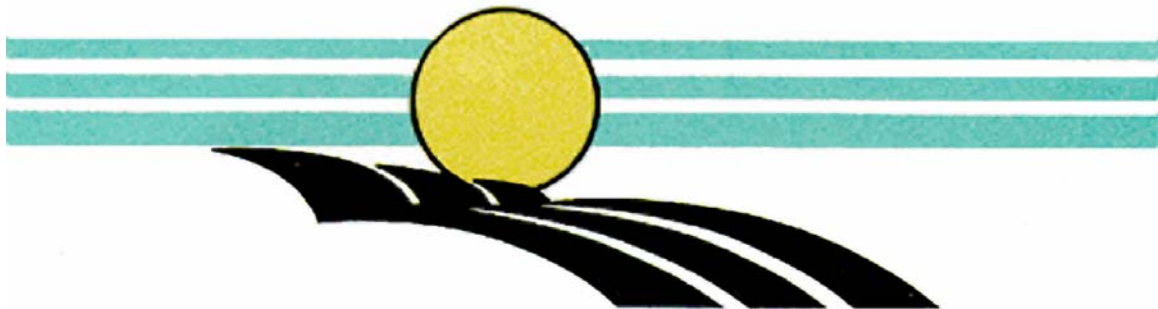


Standard Specification  
for  
Public Works Improvements

October, 2003



**LEMOORE**  
**CALIFORNIA**

711 Cinnamon Drive • Lemoore, CA 93245

**CITY OF LEMOORE**  
**STANDARD SPECIFICATIONS FOR PUBLIC WORKS IMPROVEMENTS**

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## Appendix - Standard Construction Drawings

## **INTRODUCTION**

These specifications govern all construction of public works improvements in the City of Lemoore. All work done within the public right-of-way, whether performed by a Contractor under contract to the City or by another party, shall be in conformance with this document. These specifications shall also govern work on private property which serves a public purpose, such as utility pipelines, drainage facilities, roads, and parking lots. All such projects, whether in public right-of-way or on private property, are referred to in this document as "public works".

## **EXCEPTIONS TO THESE STANDARD SPECIFICATIONS**

The only exceptions to this policy shall be those approved in writing by the City Engineer or the Public Works Director. The City of Lemoore reserves the right to enforce a more stringent requirement in any given situation where, in the opinion of the City Engineer or the Public Works Director (referred to herein collectively as the City Engineer), site conditions so dictate.

## **INCORPORATION OF STATE STANDARDS**

All public works shall be constructed in accordance with the appropriate provisions and construction details of the latest edition of *Standard Specifications*, published by the State of California Department of Transportation (CALTRANS), insofar as they may apply. In case of a conflict between the State Standard Specifications (referred to herein as *State Standard Specifications*) and this document, this document shall take precedence.

Measurement and payment clauses have been omitted from this document. Such clauses appear in the Special Provisions of publicly funded projects as needed. The measurement and payment clauses in the State Standard Specifications do not apply.



# **1. Clearing and Grubbing**

## **1.1 General**

Clearing and grubbing shall consist of the removal and disposal of all materials, roots, existing concrete, existing asphaltic materials and/or other obstructions not specified above as required by the plans and specifications within the entire project area.

## **1.2 Obstructions**

The Contractor shall be wholly responsible for the preservation and protection of all underground pipes, conduits, and other improvements, whether or not such improvements are shown on the plans. The Contractor shall notify Underground Services Alert at least 48 hours prior to any excavation.

Existing land survey monuments shall be fully protected from coverage, damage or displacement, and shall not be disturbed unless directed by The City. If any such monuments are disturbed, they shall be replaced by monuments of similar quality and durability to their original location by the Developer's or Contractor's engineer. Replacement shall be made at no cost to the City.

## **1.3 Trees**

Trees shown for removal shall be felled and cut by means which assure minimization of damage to surrounding improvements. Large trees shall be felled in sections as required to assure that structures, utility lines, and other improvements are protected.

After falling, trees shall be cut into pieces as required, and disposed of by Contractor, in a safe and legal manner, outside of the project area. Stumps shall be ground to a depth of 12 inches below finish grade, and debris shall be kept from contaminating fill material.

## **1.4 Work in City Streets**

All of the work shown on the plans and specifications which is located within the public rights-of-way of the City shall be performed in accordance with City ordinances regulating the use of such public rights-of-way, except as otherwise provided herein.

The Contractor shall inform himself as to the various regulations and requirements of the City and shall conduct his operations in compliance therewith.

## **1.5 Traffic Control and Street Signs**

To facilitate the work, the Contractor may remove all traffic and street signs within the project area from their existing locations, and stockpile them at a location under his control. All signs so removed shall be saved from all harm, and shall be reinstalled to

their original conditions and location prior to the completion of the work, unless otherwise directed by the Public Works Director.

In the interim, the Contractor shall install and maintain traffic control devices meeting the requirements of the State of California Department of Transportation (CALTRANS) "*Manual of Warning Signs, Lights, and Devices for Use in Performance of Work upon Highways,*" latest revision, as required to control and direct traffic in an orderly and safe manner. A copy of the manual is available in the Public Works Director's office for review.

All such traffic control devices shall be shown on a traffic control plan, which shall be presented to the Public Works Department for approval not less than 48 hours prior to start of construction.

See also Section 4, *Traffic Control*.

## **1.6 Removing Concrete**

Removing concrete shall conform to Section 15 of the State Standard Specifications. Existing manholes to be abandoned shall be removed to a minimum of two feet (2') below the finished grade, and shall be backfilled with clean dirt. Existing concrete to be removed shall be saw cut at the limits of removal to a minimum depth of 1-1/2" using a diamond-coated abrasive saw. All saw cuts shall be straight and true, and shall produce a clean edge on the existing concrete designated to remain.

## **2. Roadway Excavation and Grading**

### **2.1 Roadway Excavation and Embankment**

Roadway excavation and embankment shall conform to the provisions of Section 19 of the State Standard Specifications and these Standard Specifications.

Unsuitable or surplus material shall be disposed of off the project site, Contractor shall be responsible for securing a location for such disposal and shall not dispose of excess material without entering into an agreement for the disposal of such material with the property owner. Embankment material may be suitable native material, or imported borrow material as specified below. Compaction requirements for roadway excavation and embankment are given in Section 2.4 below.

### **2.2 Imported Borrow**

Imported borrow required for backfill or embankments shall be supplied by the Contractor. Imported borrow shall be clean material free of vegetation, lumps or chunks greater than two inches (2") in diameter, and of other deleterious material. Such borrow material shall have a sand equivalent of not less than 20 and an R-Value of not less than 55. A laboratory analysis of the proposed import soil shall be submitted to City for review at least one week (seven days) prior to bringing the material onto the project site. Any material not submitted to the City in a timely manner is subject to rejection and must be removed from the project site by the Contractor at his own expense.

### **2.3 Parkway Areas**

Backfill in parkways shall be subject to the requirements of this section in addition to the standard requirements for imported borrow.

The upper 12 inches of parkway backfill material shall be completely free of asphalt and Portland cement concrete debris, and shall contain no lumps or chunks greater than one (1) inch in diameter. Should Contractor's construction operation result in any significant quantity of debris, as judged by City's Representative, being introduced into the parkway soil, all such contaminated soil shall be removed from the parkway and shall be replaced with suitable material acceptable to City.

### **2.4 Error Tolerance**

Immediately prior to placing subsequent layers of material thereon, the earthen grading plane shall not vary more than 0.10-foot from the grades specified on the plans.

## **2.5 Compaction Requirements**

Native subgrade material within the street section shall be compacted to a minimum of ninety-two percent (92%) relative compaction.

Native material beneath adjacent concrete improvements shall be compacted to a minimum of ninety percent (90%) relative compaction.

Test method California 231 (nuclear density gage) shall be used. When requested by the City's Representative, test results shall be corroborated with test method California 216. (See State Standard Specifications, Section 6-3.01).

All costs for compaction testing shall be borne by the Contractor, except when specifically directed otherwise by the City's project plans or specifications. All testing shall be conducted by a state licensed engineer or laboratory approved by the City.

## **2.6 Dust Control**

Contractor shall apply water and/or an approved dust palliative to prevent dust nuisance in and around the construction zone. This work shall conform to the provisions of Section 3, *Dust Control*.

## **2.7 Expansive Soils**

In areas where the project soils report has found native soil to be expansive, Contractor shall provide a six-inch (6") sand cushion between the compacted native soil and any concrete improvements.

A soil sample shall be deemed to be expansive if it swells three percent (3%) or more under the following conditions:

*Obtain a representative sample of native soil and compact to ninety percent (90%) relative density, using an approved test method (ASTM 1557 or California 216). Confine the sample laterally. Dry the sample to a moisture content below the shrinkage limit. Impose a vertical load of 625 PSF. Saturate the sample with water, and allow to swell for 24 hours. Determine total swell as a percentage of dry soil sample height.*

A soils report containing this data is required for review of any subdivision improvements by City. Such report shall be prepared by a civil or soils engineer registered in the State of California, and shall be supplied to City in duplicate. Samples shall be taken at sufficient intervals to assure complete information.

All concrete slabs other than sidewalks (i.e., including drive approaches, alley approaches, driveways, etc.) shall be reinforced with reinforcing bars as shown on Standard Construction Drawings.

### **3. Dust Control**

#### **3.1 General**

This work shall consist of applying water and/or an approved dust palliative and taking other such actions as may be required for the alleviation or prevention of dust nuisance in and around the construction zone. It shall be solely the Contractor's responsibility to assure that the construction site conforms to the PM-10 requirements set forth by the San Joaquin Valley Air Pollution Control District; however, City reserves the right to order an increase in Contractor's dust control effort should there be obvious dust problems. Responsibility shall extend to adjacent streets where construction dirt may be spread by wind, by construction equipment, or by public traffic through the construction area.

Dust control shall be performed on a daily basis, including weekends and holidays. Job conditions may dictate application of water or a dust palliative more than once per day. Contractor shall follow the direction of City in increasing the intensity of his dust control effort if City so directs.

Contractor shall furnish all labor, materials, tools, and equipment necessary to maintain the dust control herein specified. Failure to do so shall result in a 'Stop Work Order' until such time that City deems control has been re-established by the Contractor. City reserves the right to order such work performed by its forces or by a third party selected by the City, and to collect all charges incurred thereby from the Contractor prior to issuance of certificate of completion or occupancy for the work.

#### **3.2 Materials and Application**

##### *3.2.1 Materials*

Materials shall be water and/or an approved dust palliative as designated below.

##### *3.2.2 Dust Palliative*

Dust palliative binder shall be either miscible in water or be some form of material that is directly applied to the surface without mixing with water.

Binders that are miscible in water shall be either a resin emulsion, an SS1 type asphaltic emulsion, materials composed essentially of lignin sulfonate, or any other binder that is miscible in water in the proportions provided below in *Application*, is non-corrosive, and is effective as a dust palliative.

Binders that are directly applied to the surface without mixing with water shall be a product prepared from crude petroleum that is effective as a dust palliative.

Resin emulsion shall be composed of 57%-63% of semi-liquid petroleum resin and the remainder water to which a suitable emulsifying agent has been added. The resin emulsion shall be readily miscible with water and when diluted with water in the proportions of 1 (one) part emulsion to 10 (ten) parts water shall show no signs of

breakdown or separation of the petroleum resin base. Resin emulsion which has been stored in closed containers at temperatures above freezing for a period exceeding three months shall not be used until tested and approved.

SS-1 type asphaltic emulsion shall conform to the State of California, Department of Transportation Standard Specifications, Section 94, latest edition.

### *3.2.3 Application*

Binders that are miscible in water shall be mixed with additional water at the rate of 4-19 parts water to one (1) part binder. Mixing shall be accomplished by placing the binder and water in the spreading equipment simultaneously or by some other mixing method that will produce equivalent results, with approval by City.

The resulting mixture shall be applied with a pressure type water distributing truck equipped with a spray system or pressure type asphalt distributors conforming to the State of California, Department of Transportation Standard Specifications, Section 93-1.03, latest edition. The application rate shall be 0.2-0.8 gallons per square yard.

Binders that are applied directly to the surface without mixing with water shall be applied by equipment approved by City. The binder shall be applied at a rate of 0.10-0.25 gallons per square yard.

## **4. Traffic Control**

### **4.1 General**

Traffic shall be maintained at those locations directed by the City and in conformance with the plans, these specifications, and the Special Provisions.

Contractor shall furnish, construct, maintain, and finally remove detours, road closures, lights, signs, barricades, fences, flares, miscellaneous traffic devices, flagmen, drainage facilities shall reconstruct paving and shall provide such other items and services as are necessary to adequately safeguard the public from hazard and inconvenience. All such work shall be as provided in these specifications and as directed by the City's Representative, and shall comply with the ordinances, directives, and regulations of authorities with jurisdiction over the public roads in which the construction takes place and over which detoured traffic is routed by the Contractor.

Prior to the start of construction operations, the Contractor shall notify the City of Lemoore Police and Fire departments, giving the expected starting date, completion date, and the names and telephone numbers of two responsible persons who may be contacted at any hour in the event of a condition requiring immediate correction.

### **4.2 Construction Signing**

Construction signing used for handling traffic and public convenience shall conform to the State of California, Department of Transportation *"Manual of Warning Signs, Lights, and Devices for Use in Performance of Work Upon Highways,"* latest revision. A copy of the Manual is on file in the City Public Works office.

All signs shall be illuminated or reflectorized when they are used during hours of darkness. All cones, pylons, barricades, or posts used in the diversion of traffic shall be provided with flashers or other satisfactory illumination if in place during hours of darkness.

The signing, barricading, and diverting of traffic shall be subject to the approval of the City, except in areas outside the City limits where encroachment permits issued by other agencies shall govern over these Standard Specifications. Contractor shall submit a traffic control plan to City at least 48 hours prior to start of construction. Such plan shall indicate the proposed type, quantity and location of traffic control devices, and shall specify any other proposed traffic control measures, including flaggers, pilot vehicles, lane closures, and so forth. City will promptly review the submitted plan and return any comments to Contractor for his revision. No construction shall be allowed until City approves the traffic control plan.



Contractor shall maintain a 24-hour emergency service to remove, install, relocate, and maintain warning devices, and shall furnish to the appropriate authority names and telephone numbers of two persons responsible for this emergency service. In the event these persons do not promptly respond or the authority deems it necessary to call out other forces to accomplish emergency service, the Contractor will be held responsible for the cost of such emergency service.

#### **4.3 Vehicular Traffic Control**

Public traffic shall be permitted to pass through the construction area with as little inconvenience and delay as possible at all locations where approved alternate routes are not available.

No cross streets or intersecting streets shall be closed without approval of the City or the authority with jurisdiction over the public roads in which the construction takes place and over which detoured traffic is routed by the Contractor.

#### **4.4 Street Closure**

Should it become necessary, in the Contractor's opinion, to partly close or close a street, Contractor shall submit such a request, in writing, to the City for consideration at least 72 hours prior to the time of such proposed closure. Contractor's request shall include the estimated duration of closure and provisions for traffic control and detours. If City approves of the plan to close a street, Contractor shall notify, in writing, the Lemoore Police Department and the Lemoore Fire Department of the contemplated closure not less than 48 hours prior to such closure. Should Contractor fail to give the required notification, the closure will not be allowed until the required notification is given. Except as noted below, under no circumstances will such closure be allowed for a single period exceeding four hours, although City may allow the road to be closed more than once over the course of the project.

For road closures exceeding the above-stated four hour maximum, the request to City must be made at least 10 days in advance of the contemplated closure and the Police and Fire Departments must be notified at least 5 days prior to such closure.

#### **4.5 Permanent Traffic Controls**

All existing permanent traffic control signs, barricades, and devices shall remain in effective operation unless substitute facilities are approved.

#### **4.6 Pedestrian Traffic Control**

A minimum of one 4-foot wide pedestrian walkway shall be maintained and safely delineated along each public street at all times during construction.

#### **4.7 Access to Adjacent Properties**

At least 24 hours and not more than three (3) days prior to restricting normal access from public streets to adjacent properties, the Contractor shall notify each property owner and responsible person, informing him of the nature of the access restriction, the approximate duration of the restriction, and the best alternate access route for that particular property.

Reasonable access from public streets to all adjacent properties, as determined by City's Representative, shall be maintained at all times during the construction.

## **5. Asphalt Concrete Pavement**

### **5.1 Overview**

Asphalt paving sections for public facilities shall be designed in accordance with the Caltrans Highway Design Manual procedure for flexible pavement design. R-Values used shall be based upon soil samples taken directly from the project area. In the case of variance between samples, the lowest test value shall be used as the design value, unless it can be shown to City's satisfaction that lesser-quality material is confined to a specific area.

Notwithstanding the results of the above calculations, minimum asphalt concrete thickness shall be two inches (2") and minimum aggregate base thickness shall be six inches. (6").

Soil sterilant conforming to the specifications below shall be applied to the compacted aggregate base in all areas receiving new asphalt concrete, including streets, parking lots, and miscellaneous areas. No soil sterilant is required when reconstructing existing paved areas.

All costs for compaction testing shall be borne by the Contractor, except when specifically directed otherwise by City plans or specifications.

### **5.2 Subgrade Preparation**

Native subgrade shall be graded and compacted in accordance with the requirements of Section 2, Roadway Excavation and Grading.

### **5.3 Aggregate Sub-base**

#### *5.3.1 General*

Aggregate sub-base shall consist of mineral aggregate, spread and compacted on a prepared subgrade in conformance with the lines, grades, and dimensions shown on the plans, with the standard details and with these Standard Specifications.

#### *5.3.2 Material*

Aggregate sub-base material shall be Class 2, shall be free of vegetable matter and other deleterious substances, and shall conform to the provisions of Section 25 of the State Standard Specifications. Aggregate base shall be compacted to ninety-five percent (95%) relative compaction as determined by ASTM 1557, or such other test as may be directed by City.

## **5.4 Aggregate Base**

### *5.4.1 General*

Aggregate base material shall consist of mineral aggregate, spread and compacted on a prepared subgrade in conformance with the lines, grades, and dimensions shown on the plans, the standard details, and these Standard Specifications.

### *5.4.2 Material*

Aggregate base material shall be Class 2, shall be free of vegetable matter and other deleterious substances, and shall conform to the provisions of Section 26 of the State Standard Specifications. Aggregate base shall be compacted to ninety-five percent (95%) relative compaction as determined by ASTM 1557, or such other test as may be directed by the City.

### *5.4.3 Additional Thickness*

In the event that on-site soil conditions are such that a satisfactory subgrade cannot be prepared, additional material below the subgrade grading plane shall be removed. The native material shall be replaced by additional Class 2 aggregate base or Class 2 aggregate subbase, at the option of the Contractor, and shall be compacted in accordance with the provisions of this section.

The amount of additional aggregate base or subbase material placed will be left to the discretion of the Contractor, with the condition that the grading plane must meet City's requirements prior to City granting the Contractor permission to pave.

## **5.5 Soil Sterilant**

### *5.5.1 Areas Requiring Soil Sterilant*

The Contractor shall treat the finished and compacted aggregate base of all new areas to receive asphalt concrete pavement with an approved soil sterilant. This shall include all parking and road areas, and all miscellaneous pavement areas. Existing streets being reconstructed shall not receive soil sterilant.

### *5.5.2 Material and Application*

The sterilant shall be Trifluralin, dust or other sterilant approved by the City's Representative. The sterilant shall be applied in accordance with the manufacturer's directions. At the option of City's Representative, the area shall then be lightly sprinkled with water to prevent loss of sterilant or scuffing.

## **5.6 Asphalt Concrete Pavement**

### *5.6.1 General*

Asphalt concrete pavement shall consist of mineral aggregate blended with bituminous binder at an approved central mixing plant, in accordance with the requirements of Section 39 of the State Standard Specifications and these Standard Specifications.

### *5.6.2 Aggregate Materials, Gradation, and Lift Thickness*

All aggregates used for asphalt concrete shall be clean and free from vegetable or other deleterious matter. Aggregate gradation shall conform to those set forth in Section 39-2.02 of the State Standard Specifications for 3/4" maximum, medium, or 1/2" maximum, medium, as designated on the project plans. If the plans do not specify aggregate gradation, the following rules shall apply. All asphalt concrete surface courses shall be placed using 1/2" aggregate.

If the thickness of the asphalt course to be placed exceeds 0.20 feet, asphalt shall be placed in two lifts. The lower lift(s) shall not exceed 0.25 feet in thickness, and shall be placed using 3/4" material. The surface course shall be placed using 1/2" aggregate.

### *5.6.3 Paving Asphalt*

Paving asphalt shall be mixed with the mineral aggregate at a rate of between 3% and 7% by weight of the dry mineral aggregate. The exact amount of paving asphalt to be mixed with the mineral aggregate shall be subject to approval by City.

Unless otherwise specified on the plans and approved by City, paving asphalt shall be AR-4000. Paving asphalt for parking lots may be AR-4000 or AR-8000 at City's direction.

## **5.7 Asphaltic Paint Binder**

Asphaltic paint binder shall be applied as a tack coat to all vertical surfaces of existing pavement, concrete curbs, gutters, and construction joints against which additional material is to be placed, and to all existing pavements, which are to be overlain.

Asphaltic paint binder may be either AR-4000 paving asphalt, or SS-100 asphaltic emulsion cut back 50 percent with water. The application rate shall be 0.10 gallon per square yard, or as directed by City.

## **5.8 Spreading and Compaction of Asphalt Concrete Paving**

### *5.8.1 General*

Asphalt concrete finish courses and overlays shall be placed only when the ambient air temperature is above 50° F. Asphalt concrete base courses shall be placed only when the ambient air temperature is above 40° F.

