the fusion equipment supplier and have a minimum of two (2) years of experience fusing HDPE pipe of similar diameters used on the project. Electrofusion couplings may also be used to fuse HDPE pipe sections.

Mechanical couplers may be used to mechanically connect HDPE pipe provided that the couplers are specifically manufactured for use on HDPE pipe and are approved for use on HDPE pipe, as recommended by the manufacturer of the coupling.

II-B1-1.05.02. Fittings for HDPE Pipe

All fittings shall conform to AWWA C906, Section 2.3. All fittings shall have a Plastic Pipe Institute (PPI) material designation of PE 3408, and have a cell classification of 345464C, per ASTM D3350 with an established hydrostatic-design basis of 1600 psi for water at 73 degrees. The resin shall be listed by the PPI in its pipe-grade registry Technical Report (TR) 4, "Hydrostatic Design Basis and Maximum Recommended Hydrostatic Design for Thermoplastic Piping Materials." All fittings shall be fully pressure rated to provide a working pressure equal to that of the pipe.

Standard fittings are tees, elbows, flange adapters, transition fittings, branch and service saddles, and hot-tap tees.

II-B1-2. Appurtenances

II-B1-2.01. Valves

All line valves shall be gate valves unless otherwise approved by District Engineer. All valves adjacent to tees or crosses shall have one (1) flanged end bolted directly to the tee or cross. In-line valves shall have flanged or mechanical joints. The interior and exterior surfaces of all valves shall be coated with 6-8 mil nominal thickness of protective fusion-bonded epoxy. The fusion-bonded epoxy coating shall be applied in accordance with and shall meet all applicable terms and provisions of AWWA C116.

II-B1-2.01.01. Gate Valves

Gate valves shall be ductile iron and conform to AWWA C509, resilient seated-type valves with non-rising stems, and have "O" ring stuffing boxes. Stuffing boxes shall be bolted and constructed so as to aid valve repair. Valves shall open counterclockwise and be fitted with two (2) inch square operating nuts. All ten (10) inch and smaller valves shall be hydrostatically tested and drop tight at a pressure of not less than 500 psi and rated for 250 psi working pressure.

II-B1-2.01.02. Butterfly Valves

Butterfly valves shall be rubber seated conforming to AWWA C504 Class 250B. Valves shall open counterclockwise and be fitted with a two (2) inch square operating nut. Each butterfly valve shall be provided with a manual gear actuator, with stops in the full open and full closed positions, designed for buried service. Butterfly valves are not to be used unless explicitly approved by District Engineer.

II-B1-2.01.03. Air Release and Vacuum Relief Valves

Air release and vacuum relief valves shall be single body, combination air release valves conforming to AWWA C512 and shall be on the Approved Materials List or an approved equal. They shall be ported in size for the size of the line and length of the pipe they are protecting.

The valve body shall be designed for a water working pressure of not less than 200 psi and shall have fusion-bonded epoxy coating on the body, stainless steel floats, and all working parts shall be brass, bronze, stainless steel, or other non-corroding materials.

Air valves shall be installed in accordance with Drawings W-15 or W-16, as required.

II-B1-2.02. Tapping Sleeve Tee and Tapping Valves

Tapping sleeves conforming to this specification shall be used for all wet-tapped connections larger than 2-inch onto an existing water main. Tapping sleeves for wet tapping of PVC or ductile iron potable water mains shall be ductile iron or stainless steel tapping sleeve assembly, complete with gaskets and bolts. Each tapping sleeve shall include a tapping valve of the same size as the branch to which a drilling machine could be attached for tapping the main. Tapping sleeve and valve shall have a minimum rating of 250 psi working pressure. Tapping valve shall have a two (2) inch square nut for operation.

Tapping sleeves shall be all stainless steel tapping sleeves on the Approved Materials List, or an approved equal. Tapping valves shall be resilient-seated gate valves with non-rising stems (NRS) conforming to AWWA C509 or C515 and shall be on the Approved Materials List, or an approved equal.

Wet tapping of HDPE mains shall be accomplished with sidewall fusion or electrofusion couplings as applicable per the manufacturer's approved procedures. Mechanical tapping sleeves may also be used on HDPE pipe, provided that the tapping sleeve is approved for use on HDPE pipe, as recommended and approved by the sleeve manufacturer.

II-B1-2.03. Hydrants

All fire hydrants shall be of the wet-barrel type, which shall conform to the requirements of AWWA C503 and shall be on the Approved Materials List, or an approved equal. The approved fire hydrant for use in the District shall have one 4-1/2 inch and one 2-1/2 inch outlet for residential applications. For commercial applications, fire hydrants shall have one 4-1/2 inch and two 2-1/2 inch outlets.

Hydrant buries shall have either restrained mechanical or flanged joints. Hydrant buries shall be lined with fusion bonded epoxy, or equal lining, having a total minimum thickness of six (6) mils.

Hydrants on potable water system shall be provided with breakaway spools per Standard Detail W-6.

There shall be a minimum clearance of three (3) feet surrounding the fire hydrant.

Exterior of hydrants shall receive a primer coat and shall be furnished with traffic yellow rust-preventative enamel finish coat and shall be on the Approved Materials List, or an approved equal. Bollards around fire hydrants shall be installed as required by the District Engineer.

II-B1-2.04. Blowoffs

Blowoffs shall be constructed of the materials indicated on Drawings W-9 through W-12.

II-B1-2.05. Backflow Prevention Devices

Backflow prevention devices shall be of the type shown in the table in Section II-A10 for the appropriate service and situation. Acceptable backflow devices shall comply with California Department of Health Services Title 22 requirements.

II-B1-2.06. Valve Boxes and Valve Box Risers

Valve boxes and valve box risers shall be provided for all line valves and fire hydrant valves. The valve boxes shall be traffic-rated and shall be on the Approved Materials List, or an approved equal. Valve risers shall be eight (8) inch SDR 35 PVC pipe. Valve boxes and valve box risers shall be as shown in Drawing W-l. For valves deeper than twelve (12) feet, risers shall be ductile iron. All valve box risers shall be equipped with a centering ring or device mounted at the valve operating nut. Centering device shall be 7-inch to 7.5-inch diameter and made of high strength, durable, corrosion resistant materials; either steel with powder coating or high strength plastic and shall be on the Approved Materials List, or an approved equal.

II-B1-2.07. Tracer Wire and Warning Tape

Tracer wire shall be copper wire, Type TW, size AWG No. 10.

Warning tape shall be acid and alkali resistant polyethylene or polyolefin film. Warning tape shall be blue for potable water, six (6) inches wide, four (4) mils thick, and printed continuously with the words "Caution Buried Water Line Below" or equivalent wording.

II-B1-2.08. Service Taps and Connections

Service saddles conforming to this specification shall be used for all pipe connections 2-inch and smaller to water mains. All service valves and fittings shall conform to AWWA C800. Saddles for service taps on potable water mains shall be designed and rated for use on the diameter and pipe material of the water main to be tapped. Saddles for PVC and ductile iron pipes shall be shaped to accurately fit the contour of the main. Saddles for ductile iron pipe shall have double straps and be bronze or brass. Straps shall have a flattened design to provide large bearing surfaces for a secure installation. Saddles for PVC shall be constructed of bronze and shall have a neoprene gasket wedged in place at the tapping boss to provide a tight seal at the main.

All bronze, copper, and brass fittings, valves, and materials shall contain less than 0.25 percent (0.25%) in conformance with California law (AB1953). All service valves shall be ball-type bronze or brass valves. All single residence potable water service connections shall be a minimum of one (1) inch in diameter, commencing at the main with a service saddle and a ball corporation stop terminating with an angle meter ball valve. Service saddles for DIP shall be cast brass or bronze with silicon bronze double straps. Service saddles shall not be installed less than 5 feet away from dead end blowoffs.

Connections for fire sprinkler systems shall be as approved by the local Fire Authority and the District Engineer.

Service connections shall be as shown in Drawings W-7 or W-8.

Service connections to HDPE mains shall use a sidewall fused hot tapping tee or an electrofusion hot tapping tee. All procedures shall follow the manufacturer's recommendations. Mechanical service saddles for service taps on HDPE mains may also be used, provided that the saddles are approved for use on HDPE pipe as recommended by the saddle manufacturer. Mechanical saddles manufactured for use on PVC pipe or DIP are not acceptable for use on HDPE pipe.

II-B1-2.09. Gaskets

Gaskets shall be one-sixteenth (1/16) inch thick or greater, full-faced or ring type, made of neoprene or synthetic rubber.

Where required to connect two (2) different pipe metals, a pipe joint insulation kit shall be installed, including isolating Type 'E' full-face gasket, bolt sleeves and double washers. The insulation kit shall be NSF61 compliant and shall be on the Approved Materials List, or an approved equal.

II-B1-2.10. Transition and Flexible Couplings

Unless otherwise indicated on the Improvement Plans or directed by the District Engineer, flexible couplings shall be bolted, sleeve-type steel or ductile iron couplings conforming to AWWA C219 with fusion bonded epoxy coating and stainless steel hardware; designed and rated for use on the intended pipe materials and sizes. Couplings designed and rated for use as insulating couplings shall be used for insulated connections. Minimum body length for transition couplings shall be twelve inches (12”). Any new style transition coupling must be approved by the District prior to installation.

II-B1-2.11. Bolts and Hardware

All bolts including T-Bolts, nuts, All-Thread rod, etc., shall be stainless steel, Type 316. Bolts for flanged curb stops and flanged meters shall be fifteen sixteenths (15/16) inch. Anti-seize lubricant shall be applied on bolt threads. All bolts shall be torqued to manufacturer’s recommendation and shall be stamped or easily identifiable as type 316.

II-B1-2.12. Meter Boxes

Meter boxes shall be provided for all service meters and shall be installed as indicated on Drawings W-19 and W-20. Unless otherwise specified by the District Engineer, meter boxes shall be provided according to the meter box schedule in the Approved Materials List.

Meter boxes and lids in traffic areas shall be H-20 load rated reinforced concrete boxes with steel or cast iron lids. Meter boxes in all other areas shall be concrete or polymer composite boxes with lids of matching material. All boxes and lids shall be on the Approved Materials List, or an approved equal. Each meter box lid shall have a recessed hole for a meter reading probe. Meter box lids shall not exceed 112 pounds unless otherwise specified by the District Engineer.

II-B1-2.13. Potable Water Sample Stations

Where determined by the District, water quality sampling stations shall be installed in accordance with Drawing W-26. The sampling stations shall consist of a one (1) inch service connection stubbed out at least twelve (12) inches behind the sidewalk, an in-line corporation stop with a valve box and cover, and an above grade, lockable sampling station. The above grade, lockable sampling station shall be selected by the District Engineer. The station shall be center mounted on a four (4) inch thick concrete slab, two (2) feet square in area.

II-B1-3. Thrust Blocks

Thrust blocks shall be constructed of Class B concrete as specified in Section I-D10. Dimensions of thrust blocks shall be in accordance with Drawings W-2 and W-3.

II-B2. INSTALLATION OF POTABLE WATER PIPE AND APPURTENANCES

II-B2-1. General

All pipe, fittings, and appurtenances shall be loaded for delivery and unloaded in such a manner as to avoid damage to the pipe or appurtenance. All fittings, hardware, and installation methods shall be appropriate for the type of material being installed.

Delivery of pipe and appurtenances to the site of the Work shall not take place until immediately prior to the installation thereof.

Unless otherwise indicated on the Improvement Plans or directed by the District Engineer, pipe and appurtenances shall be distributed along the trench by the Contractor opposite or near the place where it is to be placed.

All pipe and appurtenances shall be handled with care to avoid damage. Whether moved by hand, skidways, or hoists, the pipe shall not be dropped or bumped against other pipe, accessories, or other projects.

Any unused water services must be abandoned.

II-B2-2. Pipe and Fittings

Pipe shall be laid and installed in accordance with Section I-D5 Pipe Laying. Minimum working grade cover shall be thirty (30) inches. The type of pipe and size to be used shall be as specified and indicated on the Improvement Plans. Piping runs and alignment indicated on the Improvement Plans shall be followed as closely as possible, except for minor adjustments to avoid obstructions. If major relocations are required due to unforeseen obstructions, the District Engineer shall approve such relocations.

II-B2-2.01. PVC Pipe

PVC pipe shall be laid and installed in accordance with AWWA C605 and AWWA Manual No. 23, PVC Pipe - Design and Installation. Proper implements, tools, and equipment shall be used for the placement of the pipe in the trench to prevent damage. Ductile iron fittings installed with PVC pipe shall be fusion bonded epoxy coated and lined and connected using Type 316 stainless steel bolts. The weight of fittings, valves, and other appurtenances shall not be supported or carried by the PVC pipe. Fittings, valves, and appurtenances shall be supported by concrete pad or drain rock, when in the judgment of the District Engineer, soil conditions or trench excavation does not provide proper support. Field cut PVC pipe shall have the burrs removed, ends beveled, and marked for proper insertion depth. A factory-finished beveled end shall be used as a guide in beveling. A cut shall be made square to the pipe.

PVC pipe shall not be deflected at the joints. On curved alignments, PVC pipe may be bent. Bending of the pipe shall be as specified in Section II-A5-1. Construction machinery shall not be used to bend the pipe.

Pipe shall be laid with bell ends facing the direction of laying. Reverse laying may be allowed subject to the approval of the District Engineer.

All piping must be installed with piping identifications facing up on top of pipe.

II-B2-2.02. Ductile Iron Pipe ("DIP")

Pipes shall be laid and installed in accordance with AWWA C600, Installation of Ductile Iron Water Mains and their Appurtenances.

Piping shall be laid to the lines and grade indicated on the Improvement Plans. On curve alignments, pipe joints may be deflected to make the curve with either shorter pipe sections, or fittings to conform to the alignment or grade as required by the Improvement Plans. Joints shall be deflected or pulled as specified in Section II-A5-2. Joints shall be deflected after the joint is properly assembled. For mechanical joints, the joints shall be deflected before tightening of bolts.

Cutting of pipe shall be done in a neat manner, without damage to the pipe or the lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file or power grinder to remove all roughness and sharp edges. The cut ends of push-on joint pipe shall be suitably beveled.

Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. Bolts shall be uniformly tightened to the torque values listed in Appendix A of AWWA C111. Over tightening of bolts to compensate for poor installation practice will not be permitted.

Push-on joints, where allowed by these standards, shall be carefully assembled in accordance with the pipe manufacturer's instructions and recommendations for proper jointing operations. All joint surfaces shall be lubricated with heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.

If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled.

Corrosion protection for ductile iron pipe shall be as recommended and designed by a State of California Registered Corrosion Engineer. As a minimum, it shall have a bituminous coating and shall be encased in loose polyethylene encasement for external corrosion protection. Installation of polyethylene encasement shall be in accordance with the requirements of AWWA C105. Ductile iron fittings installed with DIP shall be fusion bonded epoxy coated and lined and connected using Type 316 stainless steel bolts.

Under certain circumstances the District Engineer may require the ductile iron pipe be fusion bonded epoxy coated. See Cathodic Protection Section V for more information.

II-B2-2.03. Steel Pipe

Installation of steel pipe shall conform to AWWA Manual No. 11, Steel Pipe - A Guide for Design and Installation. The District Engineer will provide complete specifications for steel pipes prior to approval of the Applicant's Improvement Plans.

II-B2-2.04. HDPE Pipe

HDPE shall be placed in strict accordance with the manufacturer's recommendations, with Section I-D5 and Section I-D6 of these Standards, and per ASTM D2321.

Curve alignment of HDPE shall be as specified in Section II-A5-3.

Sections of HDPE pipe having cuts or gouges in excess of ten percent (10%) of the wall thickness of the pipe shall be cut out and removed. Heat fusion or electrofusion methods shall be used to install new sections of pipe. All procedures shall follow the manufacturer's recommendations.

Fused sections of HDPE pipe shall be handled such that damage to the pipe is avoided. Chains or cable type chokers shall not be used in lifting HDPE pipe. Nylon slings with spreader bars shall be used to lift fused HDPE pipe, unless otherwise approved by the District Engineer.

II-B2-2.05. Service Lines

Service lines shall rest on undisturbed earth in the bottom of the trench with a thirty-six (36) inch minimum cover (between service line and gutter flow line). Pipe embedment material for service lines shall be Class 1 backfill, in accordance with Section I-D6-2. Class 1 Backfill.

Unused services must be abandoned.

Polyethylene lines shall be snaked in the trench, as recommended by the material manufacturer, from the corporation stop to the angle curb stop. Polyethylene lines shall be continuous from the corporation stop to the angle curb stop. Mechanical couplings are not allowed. To extend beyond one hundred (100) linear feet in length, polyethylene lines may be electro- or heat-fused. All plastic service piping shall be installed with insulated ten (10) gauge copper wire spiraled around service line and extended into the meter box.

Polyethylene tubing shall not be crimped. It shall be cut with a tubing cutter that is equipped with a thin cutting wheel designed specifically for plastics. Make a square clean cut by turning the cutter around the pipe once and then turn the cutter one (1) or more times in the opposite direction to complete the cut.

Minimum radius of bend for polyethylene tube shall be thirty times the nominal tube diameter. No bends shall be constructed within ten times the nominal tube diameter from a fitting.

Compression fittings with insert stiffeners, used to connect polyethylene tubing to corporation and curb stops, shall not be installed with the insert stiffeners protruding beyond the opening of the waterworks brass coupling nut to eliminate the possibility of internally cutting the pipe by the insert stiffener. Insert stiffeners that protrude beyond the coupling nut opening when installed shall be cut to eliminate the protruding piece.

II-B2-2.05.01. Common Trench and Manifold

Domestic, irrigation from a potable service, and fire service shall be provided to commercial establishments by separate metered potable water service lines. Domestic and potable irrigation service lines to a project under one ownership may be allowed to be installed in a common trench.

Minimum separation between service lines in the trench shall be six (6) inches, and between taps at the main shall be twenty-four (24) inches.

Commercial projects with an existing service line who request an increase in water demand may be provided another metered service line by manifolding to the existing service if the existing service is large enough to accommodate increased demand. A maximum of three (3) separate meters may be manifolded on one (1) existing service line. Manifolded service lines shall be in accordance with Drawings W-24A, W-24B and W-24C, or as approved by the District Engineer.

Brass tags are required on meters whenever a cluster of meters is installed. The tags shall indicate which unit each meter services.

II-B2-2.05.02. Service Line Abandonment

Service lines shall be abandoned at the service saddle or tee at the main. Corporation stops or gate valves shall be removed and replaced with a plug or a blind flange and full circle stainless steel repair bands shall be installed.

II-B2-2.06. Corrosion Protection

All ferrous metal fittings and appurtenances, which will be in contact with backfill after installation, shall be provided with epoxy coating corrosion protection.

Ferrous metal fittings and appurtenances as herein referred to are: valves, tees, elbows, reducers, crosses, plug assemblies, pumping tees, services, blowoff installations, flexible couplings, leak clamps, tie rods, etc.

Joints, fittings, and appurtenances, which are required to be coated by the Contractor, may be coated before or in the trench.

Bare metal pipe, which extends into the soil from a concrete structure such as a pumping plant, venturi pit, valve housing, or similar structure, shall be insulated from the concrete and leak-proofed. The insulation shall extend through the concrete a minimum of three (3) inches on each side. The insulation shall consist of one (1) layer of corrosion protection tape and one (1) coat of bituminous paint. Corrosion protection tape shall be on the Approved Materials List or an approved equal. The pipe shall be clean, dry, and free from loose scale before applying the adhesive and tape. The edges of the tape shall be lapped not less than one-half (1/2) inch.

All buried ductile iron pipe shall be encased in eight (8) mil polyethylene wrap encasement. Polyethylene wrap shall be manufactured and installed in conformance with AWWA C105. A double thickness (one half lap) layer of 10 mil PVC tape wrap may be used in lieu of polyethylene encasement for pipe and joints, not including fittings, on metal pipe sizes two-inch (2”) and smaller.

Coating of all fittings shall be 6-8 mil nominal thickness of protective fusion-bonded epoxy. The fusion-bonded epoxy coating shall be applied in accordance with and shall meet all applicable terms and provisions of AWWA C116.

See Cathodic Protection Section V for more information.

II-B2-3. Appurtenances

II-B2-3.01. Valves, Valve Boxes, and Valve Box Risers

All valves shall be set plumb, supported against settlement and properly fitted to the adjacent sections of main. A valve box and riser pipe shall be installed over each valve. The valve box and riser pipe must not bear on the valve or main so that surface traffic loads are not transferred to the water pipe. When possible, riser pipe shall be one continuous piece. Riser pipe that is not continuous shall be joined by a coupling or a bell end piece of the same material as the riser pipe. The top of the valve box shall be placed flush with finished grade, unless otherwise specified or indicated on the Improvement Plans.

Valves buried more than five (5) feet from finish grade shall be fitted with extension stems, if necessary, to bring the valve operating nut to within twenty-four (24) to forty-eight (48) inches of the finished grade. The extension stem shall be enclosed or housed in a valve box riser. The riser shall extend into the valve box and the valve box shall be made flush with finish grade. Valve box shall be provided with a cover. The cover shall be traffic type when installed on street or roadways.

Valve boxes shall be firmly supported, concrete encased, and maintained centered and plumb over the wrench nut of the valve, with box cover flush with the surface of the finished pavement, finish grade, or as indicated on the Improvement Plans. The interior of the valve riser shall be free of dirt and debris and the wrench nut must be readily accessible for operation.

Installation of line valves shall be in accordance with Drawings W-13 or W-14.

Installation of air release and vacuum relief valves shall be in accordance with Drawings W-15 and W-16.

II-B2-4. Tapping Sleeves and Tapping Valves

Tapping sleeves and tapping valves are not to be used except under specific circumstances explicitly approved by the District Engineer. If tapping sleeves and tapping valves are approved for use, they shall be installed in conformity with the manufacturer's instructions and Drawings W-17 and W-17A. These drawings are not posted for public use and must be specifically requested. The section of the main where the tapping sleeve will be installed shall be thoroughly cleaned. The main's outside diameter shall be measured and the proper size tapping sleeve and tapping valve shall be installed on the main. Tapping sleeve and tapping valve shall be provided with independent supports and shall not be supported or carried by the main. The assembly shall be provided with thrust blocking per Section II-A13, and bedding and backfilling per Drawing G-2. Tapping valves shall be provided with valve box, valve risers, and extension stems, as specified for valves. Tapping sleeves shall be subject to testing and disinfection, as specified in Section II-B3.

II-B2-5. Hydrants

Hydrants shall be located and installed in a manner to provide complete accessibility and in such a manner that the possibility of damage from vehicles or injury to pedestrians will be minimized. All fire hydrants shall be installed in accordance with Drawing W-6 at the location indicated on the Improvement Plans.

