
♦

STANDARD SPECIFICATIONS

FOR INSTALLATION OF
WATER MAINS 20" AND SMALLER

November 2012
Revision 3



EAST BAY MUNICIPAL UTILITY DISTRICT

STANDARD SPECIFICATIONS
FOR INSTALLATION OF
WATER MAINS 20" AND SMALLER

EAST BAY MUNICIPAL UTILITY DISTRICT

TABLE OF CONTENTS

General Conditions (Applicant Only)

- 01000.1 - General Requirements
- 01600.1 - Materials (Applicant Only)
- 02316.1 - Trenching, Backfilling and Compacting
- 02511.1 - Miscellaneous Installation Requirements - Water Mains
- 02512.1 - Installation of ML&PCS Pipe - 20" and Smaller
- 02513.1 - Installation of ML&CS Pipe - 20" and Smaller
- 02514.1 - Polyvinyl Chloride Pipe and Fittings, Cast Iron Pipe Fittings, and Ductile Iron Pipe Fittings

- 02616.1 - Fabrication and Installation of High Density Polyethylene Pipe
- 02720.1 - Imported Backfill and Drain Rock Materials
- 02951.1 - Pavement Replacement
- 03345.1 - Controlled Density Fill
- 03376.1 - Concrete for Pipeline Installation
- 05095.1 - Pipe Welding
- 05097.1 - Flange Bolting
- 05610.1 - Fabrication of 20" ML&TWS Pipe (Applicant Only)
- 06066.1 - Polywrap
- 09961.1 - Protection from Corrosion
- 09969.1 - Fusion-Bonded Epoxy Coatings

APPENDIX A

- Flushing and Chlorination Checklist
- Sample Tap Installation Drawing
- EBMUD Contingency Plan for Contaminated Soils (District Forces Only)

INSTALLATION OF WATER MAINS
20" AND SMALLER

GENERAL CONDITIONS

1. Definitions
2. Authority of the Engineer
3. Changes
4. Inspection
5. Contractor's License and Registration
6. Instructions to Applicant
7. Guarantee
8. Relocation of Installed Main
9. Material Safety Data Sheet
10. Contaminants
11. Wage and Hour Laws, Payroll Records
12. Wage Related Workplace Postings
13. Pre-construction Conference
14. Trade Names and "Or equal as approved by the Engineer" Provision
15. Approval of Materials

1. DEFINITIONS

Wherever in the specifications and other contract documents the following terms, or pronouns in place of them, are used, the intent and meaning shall be interpreted as follows:

District: The East Bay Municipal Utility District.

Engineer: The Director of Engineering and Construction of the District acting directly or through authorized agents acting within the duties entrusted to them.

Applicant: Individual, partnership, joint venture, corporation, or public agency with whom the contract is made by the District to accomplish the work.

Contractor: Applicant, or District Forces when they are assigned responsibility for accomplishment of the work.

Weekday

Work Hours: 7:00 a.m. to 4:30 p.m. Monday through Friday.

2. AUTHORITY OF THE ENGINEER

The decisions of the Engineer shall be final and binding upon all parties with respect to all questions concerning the acceptability or classification of material, the execution of the work, and conflicting interests of Applicants or other District contractors performing related work.

3. CHANGES

If, during the progress of the work, changes in design, material, or location are deemed necessary by the District for proper construction of the work, the District reserves the right to make such changes. The increase in the cost of material and construction caused by such changes shall be borne by the Applicant, unless the changes are made on mains to be installed for the convenience of the District, in which case the increase in cost will be borne by the District.

4. INSPECTION

All work performed under this contract will be subject to inspection by the District. The Engineer shall have safe access to all parts of the work at all times. Work or material that does not conform to the specifications will be rejected at any stage of the work. The Applicant shall remove and rebuild at its own expense any part of the work that has been improperly executed.

Whenever work under these specifications is to be performed outside weekday working hours, on Saturday, Sunday, or on holidays, the Applicant or its agent shall notify the Engineer not less than 48 hours prior to beginning work.

Overtime construction work performed at the option of, or for the convenience of, the Applicant 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 periodic basis. For any such overtime beyond the regular 8-hour day and for any time worked on Saturday, Sunday, or District holidays, the charges will be 150% of the hourly pay rate of the District employee(s) performing the inspection.

District holidays are:

- New Year's Day
- Martin Luther King Day (3rd Monday in January)
- Lincoln's Birthday
- Washington's Birthday (3rd Monday in February)
- Chavez's Birthday
- Memorial Day (last Monday in May)
- Independence Day
- Labor Day (1st Monday in September)
- Admissions Day
- Columbus Day (2nd Monday in October)
- Veteran's Day
- Thanksgiving and the following day
- Christmas Day

When a holiday falls on Sunday, the following Monday shall be observed as the holiday. When a holiday falls on Saturday, the preceding Friday shall be observed as the holiday.

There will be no charge for the inspection of overtime work ordered by the Engineer.

5. CONTRACTOR'S LICENSE AND REGISTRATION

A. The Applicant or its agent performing the work shall possess a Class A or Class C-34 license from the Contractor's State License Board and such other State and local licenses as are required by law, and shall furnish satisfactory proof to the Engineer upon request that such licenses are in effect during the entire period of construction. Applicant shall also have previous experience of not less than one year in installing pressurized potable water mains 6" – 20" size.

B. The Applicant or its agent performing the work and subcontractors of any tier shall be properly registered with the State Department of Industrial Relations at the time of bid opening and for the duration of the project pursuant to Section 1725.5 of the Labor Code.

6. INSTRUCTIONS TO APPLICANT

The Applicant shall at all times be represented on the work in person or by a competent superintendent or other duly designated agent. Instructions and information given by the Engineer to the Applicant's superintendent or agent on the work shall be considered as having been given to the Applicant.

7. GUARANTEE

The Applicant hereby guarantees that any work performed by it under this contract will be performed in accordance with the drawings and specifications; that any material furnished by it will be in accordance with the drawings and specifications; and that both work and materials will fully meet the requirements of these specifications.

The Applicant hereby agrees to promptly reinstall, at its own expense, any part of the water main or any appurtenance which has not been installed in accordance with these specifications and drawings.

The District has sole responsibility for making any repairs to the newly installed pipeline and appurtenances once the pipeline is placed into service. The Applicant agrees that if, from the time that the pipeline is placed into service, any portion of the work furnished, installed, or constructed by the Applicant fails to fulfill any of the requirements of the contract, then the Applicant shall reimburse the District for all costs of said repairs (including overhead) beginning from the in-service date to within one year after written acceptance of the work completed under contract.

The Applicant shall be responsible for the full expense incidental to fulfilling any and all of the above guarantees and agreements. The above guarantees and agreements are covenants, the performance of which shall be binding upon the Applicant and its sureties.

8. RELOCATION OF INSTALLED MAIN

The Applicant is required to promptly relocate the main and appurtenances at its own expense should the street grade or alignment, curb lines, lot lines, or driveways be changed for any reason after the main and appurtenances are installed.

Should the Applicant fail to act promptly in accordance with this requirement or should the exigencies of the case require the relocation to be made before the Applicant can be notified or can respond to notification, the District may, at its sole option, perform the necessary work, and the Applicant shall pay the District the cost, including overhead, of such work.

9. SAFETY DATA SHEET (FORMERLY MATERIAL SAFETY DATA SHEET)

Attention is directed to the provisions of General Industry Safety Orders, Section 5194, Title 8, California Code of Regulations. The Applicant shall submit to the Engineer a Safety Data Sheet (SDS) for each hazardous substance proposed to be used, 10 days prior to the delivery of such substance to the jobsite or use of such substance at a manufacturing plant where the Engineer is to perform an inspection. For substances which are to be tested in District laboratories, the SDS shall be submitted with the sample(s). Hazardous substance is defined as any substance included in the list (Director's List) of hazardous substances prepared by the Director, California Department of Industrial Relations, pursuant to Labor Code Section 6382. Failure to comply with the submittal of an SDS for any hazardous substance will result in suspension of construction work.

10. CONTAMINANTS

- A. In the event of known contaminants or contaminants that are encountered during installation of the main extension facilities, Applicant shall provide a complete and specific written remedial plan prepared by a Certified Industrial Hygienist. The plan shall include the methodology, planning and design of necessary systems for the removal, treatment, and disposal of all identified soil and/or water contaminants. The Applicant shall be solely responsible for the costs of all related activities including but not limited to providing required training, personnel protective equipment, access control, remobilization, and any redesign. The Applicant shall conduct a site safety briefing for each of the following situations: 1) beginning of the job, 2) change of tasks, 3) change of personnel, 4) change of conditions.
- B. Applicant expressly agrees to indemnify, defend, and hold the District, its Directors, officers, agents, and employees free and harmless from and against any and all loss, liability, expense, costs, claims, suits, and damages including attorneys' fees related to the removal, treatment, and/or disposal of soil and/or water, contaminated with hazardous substances, including, but not limited to, petroleum products or byproducts, and any additional construction costs caused by the removal, treatment, and disposal of contaminated soil and/or water.

11. WAGE AND HOUR LAWS, PAYROLL RECORDS

- A. Prevailing wages: Pursuant to Section 1773 et seq. of the Labor Code of the State of California and any amendments thereof:

1. The District has obtained from the Director of Industrial Relations of the State of California, the general prevailing rates of per diem wages and the general prevailing rates for holiday and overtime work in the locality in which the work is to be performed, for each craft, classification, or type of worker needed to perform the work. A copy of the prevailing wage rates is on file and available for inspection by any interested party on request at the District's Specifications and Engineering Support Section. The prevailing wage rates are also available on the internet at <http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>.
 2. Applicant shall post a copy of the general prevailing rate of per diem wages at the jobsite pursuant to Section 1773.2 of the Labor Code of the State of California.
 3. The Applicant and its subcontractor shall pay not less than the specified prevailing rate of wages to all workers employed on the work.
 4. The holidays upon which such rates shall be paid shall be all holidays recognized in the collective bargaining agreement applicable to the particular craft, classification, or type of worker employed on the work.
- B. Hours of Labor: Pursuant to Sections 1810 et seq. of the Labor Code of the State of California and any amendments thereof:
1. Eight hours labor constitutes a legal day's work.
 2. The time of service of any worker employed upon the work shall be limited and restricted to eight hours during any one calendar day, and forty hours during any one calendar week.
 3. Work performed by employees of the Applicant in excess of eight hours per day, and forty hours during any one calendar week, shall be permitted upon compensation for all hours worked in excess of eight hours per day at not less than one and one-half times the basic rate of pay.
- C. Payroll Records: The Applicant or its agent performing the work and subcontractors of any tier are required to submit certified payroll records monthly online to the Labor Commissioner.

12. WAGE RELATED WORKPLACE POSTINGS

- A. The Contractor and every Subcontractor shall post at the workplace and comply with all required wage related workplace postings. Copies of the required postings may be downloaded or ordered electronically from the Department of Industrial Relations website at <http://www.dir.ca.gov/wpnodb.html>.

13. PRE-CONSTRUCTION CONFERENCE

- A. Seven days before the start of construction work, the Applicant is responsible for contacting the Engineer for arrangement of a pre-construction conference to be attended by the Applicant's project representative authorized to commit on the behalf of the Applicant and to direct the performance of the work by others. Contact phone number for Construction Inspection is (510) 287-1168 for projects in Alameda County, and (510) 287-1124 for projects in Contra Costa County.
- B. The purpose of this conference will be to establish a working relationship and understanding between the parties and to discuss project organization, job communications, the construction schedule, materials, shop drawing submittals and processing, inspection, survey requirements, testing, safety, water discharge requirements, and such other subjects as may be pertinent for the proper execution of the work. The District will provide final project drawings to the Applicant to disseminate to the parties responsible for the work, prior to or at the conference.

14. TRADE NAMES AND "OR EQUAL AS APPROVED BY THE ENGINEER" PROVISION

- A. Whenever in the specifications or on the project drawings materials or equipment to be incorporated into the work are designated by brand or trade name, such designation is intended to indicate a measure of quality and utility or as a standard. Except in those instances where the product is designated to match others in use on a particular improvement either completed or in the course of completion, the Applicant may substitute any other brand of the product of equal quality and utility on approval of the District.

15. APPROVAL OF MATERIALS

- A. The Applicant shall furnish to the District such quantities of construction materials as may be required by the Engineer for test purposes.
- B. Each sample submitted shall be labeled. A letter, in duplicate, submitting each shipment of samples shall be mailed to the Engineer by the Applicant. Both the label on the sample and the letter of transmittal shall indicate the material represented, its place of origin, the names of the producer and the Applicant, the Agreement number, and a reference to the applicable project drawings and specification paragraphs.
- C. Materials of which samples are required shall not be used on the work until approval has been given by the Engineer in writing. Approval of any sample shall be only for the characteristics or for the uses named in such approval, and no other.

END OF SECTION

SECTION 01000.1

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

These specifications cover installation of polyvinyl chloride and steel water mains by Contractor. Installations under these specifications are applicable to steel pipe not more than 20" diameter, and to polyvinyl chloride pipe from 2" diameter and larger up to 12" diameter. When steel pipe larger than 20" diameter or high density polyethylene pipe larger than 12" is to be installed by Contractor, additional specifications will be provided.

Unless noted otherwise, the Applicant or District Forces shall comply with all the requirements of these specifications.

B. Drawings:

1. Standard drawings: District's Standard Drawings for Installation of Water Mains 20" and Smaller form a part of these specifications and shall be followed in the installation of water mains.
2. Project drawings: Drawings showing the size and location of the mains to be installed and other pertinent details will be provided for each project, and when so provided will become a part of these specifications.
3. In case of conflict between the project drawings and specifications, the specifications shall govern. In case of conflict between the project drawings and the standard drawings, the project drawings shall govern. Specific requirements shall take precedence over general requirements.

C. Related Work Done by District:

1. See the General Conditions, Article 7, for District repairs to the pipeline after it has been placed in service.
2. The District will install service laterals and meters once the pipeline has been completed and connections made to existing mains; required main kills have been performed; and the pipeline has been certified for water quality and placed into service by the Engineer.

1.2 PRE-JOB REQUIREMENTS

- A. Permits: Obtain all necessary permits for doing work and provide copies to the Engineer. Where requirements of a permit differ from those of the District Drawings and Specifications, the more stringent requirements shall apply.
- B. Prior to obtaining District-furnished material or start of construction for the water mains, Applicant shall ensure that:
 - 1. Earthwork and rough grading is completed; the pavement subgrade is acceptable to the city or county having jurisdiction; the street area is rough graded to within 0.5 feet to the plus of subgrade; and all sewage and storm pipelines have been installed as shown on improvement drawings as submitted to the District for design purposes of the new pipeline.
 - 2. Survey stakes are established by a California licensed land surveyor as follows:
 - a. Set offset stakes along the pipeline alignment at an offset distance of not more than 17 feet from the center line of the alignment, and not more than 50 feet apart.
 - b. Indicate on offset stakes the offset distance, pipeline alignment survey station, feature (valve, tee, etc.) and cut or fill to the top of curb elevation. In addition, where profile is shown on project drawings, provide cuts to outside bottom of pipe and top of curb elevation/finish grade. The stationing shown on the offset stakes shall be consistent with the transit line stationing shown on the District drawings.
 - c. Set offset stakes at forward and backward tangents of angle points located along pipeline alignment.
 - d. Set offsets stakes at valves, tees, galvanic anode test stations, air valves and other appurtenances.
 - e. Set offset stakes at grade breaks.
 - f. Provide at least two offset stakes with elevations to top of curb for each fire hydrant. Maximum offset stake distance is 10 feet. See Standard Drawing 9496-GB for setback requirements.
 - g. Provide information at 500-foot intervals that ties the pipeline alignment survey to the transit line survey.
 - h. Indicate on field stakes the top of curb elevation where each storm drain crosses the pipeline.

3. The following documentation is furnished to the Engineer:
 - a. Statement that alignment and grade of the street area along the pipeline right of way is in accordance with the city or county approved improvement plans, coincides with the District drawings, and that the elevation of the street area is within 0.5 feet to the plus of subgrade.
 - b. City or county approved road pavement sections and extent for all pavement structures within the project. This shall include the extent and limits of all decorative pavement structures.
 - c. Cut sheets for the pipeline shall include as a minimum all information required on survey stakes and street name for each section surveyed.
 - d. Written designation of Competent Persons. See Section 02316.1.
 - e. Copy of each permit, including approved traffic control plans, required for this work.
 - f. Required submittals and samples for approval. Do not proceed until all items requiring approval have been approved by the Engineer.
 - g. Chlorination and flushing plan per Section 02511.1.

1.3 REFERENCES

- A. Referenced Standards: The standard referred to, except as modified, shall have full force and effect as though printed in this Specification, and shall be the latest edition or revision, unless a particular edition or revision is indicated. Abbreviations and terms, or pronouns in place of them, shall be interpreted as follows:

ASTM	-	ASTM International
AWWA	-	American Water Works Association
Cal/OSHA	-	California/Occupational Safety and Health Administration
CSS	-	Caltrans Standard Specifications, State of California, Department of Transportation
NACE	-	National Association of Corrosion Engineers, Standards
NSF	-	NSF International

1.4 LAYOUT OF PIPELINES

- A. The alignment and elevation of the water main and appurtenances shall be established in the field by the Contractor by measurement from the curb and by surveying. The Contractor shall preserve all bench marks, stakes, and other survey marks and, in case of their removal or destruction, the Contractor shall be responsible for their accurate replacement.

1.5 CONSTRUCTION FACILITIES AND CONTROLS

A. Water:

1. Applicant only:

- a. The District will furnish water for hydrostatic testing and disinfection of the pipeline. Water for initial testing and disinfection will be furnished without charge. See Section 02511.1.
 - b. Applicant shall provide all construction water except that provided by the District for hydrostatic testing and disinfection.
2. Provide and maintain all necessary equipment and facilities for conveying water, including water for testing and disinfection, to places where it will be used and for increasing the pressure if required.
 3. Plan and perform work in a manner which will avoid waste of water.

B. Discharged Water:

1. Provide for the caring of drainage on the entire work area and the disposal of such drainage from commencement of work until completion. District Forces shall comply with requirements contained in the District's Water Discharge Field Practice Manual. Applicant shall comply with Section 02511.1 and with the following requirements:
 - a. Water discharged from or flowing from the jobsite shall be of such purity and cleanliness as not to introduce any contaminants into any water course, stream, lake, reservoir, or storm drain system. Contaminants include but are not limited to silt, construction debris, concrete, or washings thereof; petroleum or paint products; or other hazardous substances. No liquid except clean, dechlorinated water shall be discharged or allowed to flow from the site.
 - b. Discharged water includes but is not limited to rainwater, groundwater, water pumped or otherwise removed from excavations whether introduced to the excavation or naturally occurring groundwater, water furnished to the Applicant by the District, and water used by the Applicant for any purpose.
 - c. Discharged water shall cause no erosion of earth, whether disturbed or not disturbed, or of excavated or dredged earth stored on site, or of material imported for fill or other purposes.
 - d. No soil or other material shall be discharged in a quantity that will have an adverse affect on the receiving waters. Discharge shall not cause or contribute to a violation of any water quality standard.

- e. In addition to other requirements, treat and test discharged water to ensure:
 - (1) Non-detectable total chloramine residual (below the detection limit of the test method).
 - (2) pH greater than 6.5 and less than 8.5.

C. Public Safety:

- 1. Provide and maintain such fences, barricades, "Street Closed" signs, warning lights and watchmen as may be required to provide safety against accidents to the public and to comply with all permit requirements. In no case shall the spacing between the warning lights be more than 50 feet along the length of the trench where it is adjacent to or within the boundaries of a thoroughfare.
- 2. Convenient access to driveways, houses, and buildings along the line of work shall be maintained at all times. Temporary approaches to, and crossings of, intersecting streets shall be provided and kept in good condition.
- 3. No material or equipment shall be placed where it will interfere with the free and safe passage of public traffic.

D. Maintaining Service:

- 1. Operating nuts of valves controlling live lines shall be accessible and operational at all times.
- 2. No material or other obstruction shall be placed within 15 feet of fire hydrants and blowoffs.

E. Sound Control:

- 1. Comply with all local sound control and noise level rules, regulations and ordinances that apply to the work performed.

F. Construction Cleaning:

- 1. Maintain the site and all stored items in a neat and orderly condition allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
- 2. Dispose of refuse as often as necessary so that at no time shall there be any unsightly accumulation of rubbish.
- 3. Sweep the paved street in the work area with a mobile sweeper on a daily basis. The sweeper shall be equipped with a dust suppression system and capable of collecting rock, gravel, sand, and dust.

4. Prior to completion of the work, remove from the jobsite all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final cleaning to leave a completely clean project.

G. Dust and Littering Control:

1. Provide and maintain dust control within the site and provide adequate measures to prevent a dust problem for neighbors.
2. Load all trucks in a manner that will prevent dropping of materials or debris on streets. Trim loads and remove all material from the shelf area of vehicles to prevent spillage. Take precautions when necessary to avoid creating dust and littering by watering the load after trimming and by promptly sweeping the pavement to remove dirt and dust.

H. Traffic Control:

1. Comply with all traffic control requirements of agencies having jurisdiction.

I. Confined Spaces:

1. Attention is directed to the provisions of Article 108 of the General Industry Safety Orders, Title 8, California Code of Regulations, and Article 4 of the Construction Safety Orders, Title 8, California Code of Regulations.
2. Definition: Confined spaces for the purpose of this Article shall mean the interior of storm drains, sewers, vaults, utility pipelines, manholes, reservoirs, and any other such structure which is similarly surrounded by confining surfaces so as to permit an oxygen deficient atmosphere or the accumulation of dangerous gases or vapors.
3. Tests for the presence of combustible or dangerous gases and/or oxygen deficiency in confined spaces shall be made with an approved device immediately prior to a worker entering the confined space and at intervals frequent enough to ensure a safe atmosphere during the time a worker is in such a structure. A record of such tests shall be kept at the jobsite.
4. No employee shall be permitted to enter or remain within a confined space, where tests indicate the presence of a hazardous atmosphere, unless the employee is wearing suitable and approved respiratory equipment, or until the hazardous atmosphere has been removed from the confined space by continuous forced air ventilation.
5. Confined spaces that contain or that have last been used as containers of toxic gases, light oils, hydrogen sulfide, corrosives, or poisonous substances, shall, in every case, be tested by means of approved devices or chemical analysis before being entered without wearing approved respiratory equipment.

6. Sources of ignition, including smoking, shall be prohibited in any confined space until after the atmosphere within the confined space has been tested and found safe.
7. Reservoirs, vessels, or other confined spaces having openings or manholes in the side as well as in the top shall be entered from the side openings or manholes when practicable.

J. Worker Safety:

1. The safety provisions of applicable laws and construction codes shall be observed. All safety standards, orders, rules and regulations applicable to the work to be performed and issued pursuant to the California Occupational Safety and Health Act shall be obeyed and enforced.

K. Restoration of Property:

1. Restore all damaged property, including sidewalks; adjacent roadway surface; curbing; pipes; conduit; gas, water and other services; meter boxes; sewers; monuments; stakes; trees; shrubs and other planting and other public or private property to their original "as-found" condition or as otherwise specified, at the completion of the work.

1.6 SUBMITTALS (Applicant Only)

- A. Submission requirements specified in the submittal sections of the technical specifications pertain only to the Applicant. Submit 5 copies of data and drawings by mail to:

Construction Division, MS #62
East Bay Municipal Utility District
P.O. Box 24055
Oakland, CA 94623-1055
Attn: Supervising Construction Inspector

or have them hand delivered to:

Construction Division Office
1100-21st Street Oakland, CA 94607

1.7 PRE-ACCEPTANCE INSPECTION

- A. When the work has reached a suitable completion stage, the Engineer and the Contractor shall make a joint inspection of the job to determine the deficient work items required to be completed prior to the acceptance of the job by the District. The Contractor is responsible to schedule this meeting with Engineer 48 hours prior to requested date. The deficient work items will be transmitted in writing to the Applicant once the job walk is completed.