Asphalt concrete shall not be placed during precipitation, nor when the threat of local precipitation according to the National Weather Service is greater than 70 percent, nor when, in City's opinion, the weather conditions are not or will not be suitable for the proper handling, finishing, or compacting of the asphalt concrete mixtures.

Asphalt concrete more than 0.20 feet in thickness shall be placed in layers. See the aggregate gradation and lift thickness requirements under Section 5.6.2 above.

Asphalt concrete to be placed on road shoulders and other areas off the traveled way shall be spread in the same manner as specified above. When the shoulders or other areas are less than five feet (5') in width, asphalt concrete may be placed in one or more layers by any mechanical means that will produce uniform thickness and texture. Asphalt concrete shall not be handled, spread, or windrowed in a manner that will stain the surface of existing improvements.

Longitudinal joints in the top layer of the pavement shall correspond to the edges of the proposed traffic lanes, unless such requirement is waived by the City's Representative in writing prior to the paving operation. Longitudinal joints in lower layers shall be offset by not less than 0.5 feet from the joints in the layer immediately above. Contractor shall take particular care to assure that longitudinal joints fall outside the wheel path area in any of the proposed lanes.

Unless otherwise specified, the top layer of asphalt concrete for the traveled lanes shall be placed prior to or simultaneously with placement of the top layer in adjacent areas such as left-turn lanes, parking lanes, tapers, transitions, drive approaches, and so forth.

At locations, which are inaccessible to spreading and rolling equipment, asphalt concrete shall be spread by any method to achieve the specified results, and shall be compacted thoroughly with pneumatic tampers, or any other method, which will achieve the required degree of compaction.

#### *5.8.2 Spreading Equipment*

Spreading equipment shall conform to the requirements of Section 39-5.01 of the State Standard Specifications, which describes motor graders and self-propelled paving machines, and these Standard Specifications.

Contractor may petition the City for permission to use paving equipment other than that specified herein. Failure to make such a petition at least five business days prior to the start of the paving operation will be grounds for rejection of the proposed substitute equipment. The City may reject substitute equipment if it believes that such substitution may adversely affect the final quality of the pavement.

#### *5.8.3 Compaction Equipment*

Compaction equipment shall conform to the requirements of Section 39-5.02 of the State Standard Specifications; generally, one 8-ton steel drum roller, one 12-ton steel roller, and one pneumatic-tired roller. Each roller shall be operated by a separate operator, and all rolling equipment shall be self-propelled and reversing. Other requirements are detailed in the cited section of the State Standard Specifications.

For projects where any one of the following conditions are met, the 12-ton roller may be eliminated:

- the total quantity of asphalt to be placed is less than 1,000 tons or

- the production rate is less than 50 tons per hour, or
- the production rate is less than 100 tons per hour and asphalt is being placed on areas other than traveled lanes, or
- the width of the asphalt is less than eight feet, or
- the total thickness is less than 0.1-foot

As an alternate to the pneumatic roller, a vibratory roller may be substituted. When a vibratory roller is used for final compaction, the vibrator unit shall be turned off.

#### 5.8.4 *Compacting Small Areas*

At locations where miscellaneous areas are to be surfaced in accordance with the provisions in Section 39-7.01 of the State Standard Specifications, and where the width of the asphalt concrete pavement is less than eight feet (8'), or the total thickness of asphalt concrete to be placed is less than 0.01 foot, the required minimum rolling equipment specified in Section 39-5.02 of the State Standard Specifications may be reduced to one 8-ton, 2-axle tandem roller for each 100 tons or fraction thereof of asphalt concrete placed per hour by each asphalt paver. Areas which are inaccessible to such a roller shall be thoroughly compacted to the lines, grades and cross-sections shown on the Plans, by means of pneumatic tampers or other methods, which will produce the same degree of compaction.

#### 5.8.5 *Grade Control*

Asphalt concrete shall be finished to a smooth surface free of wrinkles, ruts, humps, depressions, and other irregularities. When a straight-edge 12 feet long is laid on the finished surface parallel to the centerline, the surface shall not vary from the edge by more than 0.01-foot. The transverse slope of the finished surface shall be uniform to the degree that no depressions greater than 0.02-feet are present when tested with a 12-foot straight-edge laid transverse to the centerline.

### **5.9 Finishing Roadway**

Finishing Roadway shall conform to the requirements of Section 22 of the State Standard Specifications, and shall include transitions between pavement and bituminous surfaces at cross streets and alleys. The finished edge of the paving shall be flush with, or up to one-quarter inch (1/4") above the gutter lip.

### **5.10 Fog Seal**

In general fog seal *shall not* be applied to new asphalt concrete surfaces, unless specifically directed by City's Representative, or shown on the plans.

When called for, fog seal shall be applied between 15 and thirty calendar days after placement of the asphalt concrete surface lift.

Material shall conform to the requirements of Section 37-1.01 of the State Standard Specifications, and shall be mixed as one part SS-1 asphaltic emulsion, and one part

added water. The mixture shall be applied to the pavement at a rate of 0.10 gallon per square yard.

SS-1 asphaltic emulsion shall conform to the requirements of Section 94 of the State Standard Specifications. Emulsion shall be homogeneous after thorough mixing.

Fog seal shall be applied by distributor spreader bar, at a temperature of 110° to 130° F. Asphaltic emulsion shall not be allowed to cool below 40° F at any time.



## **6. Asphalt Concrete Overlays**

### **6.1 General**

Overlays on existing asphalt concrete streets shall be constructed in accordance with this section, and Section 5, *Asphalt Concrete Pavement*.

### **6.2 Pavement Reinforcing Fabric**

#### *6.2.1 General*

Pavement reinforcing fabric shall be used in all asphalt concrete overlay projects unless specifically waived in writing by the project plans or project specifications.

#### *6.2.2 Material*

Pavement reinforcing fabric shall conform to the requirements of Section 88-1.02 of the State Standard Specifications. Fabric shall be manufactured of polypropylene with a weight per square yard of 3.5 ounces. During shipment and storage, the fabric shall be protected from sunlight and water.

### **6.3 Preparation of Old Pavement**

The Contractor shall prepare the surface and sub-surface in conformance with the plans and these specifications.

All cracks wider than ¼-inch shall be made flush with the surrounding surface by filling with a liquid asphalt designed for crack filling operations. The surface of the street shall be wetted, and thoroughly cleaned and swept by means of a power sweeper, so that all mud and loose dirt is removed from the road surface. Contractor shall maintain sufficient moisture on the road surface to avoid dust production as a part of this process.

#### *6.3.1 Asphalt Concrete Leveling Course*

When, in City's opinion, the existing road surface is too uneven, rough, or cracked for proper application of pavement reinforcing fabric even after sweeping and crack filling, an asphalt concrete leveling course may be required. The leveling course shall be constructed of asphalt concrete conforming to Section 5, *Asphalt Concrete Pavement*. Leveling courses shall typically be 0.08 to 0.10 feet thick; however they may be thicker as required to provide a smooth and even surface appropriate for placement of pavement reinforcing fabric.

### **6.4 Preliminary Tack Coat**

After the surface has been prepared, either by cleaning or by placement of a leveling course, a tack coat of 0.25 gal/square yard of AR4000 oil shall be applied by means of a distributor truck. The oil temperature shall be 275° to 325° F. The spray bar nozzles

shall provide a consistent, uniform coat of oil for the width of the roll of paving fabric plus a maximum of three inches on each side.

City's Representative shall confirm the oil specification prior to application, subject to the ambient air temperature at the time of construction.

## **6.5 Fabric Placement**

The fabric shall be placed on the pavement from gutter lip to gutter lip by rolling, except in those areas where fabric is being placed directly onto the compacted native subgrade, in which case manual means may be used. Such rolling shall be accomplished from a truck or tractor designed for placement of roll material.

As the fabric is rolled onto the tack coat, it shall be smoothed by brooming until it is free of wrinkles. Folds and wrinkles resulting in a triple thickness or more of fabric shall be cut with a knife and lapped to a double thickness.

Adjacent borders of the fabric shall be lapped no more than two to four inches. Any overlap in excess of that amount shall be cut off. This applied to both longitudinal and transverse joints.

## **6.6 Pavement Planing**

Existing asphalt concrete pavement shall be planed at the locations and to the dimensions shown on the plans and in accordance with these Standard Specifications.

Planing asphalt concrete shall be performed by cold planing. The cold planing machine shall have a cutter head not less than 30 inches wide and shall be operated so as not to produce fumes or smoke. The depth, width and shape of the cut shall be as indicated on the typical cross-sections or as directed by the Engineer. The final cut shall result in a uniform surface conforming to the typical cross-sections. The outside lines of the planed area shall be neat and uniform. The road surfacing to remain in place shall not be damaged in any way.

Planed widths of pavement shall be continuous. The material planed from the roadway surface, including material deposited in existing gutters or along the adjacent traveled way, shall be immediately removed from the job site and delivered to the City Corporation Yard or other such site as directed by the City's Representative. Planed material shall become the property of the City.

### *6.6.1 Width of Planed Areas*

Edges of existing roadways with gutters shall be planed so that the planed thickness of asphalt concrete overlay can be installed with the top of the overlay not more than ¼-inch above the lip of gutter. "Feathering" of asphalt concrete overlays will not be allowed along such streets.

The existing asphalt concrete surface shall be planed at each end of the overlay project to provide a smooth transition between the old and newly-constructed surfaces. The depth of the planing across the roadway width shall match the thickness of the overlay at the match line, and shall smoothly taper back to provide a transition unnoticeable to traffic.

If the Plans do not indicate a width for the planed areas, they shall be a minimum of five (5) feet wide along the side of the roadway, and a minimum of fifteen (15) feet longitudinally, across the entire section of pavement, at the point of transition from the overlay to existing pavement at the ends of the project.

## **7. Portland Cement Concrete Improvements**

### **7.1 General**

Portland cement concrete improvements shall be constructed in accordance with Section 73 of the State Standard Specifications and these Standard Specifications. As used herein, the term "*concrete improvements*" shall include curbs, gutters, curb & gutter, sidewalks, wheel chair ramps, drive approaches, alley approaches, valley gutters, and other slab concrete constructed within the City right-of-way.

### **7.2 Portland Cement Concrete**

#### *7.2.1 General*

Portland cement concrete shall conform to the requirements of Section 90-10 of the State Standard Specifications, *Minor Concrete*.

#### *7.2.2 Cement*

Cement shall be Portland Cement Type II, conforming to Section 90 of the State Standard Specifications, latest revision.

#### *7.2.3 Strength Requirements*

All Class "A" concrete shall be proportioned to attain a minimum cylinder strength of 3,000 psi in 28 days. All Class "B" concrete shall be proportioned to attain a minimum cylinder strength of 2,500 psi in 28 days. The compressive strengths are to be determined in accordance with ASTM C39. Not less than 6 sacks of cement shall be used per cubic yard of Class "A" concrete, or less than five (5) sacks of cement shall be used per cubic yard of Class "B" concrete. All ready-mix shall comply with ASTM C94-72.

#### *7.2.4 Aggregates*

Aggregates for Portland cement concrete shall conform to Section 90-2.10 of the State Standard Specifications and shall be free from deleterious coatings, clay balls, roots, bark, sticks, and other extraneous material. Appearance of such materials in the concrete mix shall be grounds for rejection of the entire transit truck of material.

#### *7.2.5 Aggregate Gradation*

Aggregates for Portland cement concrete shall conform to the requirements of Section 90-3.04 of the State Standard Specifications, for 1-inch maximum aggregate size. Unless otherwise noted on the plans, a specific aggregate gradation will not be required.

#### *7.2.6 Admixtures*

No specific admixtures are required, unless noted on the plans. Contractor may submit a concrete design containing admixtures for review by City. Such submittal shall be made at least five working days in advance of the planned concrete pour. Admixtures proposed in any such submittal shall conform to the requirements of Section 90-4 of the State Standard Specifications.

#### *7.2.7 Calcium Chloride*

Unless specifically permitted by City, calcium chloride shall not be added to Portland cement concrete. In no case shall calcium chloride be added to concrete which will be used in structures containing steel or other embedded metals.

#### *7.2.8 Proportioning*

If aggregate is greater than 1-inch aggregate size, the exact proportions of the concrete ingredients shall be established by a material testing laboratory selected by the City's Representative. Contractor shall notify the City's Representative of his proposed mix design and source of the aggregate in sufficient advance time to permit testing.

#### *7.2.9 Mixing and Transporting*

All Portland cement concrete for use in public works improvements shall be mixed in mechanical mixers, except that City may allow batches of less than 1/3 cubic yard to be mixed by hand in conformance with Section 90-6.05 of the State Standard Specifications.

Machine mixing shall conform to the provisions of Section 90-6.02 of the State Standard Specifications. Mix temperature shall be maintained between 50° and 90° F at all times.

Concrete shall be transported to the project site by vehicles conforming to the provisions of Section 90-6.03 of the State Standard Specifications. - Unless specifically allowed by City, no additional mixing water shall be added to the concrete mix during hauling or after arrival at the project site. If City does authorize such addition, the mixing drum shall be revolved not less than thirty revolutions at mixing speed after water is added and before delivery is commenced.

Any concrete which has been in the transit truck more than 45 minutes is subject to rejection by City's Representative.

#### *7.2.10 Placing*

The Contractor shall notify the City's Representative 24 hours in advance of any concrete placing. Concrete shall not be placed until all form work, reinforcement, electrical conduit, installation of fixtures to be embedded, and preparation of concrete surfaces to be bonded have been completed and are ready for new concrete.

Concrete surfaces on or against which other concrete is to be placed shall be thoroughly cleaned of surface latency. Clean aggregate shall be exposed as specified herein for joints.

Each concreting operation shall be continuous until the placing in the course, section or monolith is completed. Fresh concrete shall not be permitted to fall from a height greater than six (6) feet without the use of adjustable length pipes or "tremmies."

In order to assure that there will be no interruption in such continuous placing, the Contractor shall have available standby concrete mixing equipment ready for use in case

of breakdown, or he shall make arrangements, satisfactory to the City's Representative, with the supplier of the concrete, if transit mix concrete is being used, so that the City's Representative may be assured that once placement is started it can be completed without interruption.

Appropriate mechanical vibration shall be used in placing concrete to eliminate stone pockets and voids, to consolidate each layer with that previously placed, to completely embed reinforcing bars and other fixtures, and to bring just enough fine material to the faces of top and exposed surfaces to produce a smooth, dense and even texture. Vibrators shall be of the high frequency internal type. The number in use shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least two (2) vibrators shall be available at the site. The use of external vibration for compacting concrete will be permitted when the concrete is otherwise inaccessible for adequate compaction, provided the forms are constructed sufficiently rigid to resist displacement or damage from external vibration, and the type of vibrators are approved by the City's Representative.

#### *7.2.11 Forms*

All forms shall be smooth, mortar tight, true to the required lines and grades, and of sufficient strength to resist any appreciable amount of deflection during the placing of concrete. All foreign matter shall be removed from forms before concrete is placed therein. Forms previously used shall be thoroughly cleaned before reuse. Prior to placing concrete, all forms shall be oiled with a high penetration form oil, which leaves no film that can be absorbed by the concrete. Immediately prior to placing concrete, all forms shall be thoroughly wetted.

Forms shall not be removed until the concrete has hardened sufficiently to safely support its own weight and possible construction loads. Forms supporting concrete members which are subject to direct bending stress shall not be removed or struck until concrete test cylinders show that sufficient strength to support the required structural load has been attained. In no case shall forms be removed or released prior to the expiration of 24 hours following placing of the concrete.

Forms for all surfaces, which will not be completely enclosed or hidden below the final surface of the ground, shall be made of surfaced plywood. Insofar as practicable, forms shall be so constructed that the form marks will conform to the general lines of the structure. All sharp edges shall be chamfered with 3/4-inch by 3/4-inch triangular fillets.

Form clamps and ties with effective water stops, shall be used to maintain accurately the specified wall thickness. Ties shall be either of the threaded or snap-off type so that no metal will be left within 1-1/2-inches of the surface of the wall. The use of twisted wire ties will not be permitted.

#### *7.2.12 Openings*

Pipe sleeves, inserts for pipe connections, anchors, and forms for pipe holes must be accurately placed and securely fastened to the forms in such a manner that the placing of

concrete and stripping of forms will not alter their alignment or location. Openings may be formed at sleeve locations and sleeves placed and grouted with cement mortar containing 15 lbs. of EMBECO, or equal, per sack of cement, after wall concrete is placed. Rubber water stops may be required at block-outs and shall be placed as directed by the City's Representative.

#### *7.2.13 Joints*

Construction joints shall be made only where shown on the Plans unless otherwise approved by the City's Representative. In case of emergency, construction joints shall be placed as directed by the City's Representative. After the pour has been completed to the construction joint and the concrete has hardened, the entire surface of the joint shall be thoroughly cleaned of surface latency, and clean aggregate shall be exposed by abrasive blast cleaning. Wire brushing, air and water jets may be used while the concrete is fresh provided results equal to abrasive blast cleaning are obtained. Where subsequent concrete pour is a wall or other restricted formed member, approximately 3-inches of grout shall be placed immediately before placing first lift of concrete. Concrete shall be placed over grout before the grout begins to set. Construction joints shall be keyed. Keyways shall be formed by beveled strips or boards placed at right angles to the direction of shear. Except where otherwise shown on the Plans or specified, keyways shall be at least 1-1/2 inches in depth over at least 25% of the area of the section. Water stops may be required and shall be placed as directed by the City's Representative at the Contractor's expense and no payment will be made therefore.

When it is necessary to make a joint because of an emergency, reinforcing steel shall be furnished and placed across the joint as directed by the City's Representative. Furnishing and placing such reinforcing steel shall be at the Contractor's expense and no payment will be made therefore.

#### *7.2.14 Surface Finishes*

During the placing of concrete, care shall be taken in vibrating or otherwise consolidating the concrete to ensure surfaces of even texture free from voids.

Immediately after the forms have been removed, all form bolts shall be removed to a minimum depth of 1-1/2 inches below the surface of the concrete. All holes and depressions caused by the removal or cutting back of such form bolts shall be cleaned and filled with cement grout. All rock pockets and honeycombed areas shall be repaired by chipping back to solid concrete and filling the resulting space in the same manner as specified for bolt holes. This work shall be done immediately following the removal of forms. If in the judgment of the City's Representative rock pockets are of such an extent or character as to affect the strength of the structure materially, or to endanger the life of the steel reinforcement, he may declare the concrete unacceptable and require the removal and replacement of that portion of the structure.

Except for surfaces which are to be buried all fines and other projections shall be removed and the surfaces shall be brushed with stiff wire brushes or otherwise finished until a uniform color has been obtained. The use of carborundum stones may be required

to remove unsightly bulges or discolorations. The object of these operations is to obtain smooth, even surfaces of uniform appearance, free from unsightly bulges or depressions due to form marks and other imperfections.

All flat work shall be floated and troweled to a smooth, hard finish.

#### *7.2.15 Reinforcement*

Reinforcing bars shall be deformed billet-steel bars for concrete reinforcement, ASTM A615, Grade 40, unless otherwise provided. At Contractor's option, Grade 60 bars may be substituted for Grade 40, except that the two grades of steel may not be used interchangeably in structures.

Bars shall not be bent or straightened in a manner that would injure the material. Hooks shall conform to the Manual of Standard Practice of the American Concrete Institute.

Main reinforcing bars shall not be spliced except as shown on the Plans. Splices at points of maximum stress shall be avoided. Where bars are spliced, they shall be lapped at least 30 bar diameters and wired together to provide a minimum distance of two (2) inches between the splice and the nearest adjacent bar or surface of the concrete. Splices shall be staggered at least 40 bar diameters.

Metal reinforcement shall be accurately placed as shown on the Plans and shall be securely held in position by wiring at intersections with No. 16 or larger wire and by using concrete spacers. The minimum spacing center to center of parallel bars shall be three times the diameter, but in no case shall the clear distance between bars be less than two (2) inches. All bars shall have a clear coverage of 1-1/2 bar diameters, but not less than 2-1/2 inches measured from the surface of the concrete to the outside of the bar. Metal supports may be used provided no portion of the support extends to within one inch of the surface of the concrete. Wooden supports shall not be used.

Wire mesh used for reinforcement shall be rolled flat before placing concrete and shall be supported and tied to prevent movement during concrete placement. Mesh shall conform to ASTM A-185.

Reinforcement, at the time concrete is placed, shall be free from rust, scale and other coatings that would destroy or reduce the bond.

#### *7.2.16 Rubber Water stops*

Materials, fabrication, and splices shall conform to the article on Rubber Water stops in Section 51 of the Standard Specifications of the California Department of Transportation (CALTRANS), latest revision. Stops shall be firmly supported during concrete placement to prevent dislocation and to insure that ends remain at right angles to the construction joints. All junctions shall be welded to provide a continuous watertight seal.

#### *7.2.17 Grout*

Grout shall contain Portland cement, sand, water, and (for patching, anchoring, packing, or similar work) a non-shrinkage additive such as EMBECO. Where finish surface is not



covered, grout shall be tinted by color of cement, aggregate, or additive as approved by the City's Representative so that surface matches adjacent concrete in appearance after both have cured. Ratio of cement to sand shall be 1 to 2 by volume unless otherwise shown or specified. The proportion of non-shrinkage additive shall be in accordance with the manufacturer's instructions. Grout shall be placed against thoroughly wetted concrete and shall be water cured by providing a moist atmosphere for at least 3 days.