A fire hydrant that is improperly installed shall be removed and reinstalled properly at no cost to the District. The setting of hydrants shall conform to the following sections.

II-B2-5.01. Placement Behind Curbs and Sidewalks

Hydrant locations in the street right-of-way shall be in accordance with the following. Distances given shall be measured from center-line of hydrants.

When sidewalks are six (6) feet wide or greater and are without a planter strip, hydrants shall be twenty-four (24) inches from the face of the curb.

When sidewalks are less than six (6) feet wide and are without a planter strip, hydrants shall be twenty-four (24) inches plus the width of the sidewalk from the face of the curb.

When there is a planter strip thirty (30) inches wide or greater between curbs and sidewalks, the hydrants shall twenty-four (24) inches from the face of the curb.

When there is a planter strip less than twenty-four (24) inches wide between curbs and sidewalks, location of hydrants shall be fixed by the District Engineer. When a hydrant is located within a high-density area, a check valve may be required at the discretion of the District Engineer.

II-B2-5.02. Position of Nozzles

All hydrants shall stand plumb. Hydrants with a pumper nozzle four and one-half (4-1/2) inch and two (2) hose nozzles two and one-half (2-1/2) inch shall be installed with the pumper nozzle perpendicular to the curb. Hydrants with a pumper nozzle four and one-half (4-1/2) inch and one (1) hose nozzle two and one-half (2-1/2) inch, ninety (90) degrees opposed shall be installed so that a line bisecting the ninety (90) degree angle is perpendicular to the curb.

II-B2-5.03. Cleaning

Hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.

II-B2-5.04. Painting

Hydrants shall be painted, from the top to the ground, with a primer coat conforming to AWWA C503 and finished with not less than two coats of rust preventative enamel paint. Paint shall be on the Approved Materials List, or an approved equal.

II-B2-6. Blowoffs

Fire hydrants may be used as blowoffs and shall be installed at designated locations within public easements to aid in the flushing of water mains.

The hydrants as shown in Drawing W-6 may be installed at all dead ends mains.

A three (3) inch blowoff as shown in Drawing W-11 shall be installed at the low points of six (6) inch through fourteen (14) inch mains.

II-B2-7. Backflow Prevention Devices

Backflow prevention devices shall be installed above ground and protected against damage and vandalism using insulated green pads or a fiberglass enclosure for devices two (2) inch and smaller. Traffic posts or an enclosure shall be provided when installation is within traffic areas.

Installation of backflow devices shall be in accordance with Drawings W-21 through W-23A as applicable. Backflow prevention devices shall be installed prior to request for installation of water meters. All new or replaced backflow prevention devices shall be tested by a District-approved, certified tester immediately following installation and a backflow test report shall be submitted to the District prior to request of occupancy. Spray disinfection of new pipes, fittings, and valves of backflow prevention devices is required in accordance with Section 4.10.1 of AWWA C651 If the backflow test report is not received within 30 days, water service may be discontinued.

DSRSD Inspector shall be present during all backflow assembly installations, replacements, and repairs.

II-B2-8. Tracer Wire and Warning Tape

Tracer wire shall be installed on the top of all pipelines. Tracer wire shall come up into the valve boxes as shown on the Drawings. Plastic warning tape conforming to Section II-B1-2.07 shall be installed above water lines as shown on Drawing G-1.

When potable water is being supplied to a site also being supplied with recycled water, the warning tape conforming to Section II-B1-2.07 shall also be fastened directly to the top of the potable water main and run continuously the entire length of the pipe.

II-B2-9. Water Service Connections

Service connections shall be installed in accordance with Drawings W-7 or W-8. Water meters will be installed by the District after all fees have been paid and occupancy requirements have been met. Meter boxes, angle meter stops, meter spud or tail piece, and backflow prevention devices shall be provided and installed by the Applicant and will be properly located prior to meter installation and service connection. Service connections that are improperly installed shall be abandoned at the water main tap and a new service connection shall be installed. Adjustments to any water services in use by customers shall be coordinated with the District and completed with minimum interruption of water service to customers.

The installation of union connectors on service connections shall not be permitted.

II-B2-10. Meter Boxes

The Applicant shall provide a meter box for each water service connection and is responsible for hooking up the house side of the meter. The District will install and provide the meter after payment of the required fees. For connection of the customer's piping to meters 3-inch and above, the Contractor shall provide a flange adaptor from the Approved Materials List or an approved equal.

The meter box shall be firmly supported and centered over the meter assembly. The meter box shall be provided with pea gravel or drain rock to keep meter dry. The meter box shall have its

cover installed flush with the finished curb, sidewalk, or grade, or as indicated on the Improvement Plans. Installation of meters including meter boxes shall be in accordance with Drawings W-19 or W-20.

Meter boxes for commercial/industrial buildings, or for residential buildings, which require backflow prevention devices, shall have a six (6) inch wide concrete collar around the meter box. All concrete collars shall be broom finished.

Brass tags are required on meters whenever a cluster of meters is installed. The tags shall indicate which unit each meter services.

II-B2-11. Thrust Blocks

Thrust blocks shall be constructed of Class B concrete as specified in Section I-D10, and shall be provided for all bends, tees, crosses, reducers, and where indicated on the Improvement Plans. Thrust blocks shall be poured against undisturbed earth. If, in the opinion of the District Engineer, the earth against which the anchor bears is unsuitable to support the imposed load, Contractor shall provide such additional anchorages as may be required by the District Engineer. Ground against which concrete is to be placed shall be moistened prior to placing so that it will not absorb excessive moisture from the fresh concrete. Forms, if required, shall be smooth, mortar tight, and of sufficient strength to maintain shape during the placing of the concrete. Placing methods shall be such that the concrete will be placed in its final position without segregation. All concrete shall be placed and rodded to ensure smooth surfaces along form lines and to eliminate air pockets. The use of mechanical vibrators will not be required on thrust blocks for PVC pipe. Thrust blocks shall be placed in such a manner that pipe and fitting joints will be accessible for repair. Concrete used for thrust blocks shall be in contact with fittings and not with the pipe.

Thrust blocks shall cure at least twenty-four (24) hours prior to backfilling and allowing pressure into the main. Thrust blocks shall be constructed in accordance with Drawing W-2.

Manufactured restraint devices may be used in lieu of concrete thrust blocks for ductile iron and PVC pressure pipelines (water mains and wastewater force mains) on a case-by-case basis when approved by the District Engineer. Manufactured restraint devices shall be designed to tie the pipeline together at fittings and to transfer thrust forces to the adjacent soil by friction and soil bearing. Information to be submitted to the District Engineer when requesting approval for manufactured restraint devices shall include the following:

1. Details of the restraint system
2. Measured site-specific (or assumed worst-case) soil characteristics of importance to thrust resistance of the soil (ref: “Thrust Restraint Design Equations and Tables for Ductile Iron and PVC Pipe,” PD-6 (5-95) published by EBAA Iron)
3. Pipe and encasement details which will affect soil friction
4. Trench, pipe bedding, and depth of cover details
5. Test pressure (per II-B3-2 of these Standards)
6. Factor of safety (1.50 minimum)
7. Calculations of length of pipe to be restrained for each situation

8. Thrust Restraint Calculations using the Ductile Iron Pipe Research Association (DIPRA) method is acceptable.

Manufactured restraint devices shall be installed per manufacturer's recommendations. Manufactured restraint devices shall not be used on HDPE pipe.

II-B2-12. Curb Marking

The location of all valves, blowoffs, air valves, services, etc., shall be permanently marked in Roman Numerals on the closest curb face, or on four (4) inch by four (4) inch posts where there is no curb. At the point where a service line crosses beneath the curb, the point shall be permanently marked by a "W" stamped on the top of the curb.

II-B3. TESTING AND DISINFECTION OF POTABLE MAINS AND SERVICES

II-B3-1. General

All labor, equipment, and material, including water necessary for the testing and disinfection of potable water mains and services, shall be provided by the Contractor at no cost to the District. Testing shall include corrections, repairs, and retesting until the water mains and services pass the required test. Prior to testing, the Contractor shall provide access to all valves. All water lines shall be tested in the presence of an Inspector. Testing shall be done only after the line is adequately protected from shock loading and the street is no longer subjected to continuous abnormal construction traffic. The intent being that after testing, the possibility of pipe or joint failure due to traffic loading shall be remote. As a guide, the test shall be made after curb, gutter, and sidewalk are poured and six (6) inches of subbase or base is in place and compacted. If the total section below pavement is less than six (6) inches, then the street shall be ready for paving before testing. Additional subbase or base may be required if it appears that the street will carry excessive traffic before paving. Excessive trench failure may require retesting of the pipe in that section of the trench failure and all damaged pipe shall be repaired or replaced. Retesting and pipe repair and replacement shall be done with all cost borne by the Contractor.

All appurtenances such as water services, hydrants, blowoffs and ARVs shall be set to final elevation prior to testing.

Prior to District provision of water for testing, the Contractor shall submit a chlorination and flushing plan addressing conformance to AWWA C651 and these Standards. All phases of filling, flushing, chlorinating, and dechlorinating shall be monitored for chlorine intrusion into the existing water system. The plan shall address the items listed in the checklist in Appendix D.

To provide water for testing, the new potable water pipeline shall be connected to the existing system through a construction jumper per Drawing W-30, which consists of a water meter (rented from the District) and a District-approved reduced pressure principal backflow prevention assembly (to be provided by Contractor) downstream of a tap valve to prevent backflow of test water from the new system. After successful completion of all required testing, the valves shall be removed and a permanent connection shall be installed. Assembly shall be four (4) inch for eight (8) inch mains, ten (10) inch mains, and for twelve (12) inch mains, and six (6) inch for fourteen (14) and sixteen (16) inch mains.

All potable water mains, services and appurtenances shall pass testing and disinfection prior to beneficial occupancy of the Work by the District. District beneficial occupancy is required prior to approval of occupancy of buildings served by the newly installed water system.

II-B3-2. Testing

After the completion of backfill as required by Section II-B3-1, the newly laid pipe or any valved section thereof, shall be subjected to a hydrostatic pressure and leakage test.

If the pipeline under test contains pipes of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

II-B3-2.01. PVC Plastic Pipe Leakage and Pressure Test

Each section of the pipe to be tested shall be slowly filled with water, and all air shall be expelled from the pipe. The release of the air can be accomplished by opening hydrants, air release valves, and service line cocks at the high points of the system. The valve controlling the admission of water into the section of pipe to be tested should be opened wide before closing the hydrants, air release valves, and service cocks. After the system has been filled with water and all air expelled, all the valves controlling the section to be tested shall be closed.

The test shall subject the pipe for a duration of six (6) hours of sustained pressure of not less than 200 ±5 pounds per square inch for the first two (2) hours then lowered to 150 ±5 pounds per square inch for the remaining four (4) hours. The leakage shall be accurately measured during this period to determine the rate of leakage. The maximum allowable leakage can be calculated from the following table:

ALLOWABLE LEAKAGE FOR AWWA PVC PIPE

Nominal Pipe Size, inches	**Average Test Pressure in Line, psi**				
	50	100	150	200	250
	Allowable Leakage per 1,000 feet or 50 joints, gal/hr (L/hr)				
4	.19 (.72)	.27 (1.02)	.33 (1.25)	.38 (1.44)	.43 (1.63)
6	.29 (1.10)	.41 (1.55)	.50 (1.89)	.57 (2.16)	.64 (2.42)
8	.38 (1.44)	.54 (2.04)	.66 (2.50)	.76 (2.88)	.85 (3.22)
10	.48 (1.82)	.68 (2.57)	.83 (3.14)	.96 (3.63)	1.07 (4.05)
12	.57 (2.16)	.81 (3.07)	.99 (3.75)	1.15 (4.35)	1.28 (4.84)
14	.67 (2.49)	.95 (3.53)	1.16 (4.32)	1.34 (4.98)	1.50 (5.58)
16	.76 (2.82)	1.08 (4.02)	1.32 (4.91)	1.53 (5.69)	1.71 (6.36)

II-B3-2.02. Ductile Iron Pipe Pressure Test

Each section of the pipe to be tested shall be slowly filled with water and all air shall be expelled from the pipe. The release of the air can be accomplished by opening hydrants, air release valves and service line cocks at the high points of the system. The valve controlling the admission of water into the section of pipe to be tested should be opened wide before shutting the hydrants, air

release valves, blowoffs, and service cocks. After the system has been filled with water and all air expelled, all the valves controlling the section to be tested shall be closed and the piping allowed to soak for a minimum of 24 hours prior to pressure test.

The test shall subject the pipe to a duration of six (6) hours of sustained pressure of not less than 200 psi for the first two (2) hours then lowered to 150 psi for the remaining four (4) hours. The leakage shall be accurately measured during this period to determine the rate of leakage. The maximum amount of leakage can be calculated from the following table:

ALLOWABLE LEAKAGE PER 1,000 FEET (305 m) OF PIPELINE,* gph**

Avg. Test Pressure psi (bar)	Nominal Pipe Diameter, inches															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450(31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400(28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350(24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300(21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275(19)	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250(17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225(16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200(14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175(12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150(10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125(9)	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100(7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

* If the pipeline under test contains sections of various diameters, the allowable leakage will be the arm of the computed leakage for each size.

** To obtain leakage in liters hour, multiply the values in the table by 3.785.

II-B3-2.03. HDPE Pressure Testing

Hydrostatic testing of HDPE pipe shall be in accordance with PPI technical report TR 31/9-79. HDPE pressure pipe shall be tested at 1.5 times the pressure rated capacity of the pipe, adjusted for the ambient temperature of the test section, for three (3) hours.

For any test pressure from 1.0 to 1.5 times the system design pressure, the total test time including initial pressurization, initial expansion, and time at test pressure, must not exceed eight (8) hours. If the pressure test is not completed due to leakage, equipment failure, etc., the test section should be de-pressurized and allowed to "relax" for at least eight (8) hours before bringing the test section up to test pressure again.

The test procedure consists of initial expansion and test phases. During the initial expansion phase, the test section is pressurized to the test pressure, and sufficient make-up water is added each hour for three (3) hours to return to test pressure. After the initial expansion phase, about four (4) hours after pressurization, the test phase begins. The test phase shall be three (3) hours, after which a

measured amount of make-up water is added to return to test pressure. If the amount of make-up water added does not exceed the value in the table below, leakage is not indicated.

Nominal Pipe Diameter, Inches																		
	4	5	5- 3/8	6	7-1/8	8	10	12	13-3/8	14	16	18	20	22	24	26	28	30
Make-up Water Allowance, US Gallons per 100 ft.	0.4	0.58	0.62	0.9	1.0	1.5	2.1	3.4	3.7	4.2	5.0	6.5	8.0	10.5	13.3	15.0	16.8	19.2

II-B3-2.04. Tapping Sleeve Leakage and Pressure Test

After the assembly of the tapping sleeve, and prior to drilling of the tap, the tapping sleeve shall be subject to pressure and leakage testing.

The assembled tapping sleeve branch shall be sealed with a blind flange. The blind flange shall be fitted with a three quarter (3/4) inch NPT test plug when the tapping sleeve has no test plug. A calibrated pressure gauge shall monitor the test pressure.

Pressurized air shall be introduced through a tee fitting attached to the test port. The branch tee shall connect to the pressure gauge. The test pressure shall be 100 psi for thirty (30) minutes minimum duration without loss of pressure. When there is a drop in test pressure, the Contractor shall make the necessary corrections to make the tapping sleeve watertight. After the corrections, the tapping sleeve shall be retested.

During the assembly and testing of the tapping sleeve, the Contractor shall take the necessary precautions not to damage the existing main. Any damage to the existing main caused by the Contractor's operations shall be repaired at the Contractor's expense.

II-B3-2.05. Disinfection

Bacteriological samples will not be taken until a satisfactory hydrostatic pressure and leakage test is completed. Water samples from the disinfected pipelines shall be taken by District personnel in cooperation with the Contractor, and samples shall be tested by the District laboratory at the Contractor's expense. If bacteriological samples fail to satisfy minimum requirements, additional chlorination shall be required at the expense of the Contractor until satisfactory samples are obtained. No bacteriological samples shall be taken from fire hydrants. The Contractor shall provide, at his or her expense, an outlet from which to take the samples in accordance with Drawing W-18A. Sample points shall be installed by the Contractor at locations determined by the District Inspector.

A minimum of two bacteriological samples shall be taken from the newly installed and disinfected pipeline. The second bacteriological test sample shall be taken 24 hours after the first sample is taken. Bacteriological sample test results shall be available to the contractor within 48 hours after a sample is taken. The newly installed and disinfected pipeline shall pass two consecutive bacteriological sample tests prior to connection to the District's active potable water distribution system.

II-B3-2.05.01. Method of Disinfection

After completion of the hydrostatic pressure and leakage test, the mains shall be chlorinated in accordance with the latest revision of AWWA C651, Standards for Disinfecting Water Mains. Any one of the methods therein described may be used, with the additional requirement of 25 ppm chlorine minimum initial application. At the end of the contact period, the mains shall be thoroughly flushed and bacteriological samples taken by District personnel.

II-B3-2.05.02. Disinfection of Tie-ins

The Contractor shall disinfect all piping materials used for tie-ins by swabbing with chlorine, or by other approved methods. Following a tie-in, the area affected by the tie-in shall be thoroughly flushed and bacteriological samples will be taken by District personnel.

The exterior surfaces of the main to be enclosed by the tapping sleeve and the interior of the tapping sleeve shall be disinfected by swabbing with chlorine prior to the assembly of the tapping sleeves.

II-B3-2.06. Flushing

After completion of the test and chlorination, the Contractor shall thoroughly flush all water from the line with fresh water from the existing system to completely purge and replace the chlorinated test water. It is the Contractor's responsibility to properly dispose of the flush water in a manner that will not cause damage and/or nuisance to the environment and in compliance with state and local regulations. Discharging of flush water into sanitary sewer will require District approval. Contractor is responsible for contacting District prior to discharging flush water.

II-B3-2.07 Tracer Wire Continuity Test

Prior to connection to existing mains and final paving, the contractor shall conduct continuity testing of all tracer wire installed on water lines. Tests may be conducted using either applied resistance or voltage. All testing shall be conducted in the presence of a District Inspector.

II-B4. CONNECTION WITH EXISTING DISTRICT FACILITIES

II-B4-1. Connection to Existing Mains

Any potable water main that has not passed a bacteriological test shall not be permanently connected to any existing potable water main or to any potable water main that has previously passed a bacteriological test. All connections shall be made in the presence of an Inspector and with the approval of the District Engineer.

II-B4-2. Valve Operation

Only certified District personnel specifically designated and authorized by the District Engineer shall operate, open, or close any valve in the system.

II-B4-3. Interruption of Service

When a shutdown of the existing system is necessary to make the connection, shutdown shall be conducted by authorized District personnel. The operation of valves in the existing system by other than District authorized personnel will not be permitted unless approved otherwise. The Contractor

shall notify in writing the District Engineer not less than seven (7) calendar days prior to the time of a required shutdown so that the District may provide advance notice to affected customers and the fire department. In the written notice, the Contractor shall stipulate the expected length of the shutdown.

In general, shutdown in residential areas shall be made at times when there will be the least interference with residential water use. Shutdowns in other areas shall take into account any periods of heavy water use. In any event, the District must approve the timing of the shutdown and the tie-in accomplished in such a manner as to minimize the effect on any customer of the District. If the period of shutdown extends beyond the normal working hours, the Contractor shall pay the District for the necessary overtime of District personnel. No tie-ins to existing mains will be permitted until all required testing has been successfully completed.

SECTION III
SEWER SYSTEM REQUIREMENTS

SECTION III
SEWER SYSTEM REQUIREMENTS

SECTION III-A - DESIGN CRITERIA

III-A1. SEWER MAIN SIZING

Sewer mains shall be sized using Manning's Formula and the following input criteria as variable parameters in Manning's Formula.

1. Design sewage flow.
2. Manning's "n" value of 0.013.
3. Minimum and maximum velocity.
4. Minimum slope.

In addition, the minimum diameter for all sewer mains shall be eight (8) inches. Also, if a sewer main within an easement is over fifteen (15) feet deep, the District may require oversizing to facilitate future slip lining.

III-A1-1. Design Sewage Flow

Sewer mains shall be sized to provide sufficient capacity to accommodate future tributary flows in addition to the sewage flow from the project development. The Developer's Engineer shall consult with the District Engineer to become familiar with all master plan studies for determining future tributary sewage flows. The design sewage flow from the project development shall equal the total peak dry weather flow plus infiltration/inflow.

Peak dry weather flow shall be determined by multiplying the total average dry weather flow by a peaking factor. The peaking factor shall be obtained from the graph of peaking factor versus total average dry weather flow presented in Drawing S-1 of these Standards.

Average dry weather flow for residential projects shall be determined from the planned number of dwelling units and the following unit usage criteria.

Single family dwelling - 256 gpd/unit (80 gpcd with 3.2 persons/unit).

Multi-family dwelling - 160 gpd/unit (80 gpcd with 2.0 persons/unit).

Average dry weather flow for commercial projects shall be determined from the net acreage of the commercial development and the unit usage criteria of 2,500 gal/net acre/day. Average dry weather flow for industrial projects shall be evaluated on a case-by-case basis.

Infiltration/inflow in new areas only shall be determined from the gross acreage and the unit criteria of 600 gpd/gross acre.

For analysis of available capacity in existing sewer mains, the Developer's Engineer shall consult with the District Engineer and shall refer to all applicable master plan studies.

III-A1-2. Minimum and Maximum Velocity

Sewer mains shall be sized to provide a minimum velocity of two (2) feet per second when the sewer main is flowing half full.

The maximum velocity for sewer mains shall normally be eight (8) to ten (10) feet per second.

III-A1-3. Minimum Slope and Slope Changes

Minimum slope requirements are necessary to assure self-cleaning and self-oxidizing velocities to avoid significant generation of hazardous, odorous, and corrosive sulfur compounds. Where possible, use of the minimum slopes should be avoided and should not be construed as guidelines for system design. However, the District will accept the standard minimum slope. Standard minimum slopes used for sizing sewer mains shall be as follows:

Pipe Size (in.)	Standard Minimum Slope (foot per foot)
6	0.0049
8	0.0033
10	0.0025
12	0.0019
15	0.0014
18	0.0011
21	0.0009

If grades below the standard minimum must be used in order to avoid pumping, the Developer's Engineer shall consult with the District Engineer before proceeding with design. Grades below the standard minimum may be used only upon specific approval requested well in advance of completion of design.

To minimize the turbulence in manholes, the slope of any incoming sewer main shall not exceed the slope of the outgoing sewer main by more than ten (10) percent.

III-A2. LOCATION OF MAIN

III-A2-1. Location of Main in Streets

Wherever the physical limitations of the street and other utilities permit, the sewer main shall be located on the center line of the street.