END OF SECTION

SECTION 01600.1

MATERIALS
(Applicant Only)

PART 1 - GENERAL

1.1 MATERIALS FURNISHED BY THE DISTRICT

A. General:

1. Upon payment to the District in accordance with the Agreement, and after the conditions of Section 01000.1 - Article 1.2 B. have been met, the District will furnish to the Applicant pipe, fittings, and other materials, in the quantities needed for the project, as listed in Paragraph B. All other materials shall be furnished by the Applicant as specified in Article 1.2.
2. During the progress of work, District will issue any additional material, if listed in Paragraph B., required as a result of changes in design, material, or location for the convenience of the District.

B. List of District-furnished Materials:

<u>Item</u>	<u>Reference</u>
ML&PCS - mortar-lined and plastic coated steel pipe and fittings, 16" and smaller, as shown on the drawings.	Project Drawings
ML&CS - mortar-lined and coated steel pipe and fittings, 16" and smaller as shown on the drawings.	Project Drawings
Fire Hydrants, including Hydrant Set, except Items A, B, E, and J.	Standard Drawing 9496-GB
Butterfly Valves - Main Line.	Project Drawings
Gate Valves - Main Line, Hydrant, and Blowoff.	Standard Drawing 288-EA
Valve Operating Shaft Extension with nut.	Standard Drawing 1241-A
Standard Drawing 1241-A, Steel Pipe and 45° Elbows for Offset - Returns 4", 6", 8", and 12" (Applicant to fabricate).	Standard Drawing 1870-A

Size on Size Main-Line Valve with 4" Blowoff for 6" and 8" Steel and PVC Mains except Items C, E, F, H, and I.	Standard Drawing 332-EA
4" Blowoff Assembly except Items 1, 2, 10, 12-16, and 18.	Standard Drawing 169-EA
6" Blowoff and Pumping Tee except Items 1, 2, 8, 11, 12, 15, 16, 17, and 18.	Standard Drawing 199-EA
2" Blowoff Assembly except Items B-D, F-H, P, Q, R, and T.	Standard Drawing 3272-B
Flexible Coupling for Insulating Joint.	Standard Drawing 3446-GB
4" x 4" Marker Post.	Standard Drawing 1336-A
Split Tees for Wet Taps.	Standard Drawing 282-EA
Air Valves (above grade) except items 2, 3, 6, 7, 10, 11-14, 16, 17, 19-21, 23.	Standard Drawing 189.1-B
Air Valves (below grade) except items 2, 3, 6, 7, 10, 11, 13-19, 21-23.	Standard Drawing 189.2-B
Galvanic Anodes except plastic tape, cement mortar, epoxy putty, and exothermic welding kit.	Standard Drawing 286-EA
Chlorination Taps.	Standard Drawing 9020-GB
Manhole Frames and Covers	Standard Drawing 199-EA, Standard Drawing 333-EA

C. Requisition of Materials:

1. In all cases materials will be issued only upon approval by the Engineer. The Applicant shall submit a completed materials requisition form (Form P-013) to the Engineer a minimum of five work days before the date of scheduled pick-up. The Applicant shall bear the responsibility for any schedule and cost impacts due to unavailability of material if the Applicant fails to provide the required advance notice of the scheduled pick-up date. At least one day before the scheduled pick-up date, the Applicant shall call the designated location to confirm that materials are ready for pick-up. The District will identify any unavailable materials at this time. If materials are unavailable and the Applicant provided the required notice, the District may, at its discretion, elect to deliver

the remaining items rather than have the Applicant return when those items are available. Receipts for materials signed by the bearer of the request shall be conclusive evidence of delivery to the Applicant of the materials therein specified. Material requisitioned for one District job shall not be used on another without permission of the Engineer.

D. Delivery of Materials:

1. Delivery of all materials to be furnished by the District shall be taken by the Applicant at the District's yard where such material is stored. Detailed information regarding storage may be obtained by contacting the District's Material Storage Foreman at 1200 - 21st Street, Oakland, telephone (510) 986-7701. The locations, telephone numbers, and business hours of the District yards are:

Oakport Storage Center	Central Warehouse
5601 Oakport Street	1200 - 21st Street
Oakland, CA	Oakland, CA
(across from Oakland Coliseum)	(510) 986-7703
(510) 287-0426	

Hours: 8:30 a.m. - 3:30 p.m.

2. Materials will be issued only during the business hours listed above. Receipts for materials signed by the Applicant shall be conclusive evidence of delivery. All handling, loading, hauling from their delivery point to the jobsite, and unloading of such materials shall be performed by the Applicant. The Applicant shall provide all necessary materials handling equipment (including forklift), tiedowns, and dunnage. Also, see Section 02512.1, Article 1.3, and Section 02513.1, Article 1.3 as appropriate.

- E. Materials furnished by the District have been inspected and are assumed to be in perfect condition upon delivery to the Applicant. The Applicant shall inspect and ascertain the condition of all materials at the time of delivery and shall assume all responsibility for the condition of all materials from the time of such delivery until final acceptance of the work by the Engineer. If it is subsequently determined that furnished materials are defective and unsuitable for the intended purpose and such condition is not the result of damage after delivery to the Applicant and could not have been ascertained immediately upon delivery to the Applicant, the District's liability is limited to providing similar replacement material.

F. Additional Materials:

1. All materials to be furnished to Applicant under the following circumstances will be furnished at Applicant's expense and shall be paid for in full before issue by District:

- (a) For repair of damage to District property when such damage is attributable to the Applicant.
 - (b) For replacement of District materials lost by, damaged by, or stolen from the Applicant.
 - (c) For changes under Article 3 of the General Conditions, except changes made on mains installed for the convenience of the District.
2. Payment shall be by cash or certified check at the yard from which the material is furnished.
 3. Materials issued under these circumstances will be on "Materials Sales Forms" (Form No. S-014) prepared by the Engineer.
 4. If damaged District materials are repairable as determined by the Engineer, and if the damaged District materials are returned by the Applicant, the Applicant will be credited for the current material value less the repair costs.

G. Return of Materials:

1. At the completion of the job, all excess material furnished by the District and recovered materials shall be returned to the same designated location from which they were picked up (or delivered). The Applicant shall submit a completed Material Return Order (Form P-015) to the Engineer within 7 days after establishment of the in-service date. Confirmed Material Return orders and a transmittal cover letter will be mailed directly to the Contractor. Returned materials will be accepted only during the business hours listed in Paragraph D. Unloading of all returned material at the yard shall be done by the Applicant at locations designated by the District. Applicant shall furnish all necessary materials handling equipment. Excess material assembled by the Applicant shall be disassembled before returning the material to the yard.
2. The Applicant will be billed for the materials furnished by the District for installation under this specification, which are not installed or returned to the proper District yard within 20 calendar days after the new pipeline is made ready for service by the Applicant. At this time determination of the quantities and value of the materials not installed or returned will be made by the Engineer and will be billed to and shall be paid for by the Applicant.

1.2. MATERIALS FURNISHED BY THE APPLICANT

- A. The Applicant shall furnish polyvinyl chloride (PVC) pipe and associated fittings (cast iron, ductile iron, or PVC); 20" diameter steel pipe and fittings; high density polyethylene (HDPE) pipe and associated fittings; and all other material required for complete and acceptable installation of the pipe, except those items furnished by the District under Article 1.1.

- B. All materials furnished by the Applicant shall be new, of the best commercial quality, and as specified herein. Failure of the specifications to set forth or describe items or components does not relieve the Applicant of furnishing all items necessary to ensure complete performance and operation of the pipeline in the service intended.

- C. All materials furnished by the Applicant must comply with California Code of Regulations, Title 22, Division 4, Chapter 16, Article 7, Section 64591 or Section 64593, sub-paragraph (c).2. Applicant must furnish current evidence of compliance to the Engineer, if requested.

END OF SECTION

SECTION 02316.1

TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Trenching, backfilling, and compacting for the installation of pipe and pipeline appurtenances, to the required lines and grades.
- B. Related Sections:
 - 1. Section 02720.1 - Imported Backfill Materials
 - 2. Section 02951.1 - Pavement Replacement
 - 3. Section 03345.1 - Controlled Density Fill
- C. Definitions:
 - 1. Competent Person: As defined in Section 1504 of the Construction Safety Orders Title 8, Chapter 4, Subchapter 4 of the California Code of Regulations: One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.

1.2 QUALITY ASSURANCE

- A. The Contractor will take samples and perform tests to determine compliance with the specified compaction requirements.
 - 1. Compaction requirements are specified as relative compaction and expressed as a percentage. Relative compaction is the ratio of the field in-place dry density to the laboratory maximum dry density.
 - 2. Laboratory maximum dry density will be determined in accordance with California Test 216.
 - 3. Field in-place density will be determined in accordance with ASTM D 6938.

1.3 SUBMITTALS

- A. Submit written designation of Competent Persons for the District's record prior to work.
- B. Submit copy of Cal/OSHA excavation permit prior to work.
- C. Submit a detailed plan for worker protection and control of ground movement for the District's record prior to any excavation work at jobsite. Include drawings and details of system or systems to be used, area in which each type of system will be used, de-watering (if applicable), means of access and egress, storage of materials, and equipment restrictions. If plan is modified or changed, submit revised plan.
- D. Submit compaction test results for the District's record prior to hydrostatic pressure testing of pipeline.

1.4 JOB CONDITIONS

A. Existing Utilities:

- 1. Locations of known underground utilities and structures are shown on the drawings as they are supposed to exist. Appurtenances and service laterals are not usually shown if their presence can be inferred from the presence of other visible facilities.
- 2. Locations shown may be based on information furnished by the utility owners at the time of design, derived from visible surface facilities, or based on subsurface exploration by the District.
- 3. If a utility is encountered which was not shown on the drawings and is in conflict with the work, immediately notify the utility owner and the Engineer in writing and arrange for necessary work.

B. Excavation Safety:

- 1. All excavation work and all work in the vicinity of an excavation shall be in full conformance to Article 6, Excavations, of the Construction Safety Orders, in addition to other applicable safety requirements.
- 2. Designate in writing one or more individuals as Competent Persons. Written designation shall certify that each designated Competent Person has the training, knowledge, and authority required of a competent person under Article 6, Excavations, of the Construction Safety Orders.
- 3. A designated Competent Person, with authority to inspect the work and supervise conformance with Article 6, shall be on site at all times whenever any excavation work or work in or about an excavation is in progress.

4. All excavations 5 feet or greater or not in stable rock shall have a protective system to prevent earth movement. Protective system shall, at a minimum, conform to Cal/OSHA standards for sloping and benching, or for timber shoring for trenches, or for aluminum shoring for trenches; or shall be designed and constructed in accordance with tabulated data as allowed by Article 6 of the Construction Safety Orders; or shall be designed and constructed in accordance with a plan that conforms to Paragraph 5 below.
5. For excavations greater than 20 feet in depth or where the protective system differs from those specified in 4. above, detailed plans showing the materials and methods to be used shall be prepared by a California registered Civil or Structural Engineer. The registered engineer shall:
 - a. Have at least five years' responsible experience in work of this nature.
 - b. Inspect the installation of the system prior to entry of any persons into the excavation and certify in writing to the District that the system is installed as designed.
 - c. Perform any necessary additional work that may be required because of unanticipated movements, deflections, or settlements of the protective system or the ground.

C. Contaminated Soils:

1. Applicant only:
 - a. If contaminated soils are encountered or suspected, see General Conditions, Contaminants Article, for Applicant's responsibility.
 - b. Immediately notify Engineer of presence or suspected presence of contaminants. Notification is for safety of District personnel and information of the Engineer.
2. District Forces only:
 - a. If contaminated soils are encountered or suspected, follow procedures outlined in EBMUD Contingency Plan for Contaminated Soils, Appendix A.

1.5 ALTERNATES

- A. Controlled Density Fill may be used as an alternative backfill material above pipe bedding in both main and lateral trenches where permitted by the agency having jurisdiction. See Section 03345.1.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS

- A. No material shall be used for trench backfill which, because of excessive moisture or any other reason, cannot be compacted to the degree specified. Any such material shall be considered unsuitable, and if it is deposited in the trench, it shall be removed and replaced with suitable material.
- B. Imported backfill materials shall conform to Section 02720.1.
- C. Controlled Density Fill shall conform to Section 03345.1.
- D. Select backfill shall be material selected from the excavation by the Engineer. Select backfill material shall be free of organic or other unsuitable materials and shall not include rocks, boulders, or unbroken masses of soil larger than 3" in greater dimension.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. General:
 - 1. Notify city, county, or state a minimum of 3 working days prior to work when their survey monuments will be disturbed or when the trench edge will be within 3' from the closest edge of the monument so that they may be referenced and relocated. The Applicant is responsible for all costs associated for re-establishing survey monuments. Relocation shall be by or under direction of agency having jurisdiction.
 - 2. Remove all materials of whatever nature encountered necessary to install the pipeline.
 - 3. Blasting is not permitted.
 - 4. Cut pavement accurately to correct lines. Sawcut pavement and dispose of slurry as required by the agency having jurisdiction. Discharged water shall comply with Section 01000.1, Article 1.5.B.
 - 5. Keep trench dry throughout construction operations.
 - 6. Store materials to minimize obstruction to traffic.
 - 7. Trench shall be backfilled, compacted, and paved at the end of each day's work where excavation is in a public road. An alternative that will permit safe public use of the road and complies with Cal-OSHA standards may be used if advance approval is obtained from the agency having jurisdiction.

B. Alignment, Depth, and Width:

1. Trench excavation shall follow the alignment of the pipe centerline and shall be in accordance with Drawing 1992-A.
2. Excavation to a greater depth than shown on the drawings may be required if the native material at the bottom of the trench will not provide proper support for the pipe.
3. If the trench width exceeds that shown or if sloping sides are used, the maximum trench width at the crown of the pipe shall not exceed that allowed by Drawing 1992-A.
4. Sloping sides of the trench excavation will not be permitted in public streets.

C. Excavation shall be supported or excavated so that:

1. Adjoining ground shall be prevented from sliding or settlement.
2. Existing improvements of any kind shall be fully protected from damage.
3. Worker protection is provided as required by Cal/OSHA.

D. Excavation in Sidewalk:

1. Sidewalk shall be removed and replaced where the trench lies within and approximately parallels a concrete sidewalk 4' or less in width.
2. Sidewalk shall be removed and replaced to nearest parallel groove or score outside trench where sidewalk is more than 4' in width.

E. Excavation Required Beyond Trench Limits:

1. See Paragraph B.2.
2. Excavation (bell holes) where necessary in the sides and bottom of the trench at pipe joint locations shall be large enough to make joints and permit District inspection.
3. Where leaks occur, remove all adjacent saturated material.

F. Disposal:

1. Dispose of excess excavated material and excavated material that is not approved by Engineer for use as backfill. Disposal shall be in accordance with accepted excavated material disposal plan.
2. Deliver and unload salvageable pipe or other material belonging to the District to 5601 Oakport Street, Oakland. Delivery will require a Material Return Order (Form P-015) prepared by the Engineer. See Section 01600.1, 1.1 G. 1.

3.2 UTILITIES

A. Location:

1. Contractor is responsible for having all underground utilities and structures located by the owners in advance of excavation.
 - a. Notify all known owners of underground utilities in the area of proposed work and Underground Service Alert, 800-227-2600 or 800-642-2444, at least 2 working days before the start of actual excavation. Meet with owners/operators of high priority subsurface installation, that are located within 10 feet of a proposed excavation, before opening the excavation per Cal/OSHA Title 8 Section 1541.
 - b. Identify the area to be excavated as required by PUC/CA Government Code 4216.2.

B. Excavation Around Utilities:

1. Excavation and other work under or adjacent to utilities shall not interfere with their safe operation and use.
2. Probe carefully to determine the exact location of utility, and hand excavate where necessary to avoid damage. Hand excavation is required within 24" on either side of the exterior surface of any underground utility (except nonpressurized sewers, drain lines, and storm drains) as that utility has been located by the utility owner except:
 - a. Power-driven or power-operated equipment may be used for the removal of pavement if there are no utilities in the pavement.
 - b. Power-driven or power-operated equipment may be used to any depth with agreement of the utility owner.
3. In the event of damage incurred during construction to such structures or property, immediately notify the owners and other authorities, and arrange for immediate repairs.

4. Notify the local fire department every time damage to a gas utility results in a leak or suspected leak or when damage to any utility results in a threat to the public.

C. Tunneling under utilities:

1. Tunneling may be allowed for short distances with the approval of the utility owner.

3.3 BRIDGES

- A. Minimum 4-foot wide bridges adequate for pedestrian traffic and with handrails and uprights of dressed lumber shall be installed where required.
- B. Bridges adequate for handling all vehicular traffic shall be installed when excavation obstructs more than one-half the width of the street or road crossing.
- C. Provide bridges from public streets onto private property to permit safe use of all garage driveways and other roadways.
- D. Maintain bridges as long as the condition of the work requires.
- E. Relocate bridges as required to perform work in the immediate vicinity of a bridge.

3.4 BACKFILL OF TRENCHES

A. General:

1. Remove all loose material, wood, and debris from trench prior to backfilling.
2. Backfill pipeline trenches to the level of original ground surface or underside of the pavement base course.
3. Backfill material shall not be dropped directly on the pipe.
4. Shoring removal:
 - a. Carefully remove timbering, sheeting, shoring, and sheet piling using methods that will minimize caving.
 - b. Metal sheet piling, sheeting, and bracing may be left in place on approval of the Engineer.
5. Low points along the pipe trench shall not be backfilled until all backfill at adjacent higher elevations has been completed. Water collecting at the low points shall be removed by pumping or other means.

6. If the trench has been excavated below the specified depth, that portion of the trench shall be backfilled with pipe bedding material and compacted before pipe installation.
7. Backfill with the specified material to the full width of the trench as excavated.

B. Pipe Bedding and Compaction:

1. Install Class I Backfill as shown on Drawing 1992-A.
2. Bedding support under pipe:
 - a. Bring to a uniform grade to provide continuous support for the pipe sections as they are laid in final position.
 - b. If more than 3" thick, compact in 8" maximum lifts with approved plate-type vibrating equipment.
3. Pipe bedding above grade line:
 - a. Bring up simultaneously on both sides of the pipe.
 - b. Maximum lift as it is placed before compaction shall be 24" where compaction by saturating with water and vibration is permitted and used.
 - c. Maximum lift as it is placed before compaction shall be 8" where compaction by saturating with water and vibrating is not used.
4. Compaction:
 - a. Compact by saturating with water and vibrating where permitted. Saturate by water jets or by other approved means while densification by vibration is in progress. Excessive or improper saturation or flooding will not be allowed. Consolidate mass with immersion type vibrators of sufficient length to extend to the bottom of each lift. Vibrate and water jet alternately on both sides of pipe. Do not remove vibrators from the mass until water jets are removed.
 - b. Compact by impact, vibration, or a combination of these methods where compaction by saturating with water and vibrating is not permitted.
 - c. Thoroughly compact before additional fill is placed.

C. Backfill and Compaction Above Pipe Bedding:

1. Install Aggregate Base backfill material where excavation is in a paved public road, unless another backfill material is permitted by the local agency permit. Install select backfill material at other locations.

2. Install Aggregate Base backfill material in lieu of select backfill when the Engineer determines that excavated material does not meet the requirements for select backfill and orders the use of imported backfill.
3. Maximum lift as it is placed before compaction shall be 8". Lifts to 12" may be allowed if specified compaction can be obtained without adverse effects on the pipe.
4. Placement of the backfill shall not damage the pipe coating.
5. Only hand-operated motor driven mechanical compacting equipment shall be used over pipelines until the backfill has been compacted to 24" over the crown of the pipe.
6. Compaction methods and equipment are subject to the approval of the Engineer. Compaction by saturating with water and vibrating is not permitted.
7. Paved public or private roads:
 - a. Compact Aggregate Base backfill that is more than 3 feet below the existing surface to at least 90% relative compaction.
 - b. Compact Aggregate Base backfill in the upper 3 feet of the excavation to at least 95% relative compaction.
8. Other locations: Compact backfill to at least 90% relative compaction.
9. At the time of compaction, the moisture content of backfill material shall be such that the required relative compaction will be obtained.
 - a. Condition material which contains insufficient moisture or excessive moisture until the moisture content is such that the required relative compaction will be obtained.
10. Controlled Density Fill (CDF) may be used in lieu of aggregate base backfill material where excavation is in a paved public road and where this option is permitted. See Section 03345.1.

D. Backfill and Compaction in Lateral Trenches:

1. Lateral trenches:
 - a. Any trench extending from a water main at 60° to 90° angle to the centerline of a street.
 - b. Backfill with Aggregate Base material or CDF and compact as for main trench unless required otherwise by local agency permit.

2. Where leaks occur:
 - a. Remove all adjacent saturated material.
 - b. Backfill with new materials and compact as for adjoining trenches.

3.5 GRADING

- A. Top of the backfill in the areas with no additional planned improvements (such as paving or structures) shall be graded with a crown for positive drainage away from the backfill area.
- B. Areas outside of the trench limits shall also be graded for a positive drainage but grading shall not alter the existing drainage pattern.

END OF SECTION

SECTION 02511.1

MISCELLANEOUS INSTALLATION REQUIREMENTS - WATER MAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous work required for the installation of water mains and appurtenances:

1. Installation of Valves
2. Installation of Fire Hydrants
3. Installation of Location Markers and Valve Pots
4. Cathodic Protection
5. Connections to Existing Pipelines
6. Hydrostatic Pressure and Leakage Test
7. Flushing and Chlorinating
8. Salvage or Abandonment of Existing Facilities

B. Related Sections:

1. Section 02316.1 - Trenching, Backfilling and Compacting
2. Section 02512.1 - Installation of ML&PCS Pipe - 20" and Smaller
3. Section 02513.1 - Installation of ML&CS Pipe - 20" and Smaller
4. Section 02514.1 - Polyvinyl Chloride Pipe and Fittings, Cast Iron Pipe Fittings, and Ductile Iron Pipe Fittings

C. Furnished by the District:

1. Materials:
 - a. See Section 01600.1.
2. Water:

- a. See Section 01000.1

1.2 REFERENCES

- A. Standard Methods - AWWA Standard Methods for the Examination of Water and Wastewater.
- B. AWWA Standard C651-05 Disinfecting Water Mains
- C. NSF/ANSI Standard 60 Drinking Water Treatment Chemicals – Health Effects.

1.3 SUBMITTALS

- A. Submit a detailed discharged water control and disposal plan for the District's record prior to any work at the jobsite. Plan shall comply with all requirements of the specification and with regulations of the California Regional Water Quality Control Board, San Francisco Bay Region, California Department of Fish and Game, County Flood Control Districts, and any other regulatory agency having jurisdiction, whichever is most stringent.
- B. Submit a chlorination and flushing plan for approval prior to release of District-furnished material. All phases of filling, flushing, chlorinating, and dechlorinating shall be monitored for chlorine intrusion into the existing piping system. The plan shall address, as a minimum, the key elements listed in checklist provided in Appendix A.

PART 2 - PRODUCTS

2.1 FIELD INSTALLED MORTAR

- A. Portland Cement:
 - 1. ASTM C 150, Type II Low Alkali or Type V.
 - 2. Shall contain not more than 0.60% alkalies calculated as the percentage of sodium oxide plus 0.658 times the percentage of potassium oxide.
- B. Sand: ASTM C 33
 - 1. Fineness modulus:
 - a. Coating 2.70 - 3.20
 - b. Lining 2.50 - 3.00

2. Sand equivalent:

- a. California Test 217
- b. Average of three successive tests shall be not less than 75 and no individual samples shall be less than 70.

C. Reinforcement:

1. See Drawing 237-EA

2.2 POLYWRAP

- A. Section 06066.1.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

- A. Install butterfly valves and gate valves at locations shown on the drawings. See Drawing 1241-A for valve operating shaft installation details.
1. Install butterfly valve operating shaft extension with shearpin on all butterfly valves. Top of operating nut shall be between 12 to 24 inches of finished grade.
 2. Install gate valve operating shaft extension on gate valves if the valve operating nut is more than 36" below ground level. Top of shaft extension operating nut shall be between 12 to 24 inches of finished grade.