#### *7.2.18 Curing Concrete*

All newly placed concrete shall be cured in accordance with the provisions of Section 90-7 of the State Standard Specifications. Any of the prescribed methods (water, curing compound, water-proof membrane, forms-in-place) may be used.

### **7.3 Construction**

#### *7.3.1 General*

Concrete improvements shall conform to the provisions of Section 73 of the State Standard Specifications and these Standard Specifications.

#### *7.3.2 Subgrade*

The subgrade shall be constructed true to grade and cross-section, as shown on the plans. It shall be graded and compacted in accordance with the requirements of Section 2, *Roadway Excavation and Grading*.

#### *7.3.3 Expansion Joints*

Expansion joints for curb, gutter and sidewalk shall be constructed at a maximum spacing of 45 feet, and at each drive approach, and at each curb return.

### **7.4 Sidewalk Patterns**

Sidewalk patterns shall follow the requirements of the table below, and these Standard Specifications.

Residential sidewalk shall be constructed in a parkway pattern, unless specifically directed otherwise by City during plan check for the purpose of blending into existing adjoining properties. Contiguous curb, gutter, and sidewalk is limited to those areas already having a preponderance of development using the contiguous pattern, or where there are other compelling reasons to not use the parkway pattern.

Parkway pattern sidewalk shall be 4.5 feet wide, except on the arterial and collector streets where it shall be six (6) feet wide when directed by City during plan check. A four foot nine-inch distance from back of curb to front of walk shall be maintained. Additional sidewalk width shall be located in either a landscaping easement or in an separate pedestrian easement, which shall be dedicated by the property owner prior to sidewalk construction.

Commercial sidewalk shall be constructed from the back of curb to the property line, but shall not be more than 12 feet wide unless directed by City during plan check.

Zone District	Residential	Commercial
R, RM	X	
CC-SC, CH ML, MP		X
All Industrial	X <sup>1</sup>	
RA, MH	X <sup>2</sup>	

Sidewalk pattern requirements may be modified by the Planning Commission or the City staff at the time of Site Plan Review.

### 7.5 Tree Wells

All commercial sidewalks shall have provision for trees by the construction of tree wells in accordance with Standard Drawing M-3, in locations required by City. Water and sanitary sewer service shall be a minimum of ten lineal feet from edge of tree well. See also Section 28, *Street Trees*.

### 7.6 Driveway Width, Location, and Frontage Limitation

The minimum width of a commercial driveway shall be nine (9) feet. The maximum width shall be 35 feet.

The minimum width of a residential driveway shall be nine (9) feet. The maximum width shall be 28 feet.

Driveway width shall be measured at the back of the approach, and shall not include flares. Driveways shall not be closer than three (3) feet to the nearest street fixture (e.g., fire hydrant, street light).

No more than 60 percent of any frontage shall be utilized for driveways, and no driveway shall be located within five (5) feet of a property line, except in a cul-de-sac bulb or adjacent to an alley, where the minimum distance shall be three (3) feet.

### 7.7 Finishing Concrete

Sidewalks, curbs, driveways and curb returns shall be finished with a steel trowel, and given a light broomed finish.

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<sup>1</sup> Except where exempted from constructing sidewalk by the Municipal Code

<sup>2</sup> Sidewalk is only required on arterial streets in these zones. City may direct commercial pattern in lieu of residential pattern at its discretion

Drive approaches, alley approaches, gutters, and wheelchair ramps shall be given a wood float finish.

### **7.8 Rock Pockets**

Immediately upon stripping forms and prior to backfilling, all rock pockets or honeycombs shall be repaired to the satisfaction of City. Repairs shall be made with Portland cement mortar conforming to the requirements of Section 51-1.135 of the State Standard Specifications.

### **7.9 Backfilling Improvements**

After forms are removed, the area between the sidewalk and curb (if any) and the area behind the sidewalk shall be cleaned of all surplus concrete and other debris, and the area shall be filled with clean native soil suitable for planting.

If curb and gutter is installed in an area where there is an existing paved street, Contractor shall repair all excavations made for such curb and gutter installation, and shall backfill and pave the area between the old pavement and the new gutter with a like material. The edge of the existing pavement shall be cut to a true line (using a concrete saw if the existing pavement is asphalt concrete) and the excess paving material shall be removed from the project site. All paving work shall be done in accordance with Section 5, *Asphalt Concrete Pavement*.

If more than two (2) inches of cut or fill are required behind the sidewalk (or behind the curb, if no sidewalk exists), Contractor shall construct a slope not steeper than 10:1 between the top of the sidewalk (or curb) and the adjacent property.

### **7.10 Protecting Concrete**

In addition to his customary responsibilities with respect to work and materials, Contractor shall protect concrete as provided herein and in Section 90-8 of the State Standard Specifications.

Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar. The only exception to such stoppage will be in the case that Contractor protects new concrete during rainy weather to the satisfaction of City.

## **8. Encasement Concrete**

### **8.1 General**

Encasement, cradling, bidding or pipe-covering concrete shall be either reinforced or non-reinforced, uniformed or rough formed, and of the classes designated in project specifications, on project plane, or as directed by the City's Representative.

### **8.2 Materials and Workmanship**

#### *8.2.1 Earthwork*

Earthwork for encasement concrete shall conform to the provisions of Section 13, *Earthwork (Pipelines)*.

#### *8.2.2 Concrete*

Concrete for encasement purposes shall conform to the provisions of Section 7, *Portland Cement Concrete Improvements*.

## **9. Standard Specifications for Earthwork (Structures)**

### **9.1 General Conditions**

#### *9.1.1 Scope of Work*

Earthwork shall include all necessary clearing, grubbing, grading, and excavation of all classes, and of whatever substance encountered; backfilling, compaction, cleaning up debris, papers and loose rocks, restoring fences and other disturbed property, maintaining trees which are not permitted to be removed, and disposing of excess excavated material all as required for the complete performance of the work and installation of the facilities and appurtenances indicated on the Plans and specified herein. Included is controlling water, bracing excavations, stabilizing subgrade, protecting existing structures and facilities, and such supplementary operations as are necessary to properly complete the entire work indicated or specified.

#### *9.1.2 Earthwork in State, County, and City Rights-of-Way*

Earthwork within the rights-of-way of the State Department of Transportation and/or the County Road Department shall be in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these specifications.

#### *9.1.3 Relative Compaction*

Relative compaction specified herein shall be a percentage of the maximum density at optimum moisture content as determined by test method California 231 (nuclear density gage).

#### *9.1.4 Safety Precautions*

All excavations shall be performed, protected, and supported as required for safety and in the manner set forth in the operation rules, orders and regulations prescribed by the Division of Industrial Safety of the State of California. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Flashing markers or barricades shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.

#### *9.1.5 Obstructions*

Contractor's attention is directed to the possible existence of pipes and other underground improvements, which may or may not be shown on the Plans. Contractor shall preserve and protect any such improvements whether shown on the Plans or not. Where it is necessary to remove and replace or to relocate such improvements in order to prosecute the work, they shall be removed, maintained and permanently replaced by Contractor at his expense.

#### *9.1.6 Surplus Excavated Material*

Surplus excavated material shall be placed in the areas shown on the Plans. All materials that cannot be disposed of in the limits of areas shown, or where no disposal areas are shown, shall be disposed of by Contractor and at Contractor's expense.

#### *9.1.7 Imported Backfill Material*

Whenever the excavated material is not suitable for backfill, Contractor shall arrange for and furnish suitable imported backfill material, which can be compacted to the required relative density, at his expense.

#### *9.1.8 Working Area*

Except for specified off-site construction, all earthwork shall be confined strictly within site property lines or rights-of-way. Permission has not been obtained to enter upon adjacent property except where specifically indicated in these Project Specifications.

#### *9.1.9 Compaction Tests*

Compaction tests will be made by a State licensed engineer or laboratory approved-by City's Representative. The number of tests and their location and depth shall be determined by City's Representative. The costs of such testing shall be borne by the Contractor, except when specifically directed otherwise by City plans or specifications. Contractor shall make all necessary excavations for compaction tests as directed by City's Representative, and shall refill and recompact excavations to the densities specified herein.

Test method California 231 (nuclear density gage) shall be used. When requested by the City's Representative, test results shall be corroborated with test method California 216 (See State Standard Specifications, Section 6-3.01).

#### *9.1.10 Bracing Excavations*

Excavations shall be so braced or sheeted so as to provide conditions under which workmen may work safely and efficiently at all times. Rules, orders, and regulations of the Division of Industrial Safety of the State of California shall be complied with. Excavations shall be so braced, sheeted, and supported that the ground alongside the excavation will not slide or settle, and all existing improvements of any kind, either on public or private property, will be fully protected from damage. The sheeting, shoring, and bracing shall be so arranged as not to place any stress on the completed work until the general construction thereof has proceeded far enough to provide ample strength. Any damage to structures occurring through settlements, water or earth pressures, slides, caves, or other causes due to failure or lack of sheeting or bracing, or improper bracing, or through negligence or fault of Contractor in any other manner, shall be repaired by Contractor at this own expense.

Care shall be exercised in the drawing or removal of sheeting, shoring, bracing, and timbering to prevent caving or collapse of the excavation faces which are being

supported, and in such a manner as to prevent excessive backfill that might overload the pipe or conduit.

#### *9.1.11 Grading and Stockpiling*

Contractor shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water and wastewater can flow uninterrupted in existing gutters, other surface drains, or temporary drains. Material for backfill or for protection of excavation in public roads from surface drainage shall be neatly placed and kept shaped so as to cause the least possible interference with public travel. Free access must be provided to all fire hydrants, irrigation water gates, water and utility meters, and private drives.

#### *9.1.12 Dewatering*

Contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavation or other parts of the work. Dewatering shall be accomplished by methods, which will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Said methods may include well points, sump pumps, suitable rock or gravel placed below the required bedding for drainage and pumping purposes, temporary pipe lines, and other means that will not be detrimental to the proposed construction.

Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions in this Section. No concrete footings or floors shall be laid in water, nor shall water be allowed to rise over them until the concrete or mortar has set at least eight (8) hours. Water shall not be allowed to rise unequally against walls for a period of twenty-eight (28) days. Groundwater shall not be allowed to rise around pipe until jointing compound in the joints has set hard.

Contractor shall dispose of water from the work in a suitable manner without damage to adjacent property. No water shall be drained into work built or under construction without prior consent of City's Representative. Water shall be disposed of in such a manner as not to be a menace to the public health.

#### *9.1.13 Correction of Faulty Grades*

Where excavation is inadvertently carried below subgrade and/or foundation elevations, it shall be rectified by backfilling with approved sand or gravel, compacted to provide a firm, unyielding subgrade, at Contractor's expense.

## **9.2 Grading**

### *9.2.1 Stripping*

All vegetation, such as roots, brush, heavy sods, heavy growth of grass, decayed vegetable matter, rubbish, and other unsuitable material within the area of the work, shall be stripped or otherwise removed prior to starting excavation and embankment.

### 9.2.2 *Excavation*

After stripping has been done, excavation of whatever substances are encountered within the grading limits of the work shall be performed to the lines and grades indicated on the Drawings. All suitable excavated material shall be transported to and placed in the fill areas within the limits of the work. Material not suitable for embankment shall be disposed of off-site by Contractor at his expense.

### 9.2.3 *Fill*

Areas to receive fill material shall be scarified and benched in order to allow new material to bond with the existing soil. Fills or embankments shall be constructed at the locations and to the lines and grades indicated on the Drawings. Suitable material from excavation may be used for fill. Material shall be placed in horizontal layers not to exceed six (6) inches compacted depth for the full width of the cross-section and compacted as specified. Fill slopes shall not exceed 2:1.

Haul routes shall be planned to avoid passing heavy equipment over pipelines with less than six feet of cover. Where such crossings must be made, Contractor shall provide concrete encasement or approved bridging.

Embankments under pavement or structures shall be compacted to at least 95 percent of maximum density. Other embankments shall be compacted to at least 90 percent of maximum density.

### 9.2.4 *Finish*

All work areas, including excavated and filled sections and transition areas, shall be uniformly graded to the elevations shown on the Plans. The finished surface shall be reasonably smooth, compacted, and free from any irregular surface changes. Edges of spoil and borrow areas shall be rounded to blend into natural contours. The degree of finish ordinarily obtainable from either blade grader or scraper operations will be satisfactory for open areas but hand grading and raking will be required around structures and walkways. The finished surface shall be not more than 0.2 feet above or below the established grade and shall be sloped to prevent ponding.

## 9.3 **Soil Sterilant**

### 9.3.1 *General*

The Contractor shall treat the finished subgrade of specified areas with an approved soil sterilant.

### 9.3.2 *Areas Requiring Soil Sterilant*

All areas to be improved with bitumastic paved embankments, walkways, drainage structures, parking, or road surfacing.

All storm drainage pond interior surface embankments, also exterior embankment surfaces where paved, and perimeter areas (tops of berms).



### *9.3.3 Material and Application*

The sterilant shall be Trifluralin or other sterilant approved by the City's Representative applied in accord with the manufacturer's directions. At the option of City's Representative, the area shall then be lightly sprinkled with water to prevent loss of sterilant or scuffing.

## **9.4 Structure Excavation and Backfill**

### *9.4.1 General*

Structure excavation shall include the removal of all material of whatever nature necessary for the construction of structures and foundations in accordance with the Plans and Specifications. It shall include the furnishing of all labor, materials, tools, and equipment and doing all the work involved in the installation and subsequent removal of all shoring, sheeting, bracing, and other details which may be necessary.

### *9.4.2 Working Clearance*

The sides of excavations for structures shall be sufficient to leave at least two feet (2') in the clear as measured from the extreme outside of form work or the structure, as the case may be.

### *9.4.3 Excessive Excavation*

Ground shall not be dug by machinery utilizing teeth nearer than three (3) inches from any finished subgrade. The last three inches shall be removed without disturbing the subgrade. Should the excavation be carried below the lines and grades indicated on the Drawings, Contractor shall, at his expense, refill such excavated space to the proper elevation with imported sand compacted to 95% relative density.

Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and inspection, except when concrete is authorized to be placed directly against excavated surfaces.

### *9.4.4 Structure Backfill*

After structures and foundations are in place, backfill shall be placed to the original ground line or to the limits designated on the Plans. No material shall be deposited against the walls of concrete structures for a period of fourteen (14) days following pouring of concrete.

### *9.4.5 Compaction*

Backfill shall be placed in horizontal layers not exceeding six (6) inches in depth and shall be moistened and thoroughly tamped, rolled, or otherwise compacted to a minimum relative density of ninety-five percent (95%). Water settling will not be permitted. Backfill shall be placed in such way that unbalanced loading may occur during placing.

Particular care shall be exercised when backfilling at the various structures to obtain adequate compaction beneath pipes connected thereto and to avoid injury or displacement of such pipes.

#### *9.4.6 Materials*

Backfill shall consist of loose earth or sand free from stones, clods, or other deleterious material. When material from the excavation is unsuitable for use in backfill, it shall be disposed of and suitable materials, which can be compacted to the required relative density, shall be arranged for and furnished by Contractor at his expense.

#### *9.4.7 Surplus Excavated Material*

Surplus material from the excavation remaining after backfilling shall be disposed of as specified for "Excess Excavated Material: above.

### **9.5 Final Clean-up**

After backfill has been completed, the site shall be dressed smooth and left in a neat and presentable condition, free of all cleared vegetation, rubbish and other construction wastes. Surplus rock, which cannot be used for backfill, shall be hauled away and disposed of. Areas next to structures where blade-type equipment cannot reach shall be hand raked.

## 10. Sanitary Sewer and Storm Drain Pipelines

### 10.1 Sanitary Sewer Pipe Materials and Methods

#### *10.1.1 Polyvinyl Chloride Pipe*

Polyvinyl chloride (PVC) pipe and fittings for sewers shall be in conformance with ASTM D3034, SDR 35 or stronger, and shall be suitable for use as gravity sewer conduit. Provisions shall be made for contraction and expansion at each joint by means of a rubber ring. Glued joints are not acceptable.

The bell shall consist of an integral wall section with a solid cross-section rubber ring. Rings shall be factory-assembled into bells, and shall be securely locked into place to prevent displacement during assembly.

All fittings shall be PVC as manufactured by the pipe supplier, and shall be designed for use with PVC sewer pipe.

PVC pipe shall be installed over a trench bedding designed to limit long term deflection to not more than five percent (5%).

#### *10.1.2 Cast Iron and Ductile Iron Pipe*

Cast iron and ductile iron pipe will be allowed only where specifically approved by City. Developer shall submit plans for review along with technical materials submittals and substantiation for material selection. City will review the submittal and determine whether to allow the proposed material.

#### *10.1.3 Manholes*

Manholes for sanitary sewers shall conform to the provisions of Section 11, *Concrete Manholes*.

#### *10.1.4 "Wye" and "Tee" Branches*

Contractor shall place "wye" and "tee" branches as shown on the Plans. "Wye" and "tee" branches may be installed at any angle not greater than 45° from the horizontal.

Each "Wye" and "tee" branch, or the end of a sewer which does not terminate in a manhole, shall be closed at the bell with a cap made for that purpose.

#### *10.1.5 Sewer Laterals*

Sewer laterals (house branches) shall be constructed of PVC, meeting the same specifications as above for sanitary sewer mains.

Sewer laterals four (4) and six (6) inches in diameter may be connected directly to sewer mains 18 inches in diameter and greater, providing that a machine core is used to connect to the sewer main. Such sewer laterals connected to sewer mains less than 18 inches in diameter require the use of "Wye" branches.

Sewer laterals eight (8) inches and larger require a manhole at their point of connection with the main sewer, regardless of main size.

Laterals shall be constructed at the locations shown on the Plans, from the point of connection to the sewer main to a point approximately one (1) foot beyond the property line. The sewer lateral shall have a minimum depth of 24 inches at that point. Laterals shall be installed in accordance with Standard Drawing S-6.

#### *10.1.6 Sewer Lateral Plugs*

Plugs used to seal the ends of sewer laterals shall be of a type approved by the pipe manufacturer for use with its product.

#### *10.1.7 Sewer Lateral Excavations*

Excavations for constructing laterals shall be in accordance with the earthwork provisions given below, and shall be performed in such a manner that no street closure will be required.

#### *10.1.8 Curb Markings*

Contractor shall mark the location of the end of each sewer lateral by chiseling an "S" mark on the curb face, if one exists. If not, the Contractor shall mark the end of the sewer lateral with a ½" diameter iron rod, not less than 36 inches long, driven into the trench prior to backfilling. The end of the iron rod shall extend to within six (6) inches of the surface of the ground.

## **10.2 Storm Drain Pipe Materials**

#### *10.2.1 Reinforced Concrete Pipe*

Reinforced concrete pipe shall be manufactured in accordance with ASTM C-76, and shall be of the size and load classification shown on the plans. All reinforced concrete pipe shall be round rubber gasket type, centrifugally spun. Pipe shall be self-centering. The gasket or gaskets shall not be required to support the weight of the pipe. Mortar joint pipe is prohibited. Elliptical reinforcement will be allowed.

#### *10.2.2 Polyvinyl Chloride (PVC) Storm Drain Pipe*

Polyvinyl Chloride pipe conforming to the specification set forth in Section 10.1 for sanitary sewer pipe is acceptable for storm drainage. Also acceptable is PVC pipe conforming to the requirements of ASTM F-794 for large-diameter ribbed gravity sewer pipe, having integral bell-and-spigot joints and rubber gasket seals. Pipe stiffness under this specification shall be a minimum of 46 psi when measured in accordance with ASTM D-2412.

### 10.3 Excavation, Installation, and Backfill

All excavations shall be made in accordance with the trench construction safety orders issued by the Division of Industrial Safety of the State of California, and Section 13, *Earthwork (Pipelines)*.

#### 10.3.1 Alignment and Grades

The alignment and grade for pipe shall be as shown on the Plans. The flow lines shown shall be the invert or interior bottoms of the pipe.

#### 10.3.2 Trench Excavation and Preparation

Excavation shall be performed in accordance with Section 13, *Earthwork (Pipelines)* of these Specifications.

The trench bottom shall be graded to provide a smooth, firm, and stable foundation at every point throughout the length of pipe. Contractor shall use a laser grade device to ensure that the trench bottom is accurately and correctly graded. Alternative methods must be approved by City prior to the start of construction.

At each joint in the pipe, the bottom of the trench shall be recessed in the firm foundation in such a manner as to relieve the bell of the pipe of all load, and to insure continuous bearing along the pipe barrel upon the firm foundation. Should large gravel and cobbles be encountered at the trench bottom or pipe subgrade, they shall be removed from beneath the pipe and replaced with clean imported sand, which shall be compacted to provide uniform support and a firm foundation.

#### 10.3.3 Installation

Proper facilities shall be provided for stringing and lowering sections of the pipe into the trench. The pipe shall be carefully laid to the lines and grades given.

The pipe sections shall be laid commencing at the downstream end, with the spigot or tongue end in the direction of flow. Reinforced concrete pipe with elliptical reinforcement shall be placed with the minor axis in a vertical position.

Each joint of pipe shall be firmly pressed into place so that there will be no unevenness or settlement of one length of pipe with respect to the other at a joint. The interior of the pipe shall be kept free from dirt and other foreign materials as construction progresses. Any pipe, which shows undue settlement or is damaged shall be taken up and replaced or relaid at Contractor's expense.

#### 10.3.4 Grade Tolerance

All pipe shall be laid true to line and grade. Occasional variations will be allowed as follows:

Vertical	1/4"
Horizontal	2"

Tolerances given are the maximum allowable deflections if gradual and regular over a distance of 20 feet or more.