III-A2-2. Building and Other Above-ground Structure Set Back from Mains

To minimize hazards to buildings and other above-ground structures when mains are repaired, foundations or footings of buildings and other above-ground structures shall be set back a minimum of seven and one half (7.5) feet from the exterior wall of the sewer main.

The installation of mains less than seven and one half (7.5) feet from the building or above-ground structure shall be subject to the approval of the District Engineer. In such cases, AWWA C900

DR14 PVC pipe shall be used. No service connection to the sewer main is allowed within five (5) feet of the building or structure foundation.

III-A2-3. Location of Main in Easements

Sewer mains shall generally be placed in the center of easements and only in unusual circumstances shall a sewer main be approved which is closer than five (5) feet from the easement edge. Unless specifically otherwise approved, sewer mains in easements shall be straight without horizontal bends or deflections.

III-A3. MINIMUM COVER

Minimum cover of all sewer mains shall be five (5) feet.

III-A4. HORIZONTAL AND VERTICAL CURVES

All sewer mains shall have straight alignment in both the horizontal and vertical plane between manholes. Horizontal curves shall be allowed only under special circumstances and by approval of the District Engineer. An installation shall be considered a special circumstance if there is a curved street section and deviation of the sewer main from the street center line presents problems with respect to maintaining required clearances from water mains and other utilities. Horizontal curves shall not be permitted in mains exceeding 17 feet in depth. If pipe curvature is allowed for pipe sizes 12-inch and smaller, then the recommended radius of curvature shall be four hundred (400) feet and under no circumstances shall be less than two hundred and fifty (250) feet. For mains with a radius of curvature of four hundred (400) feet, manhole separation shall not exceed three hundred (300) feet. For mains with less than four hundred (400) feet of curvature, manhole separation shall not exceed two hundred (200) feet. In no case shall sewer pipes larger than 12-inch diameter have a curved alignment.

III-A5. MANHOLES

III-A5-1. Distance between Manholes

The maximum distance between manholes from center line to center line shall be no greater than three hundred and fifty (350) feet for sewer mains equal in diameter to twenty-four (24) inches or less. For sewer mains greater than twenty-four (24) inches, the maximum distance between manholes shall be no greater than four hundred (400) feet. III-A5-2. Location of Manholes

Unless otherwise approved, all manholes will be accessible to standard maintenance vehicles. Manholes placed in back or side yards will not be approved. Every reasonable effort shall be made to provide a paved or gravel roadway to manholes in open space areas.

Manholes shall be located at:

1. All abrupt grade changes.
2. All changes in horizontal alignment (except on curves).
3. All changes in pipe size.

4. The start of all sewer mains exceeding one hundred (100) feet in length from the next downstream manhole. In addition, manholes will be required in cul-de-sacs that have three (3) or more fronting lots. In cul-de-sacs, manholes shall be located no less than fifteen (15) feet from the curb line. No more than three (3) sewer laterals shall connect into any one manhole. The manhole shall be located such that the angle in the horizontal plane between the downstream and any one lateral sewer is not less than ninety degrees (90°).
5. All sewer main junctions.
6. The point of tangency of each reverse curve. (No reverse curves will be allowed between manholes, except where the District determines that the nature of the reverse curve is not significant or detrimental to the system.)
7. At the connection of a six (6) inch or larger service lateral connected to an equal or larger diameter sewer main.
6. All mains shall end in a manhole. This requirement also includes dead end mains
7. All changes in pipe materials.

In general, manholes shall not be located in the street where rainfall runoff is directed to the manhole. If this is unavoidable, then pressure (watertight) frames and covers shall be installed.

III-A5-3. Slope of Manhole Channels

When sewers of uniform size and slope pass through a manhole, the slope shall be maintained and the invert at the center of the manhole shall be given. In sewers that change slope, the slope of the incoming sewer(s) shall be carried through to the outlet and the invert elevations at the inlet(s) and the outlet shall be given. Where diameters of sewer pipes change, the elevations of the top of the incoming and outlet pipes shall match.

When the incoming sewer makes an angle of 45 to 90 degrees with the outlet sewer, add 0.10 feet to the calculated manhole elevation drop. When the angle is 15 to 45 degrees, add 0.05 to the calculated value.

III-A5-4. Drop Manholes

While not encouraged, drop manholes may be required because of some physical constraints; they should not, however, be used to merely avoid extra depth in trench unless unusual circumstances exist. All proposed drop manholes must be approved by the District Engineer. Where approved, the drop shall not exceed ten (10) feet and shall be constructed in accordance with Drawing S-3. Whenever possible, upstream slope changes should be used to avoid the need for a drop manhole.

III-A5-5. Manholes in Undeveloped Areas

Manholes in undeveloped areas shall require special protection as required in sewer materials of construction Section III-B1 and as shown on Drawing S-6.

III-A5-6. Rim Elevations of Manholes

Top elevations for all manholes shall be shown on the profile. In paved areas, the manhole rim elevation shall match the finished grades. In other than paved areas or traveled way, the height of

the manhole rim will normally be eighteen (18) inches above the finished grade, high water mark, or above the top of future fill areas. The elevations shown for the tops of manholes on the Improvement Plans shall not relieve the contractor from making final adjustments to match street surfaces.

III-A5-7. Design and Size

Standard manholes shall be concentric and in accordance with Drawing S-2. Normally, manholes will be four (4) foot diameter; five (5) foot diameter manholes are required for lines eighteen (18) inches and larger or where the depth to pipe invert exceeds ten (10) feet. Where the depth exceeds eighteen (18) feet or diameter exceeds eighteen (18) inches, the cover (lid) shall be thirty (30) inches for safety reasons. A shallow manhole in conformity with Drawing S-4 may be used upon approval of the District Engineer when a sewer main or lateral is less than minimum cover.

III-A5-8. Sampling Manholes

A sampling manhole shall be required on all nonresidential building service laterals. It shall be in a location accessible to District personnel at all times and within the private properties of developers, as directed by the District Engineer. It may be considered as a cleanout in lieu of a separate cleanout. Sampling manholes shall be constructed as shown on Drawing S-11.

Metering manholes, when required by the District for nonresidential building service laterals, shall also be constructed as standard manholes conforming to Drawing S-2 except: 1) they shall be on a straight run of pipe through the manhole with no angles or branches; 2) the slope through the manhole shall be a maximum of two (2) percent; and 3) pipe slope shall be held constant for fifteen (15) feet upstream of the manhole and through the manhole. For laterals four (4) inch to six (6) inch, a minimum of ten (10) feet of the pipe upstream of sampling manhole shall be a straight run. For laterals larger than six (6) inches, a minimum of fifteen (15) feet of the pipe upstream of the sampling manhole shall be a straight run. The downstream portion of the pipe shall have a two (2) foot minimum straight run.

III-A5-9. Sewer Pipe Stubs

Stubs shall be designed and installed in all manholes, from which future sewer line extensions are anticipated. Pipe stubs shall be a minimum of eight (8) inches in size, or as directed by the District Engineer, and shall be of an approved type of pipe. Stubs shall protrude one (1) foot outside of the manhole base and shall be plugged with a standard watertight plug or cap.

III-A6. DEAD END MAINS AND CLEANOUTS

All dead end mains shall terminate at a manhole. Rodding inlets are not allowed.

Cleanouts shall be provided in side sewer systems under the following cases.

1. At the point of connection to the house piping of single family residences.
2. At the property or easement line on side sewers serving commercial, industrial, and multi-family complexes.
3. At any single turn greater than forty-five degrees (45°).

4. At intervals along the side sewer system where the accumulative total of deflections from the point of connection to the main or from another cleanout exceeds one hundred thirty-five degrees (135°).
5. At intervals not to exceed one hundred (100) feet along the side sewer system.
6. Wherever a side sewer changes in size.

The cleanout shall be equal in size to the side sewer and shall be installed as per Drawings S-8 or S-l0 of these Standards.

III-A7. SIDE SEWERS

Each house and building shall have an independent side sewer shown on the Improvement Plans except for buildings located on a lot under one ownership. Under this exception, one side sewer may be shown, provided that the property cannot be subdivided, and upon approval of the District Engineer. Side sewers shall be installed in general conformity with Drawing S-8 of these Standards.

In tight areas, such as condominiums, the laterals may be installed with a vertical drop into the top of the side sewer (chimneyed) with the approval of the District Engineer. Two forty-five (45) degree elbows shall be used.

III-A7-1. Size

Side sewers for single-family dwellings shall normally be four (4) inch minimum diameter unless the Uniform Plumbing Code requires a larger size. Side sewers less than a 4" diameter require approval of the District Engineer. Townhouses shall normally be required to have separate four (4) inch minimum diameter laterals, rather than one six (6) inch minimum diameter lateral per building. All other laterals for apartments, multi-level condos, commercial, institutional, or industrial users shall be sized as required by the Uniform Plumbing Code.

III-A7-2. Depth and Grade

Side sewers from the main sewer to the house or building line shall be constructed at a two (2) percent grade unless otherwise approved by the District Engineer. In addition, the depth five (5) feet from face of curb in the direction toward the house or building shall normally be five (5) feet minimum from top of pipe to ground surface.

Invert elevations for all side sewers shall be indicated on the Improvement Plans. As a minimum, the side sewer invert elevations at its upstream end and at the point five (5) feet from the face of the curb in the direction of the house or building shall be indicated.

All side sewers that cross above a water main or below within one (1) foot of a water main shall be subject to the State Water Resources Control Board, Division of Drinking Water (DDW), criteria for the separation of water mains and non-potable pipelines to conform with Title 22 of the California Code of Regulations, Section 64572 (22 CCR § 64572).

III-A7-3. Location

Location of lateral sewers in public road rights-of-way shall be in relation to the nearest corner of the property being served. Unless otherwise determined by physical controls, the lateral shall be located ten (10) feet from the lower property corner at the right-of-way line of hillside lots (3 percent + slope) and on the lot center line in relatively level terrain.

III-A7-4. Connection Angle and Maximum Deflection

All sewer laterals, from property line or edge of easement to the point of connection with the main line or a manhole, shall have an alignment that provides an angle of intersection with the downstream section of main sewer of no less than ninety degrees (90°). No lateral alignments adverse to the flow of the main will be permitted.

The maximum deflection at any one point in a side sewer, not including fittings at saddle or wye connection to main sewer or at angle points having cleanouts, shall be twenty-two and one-half degrees (22-1/2°) (1/8 bend) and any two (2) consecutive deflections (bends) shall not be less than two (2) feet apart.

III-A7-5. Overflow Protection

A sewer overflow protection device shall be installed on all sewer laterals. See Drawing S-8 for details regarding installation. Installation location shall be two (2) feet from the building foundation.

III-A7-6. Use of Existing Sewer

If Applicant proposes to connect to an existing sewer facility either in operation or abandoned, Applicant shall rehabilitate existing sewer facility, including sewer pipe stubouts, such that it meets all requirements for new sewer construction.

Existing side sewers may be used for servicing new homes or buildings on a lot under single ownership only when the existing side sewers are found on examination and testing required by the District to meet all requirements for new sewer construction.

III-A7-7. Pipe Material

Side sewers for residential and general commercial service shall be PVC pipe conforming to Section III-B1-1.03 of these standards or HDPE pipe conforming to Section III-B1-1.05 of these standards.

Side sewers for industrial establishments shall be PVC or DIP.

III-A8. PUMPING STATIONS

Pumping stations are not normally allowed. They may be considered under extraordinary circumstances, but only by specific approval of the District Engineer during the preliminary design stages.

III-A9. SPECIAL DESIGN CONSIDERATIONS

Depending on the angle of deflection, high or low points in a sewer main system may require the installation of air/vacuum relief valves or blowoffs, respectively. In the case of a low point (i.e., inverted siphon), additional manholes for access and cleaning may also be required. The District Engineer on a case-by-case basis will evaluate the need for such special and additional sewer appurtenances.

III-A10. GREASE AND SAND TRAPS, GREASE INTERCEPTORS

All building connections through which: (1) liquid wastes containing grease in excessive amounts; (2) sand; or (3) other harmful ingredients may be introduced into the District sewer system shall have a grease and sand trap or grease interceptor and sampling box installed as specified below and in accordance with Drawings S-12, S-12A, S-13, S-14 and S-15.

Restaurants: All restaurants and other establishments with common food preparation facilities shall have a grease interceptor on their side sewer, outside of building and easily accessible for cleaning and inspection, as appropriately sized and approved by the District Engineer.

The size of seven hundred fifty (750) gallons or ninety-six (96) cubic feet capacity is the minimum for a grease interceptor.

Volume of grease accumulation shall determine the size of the storage tank required as follows:

Type of Restaurant	Average Grease Accumulation/Month
A. High volume - full menu Open 12-24 hrs./day Over 500 meals/day	40 cu. ft.
B. Medium volume – full menu Open 8-16 hrs./day 100-400 meals/day	20-30 cu. ft.
C. Fast food, take-out, or pizza parlor	5-10 cu. ft.

Sizes required for a particular application are as follows:

Tank Size, gals.	Capacity, cu. ft.	Max Accumulation of Grease before Cleaning, cu. ft.
750	96	30
1,000	128	40
1,200	160	50
1,500	200	60
1,600	220	70
2,000	256	80
2,500	328	90

Tank Size, gals.	Capacity, cu. ft.	Max Accumulation of Grease before Cleaning, cu. ft.
3,000	400	100
3,500	456	120

Other Commercial Business: If a vehicle wash-down area is provided, it shall be roofed and have a grease and sand trap per Drawing S-12 shall be installed. If a trash enclosure area within a commercial development is required to be connected to the sanitary sewer, the trash enclosure area shall have a roof and shall have a grease and sand trap per Drawing S-12A. Grading in the trash receptacle area shall be such that only run-off from within the receptacle area enters into the sewer for that area

Residential Apartment and Condominium Complexes: All apartment and condominium complexes shall have a roof over the trash receptacle area and shall have a grease and sand trap per Drawing S-12A serving run-off from the trash receptacle area.
All drains carrying harmful ingredients described herein shall be connected to the grease and sand trap or grease interceptor. All restroom facilities of such establishments shall be plumbed separately and connected to the building side sewer downstream of the trap or interceptor.

Grease interceptors shall be installed in such a manner that access for annual inspections shall be readily obtainable.

After grease interceptor installation (per manufacturer's specifications), testing shall be conducted in coordination with and in the presence of a DSRSD Inspector.

A sampling box shall be installed immediately downstream of the grease interceptor as shown in Drawing S-15.

III-A11. MERCURY AMALGAM SEPARATORS

Dental practices that generate amalgam wastes shall install an amalgam separator on the effluent line of the vacuum system(s) serving the facility prior to discharge to the sanitary sewer system. The amalgam separator shall meet the ISO 11143 standards that are effective at the time of installation.

Dental practices may be exempt from this requirement providing the District receives written assurance that removal or placement of amalgam fillings occurs at the facility no more than three (3) days per year and the type of practice is one of the following:

- orthodontics
- periodontics
- oral and maxillofacial surgeon
- radiology; oral pathology of oral medicine
- endodontics and prosthodontics

SECTION III-B - CONSTRUCTION STANDARDS

III-B1. MATERIALS OF CONSTRUCTION

General materials of construction requirements are contained in Section I of these Standards. The sections that follow establish the specific material requirements for sewer pipe products, manholes, and other miscellaneous sewer appurtenances.

III-B1-1. Sewer Pipe and Fittings

Unless otherwise approved by the District Engineer, sewer pipe shall be limited to PVC pipe or HDPE pipe. Pipe shall have integral bell, gasketed joints or welded (heat-fused or electro-fused) in accordance with the requirements in these specifications for the specific pipe type.

Field cut joints and connections to other gravity sewer piping materials shall be made with a mechanical compression joint composed of: a heavy duty synthetic rubber sealing component; two (2) Type 316 stainless steel clamps; Type 316 stainless steel nuts and bolts; and an adjustable stainless steel shear ring. Couplings for connections of differing pipe sizes and/or types shall be shear-banded, transition couplings according to the foregoing specification. All couplings shall be designed for the sizes and types of pipe being connected. Grouted connections to cast-in-place concrete manhole bases shall be made with a rubber ring water stop.

III-B1-1.01. Vitrified Clay Pipe (VCP)

VCP pipe and fittings are not allowed for use on District facilities

III-B1-1.02. Ductile Iron Pipe (DIP)

DIP is not allowed for use on District sewer facilities without special approval from the District Engineer.

III-B1-1.03. Polyvinyl Chloride Pipe ("PVC" Pipe)

PVC pipe and fittings for sizes 4-inch through 15-inch shall meet the requirements of ASTM D3034, SDR 26, cell classification 12454-B or 12454-C. PVC pipe and fittings for sizes 18-inch through 27-inch shall meet the requirements of ASTM F679, SDR 26, Wall T-l, cell classification 12454-C.

Bell and spigot joints shall meet the requirements of ASTM D3212 with integral bell push-on type elastomeric gasket joints.

Pipe fittings having either spiral or concentric external reinforcing ribs will not be acceptable.

Installation of PVC pipe shall meet the requirements of ASTM D2321. All field cut PVC pipe shall be beveled and lubricated before joining.

III-B1-1.04. ABS Wall Pipe

ABS pipe and fittings are not allowed for use on District facilities.

III-B1-1.05. HDPE Pipe and Fittings

HDPE pipe shall be minimum DR17 and conform to ASTM F714-94, "Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter," or ASTM D3035-93 "Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter."

HDPE pipe shall have a Plastic Pipe Institute (PPI) material designation of PE 4710, a cell classification of PE 445574 per ASTM D3350, and have an established hydrostatic design basis of 1600 psi at 73 degrees F.

All HDPE fittings shall be manufactured from the same resin type, grade, and cell classification as the pipe, and shall be fully pressure rated.
HDPE pipe joints shall conform to the requirements of Section II-B1-1.05 of this specification.

A data logger be used by the developer when carrying out butt fusion but is not required for electrofusion.

III-B1-2. Manholes

This section covers the materials of construction for standard, drop, shallow, and sampling/metering manholes. All manholes shall be constructed of precast reinforced concrete concentric cone sections with a minimum access opening diameter of twenty-four (24) inches. Eccentric cones may be used upon specific approval by the District Engineer. Material specifications are as follows:

Manhole Component	Material Specification
Concrete	Materials, handling, finishing, and curing as specified in concrete Section I-D10-1. Manhole bottom shall be Class B concrete.
Precast Sections	Circular precast concrete, ASTM C478 except as modified. Vacuum tested.
Medium thickness	Six (6) inches.
Reinforcement	As indicated on Drawings S-2, S-3, and S-4.
Openings	Circular with surfaces grooved or roughened to improve mortar bond.
Mortar	Commercial strength non-shrink grout.
Manhole Water Stop	One-piece or spliced one-piece waterstop made of synthetic rubber or PVC, designed to prevent water intrusion between pipes and concrete manholes.
Gaskets	
Mastic	Fed Spec SS-S-210.
Plastic	Fed Spec SS-S-00210.
Coal Tar Paint	Use coal tar paint from DSRSD Approved Materials List, or approved equal.
Asphalt Varnish	Fed Spec TT-V-51.
Coatings	ASTM A 48, Class 35B or better with asphalt varnish coating applied at the foundry.
Manhole Frame and Covers	Use manhole frame and cover from DSRSD Approved Materials List, or approved equal. Dimensions shown in Drawing S-4.

Manhole Steps	Prohibited.
Brick Manholes	Not Allowed.

The manhole cover and its seat in the frame shall be machined so that the cover will sit evenly and firmly in the frame and shall be match-marked. Manhole lids shall be stamped "Sanitary Sewer" as shown on Drawing S-4 Standard Manhole Frame and Cover. Where the District Engineer deems necessary for heightened protection of the public or its facilities, a hinged manhole frame and locking cover from the Approved Materials List, or an approved equal, may be required.

If castings arrive on the job without a foundry coating, one (1) coat of coal tar paint shall be applied. Before painting, all castings shall be thoroughly cleaned and properly supported. All loose rust shall be removed by wire brushing. Castings shall not be handled until the paint is dry and hard. The coating shall not become brittle when cold or sticky when hot.

Rejection of a manhole section may be made if: (1) there are damaged or cracked ends, where such damage would prevent making a satisfactory joint; (2) any continuous crack having a surface width of 0.01 inches or more and extending for a length of twelve (12) inches or more, regardless of position in the wall; (3) fractures or cracks passing through the wall except for a single end joint that does not exceed the joint depth; or (4) surface defects indicating honeycombed or open texture.

A sealing (water stop) gasket shall be installed on all flexible (plastic) main and lateral sewer pipes entering manholes; all manhole wall penetrations that are within groundwater tables; and other locations required within these standards. The water stop gasket shall be made of synthetic rubber or other suitable material and shall be on the Approved Materials List, or an approved equal. The water stop gasket shall be firmly seated perpendicular to the pipe axis, around the pipe exterior, and cast into the structure to seal against water leakage.

When manholes are constructed in natural or manmade drainage courses or flood channels, the manhole covers shall be watertight and shall be fitted with a composition gasket and bolted down with eight (8) stainless steel cap screws. To further alleviate infiltration, all interior concrete surfaces including the manhole shafts shall have at least one (1) coat of primer and two (2) coats of protective coating from the Approved Materials List, or approved equal. In other undeveloped areas above the high water level, bolt-down vandal-proof manhole covers shall be used.

III-B1-3. Saddle Fittings

Saddle fittings used for connecting new lateral sewers to existing mains shall be wye branched and shall be fabricated of a material approved by the District Engineer. The wye saddle shall consist of a flange component necessary for preventing the fitting from protruding into the main.

III-B2. INSTALLATION OF SEWER PIPE AND APPURTENANCES

General requirements for installation of pipe and general construction requirements are contained in Section I-D of these Standards. The sections that follow establish the specific requirements as relating only to installation of sewer pipe and sewer appurtenances.

III-B2-1. Pipe and Fittings

Sewer pipe laying shall proceed upgrade with the spigot ends of bell and spigot pipe pointing in the direction of flow.

III-B2-2. Manholes

Standard, drop, and shallow manholes shall be constructed in accordance with Drawings S-2, S-3, and S-4, respectively. All materials for precast manhole sections shall conform to the requirements set forth in Section III-B1-2.

Manholes shall not be located in easements with steep slopes. However, when a manhole is required under special circumstances to be installed in steep slopes, standard and shallow manholes shown in Drawings S-2, S-3, and S-4 may be installed subject to the approval of the District Engineer. Use of manholes in steep slopes shall be reviewed by the District Engineer on a case-by-case basis.

Prior to work on existing manholes, a temporary false bottom shall be installed inside of the manhole as shown on Drawing S-16.

III-B2-2.01. Assembly of Precast Sections

All wall and floor joints shall be cleaned prior to setting any manhole sections. These sections shall be set into position using a preformed plastic sealing gasket or mastic sealing gasket. If the plastic gaskets are used, they shall be in strict conformance with the manufacturer's recommendations including application of a primer coat, drying the joint, and careful use of the gasket to avoid displacement. If mastic is used, it shall be first approved by the Inspector and shall be placed to provide a tight joint.