3.2 INSTALLATION OF FIRE HYDRANTS

- A. Install hydrant assembly per Drawing 9496-GB at locations indicated on the drawings. Applicant is responsible to verify that all fire hydrant locations are in compliance with District and Fire District Standards.
- B. Install hydrant with proper setback clearances from face of curb and edge of sidewalk. Maintain minimum 5 feet clearance from fences, walls, structures, and edges of driveways.
- C. If riser flange is above top of curb height or visible, raise hydrant by cutting riser and welding on an appropriate pipe section to conform to final grade elevation. Repair mortar as required. Otherwise an approved hydrant extension is acceptable if approved by the Engineer.
- D. Wrap fire hydrant outlets with plastic bags after installation. Plastic bags to remain in place until water quality has been cleared and fire hydrants are placed in service.

3.3 LOCATION MARKERS

- A. See Drawing 303-EA for pipeline markers.
- B. See Drawing 1336-A for valve, blowoff, air valve, and test station markers.
- C. See Drawing 2002-A for curb field markings.

3.4 VALVE BOXES

- A. See Standard Drawing 321-EA.

Valve Pot Cover Code: Red = Zone Valves (always closed)
 White = Hydrant Valves
 Blue = Distribution Line Valves
 Purple = Recycled Water

3.5 CATHODIC PROTECTION

- A. Install cathodic protection as shown and specified.
- B. Steel pipe with an insulating coating shall meet the cathodic protection criteria of NACE RP0169-92, Paragraph 6.2.2.1.1.
- C. District will test for compliance with specified corrosion control requirements after main has been placed in service.
- D. In the event of noncompliance, repair as directed by the Engineer until compliance is obtained.

3.6 CONNECTIONS TO EXISTING PIPELINES

- A. General:
 - 1. Connections to the existing mains are shown on the drawings. When a wet tap is designated or when it is determined by the Engineer that a wet tap is required, the District will install the gate valve and split tee or nozzle, and will make the tap. The Contractor shall perform all other work necessary to complete the connection including, but not necessarily limited to, traffic control, excavation, shoring, preparation of the existing pipe for wet tap, connection of the new main to the gate valve, repair of coating to the existing main, application of coating to new installation, adequate blocking where required and concrete anchors where applicable, backfill, compaction, and pavement replacement.

2. Connections to the existing mains prior to hydrostatic pressure testing and chlorination are permitted if subsequent pressure tests are performed against closed, resilient-seated gate valves. If the gate valves are found to be leaking or not of resilient seat, the new pipeline shall be physically isolated and shall have passed the pressure test and chlorination before connection is made to the existing main. Only one connection to the source main is permitted until the pipeline has successfully passed the water quality testing.
3. Applicant only: The existing main may not be located as shown on the contract drawings. The Applicant shall pothole the point of connection to determine the exact location of the main prior to the start of work. The District is not responsible for additional costs incurred arising from the existing main being located differently from that shown on the contract drawings.
4. Applicant only: All costs of making connections to existing mains shall be borne by the Applicant, regardless of the day or time at which the connection work is performed. Pressure testing against closed, resilient-seated gate valves shall be done at Applicant's risk. The District assumes no liability for Applicant's additional costs resulting from District-furnished valves which are found to be leaking during pressure testing.
5. Applicant Only: Give a minimum 5 working day written notification to the Engineer to schedule any flushing and connection operations to be performed.

B. Shutdowns of Existing In-Service Pipelines and Other Distribution Facilities:

1. District personnel will operate all valves in the service system for shutdown.
2. Shutdowns shall be scheduled, for as short a period as possible, during a regular working day unless ordered otherwise by the Engineer.
3. Shutdowns shall cause minimum interference with the operation of the District's distribution system.
4. Connection work shall be completed without interruption.
5. Schedule of shutdown and connection operations shall be prepared jointly by the Contractor and the Engineer.
6. Applicant only: When shutdowns exceed their scheduled time limits and there is no improvement shown in the progress of the work, the District reserves the right to bring in its own crew to complete the connection and restoration of water service and to backcharge the Applicant for all of the associated costs.

C. Existing Mains that are Provided with Fittings for Connecting to New Main:

1. Flush blowoff on existing main and install sample tap 5 days prior to connection.
 2. Remove plug or bulkhead from existing main.
 3. Remove dished heads or ring-tight plugs after new main is satisfactorily pressure tested and chlorinated, if applicable.
 4. Clean and disinfect the ends. Swab or spray the interior of connection pipe with a 1 percent hypochlorite solution.
 5. Make connection.
 6. Restore water service to existing main. Flush and sample.
 7. Repair protective coating, as necessary.
- D. Existing Mains that are not Provided with Fittings for Connecting to New Main:
1. Flush blowoff on existing main and install sample tap 5 days prior to connection.
 2. Remove the required amount of existing pipe.
 3. Remove dished heads or ring-tight plugs after new main is satisfactorily pressure tested and chlorinated, if applicable.
 4. Make connection by means of fittings and pipe.
 5. Restore water service to existing main. Flush and sample.
 6. Apply necessary protective coating.
- E. If new pipeline is isolated for pressure test and chlorination, final connection piping shall be less than 6 feet in length and shall be thoroughly disinfected prior to installation. Flush and request sampling by the District. See Article 3.8 C.
- F. Collars and rods shall be used on all plugs.
- G. Cement Lining: See Section 02513.1, Article 3.9.
- H. Mortar Coating (ML&CS) Pipe: See Section 02513.1, Article 3.10.
1. Valves, fittings, branches, and damaged areas:
 - a. Hand plaster with mortar.
 - b. Repair original damaged coating.

- c. Bond new coating to old with epoxy or adhesive under strong pressure to provide coating of thickness of pipe coating.
- d. If the existing ML&CS pipe is wrapped with polywrap or a similar material, install polywrap in accordance with Section 06066.1.

3.7 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. Test Equipment Set-up:

1. Contractor shall furnish hoses, pumps, pressure gauges, leakage measuring device, connections, relief valves, other necessary apparatus, and personnel required for making the tests.
2. The pressure gauge shall register pressure in pounds per square inch gauge (psig). The range of the gauge shall be from 0 psig to $((1.5 \times \text{test pressure}) + 50.0)$ psig. The gauge face shall have a 1 psig increment inscribed. The gauge shall be calibrated within 45 days prior to the hydrostatic test and the calibration tag affixed to the gauge.
3. The gauge assembly shall be equipped with a 3/4" hose bib and isolation valve to allow the Engineer to install a second gauge and pressure monitoring device.
4. District may test pressure gauges for accuracy.

B. General:

1. Applicant only: Give a 5 working day minimum written notification to the Engineer to schedule filling and testing of the pipeline. The Applicant is not allowed to fill the pipeline until the submittals of Article 1.3 have been submitted and reviewed by the Engineer.
2. Hydrostatic pressure and leakage test shall be performed in the presence of the Engineer.
3. Pipeline may be divided into sections and tested in stages as approved by the Engineer.
4. Test shall be scheduled to begin and be completed during weekday (Monday - Friday) working hours.

C. Before Testing:

1. All appurtenances shall be completed and shall be tested concurrently.

2. Interior of the pipeline shall be thoroughly cleaned and flushed with water for 1-2 minutes immediately prior to actual testing.
3. Trench backfill, except permanent pavement, shall be installed, compacted, and tested to the satisfaction of the Engineer.
4. Concrete thrust or reaction blocks shall be cured for at least seven days. The time required may be reduced if additional restraint, approved by the Engineer, is provided.

D. Filling the Pipeline:

1. All air vents and fire hydrants shall be open during the filling of the pipeline with water.
2. For mortar-lined pipe only: After a test section is completely filled, and air vents and fire hydrants closed, the pipeline shall be allowed to stand under pressure for a minimum of 24 hours, to allow the lining to absorb water and permit the escape of air.
3. Examine valves and exposed connections for leaks during this period. Repair all visible or known leaks.

E. Hydrostatic Pressure and Leakage Test:

1. For physically-isolated pipeline only: After filling the pipe, the filling apparatus shall be either disconnected or physically isolated from the pipeline.
2. All points in the pipeline being tested shall be subject to a minimum pressure of:
 - a. 150 psi for polyvinyl chloride pipe.
 - b. 175 psi or 125% of working pressure at that point, whichever is greater, for steel pipe.
3. Raise the pipeline pressure to the initial test pressure by means of a pump connected to the pipe in a manner satisfactory to the Engineer.
4. For 16" and 20" pipe:
 - a. The pipeline pressure shall be maintained within 10 psig of the test pressure for a period of 24 hours. At no time shall the pressure be allowed to drop more than 10 psig below the test pressure. At the end of the test period, the pressure shall be brought back to the test pressure for determining the total leakage or as specified by the Engineer.

5. For all other pipe:
 - a. Maintain pressure within 10 psig of the initial test pressure specified for 30 minutes. Then reduce pressure to line pressure.
 - b. Repeat 3. above.
 - c. Maintain test pressure within 10 psig of the initial test pressure specified for two hours minimum. At the end of the test period, bring pressure back to the initial test pressure to determine total leakage.
6. An inspection for leaks along the pipeline shall be made by the Contractor while pipe is under pressure and in the presence of the Engineer.
7. Any leaks found shall be recorded by the Contractor and record provided to the District.
8. Use of sound level meter for detecting leaks in the pipeline and its results will not relieve Contractor of responsibilities for furnishing a pipeline which will pass the leakage test.
9. Measured leakage for the pipe is the total quantity of water required to be pumped into the pipeline to maintain the test pressure specified during the respective 24-hour or 2-hour test and to bring pressure back to the initial test pressure less the measured leakage through the bulkheads and exposed connections.
10. For successful completion of the test, the measured leakage shall not exceed:
 - a. 7.5 gallons per inch of inside diameter per mile of pipe per 24 hours for PVC pipe 6" and larger.
 - b. 1.5 gallons per inch of inside diameter per mile of pipe per 24 hours for steel pipe and 2" PVC pipe.

F. Repairs and Retests:

1. Repair all known leaks and retest the pipe until the hydrostatic pressure and leakage test is successfully completed.
2. Any damage to the protective lining and coating of the pipe and to the caulking or jointing material after the testing shall be repaired.
3. Repairs shall be made subject to the approval of the Engineer.

4. Excavate where required to locate and repair leaks or other defects that develop under the test.
 - a. Remove backfill and paving already placed.
 - b. After repairs, backfill and pave in same manner as initial work.

3.8 FLUSHING AND CHLORINATING

- A. Flushing and chlorinating shall be conducted only after the successful completion of the hydrostatic pressure and leakage test.

Applicant only:

1. Give a written minimum 5 working day notification to the Engineer to schedule flushing and chlorinating operations.
 - a. Schedule shall allow delivery of samples to the District's Laboratory Services Division in Oakland before 2:00 p.m. Monday through Friday, on day samples are taken.
2. Give 24-hour telephone notification to confirm scheduling of the Engineer to witness all phases of flushing and chlorination and dechlorination procedures.
3. Applicant shall not perform flushing, chlorinating, or dechlorinating without the presence of the Engineer.
4. Applicant shall not chlorinate or sample the new pipeline on weekends, District holidays, or outside the hours of 7:00 am - 4:30 pm. See General Conditions, Article 4.

B. Contractor shall:

1. Make necessary piping connections.
 - a. Install District-furnished chlorination taps for injection of chlorine at locations designated by the Engineer.
 - b. Install temporary blowoffs at every 1,000 feet of pipeline or at locations designated by the District. Each temporary blowoff shall be equipped with a sample tap. See sample tap installation drawing, Appendix A. Sample taps, once installed, shall remain on the blowoffs until water quality test results are satisfactory to the Engineer.
 - c. Temporary blowoffs shall permit adequate flushing of the main. The minimum size of blowoffs and minimum number of outlets shall be:

DIAMETER OF MAIN TO BE FLUSHED	REQUIRED BLOWOFF DIAMETER	NUMBER OF OUTLETS
2"	2"	1
4"	2"	1
6"	4"	1
8"	4"	2
12"	4"	3
16"	6"	4
20"	6"	8

Use 2-1/2" fire hose and dissipator on each outlet.

- d. Remove temporary chlorinating and flushing assemblies when water quality test results are satisfactory to the Engineer. Removal shall be accomplished in the presence of the Engineer. Return District-furnished chlorination taps to the Engineer.
2. Flush and chlorinate the pipeline in accordance with AWWA C 651, AWWA Standard for Disinfecting Water Mains (latest edition).
 - a. Use Sodium Hypochlorite per Section 4.1.2 of AWWA C 651. Sodium hypochlorite to be used for chlorinating shall be NSF/ANSI 60 certified. Available chlorine shall be 12-1/2% to 13% by volume. Sodium hypochlorite shall be stored out of sunlight.
 - b. Use Continuous Feed Method of Section 4.4 of AWWA C 651. The main shall be flushed until at least all of the water in the line has been replaced once and for such additional time as may be required for the blowoff water to flow clean.
 - c. Pump shall have a pumping capacity range up to 24 GPH. The use of a high pressure/high capacity pump to inject chlorine is prohibited. Pump shall be Chem-O-Feeder Model No. 1210 Simplex or duplex Series type pump or approved equal.
 - d. Provide an eyewash station that complies with ANSI Z358.1(1998) regulations onsite during the chlorination.
 3. Connect to water source, convey to piping, and dispose of water during flushing without flooding, inundating or damaging any property, or harming the environment with the chlorinated water.
 - a. See Section 4.5 and Appendix C of AWWA C 651 for disposal of heavily chlorinated water.

- b. Water to be discharged shall meet the requirements of Section 01000.1, Article 1.5.B., Discharged Water.
4. Provide English-speaking personnel on the job to work with the Engineer at all times during flushing, chlorinating, dechlorinating, and sampling. There shall be radio communication between injection pump operator and personnel operating blow-offs and valves.
5. Operate valves, under District direction, and provide other necessary assistance to the District. System gate valves are to be operated only by the District.
6. Cover fire hydrant openings with plastic bags to prohibit usage prior to chlorination. Cover to remain in place until water quality test results are satisfactory to the Engineer.
7. Applicant only: Prior to chlorination set up sample points on the existing source main in accordance with approved chlorination and flushing plan to ensure that the existing system chlorine residual is maintained during the chlorination process. Check chlorine residual in source main continuously during chlorination as directed by the Engineer and again, once all chlorination equipment is disconnected from the chlorination tap to ensure that the source water is left at a safe level.
8. Immediately after chlorination, relieve pressure on the chlorinated main, through proper discharges, to a pressure lower than the pressure of the source water at the source connection by a minimum of 10 psi or as directed by the Engineer.

C. District will:

1. Designate locations for chlorination taps and temporary blowoffs.
2. Take a source sample after proper notification by the Contractor:
 - a. Prior to initial chlorination and filling.
 - b. Each time the tract is fully sampled.
3. Direct and control the operation of valves at all times.
4. Sample and test the water to determine if it meets the following required water quality standards:
 - a. Coliform Bacteria: Absence of coliforms as interpreted by the enzyme substrate assay technique in accordance with Procedure 9223B of Standard Methods for the Examination of Water and Wastewater.

- b. Chlorine Residual: Chlorine residual equivalent to the source water reading or at an acceptable level determined by the District as interpreted by the N,N-Diethyl-p-phenylenediamine (DPD) colorimetric method in accordance with Procedure 4500-Cl G of Standard Methods for the Examination of Water and Wastewater.

5. Notify the Contractor of test results within 3 working days after sampling.

D. Flushing/Chlorinating/Testing Operations:

1. These operations normally take about five working days.
2. If the test results indicate that:
 - a. Following chlorination, if chlorine readings indicate that the residual chlorine has not been lowered to a level equivalent to the source water or at a higher level determined to be acceptable by the District, then, the Contractor has to continue flushing to bring the residual chlorine level down to the acceptable level.
 - b. Following reflush, if chlorine readings indicate that the residual chlorine is less than a level equivalent to the source water or at a lesser level determined to be acceptable by the District, the Contractor shall flush until water equal to a minimum of 1 1/2 times the volume of the new pipe has been displaced.
 - c. Such conditions, encountered in a and b above, may require that the collection of bacteriological samples has to be rescheduled at a later date.
3. Applicant only: All costs for resampling and retesting shall be borne by the Applicant unless it is determined by the Engineer that the need for resampling and retesting is not the fault of the Applicant.

3.9 SALVAGE OR ABANDONMENT OF EXISTING FACILITIES

- A. Abandon existing facilities as indicated on the drawings (usually RFS - remove from service sketches).
- B. Plug ends of abandoned pipelines with concrete. Fill pipe with concrete to 12" from end minimum.
- C. Valves:
 1. Salvage valve pot covers over abandoned valves.

2. Cut and remove top 4" of abandoned valve pots and fill with Class II aggregate base rock, compact in same manner as trench backfill and install permanent asphalt paving.

D. Hydrants:

1. Close hydrant valve in street and comply with Paragraph C.
2. Salvage hydrant bodies.
3. Remove upper portion of the hydrant ell or extension to minimum 6" below existing ground.
4. Fill remaining portion of ell with concrete.

E. Air Valves:

1. Salvage valves and boxes. If valve box is located in sidewalk, remove box in its entirety and repair sidewalk satisfactory to the agency having jurisdiction.

F. Test Stations:

1. Remove and dispose.

G. Markers:

1. Remove locating markers and/or curb markers.

H. Materials Salvaged:

1. Deliver and unload at the District's Oakport Storage Center, 5601 Oakport Street, Oakland, California.

END OF SECTION

SECTION 02512.1

INSTALLATION OF ML&PCS PIPE - 20" AND SMALLER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Installation of mortar lined and plastic coated steel pipe (ML&PCS), 20" nominal diameter and smaller.
- B. Related Sections:
 - 1. Section 02316.1 - Trenching, Backfilling, and Compacting
 - 2. Section 02511.1 - Miscellaneous Installation Requirements
 - 3. Section 03376.1 - Concrete for Pipeline Installation
 - 4. Section 05095.1 - Pipe Welding
 - 5. Section 05097.1 - Flange Bolting
 - 6. Section 05610.1 - Fabrication of 20" ML&TWS Pipe (Applicant-Only)
 - 7. Section 06066.1 - Polywrap
 - 8. Section 09961.1 – Protection from Corrosion
- C. Definition: ML&PCS is cement mortar lined steel pipe and may be either extruded plastic coated or plastic tape wrapped. Project drawings usually refer to pipe 16" and smaller as ML&PCS, larger pipe as ML&TWS.

1.2 REFERENCES

- A. AWWA C209: AWWA Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
- B. ASTM C 33: Specification for Concrete Aggregates.
- C. ASTM C 150: Specification for Portland Cement.

1.3 PIPE HANDLING, TRANSPORTING, AND STORAGE

- A. Do not damage lining or coating during handling, transporting, or storage.
- B. Transporting Pipe:
 - 1. Block pipe to prevent shifting.
 - 2. Use padded blocking, padded cables, and padded chains for securing the load.
- C. Storage at the Jobsite Prior to Laying:
 - 1. Store pipe in a manner safe to the public and in accordance with the local agency requirements.
 - 2. Use specially prepared ground, padded skids, cradles, or sand bags to support pipe.
 - 3. Keep interior of all pipe, fittings, and appurtenances free of dirt or foreign matter. Maintain pipe end covers until installation in the trench.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS FURNISHED BY THE DISTRICT

- A. Sixteen-inch nominal diameter and smaller.
- B. Steel pipe will normally be furnished in 40-foot sections, lined with cement mortar to the end of the section, and coated with extruded plastic, or plastic tape wrapped to within a few inches of the end of the section as shown on the drawings.
- C. Steel pipe fittings will be furnished as shown on the drawings.

2.2 STEEL PIPE AND FITTINGS FURNISHED BY APPLICANT

- A. Twenty-inch nominal diameter.
- B. Steel Pipe:
 - 1. Section 05610.1.
- C. Steel Pipe Fittings:
 - 1. Drawing 309-EA.

2. Cement mortar lined in accordance with AWWA C104.
 - a. Lining thickness in accordance with Drawing 1884-A.
 - b. No seal coat.

2.3 STEEL PIPE CASING

- A. The casing shall be new plain straight cylinder steel pipe with outside diameter and wall thickness not less than shown on the drawings. Spiral welded seams are not permitted.
 1. Each end shall be beveled to $35^{\circ} \pm 2^{\circ}$ and leaving a root face of $1/8" \pm 1/32"$ for butt welding. All butt welds shall be complete joint penetration.
 2. The butt welds in the casing pipe and field joints will be subject to ultra sonic inspection in accordance with ASME Volume VIII Appendix 12.
- B. The casing pipe shall be ASTM A53 grade B Steel Pipe, Black or Hot-Dipped Zinc-Coated, Welded or Seamless; A134 Steel Pipe, Electric-Fusion (ARC)-Welded (Sizes NPS 16 and Over); A139 grade B or C, Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over); API 5L grade B, Line Pipe; ASTM A671 Steel Pipe, class 10, grade 60, 65, or 70.

2.4 FIELD MORTAR LINING

- A. Portland Cement:
 1. ASTM C 150, Type II or Type V.
 2. Shall contain not more than 0.60% alkalis calculated as the percentage of sodium oxide plus 0.658 times the percentage of potassium oxide.
- B. Sand:
 1. ASTM C 33.
 2. Fineness modulus: Lining 2.50 - 3.00.
 3. Sand equivalent:
 - a. California Test 217.
 - b. Average of three successive tests shall be not less than 75 and no individual samples shall be less than 70.

2.5 FIELD COATINGS

A. Spirally wrapped pipe tape:

1. Tape shall conform to AWWA C209, Type II.
2. For Applicant supplied pipe, tape coatings shall be products of the manufacturer of the shop applied tape coating and shall be recommended by the manufacturer for use as a field applied tape.
3. The tape shall be resistant to ultraviolet light degradation.
4. Acceptable products:
 - a. Polyken 930 tape and Polyken 1027 primer.
 - b. Tek-Rap 270 Series and Tek-Rap 200 Series primer.
 - c. Tapecoat CT and TC Coldprime.
 - d. Wrap-tite WT 330-35 tape and WT27EF primer available from Protection Engineering, Pittsburg, CA (925) 427-6200.
 - e. Or equal as approved by the Engineer.
5. Minimum tape thickness: 35 mils.
6. Tape width: As recommended by the tape manufacturer for the pipe diameter but not less than 2" and no more than 4" wide.

B. Mastic: See Section 09961.1.

C. Polywrap: See Section 06066.1.

2.6 CASING INSULATORS

A. Acceptable products:

1. Available from Calpico, Inc., South San Francisco, (650) 588-2241. See drawings for specific model number.
2. Or equal as approved by the Engineer.

2.7 CASING END SEALS

A. Acceptable products:

1. TDW Z-Seal, available from T. D. Williamson Inc., Concord, CA, (510) 687-2484.
2. Calpico Model C, available from Calpico, Inc., South San Francisco, (650) 588-2241.
3. Or equal as approved by the Engineer.

PART 3 - EXECUTION

3.1 PLACING PIPE IN TRENCHES

- A. Maximum length of pipe placed in the trench shall be limited to a single length of shop-fabricated pipe. Do not use steel cables or chains. Double position straps are required for proper support and protection of pipe.
- B. Do not install water mains in the same trench with other utilities without approval of the Engineer.
- C. Pipe interior shall be clean and free of dirt and debris, and shall be maintained in the same manner during and after installation.
- D. Install pipeline with a minimum cover of 36" below finished grade. Pipelines 16" and greater shall have a minimum cover of 42" below finished grade. Maximum cover shall be 48" or as directed by the Engineer.
- E. Allow inspection by Engineer of the underside of the pipe, prior to lowering pipe into trench. Repair any defects.
- F. Pipe shall have uniform bearing on compacted Class I backfill except at bell holes for field joints and at locations where excavation below grade for the pipe has been performed to provide for required structures. Laying of pipe is permitted on specially prepared mounds equally spaced to allow testing and repair of coating. Remove all blocking from under pipe prior to commencement of backfilling.
- G. Straight sections of pipe shall be cut:
 1. To provide closure pieces of correct length.
 2. To permit the proper location of the pipe sections.
 3. To locate valve, fittings, and appurtenant structures.

- H. At the end of each working day when pipe laying operations are not in progress, watertight plugs shall be installed for closure of open ends of pipeline, and covered with backfill material.