#### *10.3.5 Backfilling*

At Contractor's option, backfilling may be completed prior to leakage tests or infiltration tests. After the pipe has been properly laid and inspected, the trench shall be backfilled in accordance with the provisions of Section 13.3.

### **10.4 Sewer Design Standards**

- Only PVC (polyvinylchloride) pipe shall be utilized, not vitrified clay (VCP), because of slope and groundwater constraints.
- Minimum slopes for eight (8) inch sewer shall be .0024 for polyvinylchloride (PVC) pipe.

For other pipe sizes, minimum slopes shall be based on a minimum velocity of two feet per second at twice average flow with an 'n' value of .011 for PVC.

- Minimum sewer size: eight-inch
- Residential flows: 100 gallons per capital per day, 3.0 persons per single-family dwelling, 2.5 persons per multi-family dwelling, 4.0 peaking factor.
- Commercial flows: five gallons per minute per acre except when greater flows are determined by City Engineer to be essential for planned development.
- Industrial flows: ten gallons per minute per acre except when greater flows are determined by City Engineer to be essential for planned development.
- Piping to be designed for half-full at peak flows for pipe sizes less than fifteen-inch and three-fourths full at peak flows for pipe sizes fifteen-inch or larger.
- Manhole spacing guidelines:
  - a. Sewers, eight-inch: 450 feet maximum
  - b. Sewers, ten-inch – twelve-inch: 500 feet maximum
  - c. Sewers, fifteen-inch and larger: 600 feet maximum
  - d. At all angle points in horizontal and vertical alignment.
  - e. At the terminal end of all lines

Drop manholes will not be permitted unless approved by the Engineer.

Clean-outs will not be permitted except on dead-end lines of 200 feet in length or less.

Horizontal bends in lines will be permitted without manholes only with the approval of the City Engineer of submitted calculations demonstrating compliance with manufacturer's recommendations.

#### **10.5 Storm Drain Design Slopes**

Storm drain pipes shall be designed for positive drainage. Actual design slopes shall be calculated using the hydraulic grade line of the storm drain system.

## **11. Concrete Manholes**

### **11.1 General**

Concrete manholes shall be constructed at no less than 500 feet spacing in accordance with the design, size and details, and locations shown on the Plans. The manholes shall be constructed of precast concentric concrete manhole units in accordance with the Plans and these Specifications. Clean-outs may be utilized at the end of dead-end lines of no greater length than 200 feet (See Standard Plan S-5).

### **11.2 Materials and Workmanship**

#### *11.2.1 Excavation and Backfill*

Excavation and backfill shall be done in accordance with the provisions of Section 13, *Earthwork (Pipelines)* of these Specifications.

#### *11.2.2 Concrete*

All concrete used in the construction of manholes shall be Class "A" and conform to the provisions of Section 7, *Portland Cement Concrete* of these Specifications.

#### *11.2.3 Mortar*

Mortar used in manholes shall be composed of one part Type II Portland cement and two parts sand. Addition of hydrated lime or fire clay for workability shall not exceed 20% of the cement content.

### **11.3 Construction**

#### *11.3.1 Precast Manholes*

Precast manholes shall conform to the size, shape, form, and details shown on the Plans. Concrete for precast manhole units shall be Class "A." The precast cylinder units, the precast concrete taper sections and precast concentric flat-top sections shall meet the strength requirements for Precast Reinforced Concrete Manhole Risers and Tops (ASTM Specifications, designation C-478). The minimum allowable steel shall be hoops of No. 4 wire, to be cased into each unit at appropriate places as a precautionary measure for handling. Each manhole section shall be set in a bed of mortar to make a watertight joint, shall be neatly pointed inside and outside, and shall be set plumb. Kent Seal, or approved equal, shall be used to seal all manhole joints. Sections of various heights shall be used in order to bring the top of the manhole ring and cover to the elevation established on the Plans or by City's Representative.

Where PVC pipe is joined to a concrete manhole, a rubber O-ring shall be installed around the outside of the pipe at the location of the concrete mortar joint, to provide a water-tight seal between the PVC and the concrete.



The precast manhole rings shall be jointed with a minimum thickness of one-half inch (1/2") of Portland cement mortar. Mortar shall be comprised of one (1) part Portland cement to two (2) parts of clean, well-graded sand with one-hundred percent (100%) passing a number eight (8) sieve. Cement, aggregate, and water for mortar shall conform to the applicable provisions of the *Portland Cement Concrete* of these Specifications.

#### *11.3.2 Manhole Bases*

Manhole bases shall be constructed of Class "A" concrete to the form and dimensions shown on the Plans. Said concrete bases shall be poured on undisturbed soil or gravel if groundwater encountered, add 1-1/2" diameter base rock to a depth of one (1) foot below base: as called for on the Plans. Bases shall have 48 hours set before precast concrete units are laid thereon, unless variance is approved by the City's Representative.

#### *11.3.3 Manhole Frames and Covers*

Manhole frame and cover sets of the type, size, and quality indicated on the Plans shall be installed at the locations shown.

Castings for frame and cover sets shall conform to the requirements for Gray Iron Castings in ASTM A-48 for Class No. 30 Castings. Before leaving the foundry, all castings shall be thoroughly cleaned and subjected to a hammer inspection, after which they shall be dipped twice in a preparation of asphalt, or coal tar and oil, applied at a temperature of not less than two-hundred-ninety degrees (290°) Fahrenheit, and in such a manner as to form a tough and durable coating. Each cover shall be ground or otherwise finished so that it will fit in its frame without rocking. Frames and covers shall be match-marked in sets before shipping to the site. Covers shall be identified as shown in Standard Drawing No. S-4.

#### *11.3.4 Setting Manhole Frames and Covers*

The elevations at which manhole frames and covers are to be set shall conform to the requirements set forth on the Plans, but in all cases shall be as directed by City's Representative. Where the cover is in existing pavement or in the traveled way of the existing road shoulder, it is to be placed flush with the existing surface, per Standard Drawing No. S-7. Where the structure is outside the limits of the traveled shoulder but not in a roadside ditch, it should be placed 0.50-foot or more above the existing ground surface. Where the manhole cover falls in an existing roadside ditch, it is to be placed approximately one and one-half feet (1-1/2') above the existing ground surface or as directed by City's Representative. Manhole frames shall be set at the required grade and shall be securely attached to the top of the precast manhole shaft unit with a cement mortar bed as shown on the Plans. After the frames are securely set covers shall be installed and all necessary cleaning and scraping of foreign materials from the frames and covers shall be accomplished to insure a satisfactory fit.

#### *11.3.5 Pavement Removal and Resurfacing*

Resurfacing of all excavations for construction of manholes shall conform to the provisions of these Standard Specifications and the Standard Drawings.

#### *11.3.6 Water Tightness of Manholes*

It is the intent of the Plans and Specifications that manholes and appurtenances be as watertight and free from infiltration as possible. Where manholes are to be given a protective lining and coating, they shall be free of *any* seeping or surface moisture. The adequacy of manholes and appurtenances as to water tightness shall be determined by City's Representative, and shall be tested by filling with water when so ordered by City's Representative. Any evidence of leakage shall be repaired to the satisfaction of City's Representative at the sole expense of Contractor.

## **12. Testing of Sanitary Sewers and Storm Drains**

### **12.1 Low-Pressure Air Test for Sanitary Sewers and Storm Drains**

Prior to testing, all lines shall be thoroughly cleaned by flushing and shall have passed a Wayne ball of appropriate size.

All sanitary sewers and storm drains shall be air-tested. All leakage tests shall be completed and approved prior to placing of permanent resurfacing.

When leakage or infiltration exceeds the amount allowed by the specifications, the Contractor at his expense shall locate the leaks and make the necessary repairs or replacements in accordance with these Specifications to reduce the leakage or infiltration to the specified limits. Any individually detectable leaks shall be repaired, regardless of the results of the tests. Leakage tests shall be made on completed pipelines as follows:

The Contractor shall furnish all materials, equipment, and labor for making an air test. Air test equipment shall be approved by the Engineer, unless otherwise provided on the plans or in the specifications.

The Contractor may conduct an initial air test of the sewer mainline after densification of the backfill, but prior to installation of the house connection sewers. Such test will be considered to be for the Contractor's convenience and need not be performed in the presence of the Engineer.

Each section of sewer shall, however, be tested between successive manholes by plugging and bracing all openings in the sewer mainline and the upper ends of all house connection sewers. Prior to any air pressure testing, all pipe plugs shall be checked with a soap solution to detect any air leakage. If any leaks are found, the air pressure shall be released, the leaks eliminated, and the test procedure started over again. The Contractor has the option of wetting the interior of the pipe prior to the test.

The final leakage test of the sewer mainline and branching house connection sewers, shall be conducted in the presence of the Engineer in the following manner:

Air shall be introduced into the pipeline until 20 kPa (3.0 psi) gage pressure has been reached, at which time the flow of air shall be reduced and the internal air pressure shall be maintained between 17 kPa and 24 kPa (2.5 and 3.5 psi) gage pressure for at least two minutes to allow the air temperature to come to equilibrium with the temperature of the pipe walls. Pressure in the pipeline shall be constantly monitored by a gage and hose arrangement separate from hose used to introduce air into the line. Pressure in the pipeline shall not be allowed to exceed 34 kPa (5 psi) gage pressure.

After the temperature has stabilized and no air leaks at the plugs have been found, the air Oressure shall be permitted to drop, and when the internal pressure has reached 17 kPa (2.5 psi) gage pressure, a stopwatch or sweep-second-hand watch shall be used to determine the time lapse required for the air pressure to drop to 10 kPa (1.5 psi) gage pressure.

If the time lapse (in seconds) required for the air pressure to decrease from 17 to 10 kPa (2.5 to 1.5 psi) gage pressure exceeds that shown in the following Table, 12.1. Low pressure Air Test, the pipe shall be presumed to be within acceptance limits for leakage.

If the time lapse is less than that shown in the table, the Contractor shall make the necessary corrections to reduce the leakage to acceptance limits.

**TABLE 12.1 Low pressure Air Test**  
Time in Seconds for Pressure to Drop from 10 to 17 kPa (2.5 to 1.5 psi) Gage Pressure

Main Line		100mm (4") House Connection					Main Line		150mm (6") House Connection				
Nominal Diameter mm (in.)	Length m (feet)	House Connection Length					Diameter mm (inches)	Length (feet)	House Connection Length				
		0 m (0 ft)	30 m (100 ft.)	60 m (200 ft.)	90 m (300 ft.)	120 m (400 ft.)			0 m (0 ft)	30 m (100 ft.)	60 m (200 ft.)	90 m (300 ft.)	120 m (400 ft.)
200 (8)	0 (0)	0	20	40	50	70	200 (8)	0 (0)	0	40	80	100	100
	15 (50)	40	50	70	90	80		15 (50)	40	70	110	110	110
	30 (100)	70	90	100	100	90		30 (100)	70	110	120	110	110
	45 (150)	110	120	110	100	100		45 (150)	110	120	120	120	110
	60 (200)	140	120	110	110	100		60 (200)	140	130	120	120	120
	90 (300)	140	130	120	110	110		90 (300)	140	130	120	120	120
	120 (400)	140	130	120	120	110		120 (400)	140	130	130	120	120
250 (10)	15 (50)	50	70	90	100	90	250 (10)	15 (50)	50	90	120	120	110
	30 (100)	110	130	120	110	110		30 (100)	110	140	130	130	120
	60 (200)	170	150	140	130	120		60 (200)	170	150	140	140	130
	90 (300)	170	160	150	140	130		90 (300)	170	160	150	140	140
	120 (400)	170	160	150	150	140		120 (400)	170	160	150	150	140
300 (12)	15 (50)	80	100	110	110	110	300 (12)	15 (50)	80	120	140	130	120
	30 (100)	160	170	150	140	130		30 (100)	160	170	150	140	140
	60 (200)	200	180	170	160	150		60 (200)	200	180	170	160	150
	90 (300)	200	190	180	170	160		90 (300)	200	190	180	170	160
	120 (400)	200	190	180	180	170		120 (400)	200	190	180	180	170
375 (15)	15 (50)	120	140	160	140	130	375 (15)	15 (50)	120	160	160	150	140
	30 (100)	250	220	190	170	160		30 (100)	250	210	190	170	160
	60 (200)	260	230	220	200	190		60 (200)	260	230	210	200	190
	90 (300)	260	240	230	220	210		90 (300)	260	240	220	210	200
	120 (400)	260	240	230	220	220		120 (400)	260	240	230	220	210
450 (18)	15 (50)	180	200	190	170	150	450 (18)	15 (50)	180	220	190	170	160
	30 (100)	310	260	230	210	190		30 (100)	310	260	220	200	190
	60 (200)	310	280	260	250	230		60 (200)	310	280	260	240	220
	90 (300)	310	290	280	260	250		90 (300)	310	290	270	260	240
	120 (400)	310	290	280	270	260		120 (400)	310	290	280	270	260
525 (21)	15 (50)	240	260	230	200	180	525 (21)	15 (50)	240	260	220	200	180
	30 (100)	360	310	280	250	230		30 (100)	360	300	260	240	220
	60 (200)	360	330	310	290	280		60 (200)	360	330	300	280	260
	90 (300)	360	340	320	310	300		90 (300)	360	330	320	300	290
	120 (400)	360	340	330	320	310		120 (400)	360	340	330	310	300
600 (24)	15 (50)	320	320	270	240	210	600 (24)	15 (50)	320	310	260	220	200
	30 (100)	410	360	320	290	270		30 (100)	410	350	310	280	260
	60 (200)	410	380	360	340	320		60 (200)	410	370	350	320	310
	90 (300)	410	390	370	360	350		90 (300)	410	380	360	350	330
	120 (400)	410	390	380	370	360		120 (400)	410	390	370	360	350
675 (27)	15 (50)	400	370	310	280	250	675 (27)	15 (50)	400	350	290	260	230
	30 (100)	460	410	370	340	310		30 (100)	460	390	350	320	290
	60 (200)	460	430	410	390	370		60 (200)	460	420	390	370	350
	90 (300)	460	440	420	410	390		90 (300)	460	430	410	390	380
	120 (400)	460	450	430	420	410		120 (400)	460	440	420	410	390
Nominal	Length	House Connection Length					Nominal	Length	House Connection Length				

Diameter mm (in.)	m (feet)	0 m (0 ft)	30 m (100 ft.)	60 m (200 ft.)	90 m (300 ft.)	120 m (400 ft.)	Diameter mm (in.)	m (feet)	0 m (0 ft)	30 m (100 ft.)	60 m (200 ft.)	90 m (300 ft.)	120 m (400 ft.)
750 (30)	15 (50)	490	420	360	310	280	750 (30)	15 (50)	480	490	330	290	260
	30 (100)	510	460	420	380	360		30 (100)	510	440	390	360	330
	60 (200)	510	480	460	440	420		60 (200)	510	470	440	420	390
	90 (300)	510	490	470	460	440		90 (300)	510	480	460	440	420
	120 (400)	510	500	480	470	460		120 (400)	510	490	470	460	440
825 (33)	15 (50)	560	460	400	350	320	825 (33)	15 (50)	560	440	370	320	290
	30 (100)	560	510	460	430	400		30 (100)	560	490	440	400	370
	60 (200)	560	530	510	490	460		60 (200)	560	520	490	460	440
	90 (300)	560	540	520	510	490		90 (300)	560	530	510	490	470
	120 (400)	560	550	530	520	510		120 (400)	560	540	520	510	490
900 (36)	15 (50)	610	510	440	390	360	900 (36)	15 (50)	610	480	410	360	320
	30 (100)	610	560	510	480	440		30 (100)	610	540	480	440	410
	60 (200)	610	580	560	530	510		60 (200)	610	570	540	510	480
	90 (300)	610	600	580	560	540		90 (300)	610	590	560	540	520
	120 (400)	610	600	580	570	560		120 (400)	610	590	570	560	540
975 (39)	15 (50)	660	560	490	440	390	975 (39)	15 (50)	660	530	450	390	350
	30 (100)	660	610	560	520	490		30 (100)	660	590	530	480	450
	60 (200)	660	630	610	580	560		60 (200)	660	620	590	560	530
	90 (300)	660	640	620	610	590		90 (300)	660	640	610	590	570
	120 (400)	660	650	630	620	610		120 (400)	660	640	620	610	590
1050 (42)	15 (50)	710	610	540	480	430	1050 (42)	15 (50)	710	580	490	430	390
	30 (100)	710	660	610	570	540		30 (100)	710	640	580	530	490
	60 (200)	710	680	660	630	610		60 (200)	710	670	640	610	580
	90 (300)	710	690	680	660	640		90 (300)	710	690	660	640	620
	120 (400)	710	700	680	670	660		120 (400)	710	690	670	650	640

Note: 500 foot distances between manholes shall have the same allowable pressure drop time on the Table above stated as 400 foot distances.

### 12.1.1 Adjustment of Pressure for Groundwater

Should the pipe section being tested lie below the local groundwater table, the test pressures shall be raised in proportion to the depth of the centerline of the pipe below the water table. Additional pressure (beyond the 3.5 psig specified above) shall be added at the rate of 0.433 psig per foot and depth below groundwater. Pressure drop shall be timed between 0.5 psi of 1.0 psi below maximum pressure.

### 12.1.2 Corrective Measures

Failure of a section of pipe to pass the low-pressure air test shall be taken as evidence that a fault exists in the test section. It shall be the Contractor's responsibility to repair the section to the point where an air test can be successfully conducted.

## 12.2 Video Inspection

Video inspection of all sewer lines is required. Video inspection of storm drain lines may be required when deemed essential by the City's Representative or so required by City project plans or specifications. Such inspection will be arranged by the City's Representative, and paid for by the Contractor prior to final acceptance of the improvements. The inspection shall be in color, and shall be recorded on VHS-format ½" tape, which shall become the property of the City.

The City shall be the sole judge as to the acceptability of construction revealed by such inspection. If there are areas of pipeline not within the allowable grade tolerance, or if the inspection reveals holes or leaks in the pipeline, the Contractor will be so notified, and will be responsible to make needed repairs. The City will not advise the Contractor as to recommended procedures, but will limit its comments to the acceptability of the end

product. The video may also be used in the event of failure of an air test to help isolate the problem area; however failure of the video inspection to isolate the problem area shall not relieve the Contractor of his responsibility to repair the line.

If video inspection for other than a failed air test reveals faults such as broken pipe, improperly completed joints, misalignment, or improper grades, such faulty areas shall be promptly removed and replaced by the Contractor. Both the video inspection and subsequent repairs shall be at Contractor's expense.

### **12.3 Exfiltration Water Testing**

At the City's sole option, storm drains may be checked for leakage by exfiltration water testing rather than by air testing.

The allowable water exfiltration for any length of pipe between manholes shall not exceed fifty gallons per inch of internal pipe diameter per twenty-four hours. Exfiltration testing shall start with the upstream manhole filled to the bottom of the ?.

## **13. Earthwork (Piping and Pipelines)**

### **13.1 General Conditions**

#### *13.1.1 Earthwork Defined*

Earthwork shall include all necessary clearing, grubbing, grading, and excavation of all classes, and of whatever substance encountered; backfilling, compaction, cleaning up debris, papers, and loose rocks; restoring fences and other disturbed property; maintaining trees which are not permitted to be removed; and disposing of excess excavated material, all as required for the complete performance of the work for the installation of the facilities and appurtenances indicated on the Plans and specified herein. Included is controlling water, bracing excavations, stabilizing subgrade, protecting existing structures and facilities, and such supplementary operations as are necessary to properly complete the entire work indicated or specified.

#### *13.1.2 Earthwork in State, County, and City Rights-of-Way*

Earthwork within the rights-of-way of the State Department of Transportation or the Kings County Road Department shall be in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence over and supersede the provisions of these Specifications.

#### *13.1.3 Relative Compaction*

Relative compaction specified herein shall be a percentage of the maximum density at optimum moisture content as determined by test method California 231 (nuclear density gage). Unless otherwise specified, the relative compaction for earthwork in open fields shall be 85%. In populated areas and in public and private roads and driveways, the relative compaction shall be as shown on Standard Drawings M-7 and M-8.

#### *13.1.4 Safety Precautions*

All excavations shall be performed, protected and supported as required for safety and in the manner set forth in the operation rules, orders, and regulations prescribed by the Division of Industrial Safety of the State of California. Barriers shall be placed at each end of the excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.

#### *13.1.5 Obstructions*

Contractor's attention is directed to the possible existence of pipe and other underground improvements, which may or may not be shown on the Plans. Contractor shall preserve and protect any such improvements whether shown on the Plans or not. Where it is necessary to remove and replace or to relocate such improvements in order to prosecute the work, they shall be removed, maintained, and permanently replaced by Contractor at his expense.

### *13.1.6 Dewatering*

Contractor shall provide and maintain ample means and devices to promptly remove and properly dispose of all water entering the excavation or other parts of the work. Dewatering shall be accomplished by methods, which will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Said methods may include well points, sump pumps, suitable rock or gravel placed below the required bedding for drainage and pumping purposes, temporary pipe lines, and other means that will not be detrimental to the proposed construction.

Dewatering for the pipelines and appurtenant structures shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accord with the provisions in this Section. No concrete footings or floors shall be laid in water nor shall water be allowed to rise over them until the concrete or mortar has set at least eight (8) hours. Water shall not be allowed to rise unequally against newly-poured concrete walls until they have been allowed to cure for a period of twenty-eight (28) days. Groundwater shall not be allowed to rise around pipe until any jointing compound in the joints has set hard.