The top cone section shall be set at such an elevation that not more eighteen (18) inches height of entrance or manhole throat is present with the manhole cover at finish grade.

III-B2-2.02. Manhole Base and Channels

Sewer lines shall first be laid as a whole pipe through manholes. After the manhole floor and walls have been set, the top half of the piping within the manhole shall be carefully cut off to within one (1) inch longitudinally of the inside wall of the precast section and the sides mortared to form a smooth channel as indicated on Drawing S-2.

Precast manhole base shall not be allowed. Unless otherwise required by the District Engineer, the width of the opening at the top of base block shall be the inside diameter of the pipes in the manhole.

In the manholes where the pipe cannot be laid through, the pipes shall be joined by smooth curves, worked to conform with the lower halves of the pipe.

In angle point manholes and in junction manholes, the pipes shall be joined by smooth curves, warped to conform with the lower halves of the pipe. In all cases, the upper portion of the manhole channel from the midpoint of the pipes in the manhole to the top of the base block shall be constructed vertically.

The manhole channel shall be completed in the original pour, unless otherwise directed by the District Engineer.

III-B2-2.03. Adjustments to Street Grade During Construction

The Contractor shall set the transition section after the finished street elevation is known. The Developer shall coordinate the fitting of entrance sections, frames, and covers with the final paving so that the finished manhole covers blend neatly with the street surface. Successful completion of the testing of sewer line does not relieve the Contractor from making these final adjustments.

Frames and covers shall be installed on top of manholes to positively prevent all infiltration of surface or ground water into manholes. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring as shown on Drawing S-2. On sloping finish grade, frames and covers shall be installed as shown on Drawing S-6.

Manholes located in unimproved easements or undeveloped areas not subject to vehicular traffic shall be provided with wire mesh reinforced concrete encasement as shown in Drawing S-6. In addition, a marker post shall be erected not more than four (4) feet from the center of the manhole. The post shall be provided with the necessary identification marks as required by the District Engineer. Marker post shall be as shown in Drawing G-4.

III-B2-2.04. Adjustment to Street Grade After Construction

The Contractor shall be required to make any adjustments in the manhole cover sections during the one-year guarantee period if there is additional paving work. This work consists of removing and replacing the manhole frame and the grade rings. Adjustments shall be accomplished by excavating as necessary, lifting off the frame and grade rings as directed, thoroughly cleaning the frame's bottom bearing surface, coating it with asphalt paint similar to the original coating, removing the old mortar from the manhole cone and grade rings, and replacing the existing frame and grade rings to the new grade as specified for new manholes.

III-B2-2.05. Manhole Collar

All manhole collars shall be poured only after the frame has been centered over the manhole shaft. Unless otherwise specified by the District Engineer, in unpaved areas a concrete collar shall be poured around the frame and shaft so as to securely anchor the frame to the shaft. In paved areas, concrete shall be poured around the manhole frame and shaft in lieu of rock base to a point two (2) inches below the rim unless otherwise required by the City or other public agency having jurisdiction.

III-B2-2.06. Manholes with Drop Connections

Drop Manholes are only allowed in special circumstances and upon the approval of the District Engineer.III-B2-2.07. Pipe Stubout on Future Connections

Lateral sewer and sewer main connection stubouts shall be provided in manholes where shown on the Improvement Plans. The connection stubouts shall be placed in the manhole base and protrude one (1) foot outside the base. All stubouts shall be furnished with a watertight plug capable of

withstanding all internal or external pressures without leakage. All plugs shall be adequately braced to prevent blowoffs.

III-B2-2.08. Flexible Pipe Connections to Manholes

All lateral sewers and sewer mains entering manholes shall be installed with a water stop, firmly seated perpendicular to the pipe axis, around the pipe exterior, and cast into the structure as a water stop. The water stop shall be one-piece or spliced one-piece; made of synthetic rubber or PVC; and shall be designed to prevent water intrusion between the pipe and concrete manhole wall. Water stops shall be on the Approved Material List or an approved equal.

III-B2-2.09. Manhole Protection

During construction, particular care must be taken to protect the manhole from damage and to keep rock, dirt, and debris from getting into the sewer. After the sewer pipe through the manhole has been broken out and channel finished, a close fitting board cover shall be placed over channel and covered with building paper. A temporary metal plate cover, of adequate strength, close fitting, and well secured, shall be placed over the manhole opening until the frame and cover are permanently installed. Manholes in undeveloped areas, which are above finish grade as required, shall be secured with wire mesh and concrete as shown on Drawing S-6.

III-B2-3. Cleanouts

Cleanouts shall consist of a wye branch fitting of the same diameter as the side sewer and installed so the open end of the wye branch is directed to facilitate cleaning. The riser from the wye branch shall be brought to finish grade as shown in Drawing S-10.

III-B2-4. Lateral Sewers

The Contractor shall install only those lateral sewers shown on the Improvement Plans or called for in writing by the District Engineer or by the Developer with the written approval of the District Engineer. Workmanship shall be equal to that specified for the street sewers. No lateral sewer shall be covered until the Developer's Engineer has recorded its location.

The Contractor shall mark the location of all lateral sewers with the letter "S" at least two (2) inches (50 mm) high engraved into the curb at the time of curb installation. For laterals in vacant lots or where no concrete curbs exist, Contractor shall furnish and place 2" x 2" x 12" long hubs at the property line directly above the end of the pipe, with the letters "H.L." and the depth to the lateral marked on the hub with paint.

Unless otherwise shown on the Improvement Plans, lateral sewers shall be installed from the street sewer to the lot line in accordance with Drawing S-9 and plugged at the lot line in preparation for the leakage test. Laterals shall consist of factory-made standard wye branch or tee fittings with ends to suit the street sewer pipe, tilted 30 degrees upward, and plugged with factory-made removable plugs. Wyes shall face in a logical manner to facilitate future installation of house laterals to the properties to be served. The branch portion shall be firmly embedded on all sides and shall be plugged with a watertight plug until the side sewer is constructed.

III-B2-4.01. Deep Lateral Sewers

In general, lateral sewers shall not slope more steeply than 45 degrees. Lateral sewers sloping more than 30 degrees, but less than 45 degrees, shall be cradled in concrete. Lateral sewers sloping 30 degrees or less shall be bedded and laid to the same standards as street sewers, without need for cradling in concrete. Vertical chimneys shall not be allowed.

In tight areas, such as condominiums, the laterals may be installed with a vertical drop into the top of the side sewer (chimneyed) with the approval of the District Engineer. Long radius ninety (90) degree elbows shall be used.

III-B2-4.02. Overflow Protection

An overflow protection device shall be installed at each building's connection to the house sewer. Overflow protection devices shall be placed in well-drained locations near the premises being protected, with unobstructed access for observation and repair.

III-B2-4.03. Abandonment

Lateral sewers to be temporarily abandoned shall be plugged at property line or as directed by the District Engineer. Lateral sewers to be permanently abandoned shall be plugged at the sewer main.

III-B3. TESTING, CLEANING, AND TELEVISION INSPECTION

Testing, cleaning, and television inspection requirements shall be as follows. Upon successful completion of testing, access to manholes must be maintained at all times.

III-B3-1. Testing

All completed sewer mains, force mains, and lateral sewers shall be tested by and at the expense of the Contractor in the Inspector’s presence prior to acceptance of Work and prior to connection to the house sewer. House sewer or building sewer shall be tested according to the Uniform Plumbing Code. The conditions under which testing shall be performed shall be as follows:

1. After all proposed Work, including mains, manholes, laterals, and connections, has been completed.
2. After the installation of all other underground utilities.
3. In improved areas, after the roadway base rock has been placed and compacted.
4. In unimproved areas, after the backfill is satisfactorily compacted.
5. After access to all manholes has been provided.

III-B3-2. Air Testing

Unless otherwise required, all sewer testing shall be performed by the air testing procedure, which is described as follows:

After plugging all openings and providing thrust blocking as necessary, air shall be admitted to the section under test at an inlet pressure not exceeding five (5) psi from a source regulated by an

adjustable pressure control valve and measured by a sensitive pressure gauge calibrated from zero (0) to no more than ten (10) psi. When the internal gauge pressure has reached 3.5 psi under stabilized temperature conditions, the air supply to the test section shall be cut off. The Inspector shall then observe the time interval during which the internal pressure drops 1.0 psig from at least 3.5 psig. The length of time for such loss shall not be less than that shown in the following table for the street sewer size being tested and also for the length of main line being tested.

Test plugs for any air test shall not be removed until the pressure is no longer measurable. Air shall be released slowly through a valve. If the pipe to be tested is submerged in ground water, determine the backpressure due to ground water submergence and increase all gauge pressures in the test by that amount. If a test pressure greater than eight (8) psig results, air testing shall not be used, and exfiltration testing will be required.

III-B3-2.01. Air Loss Time Tables

Tables 1 and 2 contain the specified minimum times required for a 1.0 psig pressure drop from a starting pressure of at least 3.5 psig. Table 1 shall be used for PVC sewers.

TABLE 1. PVC SEWER
MINIMUM TIME (MINUTES-SECONDS) FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF SEWER

Pipe Dia., In.	Min Time	Length for Min Time, ft.	Time for Longer Length, sec.	100	150	200	250	300	350	400	450
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

III-B3-3. Air Test Failure

If the air test indicates leakage greater than the specified limits, the Contractor shall locate the defects by inspection and shall make such repairs and replacements as are necessary. To locate the section of sewer that fails the air test, the various methods that may be used include remote cameras, adjustable low pressure air devices, or the filling of the line with water by plugging the inlet of the downstream manhole and maintaining at least a two (2) foot (0.6 m) depth over the outlet of the upstream manhole until the leaks are located by observing wet spots along the trench. Water shall be drained in a manner approved by the Inspector. Under no conditions shall clay, cement, or other sealer be applied inside the pipe in order to meet the test requirements. All defective portions shall be exposed and repaired or replaced, including defective bedding, to the satisfaction of the Inspector.

III-B3-4. Water Exfiltration Test

Water exfiltration test will not be used.

III-B3-5. Testing Deflection of PVC Sewer Pipe

The inside diameter of an installed section of PVC sewer pipe shall not be allowed to deflect more than five (5) percent. All PVC pipe main sewers shall be checked by means of a pipe deflection gauge. The pipe deflection shall be checked in the presence of the Inspector after the placement of all trench backfill and prior to surface restoration.

The pipe deflection gauge shall be fabricated to permit passage through installed sections of pipelines within the specified maximum five (5) percent deflection of the base inside diameter of the PVC pipe. Any section(s) of plastic pipe that does not permit deflection gauge passage will not be accepted and said section(s) shall be properly repaired or replaced and rechecked as directed by the District Engineer.

Rerounding through the use of a vibratory machine will not be permitted.

III-B3-6. Testing of Manholes

The test shall be conducted prior to paving.

All lift holes shall be filled with non-shrink grout.

All pipe inlets and outlets in the manhole shall be plugged sufficiently secure to hold against vacuum pressure.

The rubberized test plate shall be placed on the cone after potential leaks on the top of the cone have been sealed.

A vacuum of ten (10) inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to nine (9) inches. Following are the minimum test times for respective manhole barrel inside diameters:

Test Times	Inside Diameter
60 seconds	48-inch
75 seconds	60-inch
90 seconds	72-inch

If a manhole fails the test, repairs shall be made with non-shrink grout. Retesting shall proceed until passing test is conducted.

III-B3-7. Cleaning

Upon satisfactory completion of the testing and after all necessary repairs and adjustments have been made including setting manhole frames to final elevations, the entire new system of sewers and manholes shall be cleaned. Before beginning the cleaning operation, a sand trap shall be placed in the manhole at which the new work connects to the District's system, and it will remain in place until all solid matter has been removed. The sand trap shall be on the Approved Materials List, or an approved equal. Under no conditions shall material other than clear flushing water be discharged into the District's system before final acceptance of the new work. Splattered mortar and all irregularities shall be removed from the flow channels, leaving smooth dense uniform surfaces finished in a thoroughly first-class manner.

Hydraulic jetting shall be used to clean the entire system of new sewers. Those sections, which cannot be visually inspected by mirroring between manholes, will be cleaned only in the presence of an Inspector. Prior to the beginning of this work, excessive amounts of debris shall be removed by the Contractor.

Solid material washed into the lowest manhole(s) shall be removed from the system. The standard sand trap between the new work and the District system shall be removed only after all phases of the work have been approved after final inspection.

III-B3-8. Television Inspection

Upon completion of sewer cleaning by the Contractor, all sewer main lines shall be television inspected by the District prior to acceptance. Prior to TV inspection, the Contractor shall thread 1/4-inch nylon rope from structure to structure. The cost of television inspection shall be included in the sewer inspection fees per District Code and collected in advance. If it is necessary to television inspect sewer lines more than once, additional fees shall be collected in advance. If sediment buildup or other conditions exist and are observed which would impair measurement or function of the camera target during TV inspection, then TV inspection may be postponed at the option of DSRSD staff. Pipe(s) shall be re-cleaned at re-inspected at Contractor's cost.

The intent is for all sewers to be free draining without sags. Television Inspection shall determine the extent and approximate depth of any sags. The sewer should be TV inspected with the pipe in "wet" conditions but without sewage actively flowing through the pipe during TV inspection. If the pipe to be inspected is actively conveying sewage, the contractor shall temporarily plug the upstream flow to allow inspection of the entire pipeline, including the invert. If the pipe is new or dry, the contractor shall first flush water through the pipe sufficient to wet the entire length of pipe to be inspected.

The following observations from television inspections will be considered defects requiring correction:

1. Sag or low spot 0.0625 x diameter of pipe or greater (e.g. 1/2 inch for 8-inch pipe)
2. Joint separations
3. Cocked joints present in straight runs or on the inside of pipe curves
4. Chips in pipe ends
5. Cracked or damaged pipe
6. Offset joints
7. Infiltration
8. Debris or other foreign objects
9. Other obvious deficiencies

III-B4. CONNECTIONS WITH EXISTING DISTRICT FACILITIES

General locations where new sewer mains and lateral sewers are to connect to existing sewer mains shall be shown on the Improvement Plans. It shall be the responsibility of the Contractor to determine the exact location and depth of the existing sewers prior to the installation of any sewer pipe.

III-B4-1. Connection of New Sewer Main to Existing Sewer Facilities

Connection of new sewer mains to existing lines shall be made at existing manholes or by constructing a new manhole over the point of connection. Should connection be proposed on an existing rodding inlet, the rodding inlet shall be removed and replaced with manhole. Extension of a rodding inlet shall not be allowed.

Where the connection is to be made into an existing manhole, the Contractor shall make the connection by breaking through the manhole base, cutting a rough channel through the manhole shelf to the existing channel, installing the new pipe with a water stop if PVC sewer, finishing a new channel within the manhole, and repairing any damage to the structure. Where the connection is to be made by constructing a new manhole on an existing sewer, the manhole and new connection shall conform to details as shown in Drawing S-2. The existing sewer shall not be broken until immediately before the cleaning and flushing operation commences.

Approved mechanical expanding type temporary plugs shall be installed in each of the following cases.

1. If there is an existing manhole at the beginning of a new system, a plug shall be installed in the new pipe at the existing manhole and another plug installed on the downstream side of the first manhole upstream in the new system pipeline.
2. If the Contractor constructs a new manhole at the beginning of a new system and an existing pipe is in the new manhole, a plug shall be installed on the downstream sides of the first two (2) manholes upstream from the existing manhole.

3. If the new system begins at an existing rodding inlet or stub, a plug shall be installed on the downstream sides of the first (2) two manholes upstream from the beginning of the new system.
4. Temporary plugs shall be installed in the open ends of sewer lines while adjusting, repairing, or pouring the top blocks on rodding inlets or similar structures.

All temporary plugs shall be installed, secured, and removed in the presence of the Inspector. Temporary plugs shall remain intact until immediately prior to the beginning of the cleaning and flushing operation. Premature removal of the plug may result in the Contractor being required to clean existing downstream sewer mains. In case of neglect or refusal by the Contractor to perform such cleaning, the District shall execute the work and bill the Contractor or the Contractor's surety for costs incurred.

III-B4-2. Connection of New Lateral Sewer to Existing Sewer Facilities

Where wyes or tees were previously installed on the main sewer, the lateral sewer shall be connected to the wye or tee as provided for the particular connection. Lateral connections to existing manholes shall be as detailed on Drawing S-2 unless otherwise shown on the Improvement Plans or directed by the District Engineer.

New wye branch or tee fittings shall be installed when a connection shall be made to an existing sewer main without previously installed connection fittings. A new connection fitting shall be of the same size and type of material as the main line. The Contractor shall be responsible for all necessary bypass pumping to maintain sewer service while connecting fittings and laterals are installed. All Work shall conform to Drawing S-9.

Tapping and saddle installation shall only be used upon approval of the District Engineer for cases where disruption of existing sewer service is unavoidable. Tapping and saddles shall be tap-tite or approved equal. Tapping and saddle connections shall be made as follows:

Excavation to permit a minimum of three (3) inches of concrete under the main and six (6) inches on the sides shall be made. The exterior of the sewer main shall then be cleaned thoroughly around its entire outside circumference, and twelve (12) inches each way measured from the center of the saddle. An opening shall then be cut in the barrel of the main sewer pipe and carefully trimmed to permit a snug fit for the spigot end of the saddle. Care shall be taken that no fragments of pipe are allowed to remain in the main sewer. The saddle shall then be installed as shown on Drawing S-9. After this operation is complete and before any pipe is connected to the saddle, the Work must be inspected and approved by the Inspector.

III-B4-3. Joining Pipes of Different Materials

When pipes of different materials are joined together, the joint shall be made as directed by the District Engineer. Joining pipes of different materials between manholes shall not be permitted. The same type of pipe material shall be used between manholes.

During repair of sewer laterals and joining pipes of different materials, shear-banded, transition coupling shall be used in accordance with Section III-B1-1 of these specifications.

SECTION IV
RECYCLED WATER SYSTEM REQUIREMENTS

SECTION IV
RECYCLED WATER SYSTEM REQUIREMENTS

SECTION IV-A - DESIGN CRITERIA

IV-A1. GENERAL

Unless otherwise noted, all recycled water design and construction work shall conform to Sections I, II and IV of these Standards, as amended. In addition, all recycled water pipes shall be purple, purple striped, or wrapped in purple polyethylene sleeve conforming to AWWA C105 specifications. Piping or piping wrap shall be permanently labeled "Caution: Recycled Water – Do Not Drink" or similar as approved by the District Engineer.

IV-A1-1. Review of Potential Uses

All potential uses of recycled water shall be reviewed by the District Engineer. Connection shall be allowed only upon the District Engineer's determination that adequate recycled water supply is available and the proposed use is identified as priority for allocation of water capacity rights. If recycled water use is allowed or required, the facilities shall be constructed in accordance with the procedures and requirements set forth in these Standards. All potential uses other than landscape irrigation shall be considered by the District Engineer on a case-by-case basis. Determination of allowed and required uses shall be in accordance with the standards of treatment and water quality regulations of the State of California and the District Code and "Recycled Water Use Guidelines." The District Engineer may set forth specific requirements as conditions prior to approving any such uses and/or require specific prior approval from the appropriate regulatory agencies.

IV-A2. DISTINCTION BETWEEN DISTRICT AND CUSTOMER FACILITIES

The design criteria for recycled water facilities are separated into two categories – District facilities and Customer facilities. District recycled water facilities typically consist of those recycled water facilities that are, or will be, owned, operated, and maintained by the District. Typically, these are facilities that are on the upstream side of and including the water meter, and are within public streets, public rights-of-way, or easements. Customer recycled water facilities typically consist of facilities that will be owner-operated and maintained, and are downstream of the water meter.

IV-A3. DISTRICT FACILITY REQUIREMENTS

IV-A3-1. Design Water Demand

All recycled water systems shall be designed using accepted design procedures and formulas. Unless otherwise approved by the District Engineer, District recycled water facilities that supply irrigation systems shall be designed to deliver peak flows of twenty-five (25) gpm per acre irrigated.

IV-A3-2. Design Water Pressure

District recycled water system pressures will vary depending on location. District recycled water system facilities shall be designed to have a minimum static pressure of forty (40) psi.

IV-A3-3. Pipe Size and Maximum Velocity

Minimum size of recycled water mains shall be four (4) inches in diameter. Smaller mains may be individually approved by the District Engineer. The maximum allowable design velocity shall be in conformance with Section II-A1-5.

IV-A3-4. Location of Main

District recycled water facilities shall typically be located in streets a minimum of three (3) feet from the curb face on the opposite side of the street from the potable water mains.

IV-A3-5. Depth and Minimum Cover

The top of recycled water mains shall be a minimum of four (4) feet below the finished street grade unless otherwise approved by the District Engineer.

IV-A3-6. Horizontal and Vertical Curves

Curves for District facility recycled water pipelines shall be in conformance with District specifications for potable water pipelines, Sections II-A5-1, II-A5-2, and II-A5-3.

IV-A3-7. Valving

Valving for recycled water shall conform to District specifications for potable water, Section II-A6.

IV-A3-8. Combination Air Release and Vacuum Relief Valves

Combination air and vacuum valves shall be installed at all high points in mains in conformance with Section II-A8.. The use of air release valves should be minimized.

IV-A3-9. Blowoffs

Blowoffs shall be installed in conformance with District specifications for potable water pipelines, Section II-A9, with the exception that recycled water blowoffs shall be designed to discharge to the sewer. Recycled water blowoff drains shall be located within twenty-five (25) feet of sewer manholes. Preferably, recycled water blowoff drains shall be aligned in the same traffic lane as the manhole.

IV-A3-10. Recycled Water Fire Hydrants

Recycled water fire hydrants shall be installed at locations where required by District Engineer in accordance with Drawing W-32.

IV-A3-11. Thrust Blocks

Thrust blocks for District recycled water facilities shall be used in conformance with District specifications for potable water pipelines, Section II-A14.

IV-A3-12. Pipe and Appurtenance Identification

See Section IV-B1-1.03 for pipe and appurtenance identification requirements.

IV-A3-13. Building Set Back from Mains

To minimize hazards to buildings and other above-ground structures when pressure mains are repaired, foundations or footings of buildings and other above-ground structures shall be set back a minimum of 7.5 feet from the outside surface of the potable water or recycled water main.

The installation of mains less than 7.5 feet from the building or above-ground structure shall be subject to the approval of the District Engineer. In such cases, polyethylene wrapped ductile iron pipe shall be used. No service connection to the water main is allowed within five (5) feet of the building foundation.