3.2 OBSTACLES IN THE WAY

A. Alignment and Elevation:

1. The clearance from existing utilities (pipelines, conduits, cables, and structures) shall be a minimum of 12" vertical and 5' horizontal, unless approved otherwise by the Engineer.
2. When 12" vertical clearance cannot be obtained, install shield between steel pipeline and existing metallic utility. See Drawing 308-EA.

B. Locating Utilities:

1. See Section 02316.1.

C. Changes in Alignment and Elevation:

1. Engineer may make adjustments as required during the progress of the work.
2. Contractor shall perform additional fabrication and installation work as required per Drawing 1870-A. If pipeline cover at utility crossings is less than 30", a 6" concrete cap is required. Install per District standards unless directed otherwise by the Engineer.

3.3 FIELD CUTS

A. Before cutting pipe remove lining and coating back from the line of cut as shown on pipe detail drawings.

1. Use care to avoid injury to the lining and coating beyond the area removed.
2. Remove and replace loosened, damaged, or broken lining or coating.

3.4 FIELD JOINTS

A. See Drawing 310-EA.

B. Longitudinal or spiral seams of the two adjoining pipes shall be offset by minimum of 2".

C. Girth Joints:

1. Remove temporary protective coating from hold-back at pipe ends. Surfaces to be joined shall be thoroughly cleaned prior to assembling the joint.
2. The clearance between outside of the spigot and inside of the bell or clearance between butt strap and pipe shall not exceed 1/16" at any location during welding operations.
3. Fit butt straps tightly against the pipe and cut to proper length. Bevel ends if thickness is greater than 1/4".

D. Coat after welding and District approval of weld. Forced cooling of welds is not permitted.

E. Flanged Joints:

1. Gasket and bolting criteria: See Drawings 323-EA, 324-EA and 325-EA.
2. Use an approved thread lubricant on all flange bolt threads.
3. Bolt up torque requirements per Standard drawing 323-EA, 324-EA 325-EA.

F. Insulating Joints:

1. See Drawings 3186-B, and 3446-GB.
2. Prior to backfill, verify that insulating joint is functioning properly. Test with a Gas Electronics Model 601 Insulation Checker in the presence of the Engineer. Make repairs and re-test the insulating joint as necessary until verification of its proper functioning is made.

3.5 PIPE INSTALLATION IN CASING

A. The pipe shall be electrically isolated from the tunnel casing.

1. Install casing insulators on the pipeline, two feet inside each end of casing, and at 10 feet on center (maximum) for the length of casing.

B. Pipe casing shall be welded together in accordance with requirements indicated on the drawings.

- C. Casing end seals shall be installed as recommended by the manufacturer of the end seals.

3.6 CONNECTIONS (NOZZLES)

- A. See Drawing 238-EA.
- B. Coat after welding and District inspection of weld.

3.7 BLOWOFFS

- A. Install size on size main-line valve with 4" blowoff in accordance with Drawing 332-EA at locations shown on the drawings or as specified by the Engineer.
- B. Install 4" blowoff assembly in accordance with Drawing 169-EA at locations shown on the drawings or as specified by the Engineer.
- C. Install 6" blowoff and pumping tee in accordance with Drawing 199-EA at locations shown on the drawings or as specified by the Engineer.

3.8 AIR VALVES

- A. Install 1" and 2" air and vacuum and air release valves in accordance with Drawing 189-EA at the locations shown on the drawings or as specified by the Engineer.

3.9 MORTAR LINING REPAIRS

- A. Cement Mortar: Mix proportions shall be approximately one part cement to three parts sand by weight.
- B. Where the mortar lining is not flush with the end of the pipe, lining shall be completed to the end of each pipe and allowed to set before making up the joints at butt-welded joints, and at the spigot of bell and spigot joints.
- C. Thoroughly clean steel plate.
- D. Bond existing mortar to new mortar with an epoxy or adhesive bonding agent.
- E. Mortar shall be applied:
 - 1. With plaster's finishing trowel.
 - 2. To same thickness as adjacent lining.

3. Obtaining a firm bond.

F. The lining at repaired areas:

1. Shall be as smooth in texture as the general pipe lining.
2. Shall be completely free of checks and cracks.

3.10 FIELD COATING

A. General:

1. Conform to the requirements of AWWA C209 unless specified otherwise.
2. Completed pipeline shall have a continuous insulating coating free of holidays and other defects.
3. Coat field girth joints, valves, fittings and branches.
4. Repair damaged original pipe coating.
5. Workers walking on the pipe shall not wear shoes that will damage the coating.

B. Preparation for Field Coating:

1. After completion of inspection of field welding:
 - a. Grind off all sharp projections and grind round all edges.
 - b. Wire brush to remove dirt, rust, and scale.
 - c. Degrease bare steel surfaces and 4" of adjacent coating using solvent and clean rags.

C. Field Coating Girth Joints, Elbows and Tees and Pipeline Appurtenances

1. Spirally wrapped pipe tape:
 - a. Prime in accordance with tape manufacturer's recommendations. Prior to primer application, ensure all welds are cool to the touch.
 - b. Spiral wrap tape onto pipe, lapping as required to provide the specified minimum applied thickness. Apply tape with sufficient tension to conform to surface irregularities and in accordance with manufacturer's instructions.

- c. Minimum applied thickness: 50 mils for 16" and smaller pipe; 80 mils for 20" pipe.
 2. Overlap adjacent existing plastic coating 3" minimum.
- D. Field coating of valves and fittings that are not epoxy-coated:
 1. Valves and fittings, including bolted flanges, flexible couplings, and nozzles, shall be mastic coated and polywrapped.
 - a. Coat with mastic.
 - b. Cover with polywrap, overlapping adjacent pipe coating one foot minimum, and tape wrap ends of polywrap to pipe.
- E. Inspection of Field Coatings:
 1. Visually inspect shop applied coatings and repair defects.
 2. Visually inspect coatings on valves and fittings.
 3. Inspect all completed coatings for holidays just prior to lowering pipe into trench. Use high-voltage flaw detector.
 4. Test pipe coatings and field girth joint coatings with Contractor-furnished high-voltage flaw detector (Tinker Razor, Model A.P.W. or A.P., or equal as approved by the Engineer) in accordance with National Association of Corrosion Engineers International Standard Practice RP-02.74, "High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation". Test in presence of Engineer. High-voltage flaw detectors: Available from Tinkor & Razor Co. San Gabriel, CA (626) 287-5259 or Farwest Corrosion Control Bakersfield, CA (661) 323-2077.
 - a. For 50 mil plastic coating, test voltage shall be 8,000-9,000 volts.
 - b. For 80 mil plastic coating, test voltage shall be 10,000-11,000 volts.
- F. Repair of Coatings:
 1. Pipe shop coatings and field girth joint coatings:
 - a. Minor damaged areas: Remove loose and torn coating before patching. Apply tape patch, with primer, to damaged area, and follow with one complete wrapping of tape around pipe.

- b. Extensively damaged areas may require complete removal of damaged coating and repair by girth joint wrapping in accordance with Paragraphs B and C above, at the option of the Engineer.
2. Coatings on valves and fittings:
- a. Minor damaged areas - touch up with mastic. Allow mastic to dry or protect with polywrap prior to backfill.
 - b. Extensively damaged areas may require complete recoating of the part in the shop at the option of the Engineer.

3.11 GALVANIC ANODES AND TEST STATIONS

- A. Install galvanic anode with test station in accordance with Drawing 286-EA Figure A at locations shown on the drawings.
- B. Install galvanic anode without test station in accordance with Drawing 286-EA Figure B when specified on the drawings.
- C. Install test station without galvanic anode in accordance with Drawing 285-EA at locations shown on the drawings.

3.12 IDENTIFICATION TAPE

- A. Non-detectable 3" blue tape, black-imprinted with "CAUTION - BURIED LINE BELOW" shall be installed as follows:
 - 1. Install tape approximately, but not less than, 1 foot above and along the centerline of the installed pipe.
 - 2. If the tape is not continuous, the tape ends shall be overlapped by 2 feet.

END OF SECTION

SECTION 02513.1

INSTALLATION OF ML&CS PIPE - 20" AND SMALLER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes: Installation of cement mortar lined and coated steel (ML&CS) Pipe, 20 inches nominal diameter and smaller.
- B. Related Sections:
 - 1. Section 02316.1 - Trenching, Backfilling, and Compacting.
 - 2. Section 02511.1 - Miscellaneous Installation Requirements.
 - 3. Section 03376.1 - Concrete for Pipeline Installation.
 - 4. Section 05095.1 - Pipe Welding.
 - 5. Section 05097.1 - Flange Bolting
 - 6. Section 06066.1 - Polywrap.

1.2 REFERENCES

- A. ASTM C 33: Specification for Concrete Aggregates.
- B. ASTM C 150: Specification for Portland Cement.
- C. ASTM A 185: Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Handling and Transporting of pipe sections:
 - 1. Lining or coating shall not be damaged.
 - 2. Block pipe to prevent shifting.
 - 3. Use padded blocking, cables, and chains for securing the load.
- B. Storage at jobsite prior to laying:
 - 1. Store pipe in a manner safe to the public and in accordance with the local agency permit.

2. Keep interior of all pipe, fittings, and appurtenances free of dirt and other foreign matter. Maintain pipe end covers until installation in the trench.
3. Store pipe in a manner such that neither the coating or lining will be damaged.
4. Use specially prepared ground, padded skids, cradles, or sand bags to support pipe.

PART 2 - PRODUCTS

2.1 STEEL PIPE CASING

- A. The casing shall be new plain straight cylinder steel pipe with outside diameter and wall thickness not less than shown on the drawings. Spiral welded seams are not permitted.
 1. Each end shall be beveled to $35^{\circ} \pm 2^{\circ}$ and leaving a root face of $1/8" \pm 1/32"$ for butt welding. All butt welds shall be complete joint penetration.
 2. The butt welds in the casing pipe and field joints will be subject to ultra sonic inspection in accordance with ASME Volume VIII Appendix 12.
- B. The casing pipe shall be ASTM A53 grade B Steel Pipe, Black or Hot-Dipped Zinc-Coated, Welded or Seamless; A134 Steel Pipe, Electric-Fusion (ARC)-Welded (Sizes NPS 16 and Over); A139 grade B or C, Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over); API 5L grade B, Line Pipe; ASTM A671 class 10, grade 60, 65 or 70.

2.2 FIELD INSTALLED MORTAR

- A. Portland cement:
 1. ASTM C 150, Type II, Low Alkali,
- B. Shall contain not more than 0.60 percent alkalis calculated as the percentage of sodium oxide plus 0.658 times the percentage of potassium oxide.
- C. Sand:
 1. ASTM C 33
 2. Fineness modulus:
 - a. Coating: 2.70 - 3.20.
 - b. Lining: 2.50 - 3.00
 3. Sand equivalent:

- a. California Test 217.
- b. Average of three successive tests shall be not less than 75 and no individual samples shall be less than 70.

2.3 REINFORCEMENT FOR CEMENT MORTAR

- A. Welded wire fabric, ASTM A 185, 2" x 4", WO.5 x WO.5, galvanized.
 1. Self furring for coating.
 2. Flat for lining.

2.4 CASING INSULATORS

- A. Acceptable products:
 1. Available from Calpico, Inc., South San Francisco, (650) 588-2241. See drawings for specific model no.
 2. Or equal as approved by the Engineer.

2.5 CASING END SEALS

- A. Acceptable products:
 1. TDW Z-Seal, available from T. D. Williamson Inc., Concord, CA, (510) 687-2484.
 2. Calpico Model C, available from Calpico, Inc., South San Francisco, (650) 588-2241.
 3. Or equal as approved by the Engineer.

PART 3 - EXECUTION

3.1 PLACING PIPE IN TRENCHES

- A. Maximum length of pipe placed in the trench shall be limited to a single length of shop-fabricated pipe. Do not use steel cables or chains. Double position straps are required for proper support and protection of pipe.
- B. Do not install water mains in the same trench with other utilities without approval of the Engineer.
- C. Pipe interior shall be clean and free of dirt and debris, and shall be maintained in the same manner during and after installation.

- D. Install pipeline with a minimum cover of 36" below finished grade. Pipelines 16" and greater shall have a minimum cover of 42" below finished grade. Maximum cover shall be 48" or as directed by the Engineer.
- E. Allow inspection by Engineer of the underside of the pipe before lowering pipe into trench. Repair any defects.
- F. Pipe shall have uniform bearing on compacted Class I backfill except at bell holes for field joints and at locations where excavation below grade for the pipe has been performed to provide for required structures. Laying of pipe is permitted on specially prepared mounds equally spaced to allow testing and repair of coating. Remove all blocking from under pipe prior to commencement of backfilling.
- G. Straight sections of pipe shall be cut:
 - 1. To provide closure pieces of correct length.
 - 2. To permit the proper location of the pipe sections.
 - 3. To locate valves, fittings, and appurtenant structures.
- H. At the end of each working day when pipe laying operations are not in progress, watertight plugs shall be installed for closure of open ends of pipeline, and covered with backfill material.

3.2 OBSTACLES IN THE WAY

- A. Alignment and elevation:
 - 1. The clearance from existing utilities (pipelines, conduits, cables, and structures) shall be a minimum of 12 inches vertical and 5' horizontal, unless approved otherwise by the Engineer.
 - 2. When 12-inch vertical clearance cannot be obtained, install shield between steel pipeline and existing metallic utility. See Drawing 308-EA.
- B. Locating utilities:
 - 1. See Section 02316.1.
- C. Changes in alignment and elevation:
 - 1. Engineer may make adjustments as required during the progress of the work.
 - 2. Contractor shall perform additional fabrication and installation work as required per Drawing 1870-A. If pipeline cover at utility crossings is less than

30", a 6" concrete cap is required. Install per District standards unless directed otherwise by the Engineer.

3.3 FIELD CUTS

- A. Before cutting pipe, remove lining and coating back from the line of cut as shown on pipe detail drawings.
 - 1. Use care to avoid injury to the lining and coating beyond the area removed.
 - 2. Remove and replace loosened, damaged, or broken lining or coating.

3.4 FIELD JOINTS

- A. See Drawing 237-EA.
- B. Longitudinal or spiral seams of the two adjoining pipes shall be offset 2" minimum.
- C. Girth joints:
 - 1. Surfaces to be joined shall be thoroughly cleaned prior to assembling the joint.
 - 2. Clearance between outside of the spigot and inside of the bell or clearance between butt strap and pipe shall not exceed 1/16 inch at any location during welding operations.
 - 3. Fit butt straps tightly against the pipe and cut to proper length. Bevel ends if thickness is greater than 1/4".
- D. Coat after welding and District approval of weld. Forced cooling of welds is not permitted.
- E. Flanged joints:
 - 1. Gasket and bolting criteria: See Drawings 323-EA, 324-EA and 325-EA.
 - 2. Use an approved thread lubricant on all flange bolt threads.
 - 3. Bolt up torque requirements per Standard drawing 323-EA, 324-EA and 325-EA.
- F. Insulating joints:
 - 1. See Drawings 3186-B, and 3446-GB.
 - 2. Prior to backfill, verify that insulating joint is functioning properly. Test with a Gas Electronics Model 601 Insulation Checker in the presence of the Engineer.

3.5 PIPE INSTALLATION IN CASING

- A. The pipe shall be electrically isolated from the tunnel casing.
 - 1. Install casing insulators on the pipeline, two feet inside each end of casing, and at 10 feet on center (maximum) for the length of casing.
- B. Pipe casing shall be welded together in accordance with requirements indicated on the drawings.
- C. Casing end seals shall be installed as recommended by the manufacturer of the end seals.

3.6 CONNECTIONS (NOZZLES)

- A. See Drawing 238-EA.
- B. Coat after welding and District inspection of weld.

3.7 BLOWOFFS

- A. Install size on size main-line valve with 4" blowoff in accordance with Drawing 332-EA at locations shown on the drawings or as specified by the Engineer.
- B. Install 4" blowoff assembly in accordance with Drawing 169-EA or 332-EA at locations shown on the drawings or as specified by the Engineer.
- C. Install 6" blowoff and pumping tee in accordance with Drawing 199-EA at locations shown on the drawings or as specified by the Engineer.

3.8 AIR VALVES

- A. Install 1" and 2" air and vacuum and air release valves per Drawing 189-EA, at the locations indicated on the drawings or as specified by the Engineer.
- B. Install 4" air and vacuum and air release valve per Drawing 333-EA at the locations indicated on the drawings or as specified by the Engineer.

3.9 MORTAR LINING REPAIRS

- A. Cement Mortar: Mix proportions shall be approximately one part cement to three parts sand by weight or an Engineer-approved pre-mixed cement mortar.
- B. Where the mortar lining is not flush with the end of the pipe, lining shall be completed to the end of each pipe and allowed to set before making up the joints at butt-welded joints, and at the spigot of bell and spigot joints.

- C. Thoroughly clean steel plate.
- D. Bond existing mortar to new mortar with an epoxy or adhesive bonding agent.
- E. Mortar shall be applied:
 - 1. With plasterer's finishing trowel.
 - 2. To same thickness as adjacent lining.
 - 3. Obtaining a firm bond.
- F. The lining at repaired areas:
 - 1. Shall be as smooth in texture as the general pipe lining.
 - 2. Shall be completely free of checks and cracks.

3.10 FIELD MORTAR COATING

- A. General:
 - 1. Completed pipeline shall have a sound, continuous, and unbroken coating of reinforced cement mortar.
 - 2. All field girth joints and fittings shall be coated.
 - 3. Damaged original coating shall be repaired.
- B. Field girth joints:
 - 1. After completion and inspection of welding by Engineer, coat as shown on the drawings.
 - 2. Clean to assure adhesion of mortar.
 - 3. Do not apply mortar against hot welds.
 - 4. Field applied mortar coating shall be reinforced with self-furring welded wire fabric tack welded to the steel cylinder.
 - 5. Mortar applied with diapers:
 - a. Use diaper wherever possible.
 - b. Diaper shall be wide enough to span the joint plus 2 inches minimum on each side and long enough to overlap 8 inches minimum on top.

- c. Cut flaps through the layers of overlapped diaper liner to form a grouting gate.
 - d. Fill diapers from one side only.
 - e. Use flexible wire to remove air pockets.
 - f. Hand plaster top of joint.
 - g. Leave diapers in place.
6. Apply mortar by hand where diaper not used.
- a. Use strong pressure to provide a dense coating of the thickness shown on the drawings.
 - b. Apply an epoxy or adhesive bonding agent to bond new mortar with existing mortar.
- C. Fittings and damaged areas:
- 1. Coat by hand plastering.
 - 2. Bond old mortar with new mortar with an epoxy or adhesive bonding agent.
 - 3. Use strong pressure to provide a dense mortar coating the same thickness as the original pipe coating.
- D. Curing:
- 1. Use curing compound or water cure. Use curing compound in accordance with the manufacturer's written instructions.
 - 2. Keep continually moist with water for seven days or until backfill is placed.
- E. Apply polywrap over mortar coated pipe, valves, and appurtenances. See Section 06066.1.

3.11 GALVANIC ANODES AND TEST STATIONS

- A. Install galvanic anode with test station in accordance with Drawing 286-EA Figure A at locations shown on the drawings.
- B. Install galvanic anode without test station in accordance with Drawing 286-EA Figure B when specified on the drawings.

- C. Install test station without galvanic anode in accordance with Drawing 285-EA at locations shown on the drawings.

3.12 IDENTIFICATION TAPE

- A. Non-detectable 3-inch blue tape, black imprinted with “CAUTION - BURIED LINE BELOW” shall be installed as follows:
 - 1. Install tape approximately, but not less than, 1 foot above and along the centerline of the installed pipe.
 - 2. If the tape is not continuous, the tape ends shall be overlapped by 2 feet.

END OF SECTION

SECTION 02514.1

POLYVINYL CHLORIDE PIPE AND FITTINGS, CAST IRON PIPE FITTINGS, AND DUCTILE IRON PIPE FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Furnishing and installing polyvinyl chloride (PVC) pipe and fittings, and cast iron or ductile iron pipe fittings.
- B. Related Sections:
 - 1. Section 02316.1 - Trenching, Backfilling, and Compacting
 - 2. Section 02511.1 - Miscellaneous Installation Requirements
 - 3. Section 03376.1 - Concrete for Pipe Installation

1.2 REFERENCES

- A. American Water Works Association:
 - 1. AWWA C104 American National Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water
 - 2. AWWA C110 American National Standard for Ductile-Iron and Gray-Iron Fittings, 3" through 48", for Water and Other Liquids
 - 3. AWWA C111 American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
 - 4. AWWA C153 American National Standard for Ductile-Iron Compact Fittings, 3" through 12", for Water and Other Liquids
 - 5. AWWA C213 AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
 - 6. AWWA C900 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in. for Water Distribution
 - 7. AWWA C605 AWWA Standard for Installation of PVC Pipe
 - 8. AWWA C907 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Fittings for Water-4 in. through 8 in.

B. American Society for Testing and Materials:

1. ASTM D 1784 Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
2. ASTM D 1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
3. ASTM D 2464 Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
4. ASTM D 2467 Socket-type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
5. ASTM D 2564 Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
6. ASTM D 2855 Recommended Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Plastic Pipe and Fittings

1.3 SUBMITTALS

- A. Applicant shall submit a manufacturer's affidavit, including references to the lot numbers of the pipe and fittings, with each shipment prior to or at the time of delivery to the jobsite. The affidavit shall state that the requirements of these specifications have been met for all the pipe and fittings furnished.

1.4 DELIVERY AND STORAGE

- A. Pipe ends shall be sealed during shipping and storage on site.
- B. Keep interior of all pipe, fittings, and appurtenances free of dirt and other foreign matter.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS - 6" UP TO 12"

- A. Polyvinyl chloride (PVC) pipe 6" and larger shall be Class 305 pressure pipe, cast iron O.D., DR 14 with elastomeric gaskets, plain end with couplings or high-deflection couplings, or integral bell ends.
- B. PVC pipe 6" up to 12" shall comply with AWWA C900 except as modified below.

Section 4.3.2.3

Delete and replace with:

1. Pipe shall be furnished in standard laying lengths of 20 feet \pm 1 inch. Random lengths shall not be furnished.
 2. Pipe sections from a fitting, coupling, or bell used for making connections shall not be shorter than 18" in length.
- C. Polyvinyl Chloride Fittings shall be Class 235 pressure fittings.
1. PVC fittings may be provided for all required fittings except flanged tees, crosses and fittings that require restraint.
 2. PVC fittings and gaskets shall meet all requirements of AWWA C907.
 3. Each PVC fitting shall have the required markings of AWWA C907.
 4. PVC push-on fittings shall be Harco, Sceptor, Ipex, or approved equal.

2.2 IRON PIPE FITTINGS

- A. For PVC pipe 6" up to 8".
- B. Cast Iron Fittings:
1. Cast iron fittings shall meet all requirements of AWWA C110 except for the dimensions in respect to laying lengths.
 2. Each cast iron fitting shall have plainly cast on the body:
 - a. The required markings of AWWA C110 and AWWA C111.
 - b. An identifying mark indicating the type of pipe for which the fitting is designed.
- C. Ductile Iron Fittings:
1. Ductile iron fittings shall meet all requirements of AWWA C153.
 2. Each ductile iron fitting shall have plainly cast on the body:
 - a. The required markings of AWWA C111 and AWWA C153.
 - b. An identifying mark indicating the type of pipe for which the fitting is designed.
- D. Fittings shall have push-on bell ends unless shown otherwise on drawings.