Contractor shall dispose of the water from the work without damage to adjacent property. No water shall be drained into work built or under construction without prior consent of City's Representative. Water shall be disposed so as not be a menace to the public health.

### *13.1.7 Bracing Excavations*

Excavations shall be so braced or sheeted so as to provide conditions under which workmen may work safely at all time. Rules, orders, and regulations of the Division of Industrial Safety of the State of California shall be complied with. Excavations shall be so braced, sheeted, and supported that the ground alongside the excavation will not slide or settle, and all existing improvements of any kind, either on public or private property, will be fully protected from damage. The sheeting, shoring, and bracing shall be so arranged as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength. Damage to structures occurring through settlements, water or earth pressures, slides, caves, or other causes due to failure or lack of sheeting or bracing, or improper bracing, or through negligence or fault of Contractor in any other manner, shall be required by Contractor at this own expense.

Care shall be exercised in removal of sheeting, shoring, bracing, and timbering to prevent the caving or collapse of the excavation faces which are being supported, and in such a manner as to prevent excessive backfill that might overload the pipe or conduit.



## 13.2 Materials and Workmanship

### 13.2.1 Clearing and Grubbing

All brush, roots, vegetation, rubbish, debris, and other deleterious material shall be removed and disposed of so as to leave the construction site clean and neat.

### 13.2.1 Trench Width

Trench widths measured at a level of one foot above top of pipe, pipelines and appurtenances shall not exceed the limits shown in the following table:

<b>Nominal Inside Pipe Diameter</b>	<b>Minimum Trench Width</b>	<b>Maximum Trench Width</b>
4" through 12"	Outside dia. plus 12"	Outside dia. plus 18"
14" through 30"	Outside dia. plus 18"	Outside dia. plus 24"

Where shoring or encasement is required, trench widths shall be established by City's Representative. If the trench width, measured at a point twelve inches (12") above the top of the barrel of the pipe, is wider than the maximum set forth above, it may be necessary to backfill the trench area around the pipe with five-sack concrete to encase or form a cradle to protect the pipe. City's Representative shall specify when said encasement or cradle is required.

### 13.2.3 Trench Depth

Trench depth shall be adequate to accommodate the pipe and its foundation at the profile shown on the Plans. In the absence of such profile grade, the top of pipe grade shall be located three feet (3') below the existing street grade or existing ground. The measurement of the depth shall be at the trench centerline.

Where the natural ground above the pipeline trench has been over-excavated and/or the pipeline is to be placed in new embankment, embankment material shall be placed and compacted to an elevation of not less than three feet (3') above the top of pipe prior to trench excavation.

### 13.2.4 Pipe Subgrade

Pipe subgrade at the trench bottom shall have a flat cross section. The bottom of the trench for pipe shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of each joint except for required "bell holes" at joints. Pipe shall not be laid on earth mounds and care must be taken to avoid creating earth mounds with the material excavated from "bell holes."

### 13.2.5 Foundations in Poor Soil

Foundations in poor soil shall be constructed by removing soft, spongy, and deleterious material below pipe bottom grade and replacing it with sand or crushed rock, as approved by City's Representative, to obtain a firm subgrade. Replacement of unsound materials to depths of two feet (2') below bottom of pipe grade shall be considered included in the

installed pipe bid price. The necessity of replacing unsuitable material at depths of more than two (2) feet below bottom of pipe grade will be determined by City's Representative and will be specifically ordered as extra work unless the necessity for such additional removal and replacement has been occasioned by an act or failure to act on the part of the Contractor, in which case the Contractor shall bear the expense of the additional excavation and backfill to the required depth.

#### *13.2.6 Correction of Faulty Grades*

All excavations carried below pipe grade shall be backfilled to proper grade and cross-section and compacted to a minimum relative density of 90%.

### **13.3 Backfill**

All trenches and excavations shall be backfilled after pipe, fittings, valves, and appurtenances have been installed.

#### *13.3.1 Procedure in Pipe Zone*

The pipe zone shall be considered to extend from the bottom of the excavation to twelve inches (12") above the top of the pipe.

Native soil material may be used for backfill in the pipe zone only if it meets the conditions below for pipe zone imported backfill.

#### *13.3.2 Pipe Zone Imported Backfill Material*

Imported backfill material for pipe, fittings, and anchor walls shall consist of clean sand having a sand equivalent value of not less than 40, as determined by California Test Method No. 217.

Backfill shall be placed in layers simultaneously on each side of the pipe for the full width of the trench. Sand may be placed and compacted in layers up to 12 inches in compacted thickness. All other material shall be placed and compacted in layers not exceeding six inches (6") in compacted thickness. In placing and compacting the backfill, particular attention is to be given to pipe haunching and fittings to provide firm support along the full length of the pipe. Care shall be exercised in backfilling to avoid damage to any pipe coating.

#### *13.3.3 Procedure Above Pipe Zone*

Material shall not be placed in this zone until approval of pipe zone backfill has been given. From the top of the pipe zone to the ground surface or subgrade, material for backfill shall conform to that specified for the pipe zone and but shall be so graded that at least 40% of the material passes a No. 4 sieve. The coarser materials shall be well distributed throughout the finer material. Backfill material shall be placed in layers of a thickness which can be consolidated throughout to the specified density with equipment, which will not damage the pipe and fittings, and as limited by these Specifications.

#### *13.3.4 Tracer Tape*

Contractor shall install metallic tracer tape at an elevation of approximately one foot (1-foot) above the top of all water, sewer, and storm drain pipes. Tracer tape shall be continuous, and shall be extended to manholes or valve boxes, with scaled ends.

## **13.4 Compaction**

All backfill shall be consolidated throughout by tamping and/or water settling to a minimum relative compaction of 90% maximum density as shown on Standard Drawing M-7 and M-8, or the density required by the agency in whose right-of-way the work is located, whichever is more restrictive.

### *13.4.1 Tamping Method*

Backfill material shall be placed in uniform layers. The moisture content of the backfill material shall be at or near the optimum required for compaction. Each layer shall be tamped until compacted to the required minimum relative density. Compacting equipment having an overall weight in excess of 100 pounds shall not be used until backfill has been completed to a depth of two (2) feet over the top of the pipe. The selection and use of compaction equipment shall be such that compaction requirements will be met without damage to the facilities.

### *13.4.2 Compaction Tests*

Compaction shall be the Contractor's responsibility and shall be made by a recognized laboratory approved by City's Representative. The number of tests and their location and depth shall be determined by City's Representative, or shall be as required by project plane and specifications. Contractor shall make all excavations necessary for compaction tests, and shall refill and recompact those excavations to the densities specified herein.

The costs of such testing shall be borne by the Contractor except when specifically directed otherwise by City plans or specifications.

Compaction tests are also required of and charged to the Contractor under various road and encroachment permits. This section in no way relieves the Contractor of obligations incurred under such permits.

### *13.4.3 Final Clean-up*

After backfill has been completed, the right-of-way shall be dressed smooth and left in a neat and presentable condition, free of all cleared vegetation, rubbish, and other construction wastes. Surplus rock, which cannot be used for backfill shall be hauled away and disposed of by the Contractor.

## **14. Cast Iron and Ductile Iron Pipe**

### **14.1 General**

This specification designates the requirements for the manufacture and installation of cast iron and ductile iron water pipe to be installed at the location and to the lines and grades shown on the Plans and as herein specified. The contractor performing the work under this specification shall furnish all labor, materials, tools and equipment which are necessary to install, complete and ready for operation, a functioning pipeline. The selection of cast iron or ductile iron pipe shall be shown on the construction drawings, or shall be made with the approval of City's Representative.

#### *14.1.1 Soil Investigation Required*

Prior to the specification and installation of cast iron pipe within the City of Lemoore, a soil corrosivity report shall be prepared by a professional engineer, registered in the State of California, and recognized as a member of the National Association of Corrosion Engineers. The report shall include a summary of field investigations, analyses, and an opinion of the relative merit and stability of cast iron pipe in the proposed environment. A recommendation as to the means of protecting pipe from corrosion, if required, should also be given.

### **14.2 Materials**

#### *14.2.1 Manufacture*

Cast iron pipe shall be cement lined and manufactured to exceed the minimum requirements of Federal Specification WW-P-421c, most current edition. Ductile iron pipe shall be cement lined and manufactured to exceed the minimum requirements of American National Standard Institute, ANSI A21.41, AWWA C-151.

#### *14.2.2 Design*

All pipe shall have a minimum tensile strength of 21,000 p.s.i. and 45,000 p.s.i. modulus of rupture. All pipe shall be centrifugally spun and properly annealed in accordance with Federal Specifications. Thickness shall be as determined by the design method outlined in ANSI A21.80 for gray iron pipe and AWWA C-150 for ductile iron pipe. Minimum thickness shall be not less than that obtained by assuming field laying condition Type 1 (flat bottom trench, backfill not tamped) and depth of cover of 5 feet.

#### *14.2.3 Joints and Accessories*

Mechanical joint and Tyton-type joint accessories and dimensions shall conform to the applicable requirements of the latest revisions of ANSI A21.11 (AWWA C-111), unless otherwise specified. Mechanical joint glands shall be gray cast iron. Bolts shall be stainless steel, Type 304.

#### *14.2.4 Cement Mortar Linings*

Cement mortar linings shall be accordance with the latest revision of ANSI A21.4 (AWWA C-104). Thicker linings, if required, shall be called out on drawings.

*14.2.5 Fittings*

All fittings used in conjunction with cast iron pipe shall be cast iron and conform to ANSI A21.10 or A21.11, for short-body cast iron fittings for 150 psi water pressure plus water hammer. All cast iron fittings shall be cement mortar lined in accordance with AWWA Standard C-104. Joints shall be mechanical, except where the Plans call for flanged fittings. Push-on joints shall not be used.

*14.2.6 Pipe Lengths*

Pipe lengths shall normally be 18 feet, except where shorter lengths are required to fit horizontal and vertical alignment. Lengths to be used for curved alignment shall be sufficiently shortened to prevent the actual pipe centerline from varying more than 0.3-foot laterally from the curved alignment centerline shown on the Plans, or more than 0.2-foot vertically from the elevations and grades shown on the Plans. Combined horizontal and vertical deflections at any rubber gasket or flexible coupling joint shall not exceed that recommended by the manufacturer (the maximum total deflection allowed shall be 4°). Minimum radii for normal laying lengths are as follows:

<b>Diameter</b>	<b>Min. radius for joint length</b>	
	<b>12 ft.</b>	<b>18 ft.</b>
6" to 12"	175 ft	250 ft
14: to 16"	225 ft	350 ft

*14.2.7 Flanges*

Flanges shall comply with ANSI Standard B16.1 for Class 125 (flat face, working pressure o-150 p.s.i.).

Gaskets shall be equivalent to 1/16-inch "Cranite." Full face type with holes pre-punched shall be used where both flanges are flat face. Ring gaskets extending to the inner edge of the bolts may be used where a raised face flange is present.

Where an adjoining flange is steel, the steel flange shall be flat face.

*14.2.8 Bolts and Nuts*

Bolts and nuts for above ground installations shall be ASTM A307 Grade B. Bolts for underground installations shall be stainless steel Type 304. All buried bolts shall be completely coated with Koppers' Bitumastic #50, or equivalent, which must applied to two coats to a minimum thickness of 15 mils per coat. Buried bolted joints shall be wrapped in plastic film in accordance with Section 25, *Plastic Film Wrap of Valves, Bolted Flanges, and Other Bolted Fittings.*

**14.3 Installation**

#### *14.3.1 General*

The cast iron pipe and cast iron water main and fittings shall be assembled in accordance with the applicable sections of AWWA Standard C-600, "Installation of Cast Iron Water Mains."

#### *14.3.2 Transportation*

Transportation shall be by competent haulers and accomplished in a manner that will avoid damage to the pipe or its lining or coating. Contractor shall unload pipe by mechanical means such as a crane or backhoe, or by rope and skids, as recommended by the manufacturer. In using skids, pipes must be prevented from striking other objects. No dropping from trucks will be allowed.

#### *14.3.3 Earthwork*

Earthwork shall be in accordance with Section 13, *Earthwork (Piping and Pipelines)* except that reference to steel pipe shall be interpreted as cast iron or ductile iron.

#### *14.3.4 General Installation Procedures and Workmanship*

Prior to laying the pipe, the bottom of the trench shall be graded and prepared to provide uniform bearing throughout the entire length of each join of pipe. Bell holes of ample dimension shall be dug in the bottom of the trench at the location of each joint to facilitate the joining. The trench shall have a flat or semi-circular bottom conforming to the grade to which the pipe is to be laid. The pipe shall be accurately placed in the trench to the lines and grades on the Plans. Fittings shall be supported independently of the pipe. Combined deflections at rubber gasket or flexible coupling joints shall not exceed 4° or that recommended by the manufacturer, if smaller. Pipe shall be handled to prevent damage to the lining and coating.

No joint shall be backfilled until it has been inspected by City's Representative. Sufficient trench space shall be left open in the vicinity of each joint to permit visual inspection around the entire periphery of the joint.

#### *14.3.5 Plastic Film Wrap*

When recommended to protect the pipe from corrosion, cast iron and/or ductile iron pipe and fittings buried underground shall be protected with plastic film wrap. Wrap shall be loose 8-mil thick polyethylene tube. All joints between plastic tubes shall be wrapped with 2-inch wide polyethylene adhesive tape, Polyken No. 900, Scotchwrap No. 50, or approved equal. Installation of plastic film shall conform to the following procedure:

- Using a sling, pick up pipe with a crane at the side of the trench and raise about 3 feet off the ground. The polyethylene tube, cut approximately 2 feet longer than the length of the pipe, shall be slipped over the spigot end of the pipe and bunched up, accordion fashion, between the end of the pipe and the sling.
- Lower the pipe into the trench. Seat the spigot into the bell of the adjacent installed pipe, and lower the pipe to the trench bottom. Provide a shallow bell hole in the trench bottom to facilitate the wrapping of the joint.
- The pipe joint shall then be made up in the normal fashion.

- Remove the sling from the center of the pipe and hook into the bell cavity. Raise the bell 3-4 inches and slip the tube of polyethylene film along the full length of the pipe barrel. Enough of the film should be left bunched up, accordion fashion, at each end of the pipe, to overlap the adjoining pipe about 1 foot.
- To make the overlapped joint wrap, the film shall be pulled over the bell of the pipe, folded around the adjacent spigot, and wrapped with at least three circumferential turns of the plastic adhesive tape in order to seal the tube of film to the pipe. The tube on the adjacent pipe shall be then pulled over the first wrap on the pipe bell and sealed in place behind the bell, using at least three circumferential turns of the polyethylene adhesive tape.
- The resulting loose wrap on the barrel of the pipe shall be pulled snugly around the barrel of the pipe, the excess material folded over the top and the fold held in place by means of short strips of the adhesive tape, at intervals 3 feet apart along the pipe barrel.

#### *14.3.6 Concrete Thrust and Anchor Blocks*

Concrete thrust and anchor blocks shall be placed as required and shall consist of Portland cement concrete containing not less than five sacks of cement per cubic yard (Class "B") and shall conform to the applicable provisions of Section 7, *Portland Cement Concrete Improvements*.

Except as allowed under Section 14.3.7 below, concrete thrust and anchor blocks shall be placed between the undisturbed ground and the fittings to be anchored. Quantity of concrete and the area of bearings on the pipe and undisturbed soil shall be as shown on the Plans, or as directed by City's Representative. Concrete shall be placed, unless specifically shown otherwise, so that the pipe joints and fittings will be accessible for repair. All concrete supports shall be allowed to cure for five days prior to filling the supported pipe with water.

#### *14.3.7 Alternative Joint Restraint*

In lieu of concrete thrust blocks and anchors, mechanical joint restraints may be used.

#### *14.3.8 Preventing Foreign Matter from Entering the Pipe*

At all times when the pipe laying is not in progress, the open end of the pipe shall be closed by a wooden plug or by other means approved by City's Representative. Upon resumption of construction, Contractor shall remove the plug and clean all foreign matter from the mouth of the pipeline before proceeding with additional construction.

#### *14.3.9 Damaged Pipe or Fittings*

Damaged pipe or fittings, whether installed or awaiting installation, shall be removed from the jobsite upon discovery by Contractor or City's Representative.

#### *14.3.10 Testing and Sterilization*

All cast iron mains and appurtenances attached thereto shall be tested and sterilized in accordance with Section 25, *Testing and Sterilization*.

## 15. Steel Water Pipe and Fittings

### 15.1 General

Except as modified herein, materials and workmanship for the manufacture and installation of steel water pipe and fittings shall conform to the applicable requirements of the following specifications or the latest revision thereof, which are hereby a part of this specification:

Federal Specification SS-P-385a  
American National Standards Institute (ANSI) B-16.5  
American Society for Testing Materials (ASTM) A570, A283, A307  
American Water Works Association (AWWA) C200, C205, C206, C207, C208.

Steel pipe shall be utilized for above-ground installations only.

### 15.2 Pipe Identification Symbols

Pipe identification symbols shown on the Plans (for example, S-18"-150) designate type of pipe (steel, cement mortar lined and coated,), nominal inside diameter measured to the internal face of cement lining (18 inches), and working pressure. Steel cylinder diameters shall be related to nominal inside diameters as specified herein.

### 15.3 Steel Pipe

Steel for cylinders shall conform to ASTM A570, Grade B or C; or A283, Grade C or D.

#### 15.3.1 Stress

Stress in steel cylinders shall not exceed 15,000 psi at the designated working pressure, with no allowance for tensile strength of concrete. Minimum cylinder thickness shall be:

<u>Nominal Inside Diameter</u>	<u>Minimum Thickness</u>
4" through 18"	0.1046"
20" and 21"	0.1345"
24" and 27"	0.1495"

The following formula shall be used to determine the stress in the steel:

$$S = \frac{P d_i}{2g}$$

Where S	=	Stress (psi)
P	=	Working Pressure (psi)
D <sub>i</sub>	=	Max Inside Diameter of Steel Cylinder (inches)
G	=	Wall Thickness of Steel Cylinder (inches)



Steel Cylinder diameters for pipe twelve inches (12") and smaller in nominal inside diameters shall conform to the following:

<b>Nominal Inside Diameter</b>	<b>Steel Cylinder Outside Diameter</b>
4"	4-1/2"
6"	6-5/8"
8"	8-5/8"
10"	10-3/4"
12"	12-3/4"

For larger pipes, the steel cylinder outside diameter shall be computed using the following formula:

$$D_o = D + 2(t+g)$$

Where  $D_o$  = Actual Steel Cylinder O.D. (inches)  
 $D$  = Nominal Inside Diameter (inches)  
 $t$  = Thickness of Cement Mortar Lining (inches)  
 $g$  = Wall Thickness of Steel Cylinder (inches)

#### 15.3.2 Maximum and Minimum Diameters

Maximum and minimum diameters at any cylinder section shall not vary more than 1/8-inch for nominal sizes up to twelve inches (12") nor more than one (1) per standard section. Girth seams shall be limited to one (1) per standard section 16 feet or less in length. Additional girth seams in longer standard sections may be employed but not to exceed one (1) per each additional full 10 feet beyond the first 20 feet. Seams in special sections may be increased as required.

### 15.4 Lining and Coating Materials

#### 15.4.1 Cement

Cement shall be Portland cement Type II for lining and Type V for coating, applied in accordance with AWWA C205, except as modified herein.

#### 15.4.2 Interior Mortar Linings

Mortar linings shall be the minimum thickness set forth in the following table:

<b>Nominal Diameter</b>	<b>Lining Thickness</b>
4" through 12"	5/6"
14" and 16"	3/8"
18" and 36"	1/2"

Finish lining thicknesses shall not vary more than 1/16-inch from those indicated. The finish diameter of the pipes finish lining shall have a tolerance of 1/8-inch.

### 15.4.3 Exterior Mortar Coatings

Exterior mortar coatings shall not be less than shown in the following table:

<b>Nominal Diameter</b>	<b>Minimum Coating Thickness</b>
4" and 6"	1/2"
8" and 10"	5/8"
12" and above	3/4"

All exterior metal surfaces except flanges shall be coated.

### 15.5 Ends of Sections

Ends of sections shall be bell and spigot with rubber gasket unless otherwise indicated.

### 15.6 Butt Strap Closures

Butt strap closures shall be installed at all points where a butt closure is made. The butt straps shall be the same thickness as the pipe wall but not less than 10-gauge, at least 10-inches wide, rolled to fit the outside cylinder diameter, and shall be centered over the ends of the pipe sections they are to join. A standard 5-inch pipe half-coupling shall be shop-welded to the top section of the butt strap to permit access for mortar lining the inside of the joint. A 5-inch steel plug shall be supplied with each butt strap assembly.

### 15.7 Flanges

Flanges shall comply with AWWA C207, Class D (flat face) for working pressure 0-150 p.s.i. Socket welding or welding neck flanges complying with ANSI B-16.5 and providing a steel bearing surface, which conforms to the nominal inside pipe diameter, are required to match with butterfly valves.

### 15.8 Gaskets

Gaskets shall be 1/16-inch "Cranite." Full face type, with holes prepunched, shall be used where both flanges are flat face. Ring gaskets extending to the inner edge of the bolts may be used where a raised-face flange is present.

### 15.9 Nuts and Bolts

Nuts and bolts used for bolting flanged-end valves to pipeline flanges above ground shall be standard hexagonal head machine bolts and hexagonal nuts conforming to ASTM A307. All buried flanges shall be bolted; 1-1/8-inch and larger in diameter shall be cadmium plated. All bolt threads shall be lubricated with graphite and oil.