IV-A4. CUSTOMER FACILITY REQUIREMENTS

IV-A4-1. Pipe Depth and Trenching

Customer facility recycled water piping shall be designed and installed in conformance with the Uniform Plumbing Code Chapter 16, Alternate Water Sources for Non-Potable Applications. The minimum depth from finished grade to top of pipe (minimum cover) shall be twelve (12) inches.

Where piping is under paved areas, these dimensions shall be increased to include the roadway section and adequately protect the piping from damage from traffic loads.

Recycled water irrigation pipelines shall be installed with the greatest possible horizontal separation from the District's potable water service lines and private potable water pipelines. Recycled water irrigation pipes shall not be installed within or across meter boxes. Recycled water pipelines shall not have physical contact with any potable water pipes or appurtenances. Where recycled water irrigation pipelines and private potable water pipelines cross, the potable water pipe shall be installed a minimum of twelve (12) inches above the recycled water piping.

IV-A4-2. Service Pressure; Pressure Reducing Valve

Static service pressure shall be as provided by the District. Customer facilities shall include a pressure reducing valve (PRV) to protect the customer facilities from excess pressures during the daily operations of the District's system. The size of the PRV shall be the same size as the water meter that provides service to the water system. The PRV shall be installed immediately downstream of the water meter, and in accordance with Drawing W-31. Request for exceptions shall be submitted to the District Engineer in writing. Exceptions may be approved by the District Engineer on a case-by-case basis.

IV-A4-3. Backflow Prevention

Backflow prevention devices are not normally required on recycled water systems, but shall be installed as required by the District Engineer on a case-by-case basis if there exists a potential for back-siphonage or backpressure of water into the recycled water main, which could impact the quality of the recycled water.

Backflow prevention devices are required on potable water connections to sites that also use recycled water, as defined in Section II-A10. This includes, but is not limited to, potable water connections for both domestic and fire services.

IV-A4-4. Hose Bibs

Hose bibs are not allowed on recycled water systems that are accessible by the general public. Quick couplers shall be installed on recycled water systems that comply with this Guide and the District Standards in areas accessible by the public. Hose bibs on recycled water systems that are not accessible by the public shall be marked with signs with the words, "CAUTION: RECYCLED WATER DO NOT DRINK."

IV-A4-5. Irrigation Systems

The design and operation of landscape irrigation systems shall comply with these Standards and the District's *Recycled Water Use Guidelines*, as well as regulatory requirements by local and state agencies. Designs shall also comply with the Uniform Plumbing Code and the Water Efficient Landscape Ordinance of the city which has jurisdiction over the project site.

IV-A4-5.01. Control of Runoff and Application Areas

For control of runoff and control of the areas to which recycled water is applied, the design of irrigation systems shall conform to the following:

1. No irrigation with recycled water shall take place within fifty (50) feet of any domestic water supply well unless specific conditions have been met as per Title 22, Section 60310 (a) (1) of the California Code of Regulations.
2. No impoundment of recycled water shall occur within one hundred (100) feet of any domestic water well.
3. In conformance with Title 22 of the California Code of Regulations, all piping and irrigation shall be designed so that spray or runoff shall not enter a dwelling or food handling facility and shall not contact any drinking water fountain. Drinking water fountains shall not be located in landscaped areas irrigated by spray-type irrigation devices. Concrete patios, walls, shrubbery irrigated by drip or bubbler systems, or other barriers shall be used to physically separate drinking fountains from areas irrigated by spray-type irrigation devices.
4. The customer recycled water facilities shall be designed not to exceed the evapo-transpiration requirements for the types of plants used, with standard and reasonable allowances for irrigation inefficiencies and storage of moisture in the soil column. The use of moisture sensors and/or weather stations to automatically adjust the amount of applied irrigation water is encouraged, but not mandatory.
5. Customer recycled water facilities shall be designed to prevent discharge of recycled water outside of the designated use area. Part circle sprinklers shall be used adjacent to roadways and property lines to confine the discharge from sprinklers to the design area.
6. The design of customer recycled water irrigation facilities shall provide watering periods that allows spray irrigation to be restricted to the hours of 9:00 p.m. to 7:00 a.m., unless otherwise stated in the permit or directed by the District.
7. Recycled water shall not be allowed to escape from the designated use areas as surface flow that would either pond and/or enter waters of the State.

8. The peak rate at which recycled water is applied shall not exceed the infiltration rate of the soil. Where varying soil types are present, the design of the peak rate of application of recycled water shall be compatible with the lowest infiltration rate present. Copies of the Developer's soils test reports shall be made available to the District upon request. No recycled water shall be applied to the irrigation area during periods when soils are saturated.
9. Flow sensor and master shut-off valves shall be installed per City of Dublin Municipal Code 8.88.080 Irrigation Design Plan or City of San Ramon's Zoning Ordinance D3-22 Landscape Requirements.

IV-A4-5.02. Record Drawings

Record drawings of the customer's facility irrigation systems shall be submitted to the District. Record drawings shall include the following information:

1. Point of connection of the on-site recycled water system to District recycled water distribution system.
2. The meter location and size (inches), meter address, and civil station number.
3. Location and size of all irrigation lines.
4. Location of isolation and line valves.
5. Location of irrigation control valves.
6. Location of quick-coupling valves.
7. Location of control wires.
8. Location, size, and type of backflow prevention devices.
9. Other related equipment as specified by the District Engineer.

IV-A4-6. Restriction of Public Access to Recycled Water

All customer recycled water facilities shall be installed to restrict public access so that the general public cannot draw water from the system. Facilities such as blowoff hydrants, blowoffs on strainers, and other such facilities, shall be restricted from public access. These facilities, both above and below grade, shall be housed in an approved lockable container colored purple. A sign reading "CAUTION: RECYCLED WATER - DO NOT DRINK," or similar shall be installed in conformance with Section IV-A4-7. An alternative acceptable means of restricting public access is the use of valves that operate by means of a recessed key slot or by means of pentagonal heads (such as those typically found on fire hydrants). Other means of restricting public access may be approved by the District Engineer.

Warning labels, as approved by the District Engineer, shall be installed on designated facilities such as on controller panels and washdown or blowoff hydrants on water trucks and temporary construction services where designated by the District Engineer or Inspector. The labels will notify the public that the system contains recycled water that is unsafe to drink.

IV-A4-6.01 Allowable Use for Recycled Water

The District provides disinfected, tertiary treated recycled water in conformance with California Code of Regulations Title 22 water recycling criteria. The most common uses for recycled water in the District's service area include landscape irrigation, soil compaction, dust control and surface cleaning, decorative fountain water supply, and industrial uses. The District may allow other uses as allowed by Title 22.

Recycled water shall not be used as a domestic or animal water supply.

IV-A4-7. Pipe, Appurtenance, and Use Area Identification

See Section IV-B1 for pipe and appurtenance identification requirements. All areas where recycled water is used that are accessible to the public shall be posted with conspicuous signs, in a size no less than four (4) inches high by eight (8) inches wide. Signs shall be purchased from the District and shall be installed by the Applicant. Signs shall be located as determined by the District, after review and approval of Applicant connection drawings.

IV-A4-8. Temporary Potable Water Service

Where recycled water is not immediately available and will be supplied in the future, the customer facilities shall be designated to use recycled water and shall be designed and constructed to the District's Standards as set forth herein. Provisions shall be made as directed by the District and these Standards to allow for connection to the recycled water facilities when they become available. During the interim period, potable water will be supplied to the recycled water facilities through a potable water connection. A backflow prevention device approved by the District will be required on the irrigation service as long as the customer facilities area uses potable water. The backflow prevention device shall be downstream of the meter and a part of the customer facilities.

IV-A4-9. Conversion from Potable to Recycled Water Supply

All non-buried existing irrigation facilities converting from potable to recycled water supply shall conform to the District's Standards as contained herein. The facilities to be converted shall be investigated in detail including review of any record drawings, preparation of required reports, and determinations by the District of measures necessary to bring the system into full compliance with these Standards.

When an existing potable water line is converted to recycled water usage, the water line shall be accurately located and tested for cross-connection in accordance with these Standards and the District's *Recycled Water Use Guidelines* in coordination with State regulatory agencies. If required, the Owner shall take action to bring the water line and appurtenances into compliance with regulatory standards. If the existing line meets the approval of the District and regulatory agencies, the line shall be approved for recycled distribution. If verification of the existing line is not possible, the line shall be uncovered, inspected, and approved by the Inspector prior to conversion.

The original potable water service connection serving the irrigation system shall be abandoned at the main in accordance with II-B2-2.05.02.

IV-A4-10. Cross Connections

No physical connection shall be made or allowed to exist between any system containing recycled water and any separate system conveying potable water.

IV-A4-10.01 Potable Water Used to Supplement the Recycled Water System

If the potable water system is used to supplement the recycled water system, an air gap separation between the two systems shall be installed.

SECTION IV-B - CONSTRUCTION STANDARDS

IV-B1. MATERIALS OF CONSTRUCTION

This section covers materials for recycled water pipes, fittings, and appurtenances for District recycled water facilities. All customer recycled water piping shall be installed in accordance with the Uniform Plumbing Code, the District's Recycled Water Use Guidelines, and all other local governing codes, rules, and regulations, including the water efficient landscape regulations of the city of jurisdiction.

IV-B1-1. Pipes and Fittings

IV-B1-1.01. Polyvinyl Chloride (PVC) Pipe and Fittings

PVC pipe and fittings for District facilities shall conform to District specifications for potable water, Sections II-B1-1.01.

IV-B1-1.02. Other Pipe Materials

Ductile iron, steel, or HDPE pipe and fittings shall conform to District specifications for potable water, Sections II-B1-1.02, II-B1-1.03, or II-B1-1.05 respectively. System appurtenances shall conform to applicable provisions under Section II-B1-2. Appurtenances.

IV-B1-1.03. Service Line Piping and Tubing

Service lines shall be polyethylene plastic. Pipe embedment material for service lines shall be Class 1 backfill, in accordance with Section I-D6-2. Class 1 Backfill.

Plastic service lines shall be polyethylene AWWA C901 for 1/2-inch to 3-inch diameter piping, or AWWA C906 for 4-inch or larger diameter piping, Class 200, in copper tubing sizes. Polybutylene piping is not acceptable. Tracer Wire TW #10 shall be twined around the polyethylene line, and extend into the meter box. Polyethylene piping for recycled water service shall have purple exterior.

IV-B1-1.04. Pipe Identification

All recycled water piping shall be clearly marked as recycled water pipe by the use of purple-colored and stenciled pipe, permanent recycled water warning tape continuously applied to the pipe, or marked plastic encasement. All marking and coloring shall be durable enough to be easily recognizable and legible for the design life of the piping.

Plastic pipe encasement or permanent warning tape attached to the pipeline shall be purple in color with the words "CAUTION: RECYCLED WATER - DO NOT DRINK," or similar printed on it as approved by the District Engineer. The lettering shall be repeated continuously on two (2) sides of the pipe, warning tape, or encasement for the full length of the pipe, warning tape, or encasement. This requirement is in addition to the underground warning tape required in Section IV-B1-2.09. The encasement or warning tape shall be on the Approved Materials List, or approved equal. The color of encasement or warning tape used for recycled water pipe shall be purple conforming to the APWA Uniform Color Code, and the lettering shall be 1" height (minimum) black or white lettering.

All piping shall be continuously and permanently marked with the manufacturer's name or trademark, nominal size, and schedule or class indicating the pressure rating.

All riser pipes for valves and blowoffs on recycled water lines shall be purple piping.

Recycled water service lines shall conform to Drawings W-7 or W-8.

IV-B1-2. Appurtenances

IV-B1-2.01. General

Unless otherwise specified below, appurtenances for District recycled water facilities shall conform to District specifications for potable water, Section II-B1-2.

IV-B1-2.02. Above-Ground Equipment

Exposed or above-ground equipment, such as blowoffs, valves, pumps, and water meters, shall be labeled with recycled water tags. Tags shall be provided by the District and fastened as specified in Section IV-B1-2.06.

IV-B1-2.03. Quick-Coupling Valves

Quick-coupling valves shall be constructed of brass with a purple rubber or vinyl cover, shall have a one (1) inch inlet with acme thread body, and shall be on the Approved Materials List or an approved equal.

IV-B1-2.04. Valve and Meter Boxes

Valve boxes in paved areas or subject to traffic loads shall conform to Section II-B1-2.06. All recycled water valve boxes shall be on the Approved Materials List or approved equal with a cast iron triangular cover for heavy traffic areas. All valve covers shall have a recognizable "RW" inscription cast or otherwise permanently marked on the top surface, as shown on Drawing W-1.

All meter boxes and customer facility valve boxes shall be purple in color and have a warning label permanently molded into or affixed onto the lid with rivets, bolts, etc. Warning labels shall be constructed of a purple weatherproof material with the warning "RECYCLED WATER" permanently stamped or molded into the label, and shall be on the Approved Materials List or equivalent.

IV-B1-2.05. Pressure Reducing Valves

Pressure reducing valves (PRV) shall be on the Approved Materials List or approved equal for irrigation systems served by 3/4-inch to 3-inch water meters. District Engineer shall review proposed PRV installations for larger sizes on an individual basis.

IV-B1-2.06. Sprinklers and Sprinkler Control Valves

All sprinkler system components used in customer recycled water facilities shall have an exposed surface colored purple to associate them with recycled water use. The exposed surface may be colored purple through the use of: (1) dyed plastic or rubber; or (2) weatherproof paint. Where possible, the exposed surface shall have the following warnings molded or hot-stamped on it: (1)

"CAUTION: RECYCLED WATER - DO NOT DRINK" in English and Spanish; and (2) an international warning symbol cautioning against drinking the water emitted through the sprinkler. Sprinklers unable to meet these specifications shall be identified with purple bilingual recycled water warning tags in conformance with Section IV-B1-2.06.

IV-B1-2.07. Identification Tags

All meters, valves, blowoffs, and controllers shall be identified using recycled water identification tags and shall be on the Approved Materials List or approved equal. Tags shall be weatherproof plastic, 3-inch by 4-inch, purple in color with the words "WARNING - RECYCLED WATER - DO NOT DRINK," or similar imprinted on one side, and "AVISO - AGUA IMPURA - NO TOMAR" on the other side, or similar as approved by the District Engineer. Imprinting shall be permanent and black in color. One tag shall be attached to each valve as follows:

1. Attach to valve stem directly or with plastic tie wrap; or
2. Attach to solenoid wire directly or with plastic tie wrap; or
3. Attach to valve cover with existing valve cover bolt.

Weatherproof stickers of equivalent color and lettering may be used as an alternative for controller units.

IV-B1-2.08. Recycled Water Sample Stations

Where determined by the District, recycled water quality sampling stations shall be installed. The sampling station shall consist of a 3/4-inch service connection stubbed out at least twelve (12) inches behind the sidewalk, an in-line corporation stop with a valve box and cover, and an above-grade lockable sampling station. The above-grade lockable sampling station shall be as shown on Drawing W-26. Station shall be purple in color and shall be center mounted on a four (4) inch thick concrete slab, two (2) feet square in area.

IV-B1-2.09. Tracer Wire and Warning Tape

Underground tracer wire shall be insulated #10 AWG THWN copper wire.

Warning tape shall be acid and alkali resistant polyethylene or polyolefin film. Warning tape shall be purple conforming to the APWA Uniform Color Code for recycled water, six (6) inches wide, four (4) mils thick, and printed continuously with the words "Caution Buried Recycled Water Line Below" or equivalent wording.

IV-B1-2.10. Thrust Blocks

Thrust blocks for recycled water systems shall conform to District specifications for potable water, Section II-B1-3.

IV-B1-2.11. Recycled Water Hydrants

All recycled water hydrants shall be wet-barrel type with one 4-1/2 inch and one 2-1/2 inch outlet, and shall conform to Section II-B1-2.03 of these Standards, except that the hydrant shall be painted

purple and shall have special thread nozzle connections for the 2-1/2 inch nozzle. Hydrant paint shall be on the Approved Materials List or an approved equal.

Positive break-off check valve assemblies shall be provided on all recycled water hydrants per Standard Detail W-32. The check valve will be installed immediately below the break-off risers or extension. Valve shall be on the Approved Materials List or approved equal. There shall be a minimum clearance of three (3) feet surrounding the hydrant.

IV-B2. INSTALLATION OF RECYCLED WATER PIPE AND APPURTENANCES

Recycled water pipe and appurtenances shall be installed in conformance with Section II-B2 of District specifications, the same as for the installation of potable water pipe and appurtenances, with the following exceptions:

1. At the point where a service line crosses beneath a curb, the point shall be permanently marked with an "R" to signify recycled water, rather than a "W," which is used for potable water.
2. Underground warning tape for recycled water pipelines conforming to Section IV-B1-2.09 shall be installed above all recycled water mains as shown on Drawing G-1.
3. During construction, above ground risers for recycled water pipe and appurtenances shall be purple in color.

IV-B3. INSPECTION AND TESTING

Recycled water piping shall be tested using potable water with an approved backflow prevention device. The testing shall be performed in accordance with District specifications, Section II-B3-1 to Section II-B3-2.04 and Section II-B3-2.07.

A continuity test in accordance with II-B3-2.07 shall be performed on the tracer wires for all recycled water pipelines.

After completion of testing, the Contractor shall thoroughly flush all water from the line with potable water from the existing system to remove debris from the pipeline. The Contractor is responsible for proper disposal of the flush water in a manner that will not cause damage and/or nuisance to the environment and in compliance with state and local regulations.

Where both potable and recycled water customer facilities exist at a site, a cross connection inspection test shall be performed on both the potable and recycled water systems. Coverage test shall be performed on the recycled water irrigation system.

IV-B3-1. Flushing

The Contractor is responsible for proper disposal of the flush water in a manner that will not cause damage and/or nuisance to the environment and in compliance with state and local regulations. Where possible, the Contractor shall flush recycled water into the sanitary sewer system.

IV-B3-2. Cross-Connection Inspection and Coverage Test

Where both potable and recycled water customer facilities exist at a site, a cross connection inspection, test, and coverage test shall be performed on both the potable and recycled water systems as described in the following subsections.

IV-B3-2.01. Visual Dual System Inspection

Prior to commencing the cross connection testing, a system inspection shall be conducted by the Inspector.

1. Meter locations of the recycled water and potable water lines shall be checked to verify that no modifications were made, nor cross connections visible.
2. All pumps and equipment, equipment room signs, and exposed piping in equipment room shall be checked visually for cross connections.

IV-B3-2.02. Cross Connection Test

The following procedure shall be performed by the Inspector to determine if a cross connection exists.

1. For purposes of this test, the on-site recycled water system shall be tested using a separate potable water connection wherever possible to minimize any subsequent disinfection requirements in the event that a cross connection is identified.
2. The potable water system shall be activated and pressurized. The recycled water system shall be shut down and completely drained. All line valves for both the potable and irrigation system shall be checked to verify they are in full open position.
3. The potable water system shall remain pressurized for a minimum period of time specified by the Inspector while the recycled water system is empty. The minimum period the recycled water system is to remain depressurized shall be determined on a case-by-case basis taking into account the size and complexity of the potable and recycled water distribution systems, but in no case shall that period be less than one (1) hour.
4. All fixtures, potable and recycled, shall be tested and inspected for flow. Flow from any recycled water system outlet shall indicate a cross connection. No flow from a potable water outlet would indicate that it may be connected to the recycled water system.
5. The drain on the recycled water system shall be checked for flow during the test and at the end of the period.
6. The potable water system shall then be completely drained.
7. The recycled water system shall then be activated and pressurized.
8. The recycled water system shall remain pressurized for a minimum period of time specified by the Inspector while the potable water system is depressurized. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than one (1) hour.

9. All fixtures, potable and recycled, shall be tested and inspected for flow. Flow from any potable water system outlet shall indicate a cross connection. No flow from a recycled water outlet would indicate that it may be connected to the potable water system.
10. The drain on the potable water system shall be checked for flow during the test and at the end of the period.
11. If there is no flow detected in any of the fixtures, which would indicate a cross connection, the potable water system shall be re-pressurized.

IV-B3-2.03. Disconnection of Cross Connections

All sites, projects and improvements involving the use of recycled water shall conform to the most current edition of the DSRSD Recycled Water Use Guidelines and Requirements. In the event that a failure or cross connection is discovered, the site supervisor shall immediately notify the District and implement an Emergency Cross-Connection Response Plan per the DSRSD Recycled Water Use Guidelines and Requirements.

IV-B3-2.04. Coverage Test for Irrigation Systems

The Owner of the customer recycled water system shall be responsible for controlling overspray and runoff from recycled water irrigation systems. To ensure that overspray or runoff is in accordance with the California Department of Drinking Water regulations, inspection by DSRSD staff prior to connection of recycled water is required.

The Site Supervisor shall attend the coverage test and shall have someone attend that is capable of making minor adjustments to the irrigation system. All modifications and costs are the responsibility of the Owner.

The Owner will be notified in writing of required modifications to the system that could not be made during the coverage test. DSRSD will not set the recycled water irrigation meter or allow connection to the recycled water system until required modifications are made.

IV-B4. CONNECTION WITH EXISTING DISTRICT FACILITIES

IV-B4-1. Connection to Existing Mains

All connections to the District's recycled water system shall be wet taps unless otherwise specified by the District Engineer. Any recycled water main that has not passed a bacteriological test shall not be permanently connected to any existing recycled water main or to any recycled water main that has previously passed a bacteriological test. All connections shall be made in the presence of an Inspector and with the approval of the District Engineer.

IV-B4-2. Valve Operation

Only certified District personnel specifically designated and authorized by the District Engineer shall operate, open, or close any valve in the recycled water system.

IV-B4-3. Interruption of Service

When a shutdown of the existing system is necessary to make the connection, it will be accomplished by authorized District personnel, or under the direction of an authorized District personnel. The operation of valves in the existing system by other than District authorized personnel will not be permitted unless approved otherwise. The Contractor shall notify in writing the District Engineer not less than seven (7) calendar days prior to the time of a required shutdown so that the District may provide advance notice to affected customers. In the written notice, the Contractor shall stipulate the expected length of the shutdown.

In general, shutdowns shall take into account any periods of heavy water use. In any event, the District must approve the timing of the shutdown and the tie-in accomplished in such a manner as to minimize the effect on any customer of the District. If the period of shutdown extends beyond the normal working hours, the Contractor shall pay the District for the necessary overtime of District personnel. No tie-ins to existing mains will be permitted until all required testing has been successfully completed.

SECTION V CORROSION CONTROL

SECTION V-A - SOIL CORROSIVITY INVESTIGATION

V-A1. GENERAL

This section outlines investigative practices and procedures for corrosion control analysis.

V-A2. SOIL INVESTIGATION

To determine what corrosion control measures are required for a buried pipeline, a soil investigation shall be performed during design and prior to project approval. The following table, Table 1, indicates the soil investigation that must be performed for each pipeline project, and a soil investigation report shall be submitted by a Corrosion Engineer licensed in the State of California, or by a NACE certified Cathodic Protection Specialist, and defined in Section V-C1.