1. Push-on fittings shall be designed to accept cast iron O.D. PVC pipe.
 2. Push-on fittings shall be Tyton or approved equal with ring gasket interchangeable with Tyton gasket.
- E. Gaskets shall conform to AWWA C111 and shall be furnished by the fitting manufacturer.
- F. All fittings shall be smooth and free from defects. No plugging or filling will be allowed.
- G. All fittings shall be epoxy coated and lined or epoxy coated and cement mortar lined.
1. Fusion-bonded epoxy shall be in accordance with Section 09969.1.
 2. Cement mortar lining shall be in accordance with AWWA C104 except the seal coat shall not be provided.
 3. Threaded holes and mating surfaces shall not be coated. Flange faces shall be coated with asphaltic varnish only. There shall be no lining material, epoxy or mortar on gasket groove.
- H. Flange and plain end nipples shall be provided without the spigot bead on spigot ends of the fittings and shall be cast with external surfaces true and smooth for use with flexible couplings.
- I. All flange fittings and flanged nipples shall be one-piece castings.
- J. Flanged fittings shall have smooth or shallow serrated face with drilling and dimensions conforming to ANSI B16.1 Class 125 Cast Iron Flanges. Drilling and dimensions of hydrant extensions shall conform to the requirement of Drawing 9496-GB.

2.3 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS - 2"

- A. Two-inch PVC plastic pipe and fittings shall be made from polyvinyl chloride Type 1, Grade 1 (Cell Classification 12454-B) conforming to ASTM D 1784.
- B. Pipe and fittings shall be Schedule 80 and shall conform to:
1. Pipe: ASTM 1785.
 2. Threaded fittings: ASTM 2464.
 3. Socket-type fittings: ASTM 2467.

- C. Welding solution and primer shall be in accordance with ASTM D 2564, shall be furnished by the same supplier who furnished the pipe, and shall be of a type compounded specifically for use with the pipe furnished.

PART 3 - EXECUTION

3.1 INSPECTION

- A. All pipe and fittings shall be subject to inspection by the Engineer at the jobsite.
- B. Each section of pipe, including couplings and adapters, and each fitting shall be inspected and approved by the Engineer as acceptable prior to installation.
- C. Pipe and fittings rejected as unacceptable by the Engineer shall be removed from the jobsite.

3.2 PREPARATION FOR INSTALLATION

- A. Each section of pipe, including couplings and adapters, and each fitting shall be thoroughly cleaned out by the Contractor before lowering into the trench and immediately prior to assembly.

3.3 PLACING PIPE IN TRENCH

- A. Install PVC pipe in accordance with AWWA C605 except as modified below.
- B. Do not install pipe in same trench with other utilities without approval of the Engineer.
- C. Install pipe to comply with the following clearances:
 - 1. 5 foot horizontal distance from parallel existing sanitary sewer.
 - 2. 1 foot vertical distance separation where pipe crosses sanitary sewer.
- D. Install pipeline with a minimum cover of 36" below finished grade. Maximum cover shall be 48" or as directed by the Engineer.
- E. Install pipe with uniform bearing on compacted Class I backfill.
- F. Clearance under couplings shall be at least 2".
- G. Bending of PVC pipe will not be permitted. Maintain alignment through use of pipe fittings or high deflection PVC couplings.
- H. Steel horizontal and vertical angle bends may be required in lieu of ring-tight bends as determined by the Engineer.

- I. Anchor all horizontal and vertical bends greater than 11-1/4°, dead-ends, tees, and crosses with concrete as shown on Drawings 194-EA and 3360-B.
- J. Install collars and rods with concrete anchors on all cast iron plugs and at other locations indicated on the drawings, or at locations deemed necessary by the Engineer.
- K. Where pipe crosses force main sewer, pipe crossing shall be at 90° angle and shall be of steel pipe extending at a minimum 5 feet on each side of the trench width or 12 feet in length, whichever is greater.
- L. When pipe laying operations are not in progress, watertight plugs shall be installed for closure of open ends of pipeline, and covered with backfill material at the end of each working day.

3.4 JOINTS

A. Polyvinyl Chloride Pipe and Fittings - 6" and Larger:

- 1. Assemble pipe and couplings in accordance with the manufacturer's instructions using a minimal amount of recommended pipe lubricant as necessary.
- 2. Check final location of rubber rings within each coupling and fitting as recommended by the pipe manufacturer.
- 3. Ensure joint, rubber ring, and lubricant are clean prior to and during installation.

B. Iron Fittings to PVC Pipe:

- 1. Push-on type joints for connection to the existing distribution system shall be made with rubber rings designed for use with the existing pipe.

C. 2" PVC Pipe and Fittings:

- 1. The connection method (threaded or socket-joint) shall be as shown on the drawings. Use socket-joint connections wherever the connection method is not shown.
- 2. Socket joint connections for plastic piping shall be made in accordance with ASTM D 2855.

3.5 TRACER WIRE

- A. Install AWG No. 12 TW or THHN, solid, insulated tracer wire with all pipe installation methods, including jacking or drilling.

1. Install wire on the trench bottom under the vertical projection of the pipe to protect the wire in all installations. Wire shall not spiral around pipe barrel.
2. Tracer wire shall form a mechanically and electrically continuous line throughout the pipeline, including jacked or drilled portions, and shall then extend to the nearest valve or other pipeline appurtenance designated by the Engineer. At the valve, the wire shall extend up outside the valve pot riser pipe into the concrete valve pot space where there shall be a 12" lead for testing purposes. At other designated appurtenances, the wire shall extend up to the box and terminate with a 12" pigtail.
3. Wire shall be spliced with a splicing device consisting of an electro-tin plated seamless copper sleeve connector. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.
4. Demonstrate that the wire installation is electrically continuous by performing a continuity test in the presence of the Engineer.

3.6 IDENTIFICATION TAPE

- A. Non-detectable 3" blue tape, black-imprinted with "CAUTION - BURIED LINE BELOW" shall be installed along the line of PVC pipe installed in ground outside buildings:
 1. Install tape approximately 1 foot above and along the centerline of the pipe.
 2. If the tape is not continuous, the tape ends shall be overlapped by 2 feet.

END OF SECTION

SECTION 02616.1

FABRICATION AND INSTALLATION OF HIGH DENSITY POLYETHYLENE PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Furnish and install high density polyethylene (HDPE) pipe 20" and smaller and fittings as shown on the drawings and as specified herein.

B. Related Sections:

1. Section 01600.1 – Materials
2. Section 02316.1 – Trenching, Backfilling and Compacting
3. Section 02511.1 – Miscellaneous Installation Requirements – Water Mains
4. Section 02512.1 – Installation of ML&PCS Pipe – 20" and Smaller

C. Definition: HDPE is high density polyethylene pipe.

1.2 REFERENCES

A. Reference Specifications: This subsection references the American National Standards Institute (ANSI) and American Water Works Association (AWWA) standards, the American Society for Testing and Materials (ASTM) standard specifications, and the National Sanitation Foundation (NSF), which are made a part hereof by such reference and shall be the latest edition and revision thereof. The ANSI/AWWA standards describe minimum requirements.

B. AWWA Standards: HDPE pipe manufacturing and installation shall conform to the following AWWA standards:

1. ANSI/AWWA C906: Polyethylene (PE) Pressure Pipe and Fittings 4-inch (100mm) through 63-inch (1,575mm), for Water Distribution and Transmission.
2. ANSI/AWWA C901: Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
3. AWWA Manual of Water Supply Practices M55, First Edition, PE Pipe Design and Installation, 2006.

C. ASTM Specifications: HDPE pipe shall conform to the following ASTM standard specifications:

1. ASTM D-1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.
2. ASTM D-2122, Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
3. ASTM D-2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
4. ASTM D-2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
5. ASTM D-3035, Specifications for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
6. ASTM D-3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
7. ASTM D-3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
8. ASTM F-714, Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter (3" IPS and Larger).
9. ASTM F-1055, Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
10. ASTM F-2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
11. ASTM F-2206, Fabricated Fittings of Butt Fused Polyethylene (PE) Plastic Pipe Fittings, Sheet Stock, Plate Stock, or Block Stock.

D. NSF Standards: HDPE materials shall comply with the following NSF Standards:

1. NSF/ANSI 61, Drinking Water System Components – Health Effects.

1.3 SUBMITTALS

A. Prior to ordering and shipping pipe to the jobsite, submit the following:

1. Manufacturer's current specifications or technical information that proves compliance with the specified requirements. Include shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new pipe and fittings. Also include manufacturer's recommendations for handling, storage, and repair of damaged pipe and fittings.
2. The pipe material shall be listed by PPI (the Plastic Pipe Institute, a division of the Society of the Plastics Industry), PPI TR-4, with a 73 degree Fahrenheit

hydrostatic design stress rating of 800 psi. The PPI Listing shall be based on ASTM D-2837 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.

- B. A minimum of five working days prior to pipe installation, submit the following:
 - 1. Manufacturer's installation instructions including instructions for joining pipe by heat fusion.
 - 2. Applicant only: Plan for construction and pressure leak testing of HDPE pipeline in accordance with guidelines provided in ASTM F-2164, and the manufacturer's recommended hydrostatic test procedure.
 - 3. Applicant only: Documentation showing fusion equipment operator's experience and laborers' training for installing HDPE pipe.
 - 4. Applicant only: Documentation showing experience in fusing and installing HDPE on at least two other projects.

C. Submit the following accompanying product shipment:

- 1. Provide a Product Certification that certifies compliance with these specifications.
- 2. The Manufacturer shall provide certification that stress regression testing has been performed on the specific product. Said certification shall include a stress life curve per ASTM D-2837. The manufacturer shall perform stress regression testing in accordance with ASTM D-2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi, as determined in accordance with ASTM D-2837.

1.4 QUALITY ASSURANCE

- A. Pipe and fitting materials shall be certified to NSF/ANSI and shall bear the NSF-61 marking.
- B. The District may request certification that the pipe produced is represented by the quality assurance data. Additionally, test results from the manufacturer's testing which show the pipe does not meet appropriate ASTM standards of manufacturer's representation, will be cause for rejection of the pipe represented by the testing. These tests may include but are not limited to density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D-3350.
- C. The District may request certified laboratory data from the manufacturer to verify the physical properties of the materials supplied under this specification or, at the District's own expense, take random samples for testing by an independent laboratory.

- D. Testing and marking of pipe and fittings shall conform to the requirements of AWWA C901 or AWWA C906 as appropriate by size.
- E. Pipe jointing by butt fusion or electro-fusion shall be performed by personnel trained in the use of butt-fusion and electro-fusion equipment and recommended procedures for new pipe connections. Only technicians trained and certified by the fusion equipment supplier shall operate fusion equipment.
- F. Applicant only: Only technicians trained and certified by the fusion equipment supplier, and who have a minimum of two years of experience fusion welding pipelines of the diameters used on the subject project shall operate fusion equipment.
- G. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the HDPE pipe. A qualified representative of the material shall perform the training.
- H. Tests for compliance with these specifications shall be made according to applicable AWWA and ASTM specifications. The manufacturer shall provide a compliance certificate for all material furnished under this specification. At the time of material delivery, the manufacturer shall provide a Product Certification that certifies compliance with applicable AWWA and ASTM specifications. The Manufacturer's Product Certification shall also state that the pipe was manufactured from one specific resin in compliance with these specifications. The certificate shall state the specific resin used, its source, and list its compliance to these specifications. The manufacturer's production code(s) shall be included on the material certification sheets.
- I. Manufacturer shall check each length of pipe produced for the items listed below. The results of all measurements shall be recorded on production sheets, which become part of the manufacturer's permanent records. The Manufacturer's quality assurance shall conform to all applicable AWWA and ASTM standards which shall include, but not be limited to:
 - 1. Check pipe in process visually, inside and out for cosmetic defects (grooves, pits, hollows, etc.).
 - 2. Measure pipe outside diameter using a suitable periphery tape to ensure conformance with ASTM F-714 or ASTM D-3035, whichever is applicable.
 - 3. Measure pipe wall thickness at equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F-714 or ASTM D-3035, whichever is applicable.
 - 4. Measure pipe length.
 - 5. Examine and check pipe marking for accuracy.
 - 6. Check pipe ends to ensure they are cut square and clean.

7. Subject inside surface to a bend-back test/“reverse bend test” to ensure the pipe is free of oxidation (brittleness).
 8. Subject pipes to pressure test per industry-accepted standards such as the quick burst test, ring tensile test, etc.
 9. Inspect pipe per industry-accepted standards for concentricity, straightness, ovality, and print line.
 10. Include additional testing: a sustained-pressure test, an elevated- temperature-sustained pressure test, and a thermal stability test.
- J. For all sizes of Applicant installed HDPE pipe, and District furnished HDPE pipelines 16-inches and greater, District plant inspection shall be required as determined by the District. The pipe and fitting manufacturer’s production facilities shall be open for inspection by the District or its designated agents. During inspection by the District, the manufacturer shall demonstrate that they have facilities capable of manufacturing the pipe and fittings required by this specification, that a quality control program meeting the minimum requirements of AWWA and ASTM specifications is in use, and that the facilities for performing the tests required by this specification are in use. See Shop Inspection Section 01450.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prevent damage to pipe and other materials during transportation, handling, and storage as recommended by the manufacturer. The pipe shall be transported using appropriate methods and intermittent checks to insure the pipe is properly supported, stacked, and restrained.
- B. Upon delivery, the pipe shall be placed and stored off the ground on suitable supports and securely blocked to prevent scratching or gouging. If pipe is stacked, it shall be done in accordance with the pipe manufacturer’s recommendations. Seal the ends of the pipe during shipping and storage onsite. Keep the interior of all pipe, fittings and appurtenances free of dirt and other foreign matter.
- C. Do not use chains, hooks or cable type chokers when lifting sections of pipe. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections.

PART 2 - PRODUCTS

2.1 HDPE PIPE AND FITTINGS FURNISHED BY APPLICANT

A. GENERAL

1. All Applicant installed HDPE pipe and fittings with the exception of service laterals, shall be furnished by Applicant in accordance with this specification.
2. Plant Inspection – See Shop Inspection Specification for HDPE, Section 01600.1.

2.2 PIPE AND FITTINGS

- A. HDPE Pipe: HDPE pipe ½-inch through 3-inch shall comply with AWWA C901. HDPE pipe 4-inch and larger shall comply with AWWA C906.
- B. HDPE Fittings: Molded fitting shall comply with ASTM D-3261. Fabricated fitting shall comply with AWWA C906 and ASTM F-2206. Electro-fusion fittings shall comply with ASTM F-1055.
- C. HDPE pipe and fittings shall be clearly marked in compliance with the manufacturing standards, including size, pressure class (PC), the manufacturer's production code, the material designation code, the date of manufacture, NSF-61, and other relevant identifying information. Upon request, the manufacturer shall provide information for deciphering the manufacturer's production code. At a minimum, the following shall be continuously indent printed on the pipe or spaced at intervals not exceeding 5-feet:
 - 1. Name and/or trademark of the pipe manufacturer.
 - 2. Nominal pipe size.
 - 3. Dimension ratio.
 - 4. The letters PE followed by the polyethylene grade in accordance with ASTM D-1248, followed by the AWWA C906 designation, and pressure rating (e.g., PE 3408/3608 AWWA C-906 160 psi).
 - 5. NSF-61 marking.
 - 6. Manufacturing standard reference, e.g., ASTM F-714 or D-3035, as required.
 - 7. A production code from which the date and place of manufacture can be determined.
 - 8. Other codes as required.
- D. Pipe:
 - 1. The pipe shall be homogeneous throughout and free of visible cracks, bubbles, holes, voids, foreign inclusions or other injurious defects. It shall be uniform in color, opacity, density, melt index and other physical properties throughout. Any pipe not meeting these criteria shall be rejected.
 - 2. The pipe shall be made of virgin material and shall contain no recycled compound. Rework material generated in the manufacturer's own plant may be blended with virgin resin of the same ASTM D-3350 classification to manufacture new pipe. Pipe containing rework material shall be marked to indicate that rework material was used. Rework material shall not exceed 10 percent by weight of total material quantity used to manufacture pipe.

3. All HDPE pipe shall include a minimum of 2 percent but no more than 3 percent carbon black for ultra-violet protection.
4. Pipe shall be supplied in the longest practical straight lengths for the project. Spooled pipe is acceptable only for 4-inch and smaller pipes.
5. Color identification as follows:
 - a. BLUE – Potable Water - either striped by co-extruding longitudinal identifiable color markings or shall be solid in color.
 - b. PURPLE - Non-potable water - shall be solid in color.
6. Material for pipe shall be high molecular weight, high density polyethylene (HDPE). The material shall have a standard PE code designation of PE 3408/PE3608 and have a minimum cell classification of PE 345434C as described in ASTM D-3350. PE 3408 resin used in the manufacturing process shall be NSF/ANSI Standard 61 approved for potable water applications.
7. Pipe shall be manufactured in Iron Pipe Sizes (IPS). Wall thickness of pipe shall be based on a Standard Dimension Ratio (SDR) of 11.0, and shall be rated for a minimum pressure class (PC) of 160 psi, unless otherwise specified.

E. Fittings:

1. Polyethylene butt-type fittings shall conform to Section 4.4 of AWWA C906 and ASTM D-3261 for molded butt-type fittings or to ASTM F-2206 for fabricated butt-type fittings. Fittings shall have a pressure class (PC) rating that is not less than the pressure class (PC) rating of the pipe to which it is joined.
2. Polyethylene electro-fusion type fittings shall conform to ASTM F-1055 and shall have pressure class (PC) ratings that are not less than the pressure class (PC) ratings of the pipe to which it is joined.
3. Material for fittings shall be high molecular weight, high density polyethylene (HDPE) and shall have a standard PE material designation code of PE 3408/PE3608 that shall have a minimum cell classification of 345434C as described in ASTM D-3350. PE resin used in fitting manufacture shall be NSF/ANSI Standard 61 approved for potable water applications.
4. Each fitting shall be clearly labeled to identify its size, material code designation, and pressure class (PC) rating.
5. Flange adapters and backup ring shall be Performance Pipe Driscoplex (800-527-0662), or approved equal. The backup ring shall be ANSI Class 150 or AWWA C20 and shall be epoxy coated.

6. Couplings shall be JCM 241-242 Optimum Range Coupling (800-527-8482), 10" length, epoxy coated per AWWA C-213, ANSI/NSF Standard 61 certified, or approved equal.
7. Service Saddles shall be JCM 406 coated service saddles with double stainless steel straps (800-527-8482), ANSI/NSF Standard 61 certified, or approved equal.
8. Electrofusion Corp Saddles shall be Central Plastics, Inc. (800-654-3872), ANSI/NSF Standard 61 certified, or approved equal.
9. Pipe stiffeners shall be JCM 231 (800-527-8482), 12" width, stainless steel, or approved equal.

F. Joints:

1. Joints between HDPE pipe, and between HDPE pipe and HDPE fittings, shall be of the thermal butt fusion or electro-fusion type, as outlined in ASTM D-2657 unless otherwise specified. All joints shall be made in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by the pipe manufacturer, or an experienced trained technician, shall perform all heat fusion joints in the presence of the Engineer. Pipe shall be furnished in standard laying lengths not to exceed 50 feet and no shorter than 20 feet.
2. All metal parts of the fittings and appurtenances shall be made of stainless steel type 316 or bronze except for those materials that are specifically designated otherwise by the manufacturer in the products approved for installation.
3. The machine used to butt-fuse the pipe joints shall include data collection equipment that documents the actual fusion time, pressure, and temperature for each joint. Heating plates shall be inspected for cuts and scrapes. Measure plate temperature shall be measured at various locations to ensure proper heating/melting per manufacturer's recommendations, and per approval by the Engineer. The machine used to fuse the pipe shall be capable of meeting all conditions recommended by the pipe manufacturer including but not limited to temperature, alignment, and interfacial fusion pressure. Printouts of the data for each joint fused shall be provided to the Project Engineer at the end of each day. The operator of the fusing machine will be responsible for establishing a numbering and labeling sequence for each joint fused and will correlate that sequence with the data collection equipment.
4. Electro-fusion joint coupling connections may be used to accommodate fit-up of pipe lengths within an excavation. Pre-heating is required. Electro-fusion couplings are to be installed per the manufacturer's instructions.
5. The following HDPE adapters shall be used to make connections to differing pipe materials, valves, and other appurtenances (unless the drawings or the Engineer indicates otherwise):

- a. Flange adaptors for HDPE to steel pipe connections. Flange adaptor bolting rings shall be compatible with AWWA Class D ring flanges, as shown on District Standard Drawing 323-EA.
 - b. Slip-joint anchor fittings for HDPE to PVC connections
 - c. Bolted flexible couplings for HDPE to ductile or cast iron pipe - no thrust restraint (DIPS to IPS)
 - d. Bolted flexible couplings for HDPE to steel pipe - no thrust restraint (IPS to IPS)
 - e. Mechanical joint (“MJ”) adapter for HDPE to ductile iron or PVC main (IPS & DIPS Bell)
6. The joint shall be visually inspected as to continuity of “beads” from the melted material, and for assurance of “cold joint” prevention (i.e. joint shall have visible molded material between walls of pipe).

G. Service laterals:

1. HDPE service laterals shall consist of a service saddle as specified in Section 2.2.D.7 and 8 and service lateral pipe of District-standard extruded copper piping per District Standard Drawing 291-EA. Installation of services including service saddle shall be by the District.

H. Acceptable HDPE pipe manufacturers:

1. WL Plastics, JM Manufacturing, and Polypipe for black pipe for potable water use. Local distributors: Maskell-Robbins, Newark, CA, (800) 638-4373 and P & F Distributors, Brisbane, CA, (415) 467-4630.
2. Performance Pipe for black pipe for potable water use. Local distributor: P & F Distributors, Brisbane, CA, (415) 467-4630 and Forrer Supply Company, Inc., Stockton, CA 800-255-1030.
3. Or equal as approved by the Engineer.

I. Acceptable HDPE fitting manufacturers:

1. Performance Pipe, Central Pipe, and Improved Piping Products for molded fittings for potable water use. Local distributors: Maskell-Robbins, Newark, CA, (800) 638-4373 and P & F Distributors, Brisbane, CA, (415) 467-4630.
2. Improved Piping Products, Independent Pipe Products, and Industrial Pipe Fittings for fabricated fittings for potable water use. Maskell-Robbins, Newark, CA, (800) 638-4373 and P & F Distributors, Brisbane, CA, (415) 467-4630.
3. Or equal as approved by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install HDPE pipe and fittings in accordance with manufacturer's installation instructions and as shown on the drawings. Trench backfill shall conform to District Standard Drawing 1992-A.

B. Joint welding:

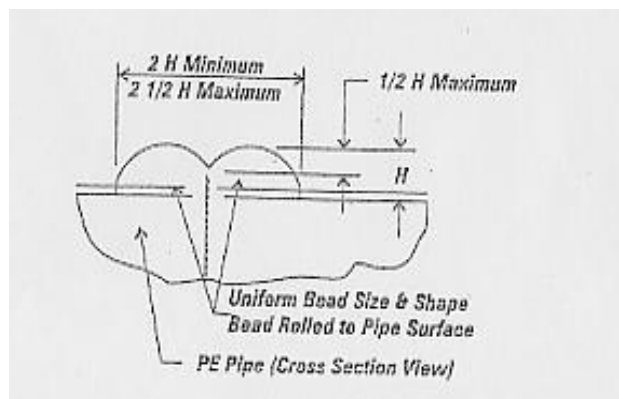
1. Sections of HDPE pipe shall be joined into continuous lengths by the thermal butt fusion method and shall be performed in strict accordance with the pipe manufacturer's printed recommendations. Threaded or solvent-cement joints and connections are not permitted.
2. Butt fusion shall conform to ASTM D-2657 and pipe manufacturer's criteria for the type of joining. Joints shall indicate a ductile rather than brittle fracture when tested.
3. Fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure. Fusion equipment shall have a temperature gauge to record temperature during pipe installation.
4. The butt-fused joint shall be true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. Joints shall have internal bead projections of not more than 1/4-inch. The joint shall be allowed adequate cooling time, per the pipe manufacturer's printed recommendations before removal of pressure. The individuals fusing the pipe shall allow further cooling prior to the application of stresses due to bending or movement of the pipe. The fused joint shall be watertight and shall have strength equal to that of the pipe.
5. All joints shall be subject to acceptance by the Engineer. All defective joints shall be cut out and replaced. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of wall thickness, shall not be used and must be removed from the site. A defective area of the pipe may be cut out and the joint fused in accordance with the procedures specified above. Discard and do not use any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Engineer.
6. Sections of the HDPE pipe shall be assembled and joined on the job site.
7. Where the HDPE pipe is connected to fittings or valves of other materials, an HDPE flange adapter shall be fused to the end of the pipe and the connection

made with bolted flange components, or a commercially manufactured adapter shall be fused to the pipe where shown on the drawings.