### 15.10 Flexible Couplings

Flexible couplings shall be APAC, ROMAC, or Ford Style FC3, with cast iron sleeves and Type 304 stainless steel bolts, or City-approved equivalent. Number and diameter of bolts and sleeve lengths and thickness shall conform to the following minimums:

Pipe Diameter	Bolts			Sleeve
	Number	Diameter	Length	Thickness
4"	3	1/2"	4"	3/16"
6"	5	5/8"	5"	1/4"
8"	6	5/8"	5"	1/4"
10"	7	5/8"	7"	1/4"
12"	8	5/8"	7"	1/4"
14"	8	5/8"	7"	1/4"
16"	9	5/8"	7"	5/16"
18"	10	5/8"	7"	5/16"
20"	12	5/8"	7"	3/8"
22"	13	5/8"	7"	3/8"
24"	14	5/8"	7"	3/8"

### 15.11 Welded Joints

One end of each section shall be swaged out to form a female or bell end, which shall permit the male or spigot end to enter approximately one inch with a clearance of approximately 1/32 inch. The spigot end shall be "sized" to permit it to enter the bell end of the adjacent section. The weld bead shall be ground flush for the distance it is to enter the bell end.

### 15.12 Special Sections and Fittings

Fitting dimensions shall conform to AWWA C208, except that reducers shall consist of taper sections between 6-inch minimum lengths of adjoining pipe. The taper shall be a minimum of twelve inches (12") in length for each 2-inch diameter change, and the gauge shall be equal to that of the larger adjoining pipe. The diameter of the 6-inch sections shall match the adjoining pipes. The gauge shall be sufficient to maintain a stress of less than 15,000 psi at the designated working pressure, and shall be not less than 10 gauge. Fittings and special sections shall be fabricated from lined and coated standard pipe sections and manually pointed with mortar. Where configuration will not permit using standard sections, such odd pieces shall be lined and coated in the manner specified for pipe, except that where such operations will not give satisfactory results, then equivalent manual methods will be permitted. All special sections and fittings shall be fabricated in a shop by the manufacturer from City-approved shop drawings under the inspection of the City's Representative. Except for butt strap closures, field fabricated fittings will not be permitted.

Outlets in special fittings shall be reinforced with collars, wrappers, or crotch plates as indicated in the following table and formula:

Pipe Diameter	Maximum Outlet Diameter		
	Collar	Wrapper	Crotch Plate
10"	6"	10"	
12"	8"	12"	
14"	8"	14"	
16"	20"	16"	
18"	10"	18"	
20"	12"	20"	
21"	12"	21"	
24"	14"	21"	24"
27"	16"	21"	27"
30"	18"	24"	30"

The effective shoulder width "W" of collars or wrappers from the inside surface of the steel riser to the outside edge of the collar or wrapper measured on the surface of the cylinder shall be not less than one-third nor more than one-half the inside diameter of the steel riser. The thickness of the collar or wrapper shall be not less than "T" as determined by:

$$T = \frac{P_w \times ID_{cyl.} \times ID_{riser}}{36,000 \times W}$$

where Pw is the design class in pounds per square inch, and other dimensions are in inches.

### 15.13 Shop Drawings

Shop drawings of all pipe and fittings including pipe layout sheets showing joints shall be submitted to City's Representative and shall be approved by him prior to fabrication of the pipe and fittings. Such approval is an additional precaution against errors and is not to be construed as relieving the Contractor for the full responsibility for the accuracy of the shop drawings. Fabrication design shall reflect all the limitations included under Section 15.17, Installation.

### 15.14 Markings

Markings shall include a designation mark for each pipe or fitting furnished. Shop drawings shall include a marking plan showing the location of each pipe and piece furnished.

### 15.15 Factory Tests

Factory tests shall be performed as set forth in referenced Specifications. All fitting girth seams not hydrostatically tested shall be dye checked. Any weld flaws shall be corrected.

### 15.16 Damaged Pipe or Fittings

Damaged pipe or fittings shall be removed upon discovery and without delay from the site of the work.

## **15.17 Installation**

### *15.17.1 Excavation and Backfill*

Excavation and backfill shall conform to Section 13, *Earthwork (Pipelines)*.

### *15.17.2 General Installation Procedures and Workmanship*

Prior to laying the pipe, the bottom of the trench shall be graded and prepared to provide uniform bearing throughout the entire length of each joint of pipe. Bell holes of ample dimension shall be dug in the bottom of the trench at the location of each joint to facilitate the joining. The trench shall have a flat bottom conforming to the grade to which the pipe is to be laid. The pipe shall be accurately placed in the trench to the lines and grades shown on the Plans. Fittings shall be supported independently of pipe. Combined deflections at rubber gasket or flexible coupling joints shall not exceed four degrees (4°) nor that recommended by the manufacturer. Bare cinch or choker-type cables shall not be used for handling pipe. Slings for pipe handling shall be belts of sufficient width to prevent damage to exterior coating. Pipe shall be carefully handled to prevent damage to lining and coating.

No joint shall be backfilled until it has been inspected by City's Representative. Sufficient trench space shall be left open in the vicinity of each joint to permit visual inspection around the entire periphery of the joint.

### *15.17.3 Rubber Ring Joints*

Rubber ring joints shall be completed in the trench. The ends of the pipe shall be thoroughly cleaned and positioned for joining. Vegetable soap solution shall be applied to the inside of the bell, and the rubber gasket snapped into the groove on the spigot end. The bell end shall be buttered with cement mortar in such a manner and in sufficient quantity to completely fill the recess between the respective linings of the two joined sections of pipe. The spigot end shall then be entered into the bell of the adjacent pipe section the distance shown on the shop drawings.

Immediately after joining, the pipe interior shall be swabbed to remove all excess mortar by drawing and approved type of swab or squeegee through the pipe. For pipe at least 24 inches in nominal inside diameter, 1 ½-inch recess between adjacent linings shall be provided and later pointed from the inside with cement mortar and troweled smooth.

The outside joint recess shall be coated with grout after a fabric diaper, as recommended by the pipe manufacturer, has first been placed around the joint and tightened securely to prevent leakage while the grout is being poured. The diaper shall be made of heavy duty sail cloth of sufficiently close weave to prevent cement loss from the mortar. The diapers shall be Mar-Mac fabric diapers or City-approved equivalent. The fabric shall be hemmed on each edge and shall contain a metal strap within each hem sufficiently longer than the circumference of the pipe to allow a secure attachment of the diaper to the pipe.

The diaper width will depend on pipe size and design and shall be the width recommended by the manufacturer. Following installation of the diapers, the joints shall be poured and rodded from one side only until the grout comes up to the top of the diaper on the opposite side. Approximately one hour after pouring the joint, the joint shall be refilled with grout. For cement mortar coated pipe, the grout mentioned above shall have a mix of 1 part cement, 2 parts sand.

*15.17.4 Welded Joints*

Welded joints shall be completed in the trench. When the pipe is being laid, both the spigot and the bell ends shall be thoroughly cleaned of all foreign matter, and all protective material shall be removed from the surfaces that are to be in contact at the joints. Just prior to joining the two ends, each shall be "buttered" with cement mortar in such a manner and in sufficient quantity to completely fill the space between the respective mortar linings. After the joining is completed, the pipe interior shall be swabbed to remove all excess mortar by drawing an approved type swab or squeegee through the pipe. For pipe at least 24 inches in nominal inside diameter, 1 1/2-inch recess between adjacent linings shall be provided and later pointed from the inside with cement mortar and troweled smooth.

All welding shall be done by experienced welders qualified in accordance with the Standards of the American Welding Society. Welding electrodes shall comply with the requirements of the Standards of the American Welding Society.

In all hand welding, the metal shall be deposited in successive layers and the minimum number of passes or beads in the completed weld shall be as follows:

<b>Steel Cylinder Thickness</b>	<b>Fillet Weld Minimum Passes</b>
Smaller than 3/16"	1
3/16" and 1/4"	2
5/16"	3
3/8"	3

When welded joints are designated on the plans, rubber ring joints or slip (lap) joints may be used as acceptable alternates. However, when rubber ring joints are welded, the outside recess between the bell and spigot shall then be caulked with a filler rod to facilitate welding. Welds shall be continuous for the circumference of the pipe and shall seal the joint.

After joints have been welded, the joint shall be coated in the same manner as specified for rubber ring joints.

*15.17.5 Fabricated Angles*

When fabricated angles must be used in water line construction, the piece containing the angle shall be welded to the adjoining pipe piece on both sides of the angle, and the far ends of the pipe pieces adjoining the fabricated angle shall also be welded.

#### *15.17.6 Butt Strap Closure Joints*

Butt strap closure joints shall be completed in the trench after the pipe has been laid to the alignment and grade shown on the Plans. They shall be field welded to the outside of the pipe along both edges by full circumferential fillet welds, or one of the edges may be shop welded and the other field welded. Half of the standard five-inch (5") pipe coupling shall be shop welded to the top section of the butt strap to permit access for mortaring the inside of the joint. After the plug is screwed down tight it shall be sealed in place by welding. Welding shall be done in the same manner as specified for welded joints.

The interior of the joints shall be filled with stiff-plastic mortar and finished off smoothly with the inside of the pipe.

For cement mortar coated pipe wire mesh, 2" x 4" No. 13 gauge clean and free from rust, shall be applied to the exterior of the butt strap joint so that the wires on the 2-inch spacing run circumferentially around the pipe. The wires on the 4-inch spacing shall be crimped in such a manner that the mesh will be held 3/8-inch from the metal joint surface. The mesh shall be lapped a minimum of 8-inches and shall be securely wired in position. The joint exterior shall then be coated with cement mortar to a minimum thickness of 1-1/2". Immediately prior to applying mortar to the interior or exterior of the joints, a cement wash shall be applied to the metal surfaces to be coated.

#### *15.17.7 Flanged Joints*

Flange faces shall be wire brushed and gaskets shall be thoroughly cleaned just prior to joining. Following the tightening of the bolts, all exposed metal surfaces, including bolts and nuts, shall be cleaned by wire brushing and then primed with Koppers' Jet Set, or City-approved equivalent. Following application of the primer, the flanged joints shall be covered with fabric diapers containing a metal insert within the fabric to provide sufficient clearance between the flanges and diapers to insure a minimum thickness of 1/2-inch coat tar coating over all flanges, nuts and bolts. The formed diapers shall then be filled from the top with Koppers' hot bitumastic coupling compound, or City-approved equivalent. The joints shall be poured from one side only until the compound shows on the other side. All metal surfaces shall be coated with compound to a minimum thickness of 1/4-inch.

#### *15.17.8 Flexible Coupling Joints*

Flexible coupling joints shall be completed in the trench after the pipe has been laid to the alignment and grade shown on the Plans. Each pipe end, for a distance of 6 to 8 inches back from the end, shall be thoroughly cleaned to remove oil, dirt, scale, and other foreign matter.

Bolts shall be tightened to the torque recommended by the manufacturer with a torque wrench, in the presence of City's Representative.

All exposed coupling and pipe metal surfaces shall be cleaned, primed, diapered and encased with hot coal tar compound as specified for flanged joints.

In addition to the bitumastic coating, a 10-mil wrap of polyethylene film shall completely encapsulate the joint, flanges, nuts and bolts on the flange in accordance with Section 25, *Plastic Film Wrap of Valves, Bolted Flanges and other Bolted Fittings*.

*15.17.9 Cement Mortar*

Cement mortar for buttering, pointing, and grouting shall consist of one part cement to two parts of washed plaster sand conforming to the latest revisions of ASTM Specification C-35, mixed with the minimum amount of water which will permit placing the mortar.

*15.17.10 Concrete Thrust and Anchor Blocks*

Concrete thrust and anchor blocks shall be placed as required, shall consist of Portland cement concrete containing not less than 5 sacks of cement per cubic yard, and shall conform to the applicable provisions of Section 7, *Portland Cement Concrete Improvements*. Concrete thrust and anchor blocks shall be placed between undisturbed ground and the fittings to be anchored. Quantity of concrete and the area of bearings on the pipe and undisturbed soil shall be as shown on the Plans, or as directed by City's Representative. Concrete shall be placed, unless specifically shown otherwise, so that the pipe joints and fittings will be accessible for repair. All concrete supports shall be allowed to cure for at least five (5) days prior to filling the supported pipe with water.

*15.17.11 Preventing Foreign Matter from Entering the Pipe*

At all times when the pipe laying is not in progress, the open end of the pipe shall be closed by a wooden plug or by other means approved by the City's Representative. Upon resumption of construction, Contractor shall remove the plug and clean all foreign matter from the mouth of the pipeline before proceeding with additional construction.

*15.17.12 Testing and Sterilization*

All steel pipe water mains and appurtenances attached thereto shall be tested and sterilized in accordance with Section 26, Testing and Sterilization.



## **16. PVC Water Pipe**

### **16.1 Materials and Assembly**

Unless otherwise shown on the Plans, all PVC pressure pipe shall be Class 150, and shall conform to the requirements of ASTM C-900 "Polyvinyl Chloride (PVC) Pressure Pipe."

The bell shall consist of a uniform wall section with a solid cross-section elastomeric ring, which meets the requirements of ASTM D-1869 and E-477. The bell shall be designed to be at least as strong as the wall section of the pipe. Provisions shall be made for expansion and contraction at each joint with an elastomeric ring.

#### *16.1.1 Joint Checking*

After assembly of each joint, the elastomeric ring shall be checked with a suitable feeler gauge. If the location of the ring is not within acceptable limits, or if there is evidence of a "fishmouth" joint, the joints shall be disassembled and reassembled in a correct manner.

### **16.2 Fittings**

Fittings for PVC pipe shall be cast iron as specified under ASA standard specification A21.10 (AWWA C110) with the wall thickness conforming to AWWA Specification C100. All fittings shall have hub ends with two (2) rubber ring seals, designed for use on PVC pipe without special milling. Fittings shall be cement mortar lined as specified under ASA A21.4 (AWWA C104).

## **17. Blow-Off Assemblies**

### **17.1 General**

Permanent blow-off assemblies shall be furnished and installed by Contractor, where sediment may collect, and at the locations shown on the Plans. Fire hydrants shall be installed for blow-off purposes at ends of cul-de-sacs. Design class shall be compatible with pipeline working pressure. The Contractor shall furnish all labor, materials, tools and equipment necessary to furnish and install, complete and ready for operation, the assemblies as shown on the Plans and herein specified. See Standard Drawing W-3.

Temporary blow-off assemblies shall be furnished and installed by Contractor at dead ends formed by phased lines in new development, where the water line will be extended by future construction. The Contractor shall furnish all labor, materials, tools and equipment necessary to furnish and install, complete and ready for operation, the assemblies as shown on the Plans and herein specified. See Standard Drawing W-8.

### **17.2 Materials, Fabrication and Installation**

#### *17.2.1 Materials*

Materials shall be of the size and kind designated on the Standard Drawings.

#### *17.2.2 Marker Posts*

In all easements and where called for on the Plans in streets, blow-offs shall be marked with a marker post. Timber for posts shall be dense structural grade redwood, graded according to the current standards of the California Redwood Association. Posts shall be 4" x 4" x 5'-4", surfaced on four sides with top chamfered. The posts shall be painted in accordance with the Painting specifications herein. On the side facing the water main or roadway, the legend *City of Lemoore* and the distance in feet from the post to the valve shall be stenciled in black letters 2 inches high. Posts shall be set 2'-4" into the ground.

#### *17.2.3 Earthwork*

Earthwork shall be in accordance with Section 13, *Earthwork (Pipelines)*.

#### *17.2.4 Dielectric Connection*

Dielectric connection with PVC tape wrap shall be provided at all connections with steel and cast iron water mains.

## 18. Water Service Assemblies: 2-Inch and Smaller

### 18.1 General

Water service assemblies shall be furnished and installed by the Contractor at the locations shown on the Plans or established in the field by the City's Representative. The Contractor shall furnish all labor, materials, tools and equipment necessary to furnish and install, complete and ready for operation, the assemblies as shown on the Plans and herein specified.

### 18.2 Materials, Fabrication, and Installation

#### 18.2.1 Materials

Materials shall be those designated on the Standard Drawings or Plans.

#### 18.2.2 Pipe and Fittings

Service pipe shall conform to the Water Service Tubing specifications herein. Copper and brass fittings shall be as designated on the Standard Drawings. Each item shall be new and conform to ASTM B62.

Meter Size	Corp. Stop	Tubing	Angle Valve
3/4"	1"	1"	1" x 1"
1"	1"	1"	1" x 1-1/4"
2"	2"	2"	2" x 2"

#### 18.2.3 Meters

Meters will be supplied by City at Contractor's expense. Meters 1-inch and smaller shall have screw connections. 2-inch meters shall have flanged connections.

#### 18.2.4 Service Taps

In no case shall a service tap be made into a main closer than 18 inches to a bell coupling joint or fitting. Service taps shall not be less than two (2) feet apart. Service taps shall be located opposite the meter locations so that the service laterals will be perpendicular to the water main and street centerline. Service tap locations varying more than five (5) feet from the perpendicular must be approved by City's Representative prior to installation. Unless otherwise noted on the plans, service taps shall be located so that the water service lateral is parallel to and two (2) feet from the property line.

#### 18.2.5 Dielectric Connections

Dielectric connections shall be provided where dissimilar metals are joined and shall conform to the Standard Drawings.

#### 18.2.6 Meter Boxes

Meter boxes and covers shall be Christy Concrete Products, Inc. *Fibrelyte*, or approved equal as shown in the following table.

<b>Meter Size</b>	<b>Meter Box Model</b>
3/4"	FL30 with FLP30 Lid
1"	FL30 with FLP30 Lid
2"	FL36 with FLP36 Lid

Meter boxes shall be set with longitudinal axis perpendicular to the street and 12 inches from the back of curb unless otherwise noted. See Standard Drawing Nos. W-1 and W-2. Where concrete curbs do not exist and are not to be constructed as part of the improvement plans, meter boxes shall be set 12 inches inside the public street right-of-way. Meter boxes shall not be set in driveways. Meter boxes at locations subject to automotive traffic loads must be approved by City's Representative prior to installation and shall be traffic-rated concrete boxes furnished with City-approved cast iron covers.

#### *18.2.7 Earthwork*

Earthwork shall conform to Section 9 *Earthwork (Structures and Miscellaneous Pipelines)*.

## **19. Butterfly Valves**

### **19.1 General**

These specifications designate the requirements for the manufacture and installation of butterfly valves. Contractor shall furnish all labor, materials, tools and equipment necessary to furnish and install, complete and ready for operation, the valves as shown on the Plans and herein specified.

### **19.2 Materials and Workmanship**

#### *19.2.1 Butterfly Valves*

Butterfly valves shall be short body, flanged type. They shall be tight closing, rubber seated valves conforming to the latest revision of AWWA C-504, except as herein modified. Valves shall be designed for tight shut-off with no water leaks when subjected to a maximum differential pressure across the disc of 150 psi for valves size 4-inch and larger. Valve shafts shall consist of a one-piece unit extending completely through the valve disc. Valve shafts shall be 18-8 stainless steel type 304, except where completely sealed from water in the valve. Valve disc fasteners shall be 18-8 stainless steel type 304. Valve discs shall be of alloy-cast-iron, conforming to ASTM A-436, type 1. The valve disc shall rotate 90° from fully open to the tightly-shut position. All buried flanged-end butterfly valves shall be bolted to the pipeline flanges with stainless steel nuts and bolts, Type 304, except that all nuts and bolts 1-1/8" and larger in diameter shall be cadmium plated.

#### *19.2.2 Valve Operators*

Valve operators shall be manual type. Operators shall be totally enclosed, self-locking, worm gear or screw type, with adjustable stops to limit disc travel. The number of complete turns of the operator required to rotate the disc 90° shall be approximately the same as an equivalent-size gate valve. All valve operators shall be fully gasketed, weatherproof, and factory packed with grease. Operators shall be of the size required for opening and closing the valve against its design water pressure, and shall have a torque rating not less than that shown in AWWA Specification C-504, Table 1, Class 150-B.

Buried operators shall be worm gear or screw type and shall be equipped with standard AWWA 2-inch operating nuts. Operators shall be specifically designed and suitable for permanent buried service.

Operators for valves located above ground shall have disc-position indicators and hand-wheel.

#### *19.2.3 Interior Coating*

The interior cast iron surfaces of valves, including the disc, shall be coated with 100-percent solids catalytically-setting epoxy, which is manufactured for use in the interior of potable water systems. The two components shall be of different colors to aid in

complete mixing. A two-coat application shall be made over the manufacturer's recommended primer. The coating shall be applied after the surface has been sandblasted to near-white metal in accordance with *Steel Structures Painting Council Specification No. 5*.

The paint manufacturer's application recommendations, including minimum and maximum drying time between the required two coats, shall be followed. All protuberances that may produce pinholes shall be removed, sharp edges shall be rounded, and special care shall be taken to remove contaminants adjacent to the seat and seating edges in order to obtain a bond. The manufacturer's pot life and maximum and minimum curing time shall be observed. Minimum total coating thickness is 18 mils.

#### *19.2.4 Exterior Coating*

Valve bodies and operator housings and extensions shall receive two exterior coats of heavy duty coal tar equal to Koppers Bitumastic No. 505. Minimum thickness is 15 mils per coat. Application shall be at the place of manufacture. The coating shall be applied after the surface has been sandblasted to "commercial" standard as defined in SSPC Specification No. 6. The paint manufacturer's application recommendations shall be followed.