Table 1. Soil Investigation Requirements

PIPE TYPE	SOIL CORROSIVITY INVESTIGATION
Steel and Ductile Iron	In-situ soil resistivities at 500 ft. intervals and soil chemical analysis at 1000 ft. intervals.
Non-Metallic Pipe with Metallic Fittings	In-situ soil resistivities at 500 ft. intervals or soil chemical analysis at 1000 ft. intervals

V-A3. SOIL RESISTIVITY MEASUREMENTS

The basic method of performing soil resistivity shall be the Wenner 4-Pin Method. This test shall be performed in accordance with ASTM G-57 standard. The soil resistivity measurements and their locations shall be tabulated and submitted for review. A typical data sheet is provided in Table 3.

The corrosion control requirements for a particular pipeline, valve, or fitting depends on the soil corrosion rating. Table 2 provides the corrosion rating and corresponding corrosion classification based on soil resistivity.

Table 2. Corrosion Rating and Classification

RESISTIVITY (OHM-CM)	CORROSION RATING	CORROSION CLASSIFICATION
0 - 500	1	Extremely Corrosive
501 - 2,000	2	Corrosive
2,001 - 8,000	3	Moderately Corrosive
8,001 - 32,000	4	Mildly Corrosive
> 32,000	5	Negligibly Corrosive

Table 3. In-Situ Soil Resistivities
Wenner 4-Pin Method

Pipeline Location: _____ Sheet _____ of ____

Pipe Size: _____ Date _____

Depth to Bottom of Pipe: _____ By: _____

TEST NO.	SAMPLE DEPTH ('D' FT.)	*LOCATION*	PIN SPACING ('D' FT.) (1)	RESISTANCE (OHM) (2)	RESISTIVITY (OHM-CM) (1)x(2)x191.5	CORROSION RATING

Resistivity Range (ohm-cm)	Corrosion Rating
0 - 500	1
501 – 2,000	2
2,001 – 8,000	3
8,001 – 32,000	4
>32,000	5

V-A4. SOIL CHEMICAL ANALYSIS

Corrosion control requirements for mortar coated steel and concrete cylinder pipe depends on the pH, chlorides, and sulfates found in the soil in addition to the soil resistivity. Additional corrosion ratings for mortar coated steel and concrete cylinder pipe based on soil chemistry parameters are provided below.

Chlorides: If chlorides of 300 parts per million (ppm) or higher are found in the soil, it shall be given a corrosion rating of 1.

Sulfates: If water soluble sulfate in soil samples exceeds 2,000 ppm and/or sulfate in water samples exceeds 1,500 ppm, the soil shall be given a corrosion rating of 1.

pH: If soils with a pH of less than 5.0 are found, the soil shall be given a corrosion rating of 1.

V-A5. LABORATORY INVESTIGATION

Soil samples shall be tested by an approved soils testing laboratory for pH, chlorides, conductivity, sulfates and sulfides using ASTM or Caltrans test methods as detailed in Table 4. The preparation of the soil sample for corrosion evaluation shall be in accordance with the applicable specification.

Table 4. Soil Laboratory Analysis

	ASTM Method	Caltrans Method
Chlorides	D512C	422
pH	D2976/D4972/G51	532/643
Conductivity	D1125	424
Sulfate	D516(SM 4500)	417
Sulfide	D4568	

SECTION V-B – CORROSION CONTROL REQUIREMENTS

V-B1. GENERAL

The external corrosion control requirements for various types of pipes are based on the soils corrosion rating as provided in Table 5.

V-B2. NEW WATER MAINS AND EXTENSIONS

Steel, Ductile Iron, Mortar Coated Steel and Concrete Cylinder Pipe: Each new main extension, of any length, from an existing metallic main, shall be electrically isolated from the existing main via an isolation flange or joint. This requirement may be altered by DSRSD at their sole discretion. The requirements for corrosion control shall be as specified in Table 5. If cathodic protection is required, it shall be designed by a Corrosion Engineer as specified in V-C1.

Non-metallic Pipe: Extensions which are constructed out of non-metallic piping material, and which utilize metallic fittings shall be provided with corrosion control as specified in Table 5 and paragraph 1-2.05.

V-B3. TEST STATION SPACING

Test stations shall be spaced at 1000 ft. maximum intervals for all major metallic transmission and distribution metallic pipelines as directed by DSRSD Engineer, Cathodic Protection Specialist, or Corrosion Engineer. In addition, test stations may be required at the starting point and ending point for each new pipeline or extensions to existing pipelines, at crossings with foreign metallic pipelines, at cased crossings and at buried insulating flanges.

GPS coordinates shall be shown on the plans for all test stations with horizontal positional accuracy of less than 1 meter preferred.

V-B4. NON-METALLIC PIPE WITH METALLIC FITTINGS AND VALVES

32-lb magnesium anodes shall be installed on DSRSD's direct buried valves and fittings, unless cathodic protection is designed by a NACE certified CP-4 Cathodic Protection Specialist, or by a Corrosion Engineer certified by the State of California. If cathodic protection is designed, and the design is signed and stamped, by a NACE CP-4 or State certified corrosion engineer, the certified project design shall take precedent. Anode weight indicates the weight of the bare anode, which does not include the weight of the anode backfill material.

Table 5. CORROSION CONTROL REQUIREMENTS

	Soil Resistivity (ohm-cm)			
	0 – 500	501 – 2,000	2,001 – 8,000	Greater Than 8,000
PIPE MATERIAL	Rating 1	Rating 2	Rating 3	Rating 4&5
Steel Pipe without Mortar Coating	1. Fusion Bonded Epoxy Coating 2. Joint Bonding 3. Test Stations 4. Electrical Isolation 5. Cathodic Protection	1. Fusion Bonded Epoxy Coating 2. Joint Bonding 3. Test Stations 4. Electrical Isolation 5. Cathodic Protection	1. Fusion Bonded Epoxy Coating 2. Joint Bonding 3. Test Stations 4. Electrical Isolation 5. Cathodic Protection	1. Fusion Bonded Epoxy Coating 2. Joint Bonding 3. Test Stations 4. Electrical Isolation
Mortar Coated Steel and Concrete Cylinder Pipe	1. Joint Bonding 2. Test Stations 3. Electrical Isolation 4. Cathodic Protection	1. Joint Bonding 2. Test Stations 3. Electrical Isolation	1. Joint Bonding 2. Test Stations 3. Electrical Isolation	1. Joint Bonding 2. Test Stations 3. Electrical Isolation
Ductile Iron Pipe	1. Fusion Bonded Epoxy Coating or Polybag 2. Joint Bonding 3. Test Stations 4. Cathodic Protection 5. Electrical Isolation	1. Polyethylene Encasement or Fusion Bonded Epoxy Coating 2. Joint Bonding 3. Test Stations 4. Cathodic Protection 5. Electrical Isolation	1. Polyethylene Encasement or Fusion Bonded Epoxy Coating 2. Joint Bonding 3. Test Stations 4. Cathodic Protection 5. Electrical Isolation	1. Polyethylene Encasement or Fusion Bonded Epoxy Coating 2. Joint Bonding 3. Test Stations 4. Electrical Isolation
Mortar Coated Steel and Concrete Cylinder Pipe	1. Joint Bonding 2. Test Stations 3. Electrical Isolation 4. Cathodic Protection	1. Joint Bonding 2. Test Stations 3. Electrical Isolation	1. Joint Bonding 2. Test Stations 3. Electrical Isolation	1. Joint Bonding 2. Test Stations 3. Electrical Isolation
Metallic Valves	1. Fusion Bonded Epoxy Coating 2. Cathodic Protection	1. Fusion Bonded Epoxy Coating 2. Cathodic Protection	1. Fusion Bonded Epoxy Coating 2. Cathodic Protection	1. Fusion Bonded Epoxy Coating
Metallic Fittings	1. Polyethylene Encasement or Fusion Bonded Epoxy Coating 2. Cathodic Protection	1. Polyethylene Encasement or Fusion Bonded Epoxy Coating 2. Cathodic Protection	1. Polyethylene Encasement or Fusion Bonded Epoxy Coating 2. Cathodic Protection	1. Polyethylene Encasement or Fusion Bonded Epoxy Coating
Repair Clamps	1. Stainless Steel 2. Cathodic Protection	1. Stainless Steel	1. Stainless Steel	1. Stainless Steel

Table 6
IMPORTED BACKFILL REQUIREMENTS

Chemical Analysis	Acceptable Range of Results	Test Method (ASTM)
Chlorides	< 300 mg/Kg.	D512C
Ph	6-10	D2976/D4972/G51
Resistivity (@100% saturation)	>3000 ohms-cm	G 57
Sulfate	<1000 mg/Kg	D516A(SM 4500)

- Imported fill to be used around buildings foundations and underground pipelines shall be a high quality backfill with the properties as indicated in Table 1-6, above.

SECTION V-C- DESIGN

V-C1. CATHODIC PROTECTION SYSTEM DESIGN

Cathodic protection system designs for distribution and transmission pipelines will be performed and stamped by a qualified Corrosion Engineer. This person shall be responsible for the design, supervision, inspection and testing of the cathodic protection system. Corrosion Engineer refers to a person who is either a licensed Professional Corrosion Engineer in the state of California or certified as a "Cathodic Protection Specialist" by the National Association of Corrosion Engineers (NACE). The qualifications for the Corrosion Engineer shall be submitted to DSRSD for approval prior to commencement of the design work.

SECTION V-D - MATERIALS

V-D1. GENERAL

Materials and workmanship shall be in accordance with all applicable state and local codes. The use of a manufacturer's name and model or catalog number is only for the purpose of establishing the standard of quality and general configuration desired. Products of other manufacturers will be considered.

V-D2. STEEL OR DUCTIL IRON PIPE - JOINT BOND WIRES

Joint bond wires shall be single-conductor, stranded copper wire with 600-volt HMWPE insulation. Supply all joint bonds complete with a formed copper sleeve on each end of the wire. All bond cables for steel or ductile iron pipelines shall be sized in project designed by a corrosion engineer.

Push-on, Mechanical, Ball or Flanged Joints-- 18 inches long and sized as follows:

FITTING/PIPE DIAMETER	WIRE COUNT AND GUAGE
Up to 8”	One (1) #8 AWG
10” to 18”	One (1) #4 AWG
20” and larger	Two (2) #4 AWG

Flexible Coupling Joints — 24 inches long and sized per table above, with two 12-inch long insulated No. 8 AWG wire pigtails.

Insulated Flexible Coupling Joints — 18-inch long, with one 12-inch long No.8 AWG wire pigtail.

Concrete Cylinder Pipe--Joint bonds shall be supplied by the manufacturer and shall include the following:

- Shop manufactured rod-cable-rod bonding cable as shown in the details. Rods shall be welded to the bell-and-spigot on opposite sides of the pipe at the spring line of the pipe.
- AWG bond wires, for each joint. Total resistance of the bond or bonds at each joint shall not be greater than 150 percent of the linear resistance of a pipe section.

V-D3. DUCTILE IRON FITTINGS & APPURTENANCES - JOINT BOND WIRES

Joint bond wires shall be single-conductor, stranded copper wire with 600-volt HMWPE insulation. Supply all joint bonds complete with a formed copper sleeve on each end of the wire.

- Push-on, Mechanical, Ball or Flanged Joints: No.8 AWG wires, 18 inches long.
- Flexible Coupling Joints: No.8 AWG wires, 24 inches long, with two 12-inch long insulated No. 8 AWG wire pigtails.
- Insulated Flexible Coupling Joints: No. 8 AWG wire, 18-inch long, with one 12-inch long No.8 AWG wire pigtail.
- Concrete Cylinder Pipe: Joint bonds shall be supplied by the manufacturer and shall include the following:

a.) Shop manufactured rod-cable-rod bonding cable as shown in the details. Rods shall be welded to the bell-and-spigot on opposite sides of the pipe at the spring line of the pipe.

b.) AWG bond wires, for each joint. Total resistance of the bond or bonds at each joint shall not be greater than 150 percent of the linear resistance of a pipe section.

V-D4. GALVANIC ANODES

High Potential Magnesium Alloy (ASTM B843): (Soil resistivities > 1000 ohm-cm)

Chemical Composition

Aluminum	0.01% Max.
Manganese	0.5 to 1.3%
Copper	0.02% Max
Silicon	0.05% Max.
Iron	0.03% Max.
Nickel	0.001% Max.
Other Impurities, Each	0.05% Max.
Magnesium	Balance

Zinc Anodes (ASTM B418, Type II): (Soil resistivities < 1000 ohm-cm)

Composition:

Iron	0.0014% Max
Cadmium	0.003% Max
Aluminum	0.005% Max
Lead	0.003% Max
Copper	0.002% Max
Zinc	Remainder

Furnish a laboratory analysis guaranteeing that all anodes supplied meet all the requirements of this Specification.

Supply each anode with No. 10 AWG stranded copper wire with THWN insulation, 10-feet long.

Silver braze the wire to a galvanized steel rod or strap which is cast into the anode. Seal this connection completely with electrical potting compound. The anode connection shall be stronger than the wire**.**

Anode Backfill Composition:

Ground Hydrated Gypsum	75 percent
Powdered Wyoming Bentonite	20 percent
Anhydrous Sodium Sulfate	5 percent

Anode backfill shall have a grain size so that 100 percent is capable of passing through a 20-mesh screen and 50 percent will be retained by a 100-mesh screen. The backfill mixture shall be thoroughly mixed and firmly packaged around the galvanic anode within the cloth bag by means of adequate vibration. Provide anode packaged in a plastic or heavy paper bag of sufficient thickness to protect the anode, backfill, and cloth bag during normal shipping and handling.

V-D5. CATHODIC PROTECTION TEST STATIONS

Flush mounted test boxes shall have a concrete body cast with a cast iron ring, with a minimum weight of 55 pounds and minimum dimensions of 8-inch inside diameter and 12-inch length. Provide with a 12-pound cast iron lid with the words "CP-Test" cast into the lid. See Approved Materials List, “Cathodic Protection”.

Terminal boxes shall be high-impact molded Lexan plastic. The test box shall be provided with sufficient terminals for each cable. Provide terminal block with nickel-plated brass binding posts, washers, and lock washers. See Approved Materials List, “Cathodic Protection”.

V-D6. TEST STATION WIRE

Wire shall be single conductor, No. 10 AWG stranded copper with 600-volt Use or THWN insulation and single-conductor, No. 8 AWG stranded copper with 600-volt Use or THWN insulation.

Backfill: 50 percent gypsum, 50 percent bentonite, in a permeable cloth bag, or approved equivalent.

Packaging: Provide electrodes packaged in a plastic or heavy paper bag of sufficient thickness to protect the electrode, backfill, and cloth bag during normal shipping and handling.

V-D7. SHUNTS

Anode metering shunts shall be 0.01-ohm, 6-amp or 8-amp capacity with 1% accuracy.

V-D8. THERMITE WELD MATERIALS

Thermite weld materials shall consist of wire sleeves, welders, and weld cartridges according to the weld manufacturer's recommendations for each wire size and pipe or fitting size and material. Each cable shall be fitted with a copper sleeve for accomplishing the weld. Interchanging materials of different manufacturers is not acceptable. See Approved Materials List, “Cathodic Protection”.

V-D9. GROUND CLUMP

Ground clamp shall be sized to fit the copper tubing and wire size, made out of high copper alloy, and rated for direct burial.

V-D10. WELD CAPS

Coating material for cable-to-pipe connections shall be as indicated in Approved Materials List, “Cathodic Protection”.

V-D11. WIRE CONNECTORS

Wire connectors shall be one-piece, tin-plated crimp-on ring connector.

V-D12. INSULATED JOINTS

Insulating joints shall be dielectric unions, flanges, or couplings. The complete assembly shall have an ANSI rating equal to or higher than that of the joint and pipeline. All materials shall be resistant to the intended exposure, operating temperatures, and products in the pipeline**.** All material shall be NSF 61 certified for drinking water application.

- Gaskets--1/8" thick full-faced neoprene faced phenolic.
- Insulating Sleeves--Full-length 1/32" thick Grade G-10 fiberglass epoxy.
- Insulating Washers--5/32" thick Grade G-10 fiberglass epoxy.
- Washers--Same material as bolts, 1/8-inch thick.

V-D13. CASING INSULATORS

Casing insulators shall be molded high-density polyethylene with plastic runners and shall consist of bolted segments, complete with stainless steel bolts for assembly.

V-D14. CASING SEALS

Casing seals shall be flexible molded rubber seals and shall be supplied complete with two stainless bands for sealing. Split seals are not acceptable.

V-D15. WALL SEALS

Wall seals shall be interlocking links of molded synthetic rubber. The links are to be connected together with stainless steel bolts. The wall seal shall be sized for the pipe size and type and the wall hole. See Approved Materials List, "Cathodic Protection".

V-D16. PIPE BACKFILL

Imported backfill placed around the pipes shall be a good quality sand backfill with a minimum resistivity of 5,000 ohm-cm, a minimum pH of 6.0, a maximum chloride concentration of 300 ppm and a maximum sulfate concentration of 1,000 ppm.

V-D17. COATINGS FOR BURIED INSULATING FLANGES

Coat buried insulating flanges with Trenton Wax Tape#1 by The Trenton Corporation or approved equal.

SECTION V-E - INSTALLATION

V-E1. GENERAL

Installation of the specified corrosion control materials shall conform to the guidelines as set forth herein. Any changes in design or method of installation of any item as specified shall be reviewed and approved by the DSRSD Engineer prior to installation.

V-E2. EXOTHERMIC WELDS

Exothermic weld connections shall be installed in accordance with manufacturer's recommendations. Coating materials shall be removed from the surface over an area just sufficient to allow proper searing of the graphite weld mold to the pipe surface. The coating shall be entirely removed in the area of the actual weld by using a sanding wheel or metal file. White metal shall be achieved free from resin films. After the weld is complete, strike the weld with a hammer using a moderate amount of force. Welds that dislodge from the pipe surface shall be replaced. Care shall be taken to prevent damage to the wires. All rough edges of the weld and slag shall be removed during this structural test.

V-E3. ANODE STORAGE AND HANDLING

Store all prepackaged anodes off the ground and keep them dry at all times. Protect them against weather, condensation, and mechanical damage. Immediately remove all wet or mechanically damaged prepackaged anodes from the site. Prepackaged anodes shall be handled with care to prevent loss of backfill material. Anodes shall not be lifted or installed by the lead wire.

V-E4. GALVANIC ANODE INSTALLATION

Remove the plastic or heavy paper bag used for shipping. The cloth bag shall remain around the anode. Care shall be exercised during installation to prevent damage to the cloth bag and loss of backfill material. After placing anodes in the trench, native soil, free of rocks and other foreign objects shall be placed around the anode to a minimum cover of one foot above the anode. Anode shall then be flooded with 5 gallons of fresh water. The remainder to the trench shall then be backfilled with native soil.

Install galvanic anodes 1 foot below the pipe invert and at a minimum distance of 3 feet from the pipeline, valve, or fitting. Provide a minimum anode spacing of 5 feet from other unprotected pipelines. Install anodes at intervals determined by the cathodic protection design.

V-E5. VALVES AND FITTINGS FOR NON-METALLIC PIPE

Each buried ductile/cast iron and steel fitting, and valve used in conjunction with nonmetallic pipe shall be cathodically protected with zinc anodes (soil resistivity < 1000 ohm-cm) or magnesium anodes (soil resistivity ≥ 1000 ohm-cm). Where two or more metallic fittings are adjacent to each other, they can be bonded together for the purposes of cathodic protection as shown on the Standard Drawings.

Anode connections to ductile/cast iron and steel fittings and valves shall be made by the exothermic weld method. Any damage to the interior coating shall be repaired in accordance with the manufacturer's recommendations.

V-E6. WIRES

Provide a minimum cover of 30 inches over all cables. Use care during installation to avoid punctures, cuts and similar damage to the insulation. Replace entire cable run where any damage to insulation occurs. Yellow caution tape shall be placed a minimum of 6 inches above any buried cables.

V-E7. TEST STATION INSTALLATION

Test stations shall be installed as shown on the Standard Drawings. A concrete collar shall be set flush with the top of curb or finish grade in paved areas and two inches above grade in landscaped areas. The terminal end of each cable shall be identified with permanent cable markers as shown in the Standard Drawings. The locations for the test stations shall be as specified in the cathodic protection design.

Provide a minimum of 18 inches of slack for each cable in each test station. Sufficient slack shall be provided to allow removal of the terminal box from the test station without disconnecting any of the cables.

V-E8. INSULATING FLANGED JOINTS

All insulating components of the insulating flanged gasket set shall be cleaned of all dirt, grease oil and other foreign materials immediately prior to assembly. Bolt holes in mating flanges shall be properly aligned at the time bolts and insulating sleeves are inserted to prevent damage to the insulation. After flanged bolts have been tightened, each insulating washer shall be inspected for cracks or other damage. All damaged washers shall be replaced. After assembly, resistance between each bolt and flange shall be measured with an approved ohmmeter and the minimum resistance shall be 50,000 ohms. Where the insulating joint is assembled in the shop and shipped as a unit, resistance shall be measured in the shop between the flanges and between each bolt and flange and shall meet the above requirements. When insulated joints are installed in a pipeline, the insulating joint shall be tested with a radio frequency insulating flange tester. See DSRSD Approved Materials List, "Cathodic Protection", for approved test equipment. For pipe diameters of 24 inch or less, one test point is sufficient. For pipe diameters of greater than 24 inches, the insulation testing shall be done at four points, one at each quadrant. All below grade insulating joints shall be coated as specified above.

V-E9. CASING INSULATOR AND SEALS

At all locations where water system piping is cased with metal casing, casing insulators and end seals shall be installed. Type and spacing of insulators required shall be at manufacturer's written recommendations and depend on type and size of casing and carrier pipe.

V-E10. BURIED FASTENERS

At all locations where water system piping or fittings are direct buried, bolts, nuts, and washers shall be 316 stainless steel or better grade, and all bolts shall be stamped with the steel grade to allow field inspection of installed metal grade.

SECTION V-F - TESTING

V-F1. GENERAL

The Contractor shall furnish, or confirm that other project members have furnished, all necessary equipment, material, and qualified personnel (e.g., Cathodic Protection Specialist or State Certified Corrosion Engineer) required to certify all tests described herein. A final checkout report shall be provided to DSRSD following completion of all testing in order to certify proper installation of any cathodic protection system. Contractor shall notify DSRSD Representative a minimum of 72-hours prior to any inspections or required testing under Section V-F - TESTING.

V-F2. ELECTRICAL CONTINUITY TESTING

For buried lengths of ductile iron or steel pipelines, conduct continuity testing of all buried joints prior to paving. All high resistive joints shall be located, and bonds shall be repaired, prior to paving.