C. Testing and Inspection during assembly:

1. On each day that fusion butt joints are made, a trial fusion shall be assembled, and fusion data for the trial fusion shall be recorded using fusion machine data recording equipment. A bent strap test shall be performed and approved by the Engineer before production begins. During assembly of the HDPE pipeline all joints shall be visually inspected and data for each field fusion shall be compared to the successful trial fusion. All joints failing the visual inspection or that do not favorably compare to trial fusion data shall be removed and redone.
 - a. **Butt Fusion bent strap test:** The bent strap test specimen shall be prepared by making a trial butt fusion and allowing it to cool to ambient temperature. A test strap shall be cut out of the trial fusion pipe and shall be of a minimum size required per ASTM D-2657. The test shall consist of bending the strap so that the ends of the strap touch. Any disbondment at the fusion shall be considered unacceptable and indicative of poor fusion quality. If failure occurs, fusion procedures and/or machine set-up shall be changed, and a new trial fusion and bent strap test specimen prepared and tested. Field fusion shall not proceed until a test joint has passed the bent strap test.
 - b. **Visual Inspection:** Butt fusion joints are visually inspected to ensure joint quality. The size and shape of the fusion beads shall be used to visually inspect if a proper joint has been made. Specifically, a) the double bead width shall be 2 to $2\frac{1}{2}$ times the height from the pipe surface, b) both beads shall be uniform in size and shape all around the joint, and c) the depth of the v-groove between the beads shall not be more than half the bead height. See figure below.

Butt Fusion Bead Visual-Inspection Guideline:



- c. Additional Testing Requirements: The Engineer will determine if additional testing is required. In that event, the Engineer will randomly select the testing of two joints, from the first 1,000 linear feet (305m) of pipe in accordance with ASTM D-638. The test specimens shall be obtained by cutting the pipe at least twelve inches on each side of the field-made joint. The ends may then be re-joined so that work may proceed. Compliance verification from a certified laboratory shall be provided to assure that the tensile strength of the joints equals or exceeds that of the materials joined. One additional test shall be made for each additional 1,000 linear feet (305m) or portion thereof. The party fusing the pipe shall be responsible for the costs of these additional tests.

3.2 CONNECTIONS TO EXISTING PIPELINES

- A. Upon completion of HDPE pipe installation, a minimum period of 24 hours shall be provided before joining HDPE pipe to existing pipe materials, to allow the HDPE pipe sufficient time to contract/regain its original size.
- B. See EBMUD's Standard Specifications for Installation of Water Mains 20" and Smaller, Section 02511.1, Subsection 3.6, for other requirements.

3.3 PIPELINE PRESSURE AND LEAKAGE TESTING

- A. General: Pipe shall be hydrostatically tested independently from other existing distribution pipe when practical. Hydrostatic test shall be performed in accordance with the guideline provided in ASTM F-2164. In the event there is a conflict between the manufacturer's recommendation and the guideline provided in ASTM F-2164, the Engineer's decision shall govern. Minimum required hydrostatic test pressure shall be 1.5 times the design working pressure of the pipe at the lowest point in the test section. If the design working pressure is not specified on the drawings, use the following as the maximum recommended hydrostatic pressure:
 - 1. For DR11 pipe, use 240 psi
 - 2. For DR9 pipe, use 300 psi
- B. Allowable leakage rate when testing HDPE pipe shall be zero.
- C. The pipeline shall be pressurized in accordance with ASTM F-2164. The hydrostatic testing procedure consists of two phases: an initial expansion phase and a test phase. For the initial expansion phase, add make-up water as necessary to maintain maximum test pressure for 4 hours. For the test phase, reduce the test pressure by 10 psi and monitor pressure for 1 hour. Do not increase pressure or add make-up water. If no visual leakage is observed, and pressure during the test phase remains steady (within 5% of the test phase pressure) for the 1 hour test, a passing test is indicated.
- D. See EBMUD's Standard Specifications for Installation of Water Mains 20" and Smaller, Section 02511.1, Subsection 3.7, for other requirements.

- E. The HDPE pipe shall be pressure tested after the line and all fittings (excluding service saddles) have been assembled.
- F. Applicant only: The pipe system shall be tested at the Applicant's expense
- G. The pipe system section under test and any closures in the test section should be restrained against sudden uncontrolled movement and trench backfill shall be completed.
- H. The temperature of the test medium and the pipe test section shall be the same, and shall be at ambient temperature. Before applying test pressure, allow time for the test medium and the pipe test section to equalize. Consult with pipe manufacturer regarding recommended waiting time for specific site conditions and especially in cases of elevated temperatures.
- I. Raise the pressure at a steady rate to the required test pressure.
- J. For any test pressures exceeding the system working pressures, the total test time shall not exceed 8 hours of duration.
- K. If a pressure test is not completed due to leakage, equipment failure, or other causes, the test section shall be depressurized. Do not re-pressurize the pipe section to the test pressure within a minimum of 8 hours elapsed time following the prior test.

3.4 PIPELINE FLUSHING AND CHLORINATING

- A. See EBMUD's Standard Specifications for Installation of Water Mains 20" and Smaller, Section 02511.1, Subsection 3.8.

3.5 TRACER WIRE

- A. Install AWG No. 12 TW, THW, THWN, THHN, or HMWPE solid, insulated tracer wire with all pipe installation methods, including jacking or drilling:
 - 1. Tracer wire shall form a mechanically and electrically continuous line throughout the pipeline, including jacked or drilled portions, and shall then extend to the nearest valve or other pipeline appurtenance or as designated by the Engineer. At the valve, the wire shall extend up outside the valve pot riser pipe into the concrete valve pot space where there shall be a 12" lead for testing purposes (see District Standard Drawing 321-EA). At other designated appurtenances, the wire shall extend up to the box and terminate with a 12" pigtail.
 - 2. Wire shall be spliced with a splicing device consisting of an electro-tin plated seamless copper sleeve connector. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

3.6 IDENTIFICATION TAPE

- A. Treated Water Pipeline:

1. Non-detectable 3" blue tape, black-imprinted with "CAUTION - BURIED LINE BELOW" shall be installed along the line of HDPE pipe installed in open cut installations:
 - a. Install tape approximately 1 foot above and along the centerline of the pipe.
 - b. If the tape is not continuous, the tape ends shall be overlapped by 2 feet.

3.7 INSTALLATION OF VALVE OPERATORS

- A. Install gate valve operators at locations shown on the project drawings. See District Standard Drawing 1241-A for installation details.
 1. Install gate valve operating shaft extension on gate valves if the valve operating nut is more than 36 inches below ground level.

3.8 LOCATION MARKERS

- A. See District Standard Drawing 303-EA, for pipeline location markers.
- B. See District Standard Drawing 1336-A for marker post for valves, blowoffs, and test stations.

3.9 VALVE POTS AND COVERS

- A. Treated Water Pipeline:
 1. See District Standard Drawings 321-EA, 277-A, Christy G5A or approved equal.

END OF SECTION

SECTION 02720.1

IMPORTED BACKFILL AND DRAIN ROCK MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish imported backfill and drain rock materials as shown on the drawings and as specified herein.

1.2 SUBMITTALS

A. Certificates:

- 1. Submit certificate of compliance with laboratory soil resistivity test results.

B. Samples:

- 1. Submit representative 50-pound samples of each material to be imported at least 2 weeks but not more than 4 weeks in advance of installation operations for testing by the Engineer.
- 2. Each sample shall be labeled showing the material transmitted, its source of origin, its intended use, the Agreement Number and pipeline job numbers referenced, and Applicant's name.
- 3. Deliver samples to the EBMUD Materials Testing Laboratory located at 1100 21st Street, Oakland. Prior to delivery, call (510) 287-1990, between 8:00 a.m. and 10:00 a.m. to make an appointment.

C. Approval:

- 1. Materials for which samples are required shall not be used on the work until approval has been given by the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Class I Backfill:

- 1. Shall be clean, sound, and durable natural or crushed sand, free from organic material and other deleterious substances.

2. Measured resistivity of material passing the No. 4 sieve, using a soil resistivity box in accordance with ASTM G57, shall not be less than 3000 ohm-cm.
3. Soil pH shall be measured in accordance with ASTM G51 and shall not be less than 6.5.
4. Shall have sand equivalent value of not less than 30 as determined by California Test 217.
5. Shall conform to the following grading when tested in accordance with ASTM C 136:

Sieve Size	Percent Passing
3/4" (19.00mm)	100
No. 4 (4.75mm)	70-100
No. 8 (2.36mm)	30-100
No. 200 (0.075mm)	0-5

B. Class III Backfill:

1. Shall be material free of roots, organic matter, and other deleterious substances, and shall not contain rocks or unbroken masses of soil larger than 3" in greatest dimension.
2. Plasticity index shall not exceed 15, determined in accordance with ASTM D 4318.

C. Class I and Class II Drain Rock:

1. Shall be clean and durable gravel or crushed stone.
2. Shall not slake nor decompose with alternate wetting and drying.
3. Class I drain rock shall have a sand equivalent value not less than 75 as determined by California Test 217.
4. Shall conform to the following grading when tested in accordance with ASTM C 136:

<u>Sieve Size</u>	<u>Percent Passing</u>	
	<u>Class I</u>	<u>Class II</u>
1-1/2"	-	100

1"	100	-
3/4"	90-100	95-100
3/8"	40-100	-
No. 4	25-40	0-7
No. 8	18-33	0-3
No. 30	5-15	-
No. 50	0-7	-
No. 200	0-3	-

D. Aggregate Base:

1. Shall be Class 2, 3/4" maximum conforming to CSS Section 26.
2. Use of recycled material is permitted provided material conforms to requirement above. Material is not recommended for use during wet conditions. If found to be pumping, material shall be rejected and replaced with suitable material.

PART 3 – NOT USED

END OF SECTION

SECTION 02951.1

PAVEMENT REPLACEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Replace all cut or damaged street pavement sections, curbs, gutters, driveways, and sidewalks following the completion of pipeline trench backfill.
- B. Related Sections:
 - 1. Section 02316.1 - Trenching, Backfilling, and Compacting

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aggregate Base:
 - 1. Class 2, 3/4" maximum conforming to CSS Section 26.
 - 2. Shall be clean, sound, and durable aggregate base, free from organic material and other deleterious substances.
- B. Prime Coat:
 - 1. Liquid asphalt Type SC-70 conforming to CSS Section 93.
- C. Paint Binder or Tack Coat:
 - 1. Asphaltic emulsion, Type SS-1 conforming to CSS Section 94.
- D. Asphalt Concrete:
 - 1. Aggregate: Type B, 1/2" maximum, medium grading, CSS Section 39.
 - 2. Paving asphalt: Grade PG 64-10, confirming to CSS Section 92.
 - 3. Mix design: CSS Section 39.

E. Portland Cement Concrete:

1. Use for base or surface course, curb, gutter, driveways, and sidewalk.
2. Conform to applicable City/County requirements, and CSS Section 90.

PART 3 - PART 3 - EXECUTION

3.1 EXISTING PAVEMENT

- A. Replace structural pavement section (pavement and base materials) to match the existing section or as required by the local agency permit.
- B. Repair all pavement damaged by the work to "as found" or better condition.

3.2 TEMPORARY PAVEMENT

- A. The material at the surface of the trench shall be relatively smooth and maintained at all times at a grade level with the adjacent existing paving.
- B. Maintain daily inspection of trench area.
- C. Maintain warning lights and barriers where unsafe conditions exist.
- D. Temporary asphaltic plant mix (cutback) surface installation:
 1. Place immediately after backfilling has been completed.
 2. Minimum thickness shall be 1-1/2".
 3. Maintain temporary paving at the same grade as the existing paving. Repair subsidence immediately.

3.3 PERMANENT PAVEMENT

- A. Install permanent replacement pavement within 14 calendar days after the backfill and all other work in the area to be paved is completed.
 1. The thickness of permanent pavement shall be equal to the adjacent permanent pavement thickness, or as required by the local agency permit, whichever is larger.
 2. If the edge of trench is within 12" of the edge of the existing pavement, that portion of existing pavement shall be removed and replaced as part of the new trench resurfacing.

3. Where gate pot covers are to be raised, existing pavement around gate pot covers shall be cut either circular or square shaped.
- B. Remove the temporary pavement just prior to placing the permanent pavement.
 - C. Prior to Installing Pavement:
 1. Sawcut edges of existing pavement to a vertical plane and in a straight line parallel to centerline of trench and at least 12" outside each side of the trench, or to the outside of bell holes, whichever is greater.
 2. Pavement cuts shall encompass all pavement adjacent to the trench that has been damaged or undermined by pipeline construction activities.
 3. Dispose of slurry as required by the agency having jurisdiction. Discharged water shall comply with Section 01000.1, Article 1.5.B.
 4. Clean edges of all mud, dust, and dirt.
 - D. Prior to Placing Asphalt Concrete:
 1. Cover catch basins and manholes to prevent any spillage running into them.
 2. Apply tack coat to edges of existing pavement by spraying.
 3. Brushes or daubers shall not be used for coating application.
 - E. Conform to CSS Section 26 and applicable City/County specifications for base installation.
 - F. Conform to CSS Section 39 and applicable City/County specifications for asphalt concrete installation. After placement of asphalt concrete, seal joints by spraying tack coat over the joints and feathering onto the existing pavements.
 - G. Conform to CSS Section 51 and applicable City/County specifications for portland cement concrete installation.
 1. When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water to a bermed or level area.
 2. Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.

3.4 STREET MARKINGS

- A. Install temporary street markings as required to control flow of traffic. Maintain for duration of need.

- B. Remove all temporary street markings by abrasive blasting. Cleanup abrasive blasting residue by sweeping.
- C. Replace in kind all street markings removed or destroyed.

END OF SECTION

SECTION 03345.1

CONTROLLED DENSITY FILL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Furnishing Controlled Density Fill.
- B. Related Sections:
 - 1. Section 02316.1 - Excavating, Backfilling, and Compacting

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 33: Specification for Concrete Aggregates.
 - 2. ASTM C 150: Specification for Portland Cement.
 - 3. ASTM C 231: Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 4. ASTM C 260: Specification for Air-Entraining Admixtures for Concrete.
 - 5. ASTM C 618: Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.3 QUALITY ASSURANCE

- A. Controlled Density Fill (CDF) mix shall be composed of a cementitious material, water, fine and coarse aggregate, and an admixture.
 - 1. The cementitious materials shall be Portland cement in combination with fly ash.
 - 2. The admixture shall be an air-entraining agent.
 - 3. The proportions of all material used in the CDF shall conform to the mix design.
 - 4. Controlled Density Fill shall have an unconfined compressive 28 day strength from 50 psi to a maximum of 100 psi.

B. Controlled Density Fill Mix Design:

1. The design of the CDF mix shall be the responsibility of the Contractor, and shall be subject to review and approval by the Engineer. Mix shall result in a final product that meets the requirements of this Section.
 - a. Concrete mix shall be designed, in accordance with ACI 229R, by an approved independent testing laboratory, employed by the Contractor, and the design submittal shall be signed by a California-registered Civil Engineer.
 - 1) Testing shall be in accordance with ASTM D4832-02 Standard Test Method for Preparation and Testing of Controlled Low Strength Material Test Cylinders.
 - 2) The testing laboratory shall submit certified copies of all laboratory trial mix reports to the Engineer
 - 3) Do not place Controlled Density Fill prior to the Engineer's review of test reports and approval of mix design.
 - b. The proportions of all material used in the concrete shall conform to the approved mix design. Adjustments may be made to the batch weights or cement and water as necessary to maintain the water-cement ratio and the stipulated slump, or to the admixture content to improve the flowability or limit ultimate strength, with the approval of the Engineer.

C. Aggregate content:

1. Aggregates need not conform to ASTM C-33. Any aggregates which produce performance characteristics of the Control Density Fill shall be submitted for approval.
2. CDF mixture shall contain no aggregate that is larger than 1/2".
3. The amount of material passing a #200 sieve shall not exceed 12 percent.
4. No plastic fines shall be present.

D. Air Content:

1. The air content by volume based on measurement made immediately after discharge from the mixer shall be determined by ASTM C 231 or C173.
2. The total measured air content of the sample prepared in accordance with ASTM C 231 or C173 shall not exceed 20.0 percent.

1.4 SUBMITTALS

- E. Concrete Mix Designs: Submit mix design at least 10 days prior to placing CDF:
 - 1. Laboratory test reports of trial strength and shrinkage tests.
- F. Affidavits/Certificates: Submit evidence of compliance with Specification requirements for cement, aggregate, and admixture with each shipment of materials.
 - 1. Mill tests and manufactures' certification of compliance with the Specifications may be accepted in lieu of testing of cement and analysis of aggregates, subject to the Engineer's approval.
 - 2. Certificates of Compliance shall be signed by the materials manufacturer and the Contractor. Concrete supplier shall be certified by the National Ready Mix Concrete Association and shall hold a valid certificate of conformance for concrete production facilities.
- G. Batch Tickets: Submit a delivery ticket with each batch of concrete delivered to the site in accordance with ASTM C94. Include mix, batch size, and the time batched.
- H. Submit for the Engineer's approval the name, address and telephone number of the laboratory, agency, mill, or ready-mix plant which the contractor intends to engage to design the concrete mixes.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cement shall conform to ASTM C 150, Type II.
- B. Fly ash shall conform to ASTM C 618, Class F. The fly ash shall not contain more than 3% carbon.
- C. Air entraining admixture shall conform to ASTM C 260.
- D. Aggregates:
 - 1. Fine aggregate: #1 sieve concrete sand.
 - 2. Coarse aggregate: #2 sieve - 3/8" pea gravel.
- E. Water shall conform to CSS 90-2.03 (non-reinforced concrete work).

PART 3 - EXECUTION

3.1 BATCHING, MIXING, AND DELIVERING

- A. CDF shall be batched by a ready mixed concrete plant and mixed and delivered to the jobsite by means of transit mixing trucks.

3.2 INSTALLATION

- A. CDF shall be discharged directly from transit mix trucks into the excavation over compacted Class I bedding material.
- B. The CDF shall be brought uniformly to the elevation of the:
 - 1. Underside of existing asphalt concrete pavement, if temporary asphaltic plant mix (cutback) is to be installed or other temporarily placed asphalt surface section to be installed.
 - 2. Finished surface, if CDF is to be removed later for installation of permanent paving.
- C. No equipment or traffic shall be allowed on the CDF until the surface of the CDF will withstand the weight of the equipment or traffic without displacement or damage.
 - 1. If necessary to prevent displacement or damage, provide steel trench plates that span the trench or other means that prevent equipment or traffic contact with CDF.

END OF SECTION

SECTION 03376.1

CONCRETE FOR PIPELINE INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Furnish and install plain and reinforced concrete for pipelines, including anchors, encasement, supports, and other pipeline appurtenances.
- B. Related Sections:
 - 1. Section 02951.1 - Pavement Replacement
- C. Work Not Included: Concrete curbs, gutters, sidewalks, and pavement shall conform to applicable city, county, or state specifications.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM C 33: Specification for Concrete Aggregates.
 - 2. ASTM C 150: Specification for Portland Cement.
 - 3. ASTM A 615: Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
 - 4. ASTM A 185: Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete compressive strength shall be a minimum of 3,000 psi at 28 days.
- B. Portland Cement: ASTM C 150, Type II containing not more than 0.60% by weight of alkalis, calculated as percentage of sodium oxide plus 0.658 times the percentage of potassium oxide.
- C. Aggregate: ASTM C 33.
- D. Water: CSS 90 - 2.03.

E. Reinforcement:

1. Bar reinforcement: ASTM A 615, Grade 60 (deformed).
2. Welded wire fabric: ASTM A 185.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Forms shall be smooth, mortar tight, and shall maintain shape during placing of concrete.
- B. Concrete anchors shall be placed against solid undisturbed ground.
- C. Reinforcing bars shall be clean and placed accurately to the dimensions shown on the drawings.
- D. Moisten ground where concrete is to be placed.
- E. Do not place concrete in free water.
- F. Consolidate concrete with vibrators while placing.
- G. Cure by keeping concrete surface moist for 7 days or by using approved curing compound.
- H. Do not backfill over anchors, concrete caps, and encasements until at least 24 hours after placing of concrete is completed.

END OF SECTION

SECTION 05095.1

PIPE WELDING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Welding steel pipe in the field.

1.2 QUALITY ASSURANCE

A. Welding Procedure Specifications:

1. All welds shall be completed in accordance with a qualified WPS.
 - a. The Contractor may use a pre-qualified WPS per AWS D1.1, Section 3 including exceptions for GMAW identified in Paragraph 3.2.1.
2. All WPS's that are not pre-qualified as given above shall be qualified in accordance with one of the following:
 - a. ASME Boiler & Pressure Vessel Code, Section IX, or
 - b. AWS D1.1, Section 4.
3. An AWS CWI shall review, sign and stamp all WPS's.
4. An AWS CWI shall witness, review, sign and stamp all PQR's.

B. Qualification of Welders:

1. Welders shall be qualified under ASME Boiler & Pressure Vessel Code, Section IX, Part QW; AWS Structural Welding Code Section 5; or AWS D1.1, Section 4 for the welding processes, positions, and procedures to be used for this project.
2. Welders shall have verifiable evidence they have maintained their qualifications in accordance with AWS D1.1, Section 4 or ASME Boiler & Pressure Vessel Code, Section IX, Part QW-322.
3. Welders shall have verifiable evidence that their qualification is current and valid under the applicable code. Requires certification in 6G test position.
4. Welder Qualification Certification shall be witnessed and evaluated by a certified AWS QCI welding inspector from an independent testing laboratory utilizing calibrated equipment.
5. Welder Qualification(s) shall be witnessed, evaluated, stamped and signed by an AWS CWI.

6. All measuring and test equipment used in the qualification of welders shall be properly calibrated, and a copy of calibration certificates provided.

C. Nondestructive Examination of Production Welds:

1. In addition to any NDE required by the Contract Documents, the Engineer may elect to perform additional NDE of in-process or completed shop or field welds to verify weld quality. Any additional NDE may be performed by District personnel or the Engineer may request the Contractor perform or subcontract these examinations.
2. Types of NDE:
 - a. Radiographic Examination (RT) per Paragraph UW-52, Section VIII, ASME Boiler & Pressure Vessel Code.
 - b. Ultrasonic Examination (UT) per Paragraph UW-53, Section VIII, ASME Boiler & Pressure Vessel Code.
 - c. Other non-destructive tests such as Liquid Penetrant (PT) and Magnetic Particle (MT) in accordance with Section V, ASME Boiler & Pressure Vessel Code. Acceptance criteria shall be as given by AWS D1.1, Section 6, Part C.
 - d. Test coupons shall be in accordance with ASTM E 8.
 - e. Welded seam shall develop strength of adjacent steel sheet or plate.
3. Cost of Examinations:
 - a. The cost of NDE identified in the Contract Documents for specific welded connections shall be borne by the Contractor.
 - b. The cost of additional NDE requested by the District will be borne by the District in the event that all examined welds are found to be acceptable. In the event of a rejected weld, the costs of all NDE, repairs, re-inspection and re-examination that result from the reject shall be borne by the Contractor.
 - c. The cost of NDE performed by District personnel will be borne by the District. The costs of repairs, re-inspection and re-examination resulting from a rejected weld shall be borne by the Contractor.

1.3 SUBMITTALS

A. Certification of welders:

1. Submit verifiable evidence of initial qualification for each welder.
2. Submit verifiable evidence indicating each welder has maintained current qualification under the applicable code.