In addition to bitumastic coating, a 10-mil wrap of polyethylene film shall completely encapsulate the valve, flanges, nuts and bolts on the flange in accordance with Section 24, *Plastic Film Wrap of Valves, Bolted Flanges and Other Bolted Fittings*.

#### *19.2.5 Earthwork*

Earthwork shall be performed in accordance with Section 9, *Earthwork (Pipelines)*.

#### *19.2.6 Valve Boxes, Nuts and Bolts, Gaskets, and Marker Posts*

Valve Boxes, Nuts and Bolts, Gaskets, and Marker Posts shall conform to the provisions of Section 20, *Gate Valve Assemblies*.

#### *19.2.7 Painting*

All exposed metal surfaces of valves installed above ground or in vaults shall be painted in accordance with Section 31, *Painting*.

## **20. Gate Valve Assemblies**

### **20.1 General**

Gate valve assemblies shall be furnished and installed by Contractor at the locations shown and/or established in the field by City's Representative. Contractor shall furnish all labor, materials, tools and equipment necessary to furnish and install, complete and ready for operation, the valves as shown on the Plans and herein specified.

### **20.2 Materials, Fabrication and Installation**

#### *20.2.1 Gate Valves*

Gate valves shall meet the requirements of AWWA specifications C-509 and, unless otherwise indicated, shall be the same size as the main or service in which they are installed. Valves shall be rated by the manufacturer for the working pressure of the pipeline in which they are installed. All gate valves shall be counter-clockwise opening. Buried gate valves shall be equipped with 2-inch square cast iron operating nuts. Exposed gate valves shall have hand wheels.

#### *20.2.2 Gate Valve, 3-Inch and Smaller, Not Buried*

The body and all interior working parts, except stems, shall be constructed of ASTM B-62 (85-5-5-5) or ASTM B-61 bronze. Gate valves shall be rising stem union bonnet, and shall have a double disc, except that a wedge disc will be accepted for Class 300 service and for 1-inch and smaller sizes. The stem bronze shall not contain more than two percent (2%) aluminum nor more than seven percent (7%) zinc and shall meet these additional requirements: a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of ten percent (10%) elongation in 2-inches.

#### *20.2.3 Gate Valves, 4-Inch Through 12 (Inches)*

Gate valves shall be non-rising stem, iron body, solid bronze internal working parts, with a styrene-butadiene rubber seat permanently bonded to an iron wedge. Bonding process shall meet ASTM D429 requirements. The minimum designated water working pressure shall be 200 psi.

Valves designated for PVC pipe shall be mechanical joint and shall have bell dimensions, which conform to ASA A21.11 (AWWA C111).

#### *20.2.4 Interior Coating*

The interior of valve bodies except the bronze and working parts shall be coated with 100 percent solid, catalytically setting epoxy, which is manufactured for use in the interior of potable water systems. The fusion method of coating 100 percent solid epoxy is acceptable. The two components shall be of different colors to aid in complete mixing. A two-coat application shall be made over the manufacturer's recommended primer. Sandblast cleaning to near-white metal in accordance with SSPC Specification No. 5 shall be rounded, and special care shall be taken to remove contaminants, which may prevent a bond adjacent to seating rings. The manufacturer's pot life and maximum and

minimum curing times shall be observed. Minimum total coating thickness shall be 18 mils.

#### *20.2.5 Exterior Coating*

As directed by the City during the Plan approval process, valve bodies, except bronze, and operator housings and extensions shall receive two exterior coats of heavy duty coal tar equal to Koppers' Bitumastic No. 505. Minimum thickness is 15 mils per coat. Application shall be at the place of manufacture.

In addition to the bitumastic coating, a 10-mil wrap of polyethylene film shall completely encapsulate the valve, flanges and nuts and bolts on the flange in accordance with Section 24, *Plastic Film Wrap of Valves, Bolted Flanges and Other Bolted Fittings*.

#### *20.2.6 Valve Boxes*

Valve boxes shall conform with the Standard Drawings. Steel pipe shall be coated with the best grade of air-blown California asphalt pipe dip. Valve box covers shall be as per the Standard Drawings. Covers shall be seated two (2) inches above the surface of the natural ground and flush with paved surfaces. Covers shall have an asphalt concrete ring constructed as shown on the Standard Drawings.

#### *20.2.7 Nuts and Bolts*

Nuts and bolts used for bolting flanged-end gate valves to pipeline flanges above ground shall be standard hex-head machine bolts and hexagonal nuts conforming to ASTM A-307, Grade "B". All buried flanged-end gate valves shall be bolted to pipeline flanges with stainless steel nuts and bolts, Type 304, except that all nuts and bolts 1-1/8-inch and larger in diameter shall be cadmium plated. All bolt threads shall be lubricated with graphite and oil.

#### *20.2.8 Gaskets*

Gaskets for flanged-end gate valves shall be full face 1/16-inch "Cranite" with bolt holes prepunched, or City-approved equivalent.

#### *20.2.9 Marker Posts*

In all easements and where called for on the Plan, gate valve assemblies shall be marked with a marker post to be located as directed by the City's Representative. Posts shall be dense structural grade redwood 4" x 4" x 5" x 4", surfaced on four (4) sides with top chamfered. The posts shall be painted in accordance with Section 32, *Painting*. On the side facing the water main or roadway, the legend "*City of Lemoore*" and the distance in feet from the post to the valve shall be stenciled in black letters two (2) inches high. Posts shall be set 2'-4" into the ground.



## **21. Water Service Tubing**

### **21.1 Copper Tubing**

#### *21.2.1 General*

All copper tubing shall be new, and shall conform to ASTM Specification B88.

#### *21.2.2 Grade and Type*

Seamless copper tubing shall be of one grade and shall be Type “K” as listed in ASTM B88. The tubing shall be furnished in annealed 64-foot coils. The tubes shall be clean, smooth, round, of proper dimensions, free from grooving, indentations, cracks, flaws and scale.

The tubing shall be made of copper having a purity of at least 99.99 percent as determined by electrolytic assay, except that silver may be counted as copper.

#### *21.2.3 Marking*

The name or trademark of the manufacturer and a symbol indicative of the type shall be permanently marked on the tubing at intervals not greater than 1-1/2 feet.

#### *21.2.4 Testing of Copper Tubing*

City will make tests, conforming to ASTM B88, locally as it considers necessary and appropriate, and such tests will be a basis for acceptance or rejection under this section. Should random sampling disclose any unsatisfactory tubing, the entire lot may be rejected. All rejected material shall be handled at the expense of Contractor.

### **21.2 Polyethylene (PE) Tubing**

#### *21.2.1 Grade, Type, and Size*

All polyethylene tubing shall conform to the requirements of Type III, Grade, 3, Class C, as described in ASTM D-2239. All polyethylene tubing shall be in copper tubing sizes.

### **21.3 Installation and Fittings**

All corporation and curb stops shall be compression-type. All curb stops must be exposed for final inspection. Any damaged or improperly located services will be rejected by City’s Representative, and shall be repaired by Contractor. Each item shall be new and shall conform to ASTM B62.

## **22. Fire Hydrant Assemblies**

### **22.1 General**

Fire hydrant assemblies shall be furnished and installed by Contractor at the locations shown on the Plans, at the end of each cul-de-sac street, and as established in the field by City's Representative. Contractor shall furnish all labor, materials, tools, and equipment necessary to furnish and install, complete and ready for operation, the assemblies as shown on the Plans and herein specified. Hydrants shall be spaced at a maximum of 300 feet.

### **22.2 Materials, Fabrication and Installation**

#### *22.2.1 Materials*

Materials shall be those designated on the Standard Drawings or Plans and described herein.

#### *22.2.2 Fire Hydrant Heads*

Fire hydrant heads, 6-inch, shall be bronze, with 6-inch flanged inlet, two 2-1/2-inch and one 4-1/2-inch valved outlets. National Standard fire hose threads covered with cast iron caps attached with chains to the fire hydrant head shall be used.

#### *22.2.3 Hydrant Riser Spools*

Hydrant riser spools shall be cast iron spools 6-inches in diameter. The riser shall be cement mortar lined and seal-coated in accordance with the latest revisions of ANSI Specifications A21.4 (AWWA C104). The fire hydrant assembly shall include a twelve-inch break off riser. The exterior surface shall be painted in accordance with Section 31, *Painting*. Paint color to match color of the fire hydrant. Where there is no curb, the elevation of the top of the riser shall be equal to the center of street elevation or as determined by City's Representative.

#### *22.2.4 Hydrant Bury*

Hydrant burys and spools shall be 6-inch inside diameter cast iron. The interior surfaces shall be cement mortar lined and seal-coated in accordance with the latest revision of ANSI Specifications A21.4 (AWWA C104). The exterior surface shall be coated with two coats of Koppers' Bitumastic #505, or equivalent. It shall be applied per the manufacturer's instructions to a minimum thickness of 15 mils each coat. In addition to the bitumastic coating, all underground flanges shall be encapsulated in a 10-mil wrap of polyethylene film in accordance with Section 24, *Plastic Film Wrap of Valves, Bolted Flanges, and Other Bolted Fittings*.

*22.2.5 Gate Valves*

Gate valves shall conform to the applicable provision of Section 20, *Gate Valve Assemblies*, and shall be bolted to the water main tee or flanged outlet. Gate valves shall not be located in 10 feet from face of curb.

*22.2.6 Nuts and Bolts*

Nuts and bolts shall conform to the applicable provision of Section 20, *Gate Valve Assemblies*.

*22.2.7 Earthwork*

Earthwork shall conform to the provisions of Section 13, *Earthwork (Pipelines)*.

*22.2.8 Painting*

Painting shall conform to the provisions of Section 31, *Painting*.

*22.2.9 Guard Posts*

Guard Posts are required except where hydrant is located behind a concrete curb.

## **23. Manual Air Release Assemblies**

### **23.1 General**

Manual air release assemblies shall be furnished and installed by the Contractor at the respective locations shown and/or established in the field by the City's Representative.

### **23.2 Materials, Fabrication and Installation**

#### *23.2.1 Materials*

Materials shall be those designated or approved equals.

#### *23.2.2 Pipe and Fittings*

Copper tubing shall be Type "K" soft. All copper tubing connections shall be made with 95% tin/5% lead solder or silver solder (pure).

#### *23.2.3 Pipe Sleeves and Covers*

The steel pipe sleeves shall be coated inside and out with the best grade of air-blown California asphalt pipe dip. Covers shall be seated flush with the surface of the natural ground or paved surface such that they will not be damaged by or present an obstruction or rough surface to traffic. Covers set in existing surfacing or public rights of way shall have a concrete ring constructed as shown on the Standard Drawings. In curbed streets a meter box with cover, as shown on the Standard Drawings, shall be used in lieu of the steel pipe sleeve and cover.

#### *23.2.4 Marker Posts*

In all easements, and where called for on the Plans in streets, blow-offs shall be marked with a marker post. Timber for marker posts shall be dense structural grade redwood, graded according to the current standards of the California Redwood Association. Posts shall be 4"x4" x 5'-4", surfaced on four (4) sides and chamfered. The posts shall be painted in accordance with Section 31, *Painting*. On the side facing the water main or roadway, the legend "*City of Lemoore*" and the distance in feet from the post to the gate valve shall be stenciled in black letters two (2) inches high. Posts shall be set 2'-4" into the ground.

#### *23.2.5 Earthwork*

Earthwork shall be done in accordance with Section 13, *Earthwork (Pipelines)*.

## 24. Plastic Film Wrap of Valves, Bolted Flanges and Other Bolted Fittings

### 24.1 General

This specification designates the requirements for manufacture, installation, and payment for Polyethylene Plastic Film Wrap around all valves, bolted flanges and other bolted fittings when buried under ground. The Contractor shall furnish all labor, materials, tools and equipment necessary to furnish and install the plastic film wrap, complete in place.

### 24.2 Materials

The polyethylene film shall be a virgin polyethylene as produced from DuPont Alathon resin or equal and shall meet the requirements of ASTM D 1248-68 for Type 1, Class A, Grade E-1, and shall have a flow rate or nominal melt index of 0.4 g/min. maximum.

The polyethylene film shall have a minimum tensile strength of 1200 psi, and a minimum elongation of 300%.

The polyethylene film shall be ten (10) mils in thickness. The length shall be sufficient to firmly attach the film to the pipe on either side of the valve, flange or fitting. The following minimum flat sheet widths shall be used for the specified valve sizes:

Valve or Flange Size	Flat Sheet Width
4"	24"
6"	24"
8"	24"
10"	30"
12"	36"
16" or larger	48" or larger

At the Contractor's option, tubular material may be cut down one side to fold out to the required width.

Tape for securing the polyethylene wrap shall be two (2) inch wide adhesive tape such as Polyken No. 900 (Polyethylene), Scotchwrap No. 5 (polyvinyl), or approved equal. The tape shall be such that the adhesive will bond securely to both metal surfaces and polyethylene film.

### **24.3 Installation**

The valves shall be wrapped by passing the flat sheet of film under the valve bottom and bringing the ends up around the body to the stem and securing it in place with two (2) inch strips of the plastic adhesive tape. The polyethylene shall be secured around the valve stem in such a manner as to leave the stem free to operate. The film shall be brought completely around the flanges and secured to the pipe with plastic adhesive tape on either side of the valve, flange or fitting.

## **25. Testing and Sterilization**

### **25.1 General**

These Specifications designate the requirements for field testing and sterilization of all water mains intended for the conveyance of potable water under pressure. The Contractor shall furnish all labor, materials (including water), tools, and equipment necessary to provide and complete field testing and sterilization, as specified.

### **25.2 Field Testing**

#### *25.2.1 Procedure*

After the pipe and all appurtenances have been laid and backfilled sufficiently for restraint, they shall be subjected to a 4-hour hydrostatic pressure test. This test shall consist of applying a pressure of 150 psi to the pipeline. Pressure tests shall be conducted subsequent to any trench backfill compactive effort with heavy duty compacting equipment having an overall weight in excess of 100 pounds.

#### *25.2.2 Maximum Length of Pipe*

Maximum length of pipe to be included in any one test shall be no more than 2,500 feet or the distance between valves, whichever is greater. The Contractor shall provide suitable test bulkheads, blocking, and fitting to permit such sectionalizing.

#### *25.2.3 Preparation*

The test shall be applied at an approved outlet or fitting located within an elevation of five (5) feet of the lowest point of the pipe section to be tested. The Contractor shall provide and later securely plug such fittings. The line shall be filled and maintained at operating pressure for a period of at least 72 hours prior to testing to satisfy any system water absorption. (This requirement does not apply to PVC lines.) Immediately prior to testing, all air shall be expelled from the pipeline. Where air valves or other suitable outlets are not available, approved taps and fittings shall be provided at all high points and later securely plugged.

#### *25.2.4 Procedure*

After the 72-hour soak period, the pressure in the pipeline shall be raised to the specified test pressure. When the test pressure has been reached, pumping shall be discontinued until the pressure in the line has dropped 10 psi, at which time the pressure shall again be raised to the specified test pressure. This procedure shall be repeated until four hours have elapsed from the time the specified test pressure was first applied. At the end of this period, the pressure shall be pumped up to the test pressure for the last time.

#### *25.2.5 Leakage*

Leakage shall be considered as the total amount of water pumped into the pipeline during the four-hour period, including the amount required in reaching the test pressure for the final time. Leakage shall not exceed the rate of 0.54 gallons per inch of nominal inside diameter per 1,000 feet of pipe per four (4) hours. If leakage exceeds this rate (as shown

in the table below), the weak points shall be located and repaired, all defective pipe, fittings, valves and other accessories discovered shall be removed and replaced with sound material, and the test repeated until leakage does not exceed the specified rate.

### **Leakage Table**

Leakage shall not exceed the number of gallons shown below during a 4-hour time interval for the pipe size and length given:

<b>Pipe (Inches)</b>	<b>Length (Feet)</b>	<b>Duration (Hours)</b>	<b>Leakage (Gallons)</b>
4	1000	4	2.16
6	1000	4	3.24
8	1000	4	4.32
10	1000	4	5.40
12	1000	4	6.48
16	1000	4	8.64

Allowable leakages for other lengths of pipe shall be prorated from the above. Combinations of pipe of different sizes shall be calculated on a pro rata basis.

## **25.3 Sterilization**

### *25.3.1 Procedure*

After pressure testing and prior to acceptance of the work, the entire pipeline, including all valves, fittings, hydrants, service laterals, and other accessories, shall be sterilized in accordance with AWWA Specification C601, which provides detailed specifications for:

- Limiting contaminating materials from entering the water mains during construction or repair;
- Removing by flushing contaminated materials that may have entered the water main during construction or repair;
- Disinfecting any residual contamination that may remain after cleaning;
- Determining the bacteriologic quality of fresh water in the water main after disinfecting the main.

### *25.3.2 Disinfecting*

During construction, Contractor shall place dry chlorine tablets in the new line in numbers sufficient to produce a chlorine residual of 50-100 PPM. Once the line is completed, it shall be filled, and hydrostatic tests performed as specified above. If the hydrostatic tests results are acceptable, the line shall remain charged an additional 24 hours, and shall then be thoroughly flushed at all extremities. The Contractor shall provide a sufficient number of suitable outlets at the end(s) of the line(s) being sterilized,



in addition to those required by the plans, to permit the main to be flushed with water at a velocity of at least 2.5 feet per second over its entire length. The outlets provided shall meet the requirements for fittings as specified for the type main constructed. Drainage facilities shall be constructed such that the water lines cannot be contaminated through the flushing outlet.

The line shall then be allowed to remain full for 48 hours, at which time sample(s) of water shall be drawn as specified below for bacteriological testing. If the bacteriological tests are acceptable, the line may be placed into service.

If the hydrostatic or bacteriological tests are not acceptable, re-sterilization will be required, using the following method:

Chlorine gas or chlorine compound solution made with liquid chlorine, calcium hypochlorite in solution or sodium hypochlorite solution, shall be water mixed and introduced into the mains to form a chlorine concentration of approximately 50-100 PPM in all parts of the line. During the sterilization process all valves, hydrants, and other accessories shall be operated. Twenty-four hours after chlorination, the water shall be flushed from the line at its extremities until the replacement water tests are equal chemically and bacteriologically to those of the permanent source of supply. The chlorine water solutions shall be diluted to a chlorine concentration of not more than 100 ppm and not less than 50 ppm. The Contractor shall keep adequate chlorine residual testing and indicating apparatus available on the site during the entire sterilization period.

### *25.3.3 Bacteriologic Samples*

One sample of water for the specified bacteriologic test shall be taken from each end of the sterilized main (located downstream of the point of introduction of chlorine disinfectant). For mains over 2,500 feet in length, additional samples shall be taken at intermediate points such that at least one sample is taken for each 2,500 feet of main or fraction thereof, plus one additional test. An acceptable test will be one where all measured chemical and bacteriological characteristics of the sample are equivalent to those of the permanent supply.

## 26. Chain Link Fence

### 26.1 General

The Contractor shall furnish and install chain link fence as shown on the Plans and specified herein. Fence shall be complete with fabric, posts, braces, wire, fittings, and gates. All materials and fittings shall be galvanized. Height of fence shown on Plans denotes height of fabric only.

### 26.2 Materials and Workmanship

#### 26.2.1 Fabric

Fabric shall be No. 11 ASW gauge copper-steel wire, woven in a one and one-half inch mesh. Unless specified otherwise, fabric shall be six feet high. Fabric shall be hot-dipped galvanized after weaving and shall conform to ASTM A392. Top and bottom of fabric shall be twisted and barbed. Wire shall have an ultimate tensile strength of 90,000 pounds per square inch. Fabric shall stand six one-minute immersions when tested in accordance with ASTM A239.

Chain link fabric shall be installed with the bottom edge two inches above the ground, and shall be tied at each post with 11-gauge wire ties at fourteen-inch centers. Tension wire (7-gauge galvanized coil spring steel wire) with 14-gauge wire ties at twenty-four-inch centers shall be installed at the top and bottom of the chain link fabric. Fabric shall be fastened to end, corner, and gate posts with 1/4" x 3/4" steel stretcher bars.

#### 26.2.2 Posts and Braces

Posts and braces shall be manufactured of good commercial quality weldable steel. Dimensions and weights of posts and braces shall conform to the following:

#### Fences Six Feet High and Higher

<b>Location</b>	<b>Type</b>	<b>Minimum Size</b>	<b>Minimum Weight (#/LF)</b>
End, angle, and corner post	Pipe	3-inch O.D.	5.79
Line posts	Pipe	2.3-inch O.D.	3.10
	H-Section	2.25-inch	3.90
Braces	Pipe	1-5/8-inch O.D.	2.27

**Fences Less Than Six Feet High**

<b>Location</b>	<b>Type</b>	<b>Minimum Size</b>	<b>Minimum Weight (#/LF)</b>
End, angle, and corner post	Pipe	2-1/2-inch O.D.	3.65
Line posts	Pipe	2-inch O.D.	2.72
	H-Section	2-inch	2.80
Braces	Pipe	1-5/8-inch O.D.	2.27

**Gate Posts**

<b>Gate Opening</b>	<b>Minimum Size</b>	<b>Minimum Weight (#/LF)</b>
6' to 12'	3-inch O.D.	5.79
Over	4-Inch	9.10

All posts shall be set in concrete footings crowned at the top to shed water and having a diameter equal to or greater than three times the cross-sectional dimension of the post, but in no case less than eight inches (8"). Footings for the line posts shall be thirty-six inches (36") deep for fences six feet (6') high. Footings for end, angle, corner, and gate posts shall be six inches (6") deeper than those for line posts.

Line, end, angle, and corner posts shall be of a total length equal to the depth of footing, plus the height of fabric. Gate posts shall be one foot (1') longer than corner posts.