V-F3. INSULATION JOINTS AND CASINGS

The Contractor shall test, or confirm other project members have tested, each insulated joint and cased crossing. All damaged or defective insulation parts shall be replaced and retested. All electrical shorts to the casing shall be cleared and retested prior to backfill. Records shall be made of all insulated joints and cased crossing test and submitted for approval.

V-F4. TEST STATIONS

The Contractor shall test, or confirm other project members have tested, all test leads to ensure they were installed in accordance with the specifications. All defective test leads shall be repaired and/or replaced and retested. Records shall be made of all test stations tested and submitted for approval.

V-F5. CATHODIC PROTECTION SYSTEM

The Contractor shall test all cathodically protected pipelines to ensure that the protection levels are within the most recent NACE SP0169 standards. Records shall be made of all anode current output and pipe to-soil potential measurements required by a DSRSD Representative and submitted for approval.

V-F6. ACCEPTANCE

All tests performed shall be reviewed and approved by DSRSD Engineer before the corrosion control work is accepted. DSRSD or their Representative reserves the right to spot check any or all tests performed by the Contractor. All construction defects must be repaired and retested before the final acceptance is made. All unacceptable tests shall be retested by the Contractor at no additional cost to DSRSD.

APPENDIX A

Approved Materials List (Capital & Developer Projects)

(Updated: September 2022)

PURPOSE AND GENERAL NOTES

The purpose of the Approved Materials List is to streamline the materials submittal and review process during construction. Contractors are strongly encouraged to use materials from the Approved Materials List as these will be expedited and do not require a full technical review by the District prior to material approval. All pipe materials shall be submitted for review and approval. However, Contractors must submit and identify that the proposed materials comply with the current Specifications and/or are on the approved list.

Use of "or equal" materials will require a formal and complete submittal subject to review by the District Engineer or the Engineer's designee prior to approval. Any schedule delays as a result of a submittal or use of "or equal" materials will be the sole responsibility of the Contractor.

In the event of a conflict between approved/contract specifications and drawings and the Approved Materials List, the approved/contract specifications and drawings shall take precedence. All material descriptions provided in this Approved Materials List are for reference in conveying the intent of the approved list, and are not comprehensive specifications. Refer to the Standard Specifications and the approved contract specifications for complete material requirements.

All materials used for potable water systems must meet California Health and Safety Code 116875 (previously AB1953). All materials that come into contact with potable water must be NSF certified or approved (http://www.nsf.org/). All potable water material submittals must include evidence of NSF certification. Please contact District staff if any Model numbers listed are out of date or no longer available.

WATER

ITEM		APPROVED MATERIALS / MANUFACTURERS:
WATER PIPING - MAINS		-
Description: DSRSD Standard:	Polyvinyl Chloride (PVC) Pressure Pipe **For mains up thru 16":** AWWA C900 DR14 Pressure Class 305 **PVC Mains 18" or larger**: AWWA C900 DR18 Pressure Class 235 II-B1-1.01	Diamond Plastics JM Eagle North American Pipe Corporation Northern Pipe Products Vinyltech
Description: DSRSD Standard:	Ductile Iron (DI) Water Pipe **For mains 4" and up:** AWWA C151 Pressure Class 350 All cement mortar lined per AWWA C104 II-B1-1.02	American (American Cast Iron Pipe Company) McWane Ductile US Pipe
WATER PIPING – JOINT RESTRAINT		-
Description: DSRSD Standard:	Mechanical Joint Restraint for Polyvinyl Chloride (PVC) Pressure Pipe II-B1-1.01.01	EBAA Iron Series 2000PV Megalug
Description: DSRSD Standard:	Mechanical Joint Restraint for Ductile Iron (DI) Water Pipe II-B1-1.02.01	EBAA Iron Series 1100 Megalug
Description: DSRSD Standard:	Push-on Joint Restraint for Ductile Iron (DI) Water Pipe II-B1-1.02.01	FIELD LOK350®, TR FLEX® (with the TR FLEX Gripper Ring® for restraining field cuts)

ITEM		APPROVED MATERIALS / MANUFACTURERS:
WATER PIPING – SERVICES		-
Description: DSRSD Standard:	Polyethylene (PE) Pressure Pipe **Services up thru 3":** AWWA C901 PE Pressure Pipe; Pressure Class 200; Copper Tubing Size (CTS) **Services 4" and up:** AWWA C906 PE Pressure Pipe, Pressure Class 200, Iron Pipe Size **Services up thru 2":** Copper Tubing Size (CTS) **Services 3":** Iron Pipe Sizes (IPS) **Services 4" and up:** Cast Iron Outside diameters (CIODs) II-B1-1.05	Interstate Plastic Centennial Plastics Performance Pipe Interstate Plastic Centennial Plastic Performance Pipe
WATER FITTINGS GENERAL		-
Description: DSRSD Standard:	General Fittings for PVC and DI Pipe; AWWA C110 or AWWA C153; with flanged or mechanical joints II-B1-1.01.02	Sigma Corp Tyler Pipe Star Pipe
Description: DSRSD Standard:	General Fittings for HDPE; AWWA C906; material designation of PE 3408; 345464C cell classification II-B1-1.05.02	Specified Fittings
WATER FITTINGS - TAPPING TEES / SLEEVES (TAPS LARGER THAN 2")		
Description: DSRSD Standard:	For PVC and DI Pipe: stainless steel (Type 304) tapping sleeve assembly, complete with gaskets and bolts. II-B1-2.02 Std Dwgs. W-17A, W-20, & W-20A	JCM 432 all stainless steel tapping sleeves

ITEM		APPROVED MATERIALS / MANUFACTURERS:
WATER FITTINGS - TAPPING SADDLES (TAPS 2" AND SMALLER)		
Description: DSRSD Standard:	For PVC Pipe: bronze or brass assembly, complete with neoprene gasket wedge. II-B1-2.08	Mueller H13000 Series McDonald 3845
Description: DSRSD Standard:	For DI Pipe: bronze or brass body and silicon bronze double straps II-B1-2.08 Std. Dwg. W-7	Mueller BR2B Series McDonald 3825
WATER FITTINGS – TRANSITION AND FLEXIBLE COUPLINGS		
Description: DSRSD Standard:	Steel or ductile iron flexible couplings with FBE coating and stainless steel hardware II-B1-2.10	For Standard connections: Smith Blair 411 For PVC to Steel pipe connections: Smith Blair 413 For insulated connections: Smith Blair 416 Powermax 3506 with stainless bolts type 304 Hymax adapter with stainless steel fasteners
WATER VALVES- MAIN LINE (UP THRU 12”)		
Description: DSRSD Standard:	Gate Valve: AWWA C509 Ductile Iron, resilient seated-type with non-rising stems, FBE coated, and have “O” ring stuffing boxes II-B1-2.01 and II-B1-2.01.01	Clow Model 2639 Kennedy Valve Model KS-RW Mueller 2360 Series

ITEM		APPROVED MATERIALS / MANUFACTURERS:
WATER VALVES- MAIN LINE (LARGER THAN 12")		
Description: DSRSD Standard:	Butterfly Valve: AWWA C504 Rubber seated, Class 250B, CCW Opening Rotation, FBE coated II-B1-2.01 and II-B1-2.01.02	Clow: Style 4500 (14"-24") & Style 1450 (30"-54") Mueller / Pratt HP250™
WATER VALVES- SPECIALTY		
Description: DSRSD Standard:	Tapping Valve: AWWA C509 or C515 Ductile Iron, resilient seated-type with non-rising stems, FBE coated II-B1-2.01	Mueller Co. Model A-2361
Description: DSRSD Standard:	Combination Air Valve (AWWA C512) single body with FBE coated body II-B1-2.01 and II-B1-2.01.03	A.R.I. D-040"
Description: DSRSD Standard:	Pressure Reducing Valve (for irrigation systems served by ¾-inch to 3-inch water meters) IV-B1-2.05 Std. Dwg. W-31	Zurn Wilkins Model 500 Series
WATER VALVES- SERVICE AND APPURTENANCE LINE (2" AND SMALLER)		
Description: DSRSD Standard:	Corporation Stops: Bronze Ball valve with AWWA inlet threads II-B1-2.08 Std. Dwgs. W-7, W-15, , W16, W-26	Ford FB Series with AWWA inlet
Description: DSRSD Standard:	Straight Curb Stops: Bronze Ball valve with Wing lock Std. Dwgs: W-24A, W-24B, W-24C, W-24D	Ford B11 & B81 Series

ITEM		APPROVED MATERIALS / MANUFACTURERS:
Description: DSRSD Standard:	Angle Meter Stops (aka Angle Curb Stops): Bronze Ball valve with Wing Lock II-B1-2.08 Std. Dwgs: W-7, W-15, W16, W-24A, W-24B, W-24C, W-24D	Ford BA43 and BFA43 Series BA43-332W-Q-NL (3/4") BA43-444W-Q-NL (1") BFA43-666-W-Q-NL (1-1/2") BFA43-777W-Q-NL (2")
METER EQUIPMENT		
Description: DSRSD Standard:	For Fire Lines: Double Detector Check Radio-Read Meter Std. Dwgs: W-23, W-23A	Neptune Sensus
Description: DSRSD Standard:	AMR Meter Interface Units For Fire Lines: Radio-Read Meter Std. Dwgs: W-23, W-23A	Datamatic Innov8 Smart Meter Register
HYDRANTS		
Description: DSRSD Standard:	Fire Hydrant: Wet Barrel Type per AWWA C503 (1-4 ½ inch and 1-2 ½ inch outlets), for residential applications; and (1-4 ½ inch and 2-2 ½ inch outlets), for commercial. II-B1-2.03 Std. Dwg: W-6	Clow Model 960 for all
Description: DSRSD Standard:	Hydrant for Recycled Water: IV-B1-2.11 Std. Dwg: W-32	Clow Model 950 Clow Model 960 with RW threading
Description:	Break Off Check Valve for Recycled Water Hydrant	Clow LP 619 Low Profile Break Off Check Valve
DSRSD Standard:	IV-B1-2.11 Std. Dwg: W-32	

ITEM		APPROVED MATERIALS / MANUFACTURERS:
BOXES AND ENCLOSURES		
Description: DSRSD Standard:	Valve Box: For line valves and fire hydrants II-B1-2.06 Std. Dwg: W-1	Oldcastle Christy G5 for potable Water Oldcastle Christy G4 for Recycled Water
Description: DSRSD Standard:	Valve Box: For Recycled Water Pressure Reducing / Pressure Relief For non-traffic areas II-B1-2.06 Std. Dwg: W-31	Christy Purple FL9 for non-traffic areas
Description: DSRSD Standard:	Backflow Enclosure Std. Dwg: W-25	To Be Approved by Construction Inspector
Description: DSRSD Standard:	Meter and Air Valve Boxes Std. dwgs: W-15, W-16, W-23, W-23A, W-24A, W-24B, W-24C, W-24D	SEE METER BOX SCHEDULE BELOW

Water Box Schedule

Facility, inch	Traffic Areas			Non-traffic Areas		
	Oldcastle Christy Model No.	Inside Width, inch	Inside Length, inch	Oldcastle Christy/Fibrelyte Model No.	Inside Width, inch	Inside Length, inch
Meter, 5/8 – 1	B1324	13-¼	24	FL30T Series	13	24
Meter, 1-½ – 2	B1730	17	30	FL36T Series	17	30
Meter, 3 – 4	B2436	24	36	N40 box B40D steel checker plate lid	24	36
Meter, 6	B3048	30	48	N48 box B48D2 steel checker plate lid	30	48
2 meters per box W-24A/ W-24C	B2436	24	36	N40 box B40D steel checker plate lid	24	36

3 meters per box W-24B	B2436	24	36	N40 box B40D2 steel checker plate lid	24	36
Air Valve, 1	B1324	13-¼	24	N/A	N/A	N/A
Air Valve, 2	B1730	17	30	N/A	N/A	N/A
Meter Radio Transmitter for Backflow	N/A	N/A	N/A	B09	8-5/8	14

Note: Covers shall be verified by DSRSD as compatible with latest version of DSRSD's meter antenna requirements. 1.5-inch and 2-inch displacement-type meters may require a larger box than listed above due to necessity of additional fittings. Coordination with DSRSD is required prior to purchase and approval for those specific meter types.

ITEM		**APPROVED MATERIALS / MANUFACTURERS:**
HARDWARE / GASKETS / MISCELLANEOUS		
Description: DSRSD Standard:	Centering Ring (in valve riser) II-B1-2.06	Placer Waterworks Model # PW-CR Box Seat QWP by New Concept Tools
Description: DSRSD Standard:	Pipe joint isolation kit II-B1-2.09	Advance Product Systems (APS) Voltacept™ G-10 Type 'E' Gasket kit with Trojan gasket GPT LineBacker® 61™ G-10 Type 'E' flange isolation kit
Description: DSRSD Standard:	Meter (3" & larger) to customer pipe connection flange adaptor II-B2-10	Uniflange® flange adaptor
Description: DSRSD Standard:	Meter Flange Adaptor: Brass or Bronze Std. Dwgs: W-16, W-16A	Ford Brass Meter Flanges CF31 Series
Description: DSRSD Standard:	Gaskets: For 2" Meter Flange Std. Dwgs.: W-24B, W-24D	Ford Rubber Gasket GT141
Description:	Valve/Vent Cover: for air release and vacuum relief valve, 2 "and smaller	Placer Waterworks: (for 1" CAV) PWAE118MDSR (for 2" CAV) PWAE218M (with name plate added)

ITEM		APPROVED MATERIALS / MANUFACTURERS:
DSRSD Standard:	Std. Dwgs.: W-15, W-16, W-27	
Description: DSRSD Standard:	Threaded Air Vent Cap with Stainless Steel Screen Std. Dwgs.: W-15, W-16	T Christy's Air Vent Cap: 1"- Model VC1 or VCM1 2"- Model VC2 or VCM2
Description: DSRSD Standard:	Meter Coupling Bushing: for 1" angle meter stop Std. Dwg: W-24A	Ford #BBIM-44-NL (1" Male Meter x 1" FIP)
Description: DSRSD Standard:	Underground Marking/ Warning Tape for Recycled Water IV-B1-1.04	Brady Identoline Presco Reef Industries Terra Tape Standard T.Christy's Enterprises
Description: DSRSD Standard:	Recycled Water Identification Tag IV-B1-2.07 Std. Dwgs: W-31, W-32	For valves, blow-offs & controllers: T. Christy ID.MAX.P2.RC006 For Fire Hydrant Sign: T. Christy
Description: DSRSD Standard:	Bronze Coupling: For Service Lines 2" and smaller Std. Dwgs.: W-16, W-24A, W-24B, W-24C, W-24D	Ford #C38-23-2-5-NL (¾" MIP x Meter nut)
Description: DSRSD Standard:	Brass Bushing: For Service Lines 2" and smaller Std. Dwg.: W-24C	Ford #C18-67
Description: DSRSD Standard:	Bronze Flanges: for meters 2' and smaller Std. Dwg.: W-24C	Ford # 7F Ford # 6F
Description: DSRSD Standard:	Quick Coupling Valve and key for Recycled Water IV-B1-2.03	Valve: Nelson Model 7645 Key: Nelson Model 7640
PAINT/ COATINGS		
Description:	Hydrant Paint Rust Preventative Enamel	For potable water system (Yellow): Kelly Moore 1700-63 Sunburst Yellow Rust Preventative Enamel For recycled water system (Purple): Kelly-Moore Dura-poxy Color #70251-0608

ITEM		APPROVED MATERIALS / MANUFACTURERS:
DSRSD Standard:	II-B1-2.03	
Description: DSRSD Standard:	Corrosion Protection PVC Tape Wrap II-B2-2.06, W13, W14	Scotchrap Tape No. 50
Description: DSRSD Standard:	Bituminous Paint / Coal Tar Mastic II-B2-2.06, W13, W14	Carboline Bitumastic No. 50 Carboline Bitumastic No. 300 series Kop-Coat Bitumastic No. 50

SEWER

ITEM		APPROVED MATERIALS / MANUFACTURERS:
SEWER PIPING- GRAVITY MAIN SEWERS		
Description: DSRSD Standard:	Polyvinyl Chloride (PVC) Pipe **For mains up thru 15":** ASTM D3034 SDR 26 **For mains larger than 15":** ASTM F679 SDR 26 III-B1-1.03	Diamond Plastics JM Eagle North American Pipe Corporation Northern Pipe Products Vinyltech
Description: DSRSD Standard:	Ductile Iron (DI) Water Pipe with epoxy lining **For mains up thru 20":** AWWA C151 Pressure Class 350, with Protecto 401™ Ceramic epoxy lining **For mains larger than 20":** AWWA C151 Pressure Class 250, with Protecto 401™ Ceramic epoxy lining III-B1-1.02	American (American Cast Iron Pipe Company) McWane Ductile US Pipe
SEWER PIPING- SIDE SEWERS		
Description: DSRSD Standard:	Polyvinyl Chloride (PVC) Pipe ASTM D3034 SDR 26 III-B1-1.03	Vinyl Tech Pipe North American Pipe
Description: DSRSD Standard:	High-Density Polyethylene (HDPE) Pipe **Services 4" and up:** ASTM F714 or ASTM D3035 III-B1-1.05	ISCO Industries JM Eagle Performance Pipe
SEWER FITTINGS		
Description: DSRSD Standard:	Sewer Lateral Tap Saddle III-B4-2	Tap-Tite Romac Industries CB Sewer Saddle Geneco Sealtite Wye Gravity Sewer Saddle E_EX (for SDR26 lateral) Fernco Flexible Tap Sewer Saddle

ITEM		APPROVED MATERIALS / MANUFACTURERS:
Description: DSRSD Standard:	Field cut couplings or Transition Couplings: Heavy rubber compression with stainless steel shear band and hardware III-B1-1; III-B4-3	Fernco Strongback 5000 RC Series Mission Rubber Flex-Seal® ARC
MANHOLE COMPONENTS		
Description: DSRSD Standard:	Coal Tar Paint III-B1-2	Carboline "Bitumastic Super-Service Black" Porter "Tarmastic 103" Tnemec "450 Heavy Tnemecol"
Description: DSRSD Standard:	Manhole Water Stop: III-B1-2	A-Lok Water-Stop Pipe to Concrete Structure Cold Joint Connector Fernco Large Diameter Concrete Manhole Adaptor (LDCMA) Christy Manhole Water-Stop Gaskets
Description: DSRSD Standard:	Manhole Coatings, in natural or manmade drainage courses or flood channels III-B1-2	Amercoat 64 primer Amercoat 320 protective coating
Description: DSRSD Standard:	Manhole Frame and Covers with side pick hole III-B1-2 Std. Dwg.: S-5	Phoenix Iron Works P1090, Clay and Bailey No. 2008BV, Neenah R-1736S
Description: DSRSD Standard:	Hinged Manhole Frame with locking Cover III-B1-2	PAMREX hinged manhole frame and locking cover
Description: DSRSD Standard:	Sand Trap for Manhole cleaning operations III-B3-7	Southwest Flexible Co. standard sand trap
Description: DSRSD Standard:	Manhole Joint Sealant Std. Dwg.: S-2	Henry Ram-Nek Joint Sealant Henry RUBR-NEK External Joint Wrap
OVERFLOW DEVICES		
Description:	Above-grade Sewer Overflow Relief Valve	<<APPROVED MANUFACTURERS TBD>>

<table>
<tr><th colspan="2">ITEM</th><th>APPROVED MATERIALS / MANUFACTURERS:</th></tr>
<tr><td>DSRSD Standard:</td><td>Std. Dwg.: S-8A</td><td></td></tr>
<tr><td>Description:

DSRSD Standard:</td><td>Below-grade Sewer Overflow Relief Valve

Std. Dwg.: S-8A</td><td>Jones Stephens Sewer Popper™ Sewer Popper Cleanout & Relief Valve</td></tr>
<tr><td colspan="3">GREASE AND SAND TRAPS</td></tr>
<tr><td>Description:

DSRSD Standard:</td><td>Grease Interceptor

Std. Dwg.: S-13 & S-14</td><td>Jensen Precast of Sacramento, CA<table><tr><th>Capacity (Gallons)</th><th>Jensen Model No.</th></tr><tr><td>750</td><td>JP750EPE-G</td></tr><tr><td>1000</td><td>JP1000EPE-G</td></tr><tr><td>1200</td><td>JP1200EPE-G</td></tr><tr><td>1500</td><td>JP1500EPE-G</td></tr><tr><td>2000</td><td>JP2000EPE-G</td></tr><tr><td>2500</td><td>JZ2500EPE-G</td></tr><tr><td>3000</td><td>JZ3000EPE-G</td></tr></table></td></tr>
<tr><td colspan="3">BOXES AND ENCLOSURES</td></tr>
<tr><td>Description:

DSRSD Standard:</td><td>Grated box for Overflow Device

Std. Dwg.: S-8A</td><td>In Traffic areas:
Oldcastle Christy V12 drain box with V12-71W C1 grate
In Non-Traffic areas:
Oldcastle Christy F08 box with V01-71C grate</td></tr>
<tr><td>Description:

DSRSD Standard:</td><td>Clean Outs

Std. Dwg.: S-10</td><td>G-5 Christy with metal lid marked "SEWER"</td></tr>
<tr><td>Description:

DSRSD Standard:</td><td>Sample Box

Std. Dwg.: S-15</td><td>Jensen Precast of Sacramento, CA
Jensen Model No.2432-Z</td></tr>
<tr><td colspan="3">CATHODIC PROTECTION</td></tr>
<tr><td>Description:</td><td>Thermite Weld Materials</td><td>All welding materials and equipment shall be the product of a single manufacturer such as “Cadweld” by Erico Products, Inc., “Thermoweld” by Continental Industries, Inc., or approved equal.</td></tr>
</table>

ITEM		APPROVED MATERIALS / MANUFACTURERS:
DSRSD Corrosion Control Standard:	1-4.08	
Description: DSRSD Corrosion Control Standard:	CP Test Stations 1-4.05	G-5 Christy with metal lid marked "CP TEST"
Description: DSRSD Corrosion Control Standard:	CP Terminal Boxes 1-4.05	Model "T-3" as manufactured by Tinker & Rasor manufacturing Company or approved equal.
Description: DSRSD Corrosion Control Standard:	Weld Caps 1-4.10	Propoxy 20 Epoxy Putty by Hercules Chemical Company Scotchkote Liquid Epoxy Coating 323 by 3M Or approved equal
Description: DSRSD Corrosion Control Standard:	Wax Tape 1-4.17	Buried Fittings: Trenton Wax Tape #1 with protective top-coat or approved equal Above Grade or Vault Installed Fittings: Trenton Wax Tape #2 or approved equal
Description: DSRSD Corrosion Control Standard:	Concrete Wall Seals 1-4.15	Link Seal, or approved equal
Description: DSRSD Corrosion Control Standard:	Insulating Flange Tester 1-5.08	Model 601 by Gas Electric, or approved equal