- B. Submit WPS's with supporting PQR's for approval.
- C. Submit verifiable evidence of current qualification for each AWS CWI used to qualify procedures or welders under Articles 1.2.A and 1.2.B above.
- D. Provide all submittals to Engineer at least seven days prior to commencing pipe welding.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES

- A. Use shielded metal arc welding (SMAW) method or flux cored arc welding (FCAW) method unless the Engineer approves another method prior to use.
- B. Welds shall be fused with base metal, uniform in appearance, free from cracks, and reasonably free from irregularities.
- C. Restart in weld zone on clean and sound metal.
- D. Limit porosity and slag inclusions in accordance with Section VIII, Boiler and Pressure Vessel Code.
- E. Repair defective welds by chipping, grinding, flame gouging, or air-arc gouging.
- F. Do not undercut along side of finished pass.
- G. Use procedures or welding sequences that will minimize eccentric stresses, shear, or distortion in the weld.
- H. Butt welds shall have complete penetration and fusion.
- I. Finished weld bead shall be central to the seam.
- J. Artificial or forced cooling of welded joints is not permitted.
- K. Low hydrogen electrode storage shall be in accordance with AWS D1.1, Article 4.5.
- L. See Drawing 323-EA, 324-EA and 325-EA for welding of flanges.
- M. Grind down all sharp weld projections prior to tape wrapping.

3.2 MANUAL WELDING

- A. Welding shall be performed in at least two layers.
- B. Passes shall not exceed 1/4" in throat dimension.

C. Welds shall be thoroughly cleaned after each pass.

END OF SECTION

SECTION 05097.1

FLANGE BOLTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install bolts, washers, and nuts for flanged connections and where shown on the drawings.
- B. Related Sections:
 - 1. Section 09961.1 - Protection from Corrosion.

1.2 REFERENCES

- A. American National Standards:
 - 1. ANSI B1.1: Unified Inch Screw Threads (UN and UNR Thread Form)
 - 2. ANSI B18.2.1: Square and Hex Bolts and Screws, Inch Series.
 - 3. ANSI B18.2.2: Square and Hex Nuts, Inch Series.
 - 4. ANSI B18.22.1: Plain Washers.
- B. ASTM Standards:
 - 1. ASTM A 449: Specification for Quenched and Tempered Steel Bolts and Studs.
 - 2. ASTM A 563: Specification for Carbon and Alloy Steel Nuts.
 - 3. ASTM F 436: Specification for Hardened Steel Washers.
 - 4. ASTM F 844: Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
- C. SAE Standards:
 - 1. SAE J 429: Mechanical and Material Requirements for Externally Threaded Fasteners.
 - 2. SAE J 995: Mechanical and Material Requirements for Steel Nuts.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bolts:

1. Conform to ANSI B18.2.1 and ASTM A 449, Type 1 or SAE J 429, Grade 5.
2. Standard hexagonal heads.

B. Nuts:

1. Conform to ANSI B18.2.2.
 - a. For 1/4" to 1 1/2" bolts, conform to ASTM A 563, Grade B or SAE J 995, Grade 5, standard hexagonal flat nuts.
 - b. For greater than 1 1/2" bolts, conform to ASTM A 563, Grade A, heavy hexagonal flat nuts.

C. Washers:

1. Conform to ANSI B18.22.1 Type A, narrow plain finish and ASTM F 436 or ASTM F 844 for sizes up to 1" diameter and ASTM F 436 for sizes greater than 1" diameter.

2.2 LENGTH OF BOLT

- A. After assembly, the bolts shall extend a minimum distance of two threads beyond the nut.

2.3 BOLT MARKING

- A. Identification symbols shall be applied to each bolt head to identify the material and grade of each bolt. The bolt identification symbols shall be as follows:
 1. Carbon Steel: Three radial lines, 120° apart.

2.4 THREADS

- A. Coarse thread series Class 2 Fit ANSI B1.1.

2.5 BOLT THREAD ANTI-SEIZE COMPOUND

- A. Compound shall be food grade meeting USDA code H2 standards for incidental contact, and shall be designed to prevent rusting, seizure and galling of bolt threads.
- B. Acceptable products:

1. Loctite Food Grade Anti-Seize.
2. Saf-T-Eze, by Saf-T-Lok[®].
3. Or equal as approved by the Engineer.

2.6 BOLT THREAD ANTI-SEIZE COMPOUND

- A. Compound shall be designed to prevent rusting, seizure and galling of bolt threads.
- B. Acceptable Products:
 1. Lubrigard anti-seize compound available from McMaster-Carr.
 2. Or approved equal.

2.7 BOLTING MATERIAL OTHER THAN STEEL

- A. Threading and dimensions shall conform to the requirements for steel heads and nuts.
- B. Class 3 Fit ANSI B1.1.

PART 3 - EXECUTION

3.1 FLANGE BOLTING PROCEDURES

- A. See Drawing 3186-B, 323-EA, 324-EA and 325-EA. Install appropriate gasket.
- B. Install washers under both bolt heads and nuts.
- C. Coat bolt threads with anti-seize compound.

END OF SECTION

SECTION 05610.1

FABRICATION OF 20" ML&TWS PIPE (Applicant Only)

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Fabricate and furnish 20" cement mortar lined and tape wrapped steel (ML&TWS) pipe, Type "TW."
- B. Pipe Description:
 - 1. Pipe details: Drawing 1884-A
 - 2. Flange details: Drawings 323-EA, 324-EA and 325-EA.
 - 3. Pipe shall be made in lengths (40'2" maximum) convenient for the Applicant.

1.2 QUALITY ASSURANCE

- A. Qualification of Welding Procedures, Welders, and Welding Operators:
 - 1. Qualify the welding procedures, welders, and welding operators in accordance with the provisions of Part QW of Section IX of the ASME Boiler and Pressure Vessel Code, or AWS Structural Welding Code, Section 5.
 - 2. Applicant to test welders at his expense.
- B. Welding Flux
 - 1. When Submerged Arc Welding (SAW) is performed, only new flux shall be used.
- C. Cylinder Fabrication Welding Tests (Tension tests, bend tests and x-rays):
 - 1. Cut tension test and bend test coupons from pipe cylinder for testing of welded seams. Take at least one set of test coupons from each heat of steel and take at least one set of test coupons daily from each welding machine and each operator.
 - 2. Test in accordance with AWWA C 200, Paragraph 4.11.5. Welded seams shall develop the ultimate strength specified for adjacent steel sheet.

3. X-ray examination of welds shall conform to Paragraph UW-52 of Section VIII of the ASME Boiler and Pressure Vessel Code.
4. Location for tests will be determined by Engineer. All x-rays and radiographs become the property of the District.
5. Contractor shall pay for all x-rays, tension tests and bend tests of welded seams as required by Paragraph UW-9(d), UW-11(a)(5)(b), UW-14(b) and UW-52, Section VIII ASME Boiler and Pressure Vessel Code. When X-ray examination discloses an unacceptable weld, two additional spot examination locations will be selected by the District as required by Paragraph UW-52 of Section VIII ASME Boiler and Pressure Vessel Code.
6. The manufacturer may elect to substitute full length Real Time Radiography for spot x-rays. Real Time Radiography shall comply with the following to be considered an acceptable alternative: Real Time Radioscopic Examination of spiral pipe welds shall comply with ASME Section V, Article 2, Mandatory Appendix II utilizing hole type IQI placement per Section T-277.1-C placed on the weld at a minimum of three locations at the approximate center of the weld and one at each end or termination of the weld. Welds shall conform to Paragraph UW-51 of Section VIII of ASME Boiler and Pressure Vessel Code. Final determination of radiography sensitivity is at the discretion of the District.
7. Repair and re-test with the same test method that identified the original defect to assure acceptable repair.

D. Hydrostatic Tests:

1. Shop test each steel cylinder to develop a circumferential tensile stress equal to 75% of minimum yield point stress for the specified steel used.
2. Maintain pressure during inspection of all seams. All surfaces shall be dry during inspection.
3. Repair by chipping, grinding, air-arcing, and rewelding.
4. Retest all repaired pipe.
5. Cylinders requiring more than 3% of any seam to be repaired may be accepted at the discretion of the District. Approved repairs shall be witnessed by the District.

1.3 SUBMITTALS

- A Submit seven copies of shop drawings, for the District's approval prior to fabrication. Shop drawings shall show the details of fabrication of fittings, and

assembly of pipe and fittings for completed pipeline. Shop drawings shall show field location number of each fitting and piece of pipe.

- B. Submit welding process and procedure for approval prior to start of fabrication.
- C. Submit certification of welders for approval prior to start of work.
- D. Submit tapecoat supplier and products to be used prior to start of work.
- E. Submit mill certificates, or certificates from approved testing laboratory or other source, for the steel used for pipe cylinders, showing conformance to appropriate ASTM Specifications including chemical and physical characteristics.
- F. Submit cylinder manufacturing and hydrostatic test reports, and non-destructive welding test reports with the appropriate information to insure compliance with these specifications.
- G. Submit certificates from approved testing laboratory or other source for cement and sand conformance to specifications.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prevent damage to pipe during transportation, handling, and storage:
 - 1. Bottom saddles shall be rigid, shaped, and cushioned to provide uniform bearing.
 - 2. Do not drag, skid, or drop pipe sections.
 - 3. Block to prevent shifting when transporting.
 - 4. Blocking, chains, and cables for securing the load shall be suitably padded.
 - 5. Cover ends of each pipe section in transit and at the site to prevent drying of the lining. A cover over the entire front end of the truck load shall also be provided during transit.
 - 6. Upon delivery, place off the ground on suitable supports, such as rubber tires or sandbags at quarter points, and securely block.

PART 2 - PRODUCTS

2.1 STEEL FOR FABRICATED PIPE CYLINDERS

- A. ASTM A 36; ASTM A 283, Grade C; or ASTM A1011 and A1018, SS Grades 30, 33, or 36.

2.2 FLANGES

A. See Drawings 323-EA, 324-EA and 325-EA.

2.3 CEMENT MORTAR LINING

Cement mortar lining shall be NSF 61 approved for potable water applications.

A. Portland Cement:

1. ASTM C 150, Type II or Type V.

B. Sand: ASTM C 33 and as follows:

1. Fineness modulus: 2.50 to 3.00.

2. Average sand equivalent of three successive samples tested by the test method California 217 shall be not less than 75, and no individual sample shall have a sand equivalent of less than 70.

2.4 MACHINE-APPLIED TAPE COATING

A. Conform to AWWA C214 except as modified herein.

B. The tape coating shall have a total thickness of 80 mils nominal and shall have one inner-layer corrosion protection tape and two outer-layer mechanical protection tapes.

C. Compatibility: Primers and tapes shall be supplied by the same manufacturer.

D. The outer layer tape shall have an integral light blue color (Federal Standard Color No. 15450) and shall be resistant to ultraviolet light degradation.

E. Approved Products:

1. Polyken YG III System

Primer, No. 1039

Innerwrap, No. 989, 20 mils nominal.

Outerwrap, No. 955,, 30 mils nominal.

Outerwrap, No. 956, 30 mils nominal.

2. Tapecoat P-TC 80 System

Primer, M/A 1000F or M/A 1100NF

Innerwrap, No. 1020, 20 mils nominal.

Outerwrap, No. 2030, 30 mils nominal.

Outerwrap, No. 2208, 30 mils nominal.

3. Tek-Rap System
 - Primer, 200 Series
 - Innerwrap, 250 Series, 20 mils nominal.
 - Outerwrap, 255 Series, 30 mils nominal.
 - Outerwrap, 255 Series, 30 mils nominal.
4. Wrap-tite System
 - Primer, WT27EF
 - Innerwrap, 55-20, 20 mils nominal
 - Outerwrap, 365-30, 30 mils nominal
 - Outerwrap, 365-30, 30 mils nominal
5. Or equal as approved by the Engineer.

PART 3 – EXECUTION

3.1 INSPECTION OF FABRICATED PIPE CYLINDERS

- A. District will inspect all phases of pipe fabrication work and will witness all tests.
- B. Notify District's Plant Inspection Section (510-287-1132) to schedule the inspection, at least one week prior to start of the fabrication work, and 2 working days prior to scheduling inspections where the travel is less than 75 miles one way from Oakland.
- C. For sites where the travel is between 75 and 200 miles one way from Oakland provide notification a minimum of 5 working days prior to required presence of Engineer.
- D. For sites within the continental United States where the travel is 200 miles or more one way from Oakland provide notification a minimum of 15 working days prior to required presence of Engineer.
- E. For international locations and sites outside the continental United States provide notification a minimum of 30 working days prior to the required presence of the Engineer.
- F. Expense of rewitnessing failed hydrostatic tests or reinspection of any phase of pipe manufacture shall be paid by the Contractor.
- G. Expense of rewitnessing or reinspection by District personnel if any of the inspections are to be performed at a locality exceeding 75 miles one way from Oakland, shall include the employee's wages, transportation, lodging (at an establishment rated three diamond or better by California State Automobile Association (AAA), or comparable listing), and incidental expenses incurred between Oakland and the shop location, at the shop location, and return to Oakland.
 1. Expense of rewitnessing or reinspection by the District's authorized agent shall be the total charge billed to the District by the agent.

2. Travel exceeding 200 miles one way from Oakland, travel expenses shall also include round trip direct route coach airfare from Oakland, San Francisco, Sacramento, or San Jose Airports to manufacturer's plant or testing facility, mid-sized car rental or taxi services, fuel, tolls, ground transportation to and from the airport, and airport parking at the departing airport.
 - a. For international or travel outside the continental United States, per diem rates are those established by the US Department of State for the specific location and dates of travel. Travel expenses may include the direct cost of securing passports, visas, language interpreters, document translators, communications, and internet access.
 - b. If weekend stays are requested to defray transportation costs, reimbursement for the inspectors stay over the weekend will include meal allowance, hotel expenses, phone and internet access charges, rental car or transportation charges to and from eating establishments, laundry service, language interpreters, or other necessary business expenses or services.
 - c. Any witness inspection that has to be repeated due to necessary rework, including District inspector's wages or if done by a District agent the agent's bill to the District, shall be paid for at the Contractor's expense.

3.2 FABRICATION OF STEEL CYLINDERS

- A. Cylinders shall be substantially true right cylinders formed from one piece of sheet or coil steel. In order to avoid steel waste, one splice in a cylinder shall be allowed provided radiographic inspection of the splice is performed and the results submitted to the Engineer. The location of the splice shall be a minimum of 24" from the end of the cylinder.
 1. The difference between major and minor axes shall not exceed 1% of the diameter of the pipe.
 2. Straightness of cylinders shall be such that no point on the surface of the cylinder shall deviate more than 1/8" in any 10 foot length as measured by a straight edge.
 3. Circumferential welds are not acceptable.
 4. The mill sheets or plates shall contain no welded seams.
- B. Type of welding shall be limited to the following methods unless approved otherwise by the Engineer prior to use.
 1. Submerged arc welding (SAW).
 2. Shielded metal arc welding (SMAW).

3. Flux cored arc welding (FCAW).
4. Resistance seam welding (RSEW).
5. Manual welding permitted on special sections not suitable for automatic welding.

C. Welding of Longitudinal or Spiral Seams:

1. Butt welds shall be used.
2. Longitudinal seams may be either parallel to the axis of the pipe or spiral. There shall be only one seam in the cylinder.
3. Seams shall have an efficiency of at least 100% of the specified minimum strength of the adjacent sheet.
4. Before welding, edges shall be thoroughly cleaned and properly formed. Forming of material shall not be performed by means of hammering.
5. Weld bead shall be central to the seam and free from depressions, undercut edges, burrs, irregularities, and valleys.
6. Weld shall be continuous for full length of seam.
7. Arc welds shall be built up uniformly at the center of the weld and have complete penetration. Height of weld bead above plate surface shall be 1/32" minimum, but not more than 1/8" on the outside nor more than 3/32" on the inside.
8. All welds shall be thoroughly fused and blend smoothly and gradually with base metal, uniform in appearance, free from cracks, and reasonably free from irregularities.
9. Scattered porosity and slag inclusions in accordance with the Standards of Section VIII of the ASME Boiler and Pressure Vessel Code will be acceptable.
10. Unacceptable defects shall be chipped, flame-gouged, or air-arc gouged to sound metal and rewelded by either manual or automatic welding as approved. The portion of the weld that must be repaired shall be as directed by the Engineer.
11. Restart the welding operation on clean and sound metal.
12. Welding technique shall ensure uniform distribution of residual stresses in the weld or adjacent metal. Undercutting will not be permitted.

13. Weld beads on the outside of plain or spigot ends and on the inside of bells shall be ground flush for a distance of 2-1/2" from the end of cylinders.
14. Butt welds made by the resistance seam welding (RSEW) method shall have not buildup either internally or externally. Pipe made by this method shall be cleaned of all material formed during the welding process beyond the outside circumference of the cylinder.

D. Handling Steel Cylinders:

1. Unlined or uncoated steel cylinders shall be adequately supported during all operations to ensure against development of a permanent out-of-round set.

3.3 APPLICATION OF CEMENT MORTAR LINING

A. The proportions of portland cement, sand, and water shall provide a compressive strength of 3,500 psi at 28 days.

1. Mix proportions shall consist of one part cement to not more than three parts fine aggregate by weight.
2. The water-soluble chloride ion content of the mortar shall not exceed 150 milligrams in 1,000 grams of mortar.
3. Compressive strength shall be determined using samples made from a small spinning device with a steel cylinder dimensioned in accordance with the standard test cylinder as described in ASTM C 31, and the mortar shall be spun in the cylinder with a thickness of at least 1-1/2". The mortar shall be removed from the mix in accordance with ASTM C 172, "Sampling Fresh Concrete." Curing of test specimens shall be the same as curing the pipe. The specimens shall then be tested in accordance with ASTM C 39, using the net mortar area to determine the compressive strength. If laboratory facilities are not available at the plant, then the tests shall be made by an approved testing laboratory. Results of compressive strength tests shall be submitted to the Engineer.

B. Pipe-lining Equipment:

1. A centrifugal lining machine shall be used. Hand-applied lining shall be prohibited.

C. Application of Lining:

1. Line after completion of shop tests and after the interior has been cleaned of loose rust, scale, oil, and foreign matter.
2. Lining shall be shop-applied. Install round-up rings at each end of pipe and install exterior ring beams before spinning the lining. Rings and beams shall

remain in place until the lined pipe section is supported for curing on sand ribbons.

3. The number and spacing of ring beams shall be adequate to maintain a rigid and round pipe section within the specified tolerance.
4. The mortar shall be deposited by a method which allows a regulated and uniform quantity of material to be applied throughout the entire length of pipe. Confine lining to dimensions shown on the pipe drawings.
5. Finished lining shall present a smooth, hard, dense, nongritty surface free from defects.
6. Engineer shall verify sampling, placement, and finish of mortar lining.

D. Handling Lined Cylinders:

1. Lined and/or coated pipe shall be supported by belt slings or shaped rubber pads providing at least 120° support during all handling operations.
2. Prevent slipping or sloughing of new lining.
3. Damaged lining: Cut out damaged lining and reline area.

E. Curing:

1. Start curing as soon as lining has set.
2. Moist curing:
 - a. Cure for not less than 4 days.
 - b. Surface shall be kept continuously wet by sealing the pipe ends airtight or by a method approved by the Engineer.
3. Accelerated curing: Steam curing may be used to speed the curing or until the lining has gained sufficient strength to be handled.
 - a. Start 3 to 6 hours after lining has been applied.
 - b. Steam shall be saturated vapor at 100°F to 130°F maximum.
 - c. Steam curing chambers shall protect pipe from drafts.
 - d. Protect from rapid drops in temperature after curing.

4. Each 1 hour of steam curing will reduce the required 4 day water cure by 4 hours.

F. Protection:

1. During water curing of the lining, protect against being heated by the atmosphere or direct sunlight to above 100°F by covering with burlap or other suitable material.
2. Keep cover continuously wet.

3.4 APPLICATION OF MACHINE-APPLIED TAPE COATING

A. Install in accordance with applicable sections of AWWA C214 as modified below.

B. Minimum Surface Preparation:

1. Prepare surface in accordance with the coating manufacturer's specifications but not less than "Commercial Blast" (SSPC-SP6).
2. Surface profile shall be per manufacturer's specification and/or recommendation.
3. Grind off all sharp edges and points on welds.
4. Weld toe tape shall not be used. Preparation of welds as described in Sub-paragraphs 3.2.C.7 and 3.2.C.8 is required to assure continuity of tape contact in the weld toe areas.

C. Prime:

1. Mix in accordance with manufacturer's recommendation.
2. Prime immediately after cleaning.
3. Coverage shall be in accordance with manufacturer's recommendations but shall not exceed 800 square feet per gallon.
4. Remove any imperfections such as foreign material, drips, and runs. Reprime.
5. Primer shall be dry to touch prior to application of inner wrap.

D. Apply Inner and Outer Tape Wraps:

1. Pipeline tape shall normally be applied at a roll body temperature above 75°F, and at an ambient temperature above 45°F, and shall be stored up to the time of

application under such conditions and for a sufficient period of time that the roll body temperature shall be above 75°F at the time of application.

2. Pipeline tape as specified shall be spirally wrapped by a wrapping machine approved by the tape manufacturer onto suitable cleaned, dry, and frost-free, primed pipe with 1" minimum lap. The end of each new roll shall overlap the end of the preceding roll by a minimum of two tape widths. This end-lap shall be hand applied without tension and shall be pressed into position by several wiping strokes of the hand. Its spiral angle shall parallel the previously applied spiral and it shall be smoothly applied without twist or distortion.
3. The free ends of outerwrap of each pipe section shall be primed and hand pressed into place.
4. Operators shall make necessary adjustments, including spindle-brake tension adjustments, to continuously provide a uniform, tight coating. A smooth, taut coating accomplished with a tape-width drawdown not in excess of 1/2% shall be considered adequate. Wrinkles, puckers, and voids shall be kept to a minimum and the specified lap shall be maintained.
5. Tape spindles shall be adjustable and provide for half-lapping the innerwrap tape by the first outerwrap and half-lapping the first outerwrap by the second outerwrap.
6. The hold-back at the pipe ends shall be as shown on Drawing 1884-A.

E. Inspection and Repair:

1. After the application of the inner pipe tape and prior to the application of the first outerwrap, the pipe tape shall be electrically tested for flaws with a high voltage holiday detector in accordance with NACE International Standard Practice RP-02-74, "High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation." Test in presence of Engineer.
2. The voltage of the detector shall be adjusted to within 20% of the voltage calculated by formula:

$$\text{Voltage} - 1250 (T)^{1/2};$$

where T = the average thickness of the inner tape wrap in mils.

The optimum travel rate of the holiday detector shall be determined by testing on a tape wrapped pipe section with a known, pin-type holiday.

3. Defective locations shall be clearly indicated by a circular mark or cross immediately upon discovery by either visual examination or by the holiday detector.

4. All holidays and minor damaged or defective coating shall be repaired immediately by removing all loose tape and outerwrap from the damaged area, applying primer, and applying a patch of the specified tape or outerwrap. Primer shall be dry to the touch before the tape patch is applied. Pinholes shall be repaired by applying primer and a patch of inner wrap tape at least 4" square. The patch shall extend a minimum of 4" beyond the damaged area. Prime the tape patch and cover with outerwrap.
5. The repaired areas shall be checked for holidays with a high voltage holiday detector.

3.5 SHOP FABRICATION OF FITTINGS

A. Welding:

4. Conform to the applicable requirements of Article 3.2, Fabrication of Steel Cylinder.

B. Bends:

4. Fabricate from sections of mortar lined and tape coated pipe, Type "TW", or from bare cylinders that have passed the shop hydrostatic test as detailed on shop drawings approved by the District.
5. Bare cylinders shall be of the same quality as specified for Type "TW" pipe.
6. Before cutting pipe remove lining and coating back from the line of cut approximately 2 inches.
7. Use care to avoid injury to the lining and coating beyond the area removed.
8. Remove and replace loosened or broken lining or damaged coating.

C. Tees and wyes:

4. Fabricate from steel plate or from bare cylinders which have passed the shop hydrostatic test.
5. Plate and cylinders shall be the same quality as specified for Type "TW" pipe.
6. Stress relieve all tees and wyes having girder reinforcement plates 1/2-inch or greater in thickness after complete fabrication.
7. Stress relieving shall conform to Paragraphs UW-40 and UCS-56 of Section VIII of the ASME Code.