APPENDIX B

Standard Drawings

Dwg. No.	Title
G-1	Standard Trench Section for Water and Sewer Mains and Side Sewer Installations
G-2	Concrete Encasement Section
G-3	Close Crossing Detail
G-4	Marker Post (4” x 4”)
G-4A	Roman Numeral Chart
G-5	Standard Trench Dam for Water and Sewer Mains and Side Sewer Installations
G-6	Clearance Requirements for Water Mains from Other Utilities and Structures
S-1	Peaking Factor Versus Average Daily Flow
S-2	Standard Manhole
S-4	Standard Shallow Manhole
S-5	Standard Manhole Frame and Cover
S-6	Miscellaneous Manhole Details
S-6A	Manhole Pad Detail
S-7	Manhole Frame and Cover Adjustment Details
S-8	Typical Side Sewer Installation
S-8A	Typical Overflow Relief Valve Installation
S-9	Lateral Sewer Connection to Existing Sewer Main
S-10	Side Sewer Cleanout Riser
S-11	Sampling Manhole
S-12	Grease and Sand Trap
S-12A	Grease and Sand Trap for Trash Enclosures
S-13	Grease Interceptor 750-1500 Gallon Capacity
S-14	Grease Interceptor 2000-3000 Gallon Capacity
S-15	Sampling Box
S-16	Manhole: False Bottom
W-1	Valve Box Installation
W-2	Concrete Thrust Blocks
W-3	Concrete Thrust Blocks for Vertical Bends
W-4	Valve Nut Extension
W-5	Backflow Prevention Method for Tanker Trucks and Portable Spray Rigs
W-6	Fire Hydrant Installation
W-7	1” Service Installation

Dwg. No.	Title
W-8	1-1/2” – 2” Service Installation
W-9	Blow-off Assembly at Dead Ends 6” Through 12” Mains
W-13	Gate Valve Installation 12” Gate Valve and Smaller
W-14	Butterfly Valve Installation 14” to 18” BFV
W-15	1” Air Release & Vacuum Relief Valve Installation - 6”-10” Potable Water Mains
W-16	2” Air Release & Vacuum Relief Valve 12” Potable Water Main or Larger Installation
W-18	Temporary Sample Taps for New Construction
W-19	Meter Box Installations - 5/8 Inch to 2 Inch
W-20	3” Meter Installation
W-20A	4-inch Service with 2-inch Meter Installation
W-21	Backflow Preventer Installation – 3/4” to 2”
W-22	2-1/2” to 10” Reduced Pressure Backflow Prevention Device
W-23	Double Detector Check for 2 -10” Fire Lines Above Ground Installation
W-23A	Double Detector Check for 2 -10” Fire Lines Above Ground Installation (Optional)
W-24A	1” Water Service with Two 5/8” Meter Manifold
W-24B	2” Water Service with Three 5/8” Meter Manifold
W-24C	2” Water Service with One 3/4” Meter & One 1-1/2” Meter Manifold Installations
W-25	Fiberglass Enclosure for Backflow Preventer
W-26	Standard Sampling Station
W-27	Air Release & Vacuum Relief Valve Vent Cover
W-28	Recycled Water Sign Post Detail
W-28A	Standard Details for Placement of Recycled Water Irrigation Signs
W-28B	Recycled Water Sign Detail
W-29	Brass Address Tags for Manifolded Meters
W-30	Construction Jumper
W-31	3/4” – 3” PRV Installation for Recycled Water Irrigation System
W-32	Recycled Water Fire Hydrant Installation
W-33	Outdoor Plumbing Schematic (Single Family Residential Only)
CP-6	CP for DI Fire Hydrant
CP-6A	CP for C-900 Pipe Fire Hydrant Installation
CP-9	4” Blow-off Assembly 6”, 8”, 10” and 12” Mains
CP-10	CP for Blow-off Assembly at Dead End 16” Mains
CP-11	CP for Blow-off Assembly Low Point of Mains 6”, 8”, 10”, 12” and 14”
CP-13	CP for Gate Valve Installation 12” Gate Valve and Smaller
CP-14	CP for Butterfly Valve Installation 14” PVC Pipe and Tee or Cross to BFV
CP-17	CP for Tapping Sleeve and Tapping Valve Installation

Dwg. No.	Title
CP-20	CP for 3” Meter Installation
CP-20A	CP for 4-inch Service w/ 2-inch Meter Installation
CP-24	CP for Manifold Main for Clustered Services Serving Condominiums
CP-32	CP for Recycled DI Water Fire Hydrant Installation
CP-32A	CP for C-900 Recycled Water Fire Hydrant Installation
CP-33	CP for Ductile Iron or Steel Pipeline
CP-34	CP for Mechanical Thrust Restraint
CP-35	CP for Pipeline Vertical Offset
CP-36	CP for Steel Casings
CP-37	CP General Notes
CP-38	CP Test Station Box Installation
CP-38A	CP Terminal Box
CP-38B	CP Cable Identification
CP-39	Anode Installation – Single Anode
CP-39A	Anode Installation – Multiple Anodes
CP-40	CP Structure-to-Cable Connection
CP-41	Horizontal Exothermic Weld
CP-41A	Vertical Exothermic Weld
CP-42	Bond Cable Installation
CP-43	CP Cable Splice Connection
CP-44	Insulating Joint Flange Kit and Flange Coating
CP-44A	CP Insulating Union
CP-44B	Insulating Joint Flange Kit and Flange Coating
CP-44C	Insulating Restrained Flange Coupling

APPENDIX C

Division of Drinking Water
Criteria for the Separation
of Water Mains and Non-Potable Pipelines

(for compliance with Title 22 of the California Code of Regulations, Section 64572)

California Regulations Related to Drinking Water
September 23, 2016

§64572. Water Main Separation.

(a) New water mains and new supply lines shall not be installed in the same trench as, and shall be at least 10 feet horizontally from and one foot vertically above, any parallel pipeline conveying:

(1) Untreated sewage,
(2) Primary or secondary treated sewage,
(3) Disinfected secondary-2.2 recycled water (defined in section 60301.220),
(4) Disinfected secondary-23 recycled water (defined in section 60301.225), and
(5) Hazardous fluids such as fuels, industrial wastes, and wastewater sludge.

(b) New water mains and new supply lines shall be installed at least 4 feet horizontally from, and one foot vertically above, any parallel pipeline conveying:

(1) Disinfected tertiary recycled water (defined in section 60301.230), and
(2) Storm drainage.

(c) New supply lines conveying raw water to be treated for drinking purposes shall be installed at least 4 feet horizontally from, and one foot vertically below, any water main.

(d) If crossing a pipeline conveying a fluid listed in subsection (a) or (b), a new water main shall be constructed no less than 45-degrees to and at least one foot above that pipeline. No connection joints shall be made in the water main within eight horizontal feet of the fluid pipeline.

(e) The vertical separation specified in subsections (a), (b), and (c) is required only when the horizontal distance between a water main and pipeline is less than ten feet.

(f) New water mains shall not be installed within 100 horizontal feet of the nearest edge of any sanitary landfill, wastewater disposal pond, or hazardous waste disposal site, or within 25 horizontal feet of the nearest edge of any cesspool, septic tank, sewage leach field, seepage pit, underground hazardous material storage tank, or groundwater recharge project site.

(g) The minimum separation distances set forth in this section shall be measured from the nearest outside edge of each pipe barrel.

(h) With State Board approval, newly installed water mains may be exempt from the separation distances in this section, except subsection (f), if the newly installed main is:

(1) less than 1320 linear feet,
(2) replacing an existing main, installed in the same location, and has a diameter no greater than six inches more than the diameter of the main it is replacing, and
(3) installed in a manner that minimizes the potential for contamination, including, but not limited to:
(A) sleeving the newly installed main, or
(B) utilizing upgraded piping material.

APPENDIX D

FLUSHING AND CHLORINATION CHECKLIST

Dublin San Ramon Services District
Water, wastewater, recycled water

Disinfection Plan
Newly Constructed Potable Water Mains
Continuous Feed Method
(Up to 16" Diameter)
Dublin San Ramon Services District

NOTE: DISINFECTION PROCESS REQUIRES A MINIMUM OF SIX WORK DAYS.

Project Name/Tract Number:	
Permit Number:	
Developer:	
Engineer of Record:	
Contractor:	
DSRSD Inspector:	
Prepared By:	
Email Address of Preparer:	
Preparer's Telephone No.:	
Estimated Start Date:	

With the submittal of this plan, include a copy of affected waterline sheets. Make sure sheets include the waterline stationing and show callouts for appurtenances. Please include all backup documentation (See Section 11-B) to support the chlorination and de-chlorination chemicals. Inspections will not begin until entire Disinfection Plan has been approved by DSRSD.

If the total length of the connection from the end of the new main to the existing main is equal to or less than 20ft, see section 10A.

Estimated Capacities (Include all pipe, including fire hydrant laterals)

_____LF ____ Inch Waterline Capacity _____gallons
_____LF ____ Inch Waterline Capacity _____gallons
_____LF ____ Inch Waterline Capacity _____gallons
_____LF ____ Inch Waterline Capacity _____gallons

Section 1
Preparation

Section 1-A - Preventative and Corrective Measures during Construction

Proper precautions shall be taken to ensure the pipe remains clean and dry during construction including but not limited to those preventative and corrective measures indicated in section 4.8 of AWWA C651-14.

Section 1-B - Measurement of Water used in Disinfection Process

All water used in the process shall be measured. Measurement shall be accomplished by utilizing a temporary construction meter. The contractor shall follow DSRSD Standard I-D1-7 Construction Water Supply where applicable to their project location.

Section 1-C - Water Supply

Water shall be supplied through a temporary construction meter equipped with an approved and tested backflow device.

Section 2
Discharge

Discharge shall be within 20 feet of end of new main at the following location(s)
Attach additional sheets as required to show discharge location.

○ Existing or new fire hydrant Station _____
○ Existing or new Service Station _____ Size _____
○ Blow-off Assembly at Station _____

Section 3
Hydrostatic Testing

Hydrostatic testing shall be completed prior to preliminary flushing and disinfection of the main. Testing must be witnessed by DSRSD designee.

Witnessed by: DSRSD Inspector_____ Date_____

Section 4
Preliminary Flushing

Preliminary flushing shall be performed after installation and before disinfection to remove particulates. The flushing velocity goal is 5.0 fps but shall be no less than 3.0 fps. Flow rate must be demonstrated to DSRSD designee.

Flow rate to achieve 3.0 fps _____ gpm
Flow rate to achieve 5.0 fps _____ gpm
Capacity of new water mains _____ gallons
Estimated Water Volume to be flushed _____ gallon
Estimated time for preliminary flushing _____ Hours/minutes

Witnessed By: DSRSD Inspector_____ Date_____

Section 5
Continuous Feed Disinfection

Section 5-A - Chlorine

Table 1. Amounts of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water. User should confirm required dosage with chemical supplier.

		Sodium Hypochlorite Required			Calcium Hypochlorite Required
Desired Chlorine Concentration In Water mg/L	Liquid Chlorine Required lb	5% Available Chlorine gal	10% Available Chlorine gal	15% Available Chlorine gal	65% Available Chlorine lb
2	1.7	3.5	1.7	1.2	2.6
10	8.3	17.1	8.5	5.7	12.8
25	21.0	43.2	21.6	14.4	32.0
50	42.0	86.0	43.0	28.7	64.0

Sodium hypochlorite or calcium hypochlorite solution conforming to ANSI/AWWA B300 and NSF 61 containing approximately 5 to 15 percent available chlorine.

Type of Chemical to be used _____
Available chlorine by volume _____ %
Manufacturer _____ (provide SDS)
Pipe Capacity _____ gal
Quantity of Chlorine feed_____ gal or lb

Section 5-B - Chlorine Injection

A chlorine injection point shall be located not more than 10 feet downstream of the temporary flushing connection.
Chlorine Injection point shall be through, select one:

○ **Temporary construction jumper at Station _____**

OR

○ **New Water Service at Station _____**

Water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water has been chlorinated to 25 mg/L (ppm) of free chlorine. Chlorine shall be measured at regular intervals in accordance with the procedures described in the current edition of *Standard Methods for the*

Examination of Water and Wastewater or *AWWA Manual M12*, or using appropriate chlorine test kits. Appropriate methods include DPD Drop Dilution Method or High-Range Chlorine Test Kits. Chlorine application shall not cease until the entire main is filled with chlorinated water to 25 mg/L of free chlorine**. If multiple discharge locations are being used, please provide a sequence of chlorination and dechlorination that describes when valves and end of line locations will be opened and closed so that all pipe sections receive the required amount of chlorine.**

Sequence (if applicable)

_____
_____
_____
_____
_____
_____

Section 5-C - Disinfection of Appurtenances

Disinfection of appurtenances shall occur while new main is chlorinated (using water dosed as indicated in Section 5.B) by operating all valves, hydrants, and service connections to ensure contact with the chlorinated water.

Appurtenances

Sta	**Description**	**Operated (Check when operated)**

Section 5-D - Retain Super-Chlorinated Water

Retain super chlorinated water in the main for 24 hours. At the end of holding period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L (ppm) of free chlorine. Chlorine residuals must be verified by DSRSD designee.

Witnessed by DSRSD Inspector: _____ Date _____

Section 6
Final Flushing

After the applicable retention period, chlorinated water must not remain in prolonged contact with pipe beyond 24-hours. Chlorinated water shall be flushed from the main, fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system. A minimum of one times the volume of water in the new pipe shall be flushed.

Flow rate for final flushing = _____ gpm _____ fps
Amount of discharge water anticipated for final flushing = _____gallons
Estimated time for final flushing = _____ minutes

Section 7
De-Chlorinating and Disposing of Background Chlorinated Water

All background chlorinated water (3.0mg/L or less) discharged during this procedure shall be dechlorinated and disposed of properly as described below.

Section 7-A – De-Chlorination Chemical

Dechlorination chemicals of food grade quality shall be used to dechlorinate all water discharged from the system adequately to result in no detectable chlorine residual when measured by an appropriate low level chlorine test kit before the water reaches the curb inlet, wastewater manhole, receiving streams or wetlands.

User should confirm required dosage with chemical supplier, water leaving the new main shall receive a dose of the de-chlorination chemical fed at a constant rate.

Table 2. Amounts of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water (AWWA C655-09).

Residual Chlorine Concentration Mg/L	Calcium Thiosulfate (CaS_2O_3) gal	Sodium Thiosulfate ($Na_2S_2O_3$-$5H_2O$) lb	Ascorbic Acid ($C_6O_8H_6$) lb	Sodium Bisulfite ($NaHSO_3$) lb	Sodium Sulfite (Na_2SO_3) lb
1	0.34	1.2	2.1	1.2	1.4
2	0.67	2.4	4.2	2.5	2.9
10	3.36	12.0	20.9	12.5	14.6
25	8.4	30.0	52.0	31.3	36.5
50	16.8	60.0	104.0	62.6	73.0

The residual chlorine concentration in the water leaving the main shall be measured at regular intervals using appropriate chlorine test kits to ensure it does not exceed .01mg/L

Chlorine Concentration prior to Dechlorinating _____ mg/L
Pipe Capacity _____ gallons
Type of Chemical _____
Brand/Manufacturer _____ (submit SDS)
Chemical quantity required _____ lb

S**ection 7-B - Discharge/Disposal**

Optional discharge methods are indicated below in order of preference: **Check one**.

- Wastewater Manhole – May be transported by hose to wastewater manhole subject to written approval from DSRSD/CCCSD. An air gap must be maintained between the discharge end of the hose and the manhole.

- Passive Storm Detention/Retention Pond – May be transported by hose to storm sewer inlet which discharges to a detention pond or retention pond with an isolation mechanism approved by DSRSD. An air gap shall be maintained between the discharge end of the hose and the inlet.

- Active storm drain connected directly to nearest waterway.

NOTE: AIR GAP REQUIRED AT DISCHARGE POINT.

Beneficial reuse:

◯ Dechlorinated water shall be transported from discharge point at Station _____ to sanitary sewer manhole at Station _____ via _____ LF fire hose.

Total Estimated gallons to be discharged from disinfection and flushing operation _____.

Flow Rate into sanitary sewer manhole _____ gpm.

◯ Storm drain disposal - Dechlorinated water shall be transported from discharge point at Station _____ to storm drain inlet at Station _____ via _____ LF fire hose.

Total Estimated gallons to be discharged from disinfection and flushing operation _____

Flow Rate into storm drain inlet _____ gpm**.**

◯ Storm drain discharges into water quality pond located at (describe) _____.

Total Estimated gallons to be discharged from disinfection and flushing operation _____

Flow Rate into storm sewer inlet _____ gpm.

Section 8
Bacteriological Tests (Bac-Ts)
(Presence/Absence and HPC Methods)

After approved disinfection and final flushing is completed, bacteriological samples shall be collected by DSRSD no sooner than 24-hours after completion of the final flushing process. Before approving of a water main/system for release, both the initial Bac-T and confirming test results must pass. Sampling and analysis process takes a minimum of 48-hours for completion. **Loss of pressure or dewatering of any portion of the main at any time during the disinfection process can/will result in a cancellation of current sequence and restart back to the preliminary flushing phase.**

- **Sample Locations**. As a minimum, at least one set of samples shall be taken from the end of the line(s), from each branch greater than one pipe length, and at intervals not to exceed 1200 feet of the new main. If there is reason to believe that trench water has entered the new main during construction or if, in the opinion of DSRSD, excessive quantities of dirt or debris have entered the main, the DSRSD representative may require samples be taken at intervals of approximately 200 feet.

Sample Locations (List by Station and Description). Attach additional sheets if required.

_____
_____
_____
_____
_____
_____

- **Procedure** - No hose shall be used in the collection of samples. Use of a combination blow-off assembly/sampling tap is recommended. Samples shall be collected by DSRSD personnel in sterile bottles treated with sodium thiosulfate.
- **Sample results –** If initial samples produce acceptable results, a confirming set of samples will be initiated no sooner than 24-hours after receipt of lab analysis results. **CAUTION:** NO flushing shall be allowed between sampling except as needed to flush the sampling port.
  If sample results indicate a failed Presence/Absence or measured HPC greater than 500 colony-forming units (cfu) per mL, the water main/system shall be deemed to have failed the test. Additional flushing shall be conducted and a second set of samples will be taken for analysis.
- **Re-disinfection –** If two successive sets of passing samples cannot be achieved, the new main must be re-flushed, re-chlorinated and re-sampled. The main shall be rechlorinated by continuous feed method (As described in Section 5-B) until satisfactory results are obtained.
-

Date/Time 1st Samples Collected _____ Pass/Fail
Date/Time 2nd Sample Collected _____ Pass/Fail

Section 9
Removal of Temporary Connections

After satisfactory bacteriological sample results have been received, all temporary connections installed for this procedure (temporary connections, temporary injection point, temporary flushing devices) must be appropriately cut and plugged at the water main in the presence of a DSRSD Inspector.

Section 10
Connection to Existing Mains

After satisfactory bacteriological sample results have been received, permanent connections may be made in the presence of a DSRSD Inspector to the active distribution system. Existing customers affected by a shutdown for final connection to new water main/system must be notified 72-hours in advance.

Sanitary construction practices must be followed during the connection process to prevent contamination of the new or existing water main.

Section 10-A - Connection of pipe length less than or equal to 20 feet

New pipe, fittings, and valves required for the connection must be spray-disinfected or swabbed with a minimum of 1 percent solution of chlorine just prior to being installed and in the presence of a DSRSD Inspector.

Section 10-B - Connection of pipe greater than 20 feet

Pipe required for the connection must be set up above ground, disinfected, and bacteriological samples taken as described in Section 8. After satisfactory bacteriological sample results have been received, the pipe can be used in connecting the new main to the active distribution system. Between the time satisfactory sample results have been received and the time that the connection piping is installed, the ends of the pipe must be sealed with plastic wraps, watertight plugs, or caps.

Section 11
Scheduling

Section 11-A – Plan Approval Timeline

Completed flushing/disinfection plans in their entirety will be reviewed by DSRSD staff for completeness and workability within a two-week period after submittal. After all required information is received and approved, DSRSD staff will notify the contractor and a start date can be scheduled.

Section 11-B - Plan Submittal

Prior to the start of the pressure testing process, the Disinfection Plan, including all attachments, must be submitted for review and approval a minimum of two weeks prior to the requested pressure testing date. At a minimum, the following four items must be included and described in written format.

1. Water main preliminary flushing process.
2. Disinfection process.
3. Final flushing plan.
4. Final connection process.

Section 11-C – Inspection Requests

A completed DSRSD Inspection Request Form is required a minimum of two working days before proposed date of pressure testing. Inspection requests for preliminary flushing, disinfection, final flushing and tie-ins shall be submitted by e-mail at least one work day in advance.

Section 11-D - Overtime

From time to time overtime may be required to complete the overall process and receive final clearance of the newly installed system. For overtime request see DSRSD Standard Procedures, Specifications and Drawings Section I-B7 -2 Cost of Inspection and Testing.

Section 11-E – DSRSD Bacteriological Sampling Timeframe

The timeframe for DSRSD collection of samples at the work site is from 8:30am to 3pm, Monday through Friday. Samples requested to be taken on Saturdays are subject to provisions of Section 11-D – Overtime. Samples collected on Saturdays must be within the hours of 8:00am and 11:00am.

Sampling by DSRSD staff must be completed no later than 3:00pm Monday through Friday. Samples requested to be taken on Saturday's are subject to provisions of Section 11-D-Overtime and must be drawn no later than 11:00am.

Table 1: Velocity (fps) Conversion to Flow Rate (gpm)(Q=VA)

Pipe size (in)	Velocity (fps)	Q (gpm)
1.5	1	6
1.5	3	17
2	1	10
2	3	29
4	1	39
4	3	118
6	1	88
6	3	264
8	1	157
8	3	470
10	1	245
10	3	734
12	1	352
12	3	1058
16	1	627
16	3	1880
24	1	1410
24	3	4230

Table 2: Pipe Capacity (gallons)

Pipe Dia (in)	Area (sf)	Volume Per 100 LF (cf)	Capacity Per 100 lf (gallons)
1.5	0.012272	1.23	9
2	0.021817	2.18	16
4	0.087266	8.7	65
6	0.19625	20	147
8	0.348888889	35	261
10	0.545415391	55	408
12	0.785	79	587
16	1.395555556	140	1,044
24	3.14	314	2,349
30	4.9087385	491	3,672
36	7.06858	707	5,288
42	9.621127502	962	7,196
48	12.56637061	1,257	9,400
54	15.90431281	1,590	11,894
66	23.7582944	2,376	17,772