- D. Tapers:
 - 4. Fabricate from steel plate of same quality as specified for Type "TW" pipe.
- E. Nozzles:
 - 4. Fabricate and attach to pipe as shown on the drawings.
- F. Mortar lining of fittings:
 - 4. The mortar lining and the quality, curing, handling and the protection of the finished lining shall conform to Article 3.3.
 - 5. Apply mortar lining by hand plastering or an approved machine method.
 - 6. For fittings fabricated from steel cylinders or plate, the thickness shall be same as specified for Type "TW" pipe sections unless otherwise shown on the drawings.
 - 7. When bends are fabricated from lined pipe, line exposed cylinder at the welded girth joint with mortar the same thickness as the adjacent pipe lining, and when the strip of exposed cylinder is more than 12 inches wide, reinforce lining with welded wire fabric tack welded to the cylinder. Use an epoxy or adhesive bonding agent to bond new mortar with existing mortar.
- G. Tape coating of fittings:
 - 4. Use the same machine applied 80-mil tape coating system used on the pipe where possible.
 - 5. Use the hand applied repair and joint wrap tape system from the same manufacturer when the machine applied system cannot be applied. Double wrap or half lap to provide 100 mils minimum thickness.
 - 6. Coating used and application procedure shall be approved by the tape manufacturer.
 - 7. Inspect and repair in accordance with Article 3.4 E.

3.6 FLANGED SECTIONS

- A. Conform to Drawings 323-EA, 324-EA and 325-EA unless shown otherwise.
- B. Flanges fabricated from segments of plate shall be stress relieved before machining.
- C. Stress relieving shall conform to Paragraphs UW-40 and UCS-56 of Section VIII of the ASME Code.

- D. Flanges shall be welded to pipe sections before machining.
- E. Lining and coating of flanges with attached pipe sections shall conform to Articles 3.3 and 3.4.

3.7 IDENTIFICATION OF PIPE AND FITTINGS

A. Cylinders:

1. Each length shall be plainly marked on the outside with a manufacturing number, metal stamped 1" from the bell end. This number shall be used in the cylinder manufacturing and hydrostatic tests to trace the steel used in manufacturing.
2. Transfer this number, by metal stamping, to all pieces to be cut from cylinder, prior to cut.

B. Pipe:

1. Pipe designations as indicated on the drawings shall be plainly marked on the lining and coating on each length of pipe, 1 foot from the bell end. In addition, the date of final coating and identification to show proper location in the pipeline, by reference to layout drawings or schedules, shall be shown.
2. Beveled pipe shall be marked to show degree of bevel, point of maximum pipe length at the spigot end, and the field top at each end.
3. Pipe sections containing angle bends, manholes, or nozzles shall be stenciled on the lining and coating at both ends.

C. Fittings:

1. Mark with appropriate identifying number or symbol indicating its location in the pipeline. Mark vertical field top on each end of each fitting.

3.8 REPAIR OF DAMAGED PIPE

- A. Obtain approval of Engineer before performing repair work.

- B. Repair in presence of Engineer or replace all pipe sections damaged during manufacturing, handling, transporting, or storing.
- C. Reshaping of cylinders, pipes, and fittings shall be accomplished by rolling or pressing. Reshaping by hammering shall be prohibited.

END OF SECTION

SECTION 06066.1

POLYWRAP

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install protective wrapping for mortar coated pipe, valves and fittings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General Purpose Adhesive Tape:

- 1. Two inches wide by 10 mils thick minimum, to 20 mils thick maximum.
- 2. Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Plymouth Slipnot 100, Manville No. V-10 Trantex, Renfru 300-10, Wrap-tite WT46-12, or approved equal.

- B. Polywrap:

- 1. AWWA C105, Type I, Class C (black), Grade E-1, 8 mil minimum thickness.
- 2. Minimum polywrap tube size shall be:

<u>Nominal Mortar Coated Steel Pipe Diameter (Inches)</u>	<u>Polywrap Flat Tube Width (Inches)</u>
4	14
6	17
8	21
10	25
12	29
14	33
16	37
18	41
20	41
24	54

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation on Pipe:

1. Cut polywrap tube to a length approximately 2 feet longer than the length of the pipe section.
2. Slip polywrap around the pipe, centering it to provide a 1 foot overlap of each adjacent pipe section.
3. Bunch polywrap accordion fashion until it clears the pipe ends.
4. Provide bell hole in trench at joints to facilitate installation of polywrap.
5. After completing pipe joint, pull bunched polywrap from preceding length of pipe, slip over end of new length of pipe, and secure in place with one circumferential turn of tape plus enough overlap to assure adhesion.
6. Slip end of the polywrap from the new section over the end of the polywrap from the preceding section until it overlaps the joint at the end of the preceding length of pipe.
7. Tape in place.
8. Take up slack width at the top of the pipe to make a snug but not tight fit along the barrel of the pipe, securing the fold at spring line as necessary with adhesive tape. Fold flap shall be in down position.
9. Repair any rips, punctures, or other damage to the polywrap with tape, or with short length of polywrap tube cut open, wrapped around the pipe and secured with tape.
10. Proceed with installation of next section of pipe in the same manner.

B. Bends Reducers and Offsets:

1. Cover with polywrap in the same manner as the pipe.

C. Non-epoxy Coated Valves and Odd Shaped Pieces:

1. Wrap with a flat sheet obtained by splitting open a length of polywrap tube.
 - a. Sheet shall be passed under the valve and brought up around the body to the stem.

- b. Make seams by bringing the edges together, folding twice, and taping down.
- c. Slack width and overlap at joints shall be handled as described above.
- d. Tape polywrap securely in place at valve stem and other penetrations.

D. Openings for Appurtenances:

1. Openings for branches, service taps, blowoffs, air valves and similar appurtenances shall be made by making an x-shaped cut in the polywrap and temporarily folding the film back.
2. After installation of the appurtenance, replace film and repair cut as well as other damaged areas in the polywrap with tape.
3. Branches, service taps, blowoffs, air valves, and similar appurtenances shall not be wrapped with polywrap unless otherwise specified or shown on the drawings.

E. Junctions Between Wrapped and Unwrapped Pipe:

1. Where polywrapped pipe joins a pipe which is not wrapped, extend the polywrap tube to cover the unwrapped pipe a distance of two feet, unless otherwise shown on the drawings.
2. Secure the end with circumferential turns of tape.

F. Cast Iron Fittings When Specified on Drawings:

1. Polywrap shall extend beyond fittings by 8" on each side and shall be secured by tape.
2. Polywrap shall be overlapped 6" when split is required. The split shall be sealed with tape.

G. Backfill:

1. Material and compaction shall be the same as specified for pipe without polywrap.
2. Exercise care to prevent damage to the polywrap.

END OF SECTION

SECTION 09961.1

PROTECTION FROM CORROSION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:

1. General guidelines for corrosion control protection of buried pipelines and miscellaneous elements.
2. Lists of coating types and brand names of approved products.

PART 2 - PRODUCTS

2.1 TYPES OF COATINGS

A. Cement Mortar - See Section 02511.1 and Section 02513.1.

B. Plastic Coating - See Section 02512.1.

C. Polywrap - See Section 06066.1.

D. Mastic - See Section 02512.1.

1. Christy's HD50 Bituminous Coal Tar Mastic.
2. Hy-Tech Coatings Bituminous Mastic 50-HT.
3. Or equal as approved by the Engineer.

E. Tape:

1. Petrolatum or Wax Tape:

- a. Densyl Tape from Denso North America.
- b. WPT1 Petrolatum Tape from Wrap-Tite.
- c. Trenton #1 Wax Tape from Trenton Corporation & Northgate Associates.
- d. Superior Corrosion Control Step 2 Belowground Wax Wrap.
- e. Or equal as approved by the Engineer.

2. For miscellaneous elements:

- a. Scotchwrap 50 or 51.

- b. Polyken 900.
 - c. Wrap-Tite WT 46-12.
 - d. Arno C-350.
 - e. Trantex V-10 or V-20.
 - f. Plymouth Slipnot 100.
3. For pipeline joints: See Section 02512.1.
- F. Galvanize structural steel, pipe, bolts, nuts, washers, and other steel items in accordance with applicable ASTM specifications:
- 1. ASTM A 123 Specification for Zinc Coatings (Hot-Dip Galvanized) on Structural Steel Shapes, Plates and Bars and Their Products.
 - 2. ASTM A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware,
 - 3. ASTM A 384 Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
 - 4. ASTM A 385 Practice for Providing High-Quality Zinc Coatings.
 - 5. ASTM B 633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- G. Corrosion Inhibiting Grease:
- 1. Denso Paste from Corrosion Control Products, Gardena, CA, (800) 421-2623.
 - 2. Fluid Film Gel, Grade B from Eureka Chemical Company, So. San Francisco, CA (650) 761-3536;
 - 3. Wrap-Tite WTP1 Paste from Protection Engineering, Pittsburg, CA (925) 427-6200
 - 4. Carboline Carbowrap Paste available from Carboline Company, St. Louis, MO (800) 848-4645.
 - 5. Or equal as approved by the Engineer.

PART 3 - EXECUTION

3.1 GENERAL

- A. Apply coatings in accordance with manufacturer's instructions and as specified.

3.2 PROTECTION OF BURIED PIPELINES

- A. Pipe with Insulating Coatings: Coat all metallic parts of the pipeline, including the joints, in-the-line elements, and branches. In-the-line elements include valves, collars, couplings, and reducers. Branches to be coated include piping for air valves, blowoffs, hydrants, and steel service taps, but do not include copper service taps or branches electrically isolated from the main. Coatings shall be continuous and free of holidays and pinholes. Coat or wrap all joints and all ferrous appurtenances (such as valves, tees, collars, air valves, and blowoffs). Install galvanic anodes with test stations as shown on Drawing 286-EA Figure A where specified on the drawings.
- B. Cement Mortar Coated Pipe: Coat all metallic parts of the pipeline including the joints, in-the-line elements, and branches with cement mortar. In-the-line elements include valves, collars, couplings, and reducers. Branches to be coated include air valves, blowoffs, hydrants, and steel service taps, but do not include copper service taps or branches electrically isolated from the main.
- C. Polyvinyl Chloride Pipe: Mastic coat all ferrous elements, unless already coated. Do not apply mastic to adjacent polyvinyl chloride surfaces.
- D. Copper and Brass Pipe: Metallically isolate copper, brass, and other nonferrous metal pipe from steel or cast iron. Eliminate points of direct metallic contact by the use of insulating bushings, coupling unions, or flanges. Also isolate nonferrous pipe from steel supports and pipe straps by insulating sleeves or tape wrapped around the pipe.
- E. Insulation from Concrete: Whenever metal pipe and fittings are partially imbedded in concrete (except mortar coated pipelines) apply a 6-inch minimum band of tape to the steel such that half of the band will be embedded in the concrete and the other half will be exposed.
- F. Bolts: On cement mortar coated pipelines, field coat exposed surfaces of bolts with cement mortar. On all other pipelines, field coat bolt surfaces with mastic.
- G. Miscellaneous Appurtenances: On other than cement mortar coated pipelines, coat all buried parts of relatively thin cross section (tie rods, leak clamps, and bolts, etc.) with mastic. On cement mortar coated pipelines, mortar coat or encase such parts in concrete.
- H. Bonding: All steel and cast or ductile iron pipe shall be electrically continuous except where electrical separation is specifically designed to avoid a bi-metallic contact or other types of corrosion cells. Thus, all joints other than welded, standard flanged, lead caulked or insulating joints shall be bonded in accordance with Drawing 220-EA.

3.3 PROTECTION OF MISCELLANEOUS ELEMENTS

- A. Miscellaneous Steel Elements Partially Embedded in Concrete (for example, a fence or sign post set in concrete): Whenever a galvanized or bare steel element is partially embedded in concrete, and is exposed to the weather or to dampness, apply a 6-inch minimum band of insulation consisting of tape, mastic, or coal-tar epoxy to the steel such that half of the band will be embedded in the concrete and the other half will be exposed.
- B. Steel Electrical Conduit: Unless otherwise specified, all buried steel electrical conduit and couplings shall be galvanized and encased in a concrete jacket of 3 inches minimum thickness all around or shall be galvanized and plastic coated to a minimum thickness of 40 mils. At all outdoor locations and at damp indoor locations, galvanized conduit shall be taped or coated at the point specified in Article 3.3.A above.
- C. Aluminum: Direct contact between aluminum and concrete or cement mortar is not permitted.
 - 1. Aluminum pipe, bolts, or frames to be installed in concrete: Completely isolate from direct contact by taping or by coating with mastic, high-build epoxy, or coal-tar epoxy.
 - 2. Aluminum structural members to be mounted on concrete: Isolate from contact by taping or coating (as described above) or by installing isolating pads of neoprene, polyvinyl chloride, or other approved insulating materials.
 - 3. Anchor bolts holding aluminum structures:
 - a. For dry interior environment, use hot-dip galvanized or cadmium-coated steel.
 - b. For damp or exterior environment, use stainless steel, cadmium-coated steel, or aluminum, except no aluminum in concrete.
 - c. For submerged or buried environment, use stainless steel or aluminum, except no aluminum in concrete.
- D. The mating surfaces of fabricated metallic elements of a structure which will be immersed in water, buried, or exposed to a humid or corrosive environment shall be sealed to prevent the entrance of moisture around the mating surfaces by an approved method.

END OF SECTION

SECTION 09969.1

FUSION-BONDED EPOXY COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Fusion-bonded epoxy coating on ferrous metal surfaces.

1.2 REFERENCES

- A. SSPC Vol 2, Steel Structures Painting Manual, Volume 2, Systems and Specifications.
 - 1. SSPC-SP 5 White Metal Blast Cleaning
 - 2. SSPC-SP 11 Power Tool Cleaning to Bare Metal
- B. AWWA C213: Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
- C. American National Standards Institute (ANSI)/NSF International.
 - 1. ANSI/NSF 61: Drinking Water System Components – Health Effects

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's current specifications or technical information that proves compliance with the specified requirements.
- B. Manufacturer's Instructions: Submit the manufacturer's written instructions and recommendations for field coating and repair of the coating system.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Applicator: Regularly engaged in application of similar coatings for at least two years immediately prior to this work.
 - 2. Workers: Experienced and knowledgeable in preparation for and application of fusion-bonded epoxy coatings.

1.5 JOB CONDITIONS

- A. Environmental conditions:
 - 1. Do not abrasive blast when ambient temperature is less than 5° F above dew point.

2. Apply coatings only when conditions are within the limits prescribe by the manufacturer but, in any case, do not apply coatings when:
 - a. Metal temperature is less than 425° F for fluidized bed.
 - b. Metal temperature is below 55° F for repair work.
 - c. Relative humidity is greater than 70 percent for fluidized bed.
 - d. Relative humidity is greater than 85 percent for repair work.
3. The cleaned pipe surface shall be protected from conditions of high humidity, rainfall, and surface moisture. The pipe surface shall not be allowed to flash rust before coating.

B. Safety:

1. Comply with the applicable safety recommendations of SSPC-PA-Guide 3 and Good Painting Practice, Chapters 2.4 and 5.3.

PART 2 - PRODUCTS

2.1 COATINGS

- A. 100% solids, fusion-bonded, thermo-setting resin powder certified in accordance with ANSI/NSF standard 61.
- B. Approved Products:
 1. Electrostatic spray: Scotchkote No. 134 for shop application and No. 314 for field repair, manufactured by Minnesota Mining & Manufacturing Co.
 2. Fluidized bed: Scotchkote No. 203 or No. 206N, for shop application and No. 312 for field repair, manufactured by Minnesota Mining & Manufacturing Co.

2.2 APPROVED APPLICATORS

- A. JIFCO, Livermore, CA, (925) 449-4665.
- B. Fast Fabricators, Inc., Marysville, CA, (530) 742-5171.
- C. California Pipe Fabricators, Dixon, CA, (707) 678-3069.
- D. APAC Coatings, Livermore, CA, (510) 447-2444.
- E. Poly-Engineering, Richmond, CA, (510) 233-1420.
- F. Reliance Powder Coating System, San Leandro, CA, (510) 895-7170.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Prepare surfaces to be coated in accordance with manufacturer's written instructions, but not less than specified herein.
- B. Grind smooth all surface irregularities, welds, and weld spatter.
- C. Grind smooth and round all sharp metal edges.
- D. Abrasive blast surfaces to white metal in accordance with SSPC-SP 5.
- E. Surface anchor profile: 1.5 to 4.0 mils.
- F. Oxidation of the steel prior to coating in the form of "blueing" or other apparent oxide formation is not acceptable. If such oxidation occurs, the material shall be cooled to ambient temperature and recleaned.
- G. The heat surface shall not leave a residue or contamination on the pipe surface. Graduated "Tempilstik" crayons shall be used and supplied to the District by the Contractor to measure the temperature. Only a small spot of pipe shall be touched with the "Tempilstik". Optical pyrometers may be used in addition to, or in lieu of "Tempilstik's". The calibration of the optical pyrometer shall be checked at least twice daily.

3.2 COATING APPLICATION

- A. Preheating, coating application, and post-curing shall be in accordance with AWWA C213 and the coating manufacturer's instructions.
- B. Dry film thickness of cured coating shall be 12 mils minimum.
- C. Finished coating shall be well bonded and have no sags and runs.
- D. Coating shall be free of holidays and pinholes.

3.3 INSPECTIONS AND TESTS

- A. The finished coating shall be inspected and tested at the coating plant by the applicator for holidays, adhesion, and for coating thickness. All testing shall be done in the presence of the Engineer.
 - 1. Holiday test: Low voltage wet sponge holiday detector, such as K-D Bird Dog or Tinker-Razor M-1, shall be used for testing. Add a non-sudsing wetting agent, such as Eastman Kodak Photo-Flo to the water used to saturate the sponge.
 - 2. Adhesion test:

- a. Tension: 3,000 psi when pulling apart two 1/2" diameter coated rods joined by coating, using an Instron testing machine.
 - b. Shear: 4,000 psi when pulling apart two coated panels with 1/2 square inch overlap and joined by coating, using an Instron testing machine.
3. High voltage holiday detector, for coatings more than 20 mils dry film thickness, shall be equal to Tinker-Rasor AP-W or D. E. Stearns Model 14/20. Use in accordance with coating manufacturer's recommendations except use voltage of 125 volts per mil of coating.
 4. Thickness: Measure with a nondestructive point film thickness gauge such as Mikrotest.
- B. Any work found defective shall be repaired and brought to full compliance with these specifications. Retest after coating repairs.

3.4 FIELD REPAIR OF COATINGS

- A. After installation of coated items, repair damaged shop-applied coatings and coat field welds with the coating manufacturer's recommended repair material. Mastic products shall not be used for interior surface repairs.
- B. Comply with coating manufacturer's recommendations for field repair.
- C. Prior to coating, clean surfaces to bare metal free of all visible foreign matter in accordance with SSPC-SP 11. Maintain specified surface profile.
- D. Apply one or two coats as required to obtain a dry film thickness of 12 mils minimum, using brush or spray. Brush shall only be used for touch-up work of less than 3 sq. ft.
- E. Comply with recommendations of the coating manufacturer.

END OF SECTION

APPENDIX A

Flushing and Chlorination Checklist

Sample Tap Installation Drawing

EBMUD Contingency Plan for Contaminated Soils (District Forces only)

FLUSHING AND CHLORINATION CHECKLIST

Contractor's Plan, as a minimum, shall address the following items:

FLUSHING PHASE

- Identify location of discharges
- Indicate where discharge is going (truck, tank, storm drain, sewer)
- If sewer, provide approval by sanitary district
- Mention whether or not flow goes into waterway (if yes, indicate discharge distance)
- Indicate location of monitoring/test points on source main
- Specify feed size
- Indicate number and size of blowoffs and hoses attached to blowoffs
- Calculate estimated flush rate (gal/min) and flush time
- Test and record source main results

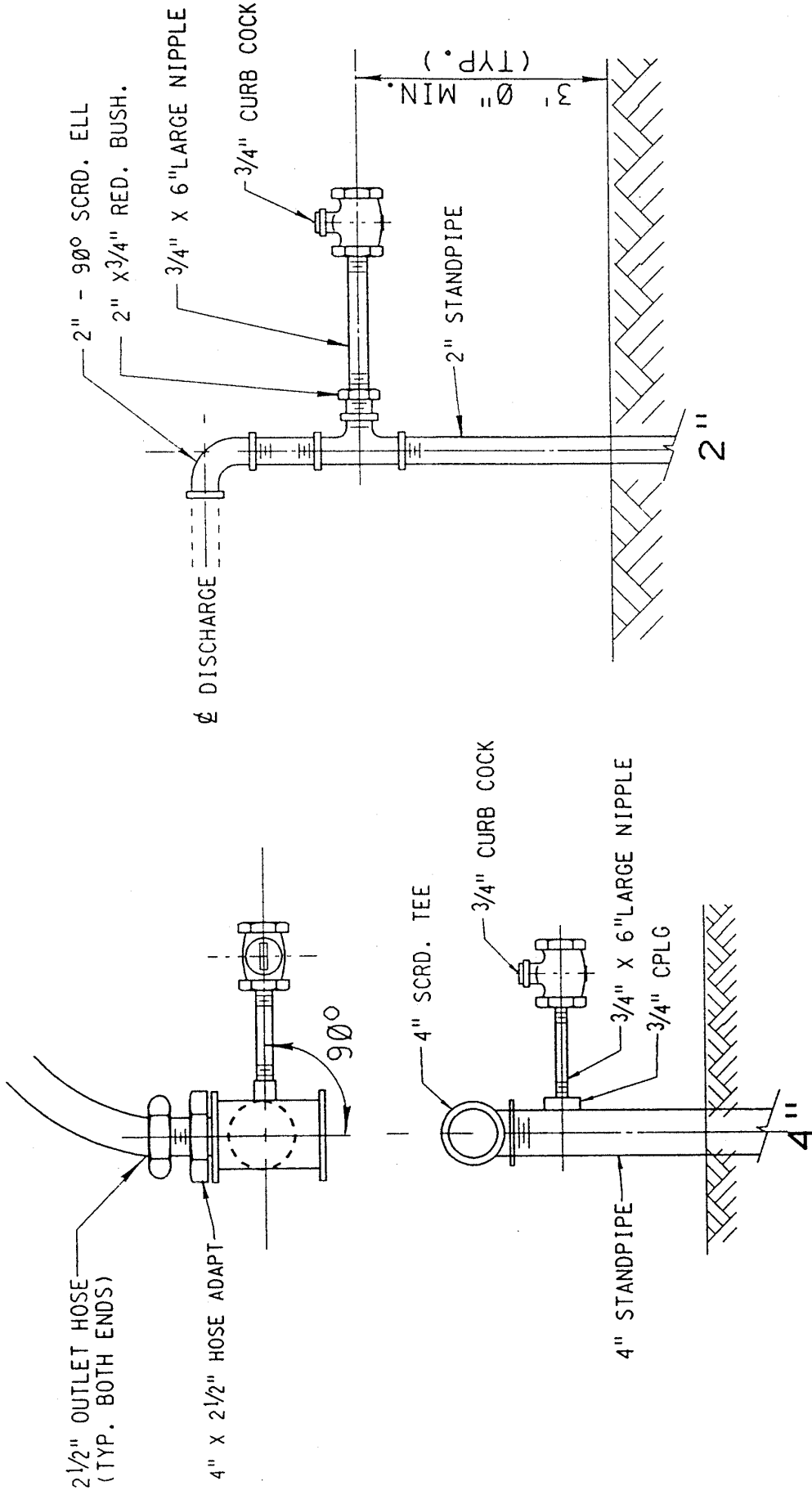
CHLORINATION PHASE

- Identify who will be doing the chlorinating
- Indicate number of trained contractor personnel to be present
- Specify pump to be used
- Indicate method of testing for chlorine residue
- Calculate estimated time to chlorinate and amount of chlorine to be used
- Specify method of verifying no chlorine intrusion to the source main
- Indicate sequence of valve operation where applicable
- Indicate method of communication
- During and after chlorination, test and record source main results

DECHLORINATION PHASE

- Specify dechlorination method
- Indicate location of disposal
- Indicate method of testing for chlorine residue, and record test results

During all phases of flushing, pH levels shall not drop below 6.5 or rise above 8.5.



FLUSHING SAMPLE TAPS (TYP.)

NTS

EBMUD CONTINGENCY PLAN FOR CONTAMINATED SOILS