All panels adjacent to end, corner, angle, or gate posts shall be braced with the same material as the top rail. Braces shall be spaced midway between top rail and ground and shall extend from terminal post to first adjacent line post. Braces shall be securely fastened to posts with suitable steel connectors and trussed from line post to terminal post with 3/8" round rod.

Posts and braces shall be galvanized in accordance with the provisions of ASTM A123.

*26.2.3 Extension Arms and Caps*

If shown on the Plans, all posts shall be fitted with pressed steel 45° extension arms, and end, corner, and gate posts shall be fitted with heavy malleable iron 45° extension arms. Each arm shall provide for securely fastening three (3) barbed wires. The top-most barbed wire shall be 12 inches above the top of fabric. Eyes shall be provided for extending top tension wire. Arms and caps shall be galvanized in accordance with ASTM A153.

*26.2.4 Gates*

Gates shall have 2-inch O.D. pipe frames weighing not less than 2.72 pounds per linear foot and galvanized in accordance with ASTM A123.

The corners of frames shall be fastened together with heavy malleable iron castings or pressed steel. Welding is not permitted. Gate frames eight feet wide and wider shall have a vertical pipe located midway between the outside vertical pipes. Frames shall be cross-trussed with galvanized 3/8" round rods. Hinges shall be pivot and socket type, and the top hinge shall be of sufficient strength to carry entire gate load. Latches shall be heavy plunger type with foot, bolt and provisions for padlock. Vertical pipe in frames shall extend twelve inches (12") above fabric to receive barbed wire and shall be fitted with malleable iron caps.

Fabric shall be the same as specified for fence and shall be attached to the frame and stretcher bars and ties as specified for fence construction.

#### *26.2.5 Barbed Wire*

Three strands of four (4) point pattern barbed wire composed of two (2) strands of 12-gauge wire with large barbs at 3-inch centers shall be installed on the extension arms and above the fabric on gates. Wire shall be galvanized as specified for fabric.

## **27. Concrete Block Masonry**

### **27.1 General**

Concrete block masonry construction shall include the furnishing of all labor, materials, tools, and equipment necessary to complete the masonry construction as shown on the Plans and herein specified.

### **27.2 Materials**

#### *27.2.1 Concrete Masonry Units*

Masonry units shall be eight-inch by eight-inch by sixteen-inch (8"x8"x16") Standard Block Grade A units conforming to ASTM C90 and manufactured in accordance with the requirements of the Concrete Masonry Association Specifications.

#### *27.2.2 Cement*

Cement for mortar shall be Type I conforming to ASTM C150.

#### *27.2.3 Mortar*

Mortar shall be freshly prepared and uniformly mixed in the ratio of 1 part Portland cement, ¼ part minimum to ½ part maximum lime putty or hydrated lime, and sand in an amount not less than 2-1/2 and not more than 3 times the sum of the volumes of cement and lime used, and shall conform to ASTM C270.

#### *27.2.4 Grout*

For grout spaces less than four inches in any dimension, grout shall be of fluid consistency and mixed in a ratio of 1 part cement, 3 parts sand.

Where the maximum dimension of grout space is greater than four inches, grout shall be of fluid consistency and mixed in a ratio of 1 part cement, 2 parts sand, 2 parts pea gravel.

"Fluid consistency" shall mean that consistency of the grout is fluid enough for pouring, and yet not so fluid that the constituent parts of the grout separate when grout is poured.

#### *27.2.5 Aggregate*

Aggregate shall be clean, sharp and well graded, and free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter.

Sand shall conform to the Specifications for Aggregates for Masonry Mortar, ASTM C144.

Pea gravel shall be graded with 100 percent passing the three-eighths-inch (3/8") sieve and not more than 5 percent passing the No. 8 sieve.

#### *27.2.6 Lime*

Hydrated lime shall conform to Specifications for Hydrated Lime for Masonry Purposes, ASTM C207.

#### *27.2.7 Admixtures*

No admixtures shall be used in mortar or grout unless approved by City's Representative.

#### *27.2.8 Reinforcing Steel*

Reinforcing steel shall be deformed bars conforming to ASTM A615 except that ¼-inch ties may be plain bars.

### **27.3 Workmanship**

#### *27.3.1 General*

All work shall be executed in the best workmanlike manner and in full compliance with the applicable building codes and ordinances.

Masonry units shall not be wet before being used.

Proper masonry units shall be used to provide for all windows, doors, bond beams, lintels, pilasters, etc., with a minimum of unit cutting.

#### *27.3.2 Bonding*

Where no bond pattern is shown on the Plans, the wall shall be laid up in straight uniform courses with regular running bond. Metal ties shall be provided horizontally at twenty-four inches (24") O.C. maximum.

Intersecting masonry walls and partitions shall be bonded by the use of steel ties at twenty-four inches (24") O.C. maximum.

#### *27.3.3 Joints*

Mortar joints shall be straight, clean, and uniform in thickness.

Exposed walls shall have joints tooled with a round (or V-shaped) bar two feet (2') long to produce a dense, slightly concave surface, well-bonded to the block at the edges. For stack bond, vertical joints shall be raked out to a depth of one-quarter inch (1/4").

Tooling shall be done when the mortar is partially set but still sufficiently plastic to bond. All tooling shall be done with a tool, which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.

Horizontal and vertical mortar joints shall be 3/8" thick with full mortar coverage on the face shells and on the webs surrounding cells to be filled.

Vertical head joints shall be buttered well for full coverage of the face shell of the block. These joints shall be shoved tightly so that the mortar bonds well to both blocks.

If it is necessary to remove a block so as to open a joint, the block shall be removed from the wall, cleaned, and set in fresh mortar.

#### *27.3.4 Reinforcing*

Reinforcing bars shall be straight except for bends around corners, or where bends or hooks are detailed on the Plans. Vertical bars shall be held in position at top and bottom and at intervals not exceeding 192 diameters of the reinforcement. Horizontal reinforcement shall conform to the Standard Drawings.

When a foundation dowel does not line up with the vertical core to be reinforced it shall not be bent over, but shall be grouted into a core in direct vertical alignment, even though it is an adjacent cell to the vertical wall reinforcing.

#### *27.3.5 Grouting*

Reinforcing steel shall be in place and inspected by City's Representative before grouting starts.

A cleanout hole shall be provided at the bottom of each cell to be poured when the height of grout pour exceeds four feet. All debris and projecting mortar shall be cleaned out before pouring grout.

Vertical cells shall have vertical alignment to maintain a continuous unobstructed cell area not less than 2"x3". All cells shall be solidly filled with grout in lifts not to exceed eight feet (8'). The pour shall be stopped 1-1/2" below the top of a course to form a key at pour joints.

Grouting of beams over openings shall be done in a continuous operation.

All bolts, anchors, etc., inserted in the wall shall be solid grouted in place.

#### *27.3.6 Wall Care*

Where masonry walls are to be left bare or painted, care shall be taken to prevent mortar splashes. No construction supports shall be attached to the wall except where specially permitted by City's Representative.

All forms shall be made tight (special attention is necessary for bottom form of block bond beams). Concrete and grout spilled on the wall shall be washed off before it sets up. After the wall is constructed it shall not be saturated with water for curing or any other purposes.

#### *27.3.7 Cleaning*

At conclusion of the masonry work, the Contractor shall clean ~~down~~ all masonry walls, remove scaffolding and equipment used in the work, clean up all debris, refuse and surplus materials and remove them from the premises.

## 28. Street Trees

Street trees shall be planted on each lot within a development prior to issuance of the occupancy certificate for said lot.

A street tree plan showing location and species of all street trees within the developments shall be submitted to the Community Development Director for approval prior to commencement of construction. Trees shall be of a species listed on the City of Lemoore Master Street Tree List, shall be of 15-gallon size, and shall be planted on an average spacing of 40 feet on center.

The Contractor is to ensure that the spacing of trees conforms with the following minimum spacing guidelines. Trees shall be planted:

1. Ten feet from alleys, driveways, fire hydrants, water lines and sewer lines.
2. Three feet from gas, electrical lines, telephone, cable television lines and adjoining property lines.

When tree spacing conflicts with the above guidelines, the Contractor is to recommend alternate locations, and contact the City for a ruling.

All trees shall be planted in accordance with Standard Drawing M-3, including supply and installation of root barriers and tree stakes.



## **29. Street Lights**

### **29.1 General**

Street light materials shall be furnished and installed by the Contractor at the locations shown and/or established in the field by City's Representative. Contractor shall furnish all labor, materials, tools, and equipment necessary to furnish and install, complete and ready for operations, the assemblies as shown on the Plans and herein specified.

### **29.2 Replacement of Existing Luminaires**

When replacing luminaires on existing street lights, new luminaires shall be as follows:

#### *29.2.1 Arterial Streets*

150 Watt High Pressure Sodium (HPS) luminaires at all intersections and 70 Watt HPS luminaires at all intermediate locations.

#### *29.2.2 Collector Streets*

150 Watt HPS luminaires at all intersections and 70 Watt HPS luminaires at all intermediate locations.

#### *29.2.3 Local Streets*

70 Watt HPS luminaires at all intersections (except intersections with arterial or collector streets) and intermediate locations.

### **29.3 New Street Lighting System**

The following provisions shall apply to the installation of new street lighting systems.

- The subdivider or developer shall install street lighting on all streets within the subdivision or development as well as on all streets adjacent to the subdivision or development.
- All light poles shall be made of concrete and shall be in accordance with the Standard Drawings. All street lights shall be served by underground electrical distribution systems.
- The type, location, mounting arm length, and luminaire intensity shall be designated by the following table:

<b>Street Type</b>	<b>Luminaire (HPS)</b>	<b>Mounting Height</b>	<b>Arm Length</b>	<b>Maximum Spacing</b>
Cul-de-sac	70 Watt	28 ft.	8 ft.	250 ft.
Local	70 Watt	28 ft.	8 ft.	250 ft.
Collector	70 Watt	32 ft.	10 ft.	165 ft.
Arterial	70 Watt	32 ft.	12 ft.	165 ft.

- Local Streets with a curb to curb width of 50 ft. or less shall have lights and electrical system on one side of the street only. Local Streets with a curb to curb width over 50 ft. shall have lights and separate electrical system on each side of the street. Spacing and wattages shall conform to the table above.
- Collector and Arterial Streets with a curb to curb width of 50 ft. or less may have lights installed on one side of the street or may stagger the lights on both sides of the street. In either situation, the maximum spacing of the lights on either side of the street shall not exceed the spacing in the table above. Wattages shall conform to the table above.
- Collector and Arterial Streets with a curb to curb width over 50 ft., or such streets with a median divider, shall have lights and a separate electrical system on each side of the street. Streets divided by a median may have light poles with double mast arms and double lights installed in the median where approved by the City. In this situation, lights will not be required on the sides of the street. Spacing and wattages shall conform to the table above.
- For the purpose of street lighting, frontage roads shall be considered as Local Streets and shall meet those lighting requirements. The developer shall be required to light both the frontage road and the major street when the major street does not meet the lighting requirements for its particular type. Street light poles may be installed with double mast arms and double lights in the median separating the frontage road and the major street, where approved by the City. Spacing and wattages shall conform to the table above.
- Each intersection and street corner shall have street lights installed with the number and wattages of luminaires designated by the following table:

<b>Type of Intersection</b>	<b># of Luminaires</b>	<b>Wattage of Luminaires</b>
Arterial Street and Arterial Street	4	150
Arterial Street and Collector Street	4	150
Collector Street and Collector Street	4	150
Arterial or Collector Street and Local Street	2	150
Local Street and Local Street	1	70

In the case of an Arterial or Collector Street intersecting with a Local Street, the lights shall be mounted along the larger street.

- Non-intersection street lights on local residential streets shall be located at the extension of side lot lines whenever reasonably possible.
- Unusual conditions may require special lighting considerations and requirements. Such unusual conditions include, but are not limited to, the existence of railroad crossings, bridges, and dead-end streets.
- The City Council may waive or relax the requirements for non-intersection street lighting if it receives a petition requesting such deletion or relaxation. The petition must be signed by individual owner/occupants representing a majority of the adjoining property owners or by the developer/owner in the case of undeveloped land. When such a petition is received, the matter shall be referred to the Community Development Director, who shall submit a report with appropriate recommendations for Commission's consideration and recommendations for later Council action.

#### **29.4 Regulations and Codes**

Regulations and codes shall conform to Section 86-1.02 of the State Standard Specifications.

#### **29.5 Street Light Standard and Mast Arm**

Street light standards and mast arms shall be in conformance with Standard Drawing M-2.

#### **29.6 Pull Boxes**

Pull boxes shall be in conformance with Standard Drawing M-2.

### **29.7 Conduits**

Conduit shall conform to Section 86-2.05 of the State Standard Specifications.

Once conduit is installed and backfill compacted, all lines shall be tested with a mandrel and thoroughly swabbed out to remove foreign material before the pulling of cables.

A No. 12 copper pull wire or a pull rope shall be installed in conduits, which are to receive future conductors. The pull rope shall consist of a flat, woven, lubricated, soft-fiber polyester tape with a minimum tensile strength of 1,800 pounds and shall have printed sequential measurement markings at least every three feet. At least two feet of pull wire or rope shall be doubled back into the conduits at each termination.

### **29.8 Conductors**

Conductors shall conform to Section 86-2.08 of the State Standard Specifications.

### **29.9 Excavating and Backfill**

Excavation and backfill shall conform to Section 86-2.1 of the State Standard Specifications.

### **29.10 Ownership**

All street lighting facilities shall be the property of the City.

## 30. Hydrologic Design Criteria

### 30.1 General

The design criteria in this section are the minimum acceptable criteria for use by designers of drainage facilities to be developed within the City. Designers are cautioned to apply their own expertise and judgment in development of final designs. Certain projects or clients may appropriately require more stringent criteria. However, the City will not reimburse for costs associated with systems designed to criteria higher than listed herein, unless those higher criteria have been mandated by City staff or governing bodies.

### 30.2 Collection Systems

All elements of the storm drainage collection system (streets, gutters, inlets, pipes, and pump stations) shall be designed in accordance with the modified Rational method presented below. This method does not provide for the most intensive, short-duration storms, which are considered by the standard Rational method. The peak flows from such storms are handled through short-term ponding within street areas. Once the brief peak has passed, the inlets, pipes and pump stations designed according to the City's criteria quickly clear the streets.

Calculated flow for a given system (Q) shall be derived from the standard formula:

$$Q = CiA$$

Where:

Q	=	Runoff Flow (cubic feet per second)
C	=	Runoff Coefficient (Per Table, Section 30.2.1 or as directed)
i	=	Rainfall Intensity (inches/hour, per table, Section 30.2.2)
A	=	Tributary Area (acres)

Inlets, pipes and pump stations are designed to handle a time-averaged event with approximately a two-year return frequency. Runoff coefficients are given in Section 30.2.1. These shall be used for any future development under consideration. If a specific site plan is available, and higher runoff can be anticipated, City may direct use of higher runoff coefficients. For example, an industrial development covering its entire site with building and impervious surface would require a runoff coefficient of 0.95 rather than the standard 0.80 given in the table.

#### *30.2.1 Runoff Coefficients (Inlet, Pipeline and Pump Station Design)*

Commercial and Industrial	0.80
Multi-Family Residential	0.55
Single Family Residential	0.30
Open Space (Parks & School Yards)	0.20

### 30.2.2 Rainfall Intensity and Accumulation

Commercial and Industrial	0.50 in/hr
All Residential	0.30 in/hr

10 yr, 2-day event	2.40 inches
100 yr, 10-day event	4.98 inches

## 30.3 Pump Stations

Storm drain pump stations shall be designed in accordance with the requirements of this section, the Standard Drawings, and any applicable Storm Drain Master Plan for the subject area. It shall be the responsibility of the project engineer to determine whether the project is affected by a Storm Drain Master Plan, and to coordinate his design with the construction of required Master Plan facilities.

Pump stations shall be duplex centrifugal pumps, and shall be provided with trash racks and non-clog pumps in accordance with the Standard Drawings. Should site-specific conditions so dictate, alternative designs will be considered if it can be demonstrated that such alternatives are in the interest of the City. Such alternatives could include propeller or other-type pumps, or alternative wet well designs. In any case, the quality and durability of the supplied hardware and facilities shall be of the level shown on the Standard Drawings.

Pumps shall be selected and designed to provide the required flow when running in tandem, and at least 60 percent of the maximum design flow when running singly. Design engineer shall submit pump design calculations for review along with the Improvement Drawings. Calculations shall include pump curves (simplex and duplex operation) and system head curves overlaid on the same scale. The operating range shall give consideration to all variable conditions including discharge head and depth of water in the wet well. Typically, pumps shall be selected to run to the right of the point of peak efficiency on the pump curve. Variance from that policy requires approval of the City Engineer.

Pump submittals shall indicate type, make, model, horsepower, selected impeller type and model number, overall efficiency (wire to water), motor voltage, and any other pertinent information. Typically, impellers shall be single-vane non-clog or vortex; however, in larger diameters dual vane impellers may be considered if in the interest of the City.

Wet wells shall be designed to provide not more than ten pump starts per hour for the selected pump and the system conditions. Design engineer shall submit calculations demonstrating the range of required pump starts for approval along with the Improvement Drawings.

Wet wells shall be of sufficient depth to allow complete drainage of tributary pipelines. That is, pump shut-off elevation shall be at or below the inlet flowline elevation.

Pump stations shall be located within public rights-of-way, or in landscape easements, so that there is ready vehicular access for pump maintenance.

Pump control panels and electric service shall be located near a right-of-way boundary, against a fence or masonry wall as may be the case. A masonry enclosure with chain link or wrought iron gates (as directed by City) shall be constructed in accordance with the Standard Drawings. Control Panel shall be located so as to give a direct line of sight to the pump station by a person standing at the control panel.

### **30.4 Storm Drainage Basin Classification**

Storm drainage basins shall be classified as temporary or permanent, detention or retention, as defined herein. Design engineer shall submit appropriate calculation supporting the selected size and design criteria for any basin included in a development along with the Improvement Drawings.

#### *30.4.1 Temporary Basins*

A basin shall be designated as "temporary" if it meets all of the following conditions:

- Provides protection only for a single development or portion thereof
- Is within an area covered by a Storm Drainage Master Plan, and does not conform to the scope of work given in the Master Plan.
- Is anticipated to have a useful life of five years or less, in City's sole opinion

#### *30.4.2 Permanent Basins*

Any basin not meeting one or more of the conditions given in Section 30.4.1 shall be designated a "permanent basin."

#### *30.4.3 Detention Basins*

Basins which meet the following criteria shall be designated as "detention basins:"

- Designed to receive storm water and concurrently discharge to an irrigation ditch or other facility at a flow rate, which is a major fraction of the peak inflow rate, although that rate may be greatly reduced by the detention structure.
- Downstream facility is not subject to restrictions on flow discharge or quantity under most operating conditions during the year.

#### *30.4.4 Retention Basins*

Any basin which has no relief outlet, or which has an outlet not meeting the conditions in 30.4.3, shall be designated a "retention basin."

#### *30.4.5 Basin Volumes*

All detention basins shall be designed to handle a total of 3.32 inches of rain, with no allowance for percolation or evaporation. Developer's engineer shall prepare a hydrograph for each detention or retention basin, and shall submit the design to the City Engineer for approval.

All retention basins shall be designed to handle a total of 4.98 inches of rain, with no allowance for percolation or evaporation.

### **30.5 Basin Design Criteria**

#### *30.5.1 General*

Many design criteria are common among the four basin classifications. The requirements of this section apply to all basins, whether temporary or permanent, detention or retention.

- Maximum water surface level shall be 0.50 feet below the lowest hydraulic gradeline of the incoming pipes.
- Hydraulic gradelines of storm water collection pipes shall not exceed the flow line elevation of any inlets along such pipe.
- Minimum basin freeboard shall be 2.00 feet.
- Minimum basin bottom elevation shall be determined by the City Engineer upon review of groundwater data submitted by the Developer's engineer, but shall in no case be lower than 5.0.
- Basin bottom shall be sloped at 0.5% minimum toward the basin outlet in detention basins, or toward any single area in retention basins, to minimize puddling at low water levels.
- Provide minimum 8'-6" access path around perimeter of all basins.
- Provide six-foot chain link fence built in accordance with Section 26, *Chain Link Fence*, around the outer perimeter of the pond, unless not required by the City. A minimum of one (1) 12-foot swinging gate with access to public streets shall be provided for maintenance purposes. Such access may be either direct, or through an approved access easement.



*30.5.2 Criteria for Specific Pond Types*

Individual requirements for specific basins are presented in matrix format on the following page. Find the appropriate quadrant of the matrix, selecting between temporary and permanent, and between detention and retention basins, to get the applicable design criteria.

These criteria are minimums acceptable to the City, and may be exceeded at the Developer's option.

Calculation of required pond volume, maximum permissible water surface elevation, and system hydraulic gradeline shall be submitted by the design engineer, along with the Improvement Drawings.

*30.5.3 Detention Basin Calculations*

Where detention basin criteria call for submission of a hydrograph, it shall be prepared by the design engineer in conformance with the provisions of this section.

The design storm for the hydrograph shall be the rainfall intensity set forth in Section 30.2.2. The runoff coefficient shall be prorated to account for the composite land use within the study area set forth in Section 30.2.1. The duration of the storm shall be the time required to achieve the rainfall accumulation set forth in Section 30.2.3 at the calculated rainfall intensity.

The design storm shall be routed through the proposed basin and pump station.

The pump's outflow shall be considered to be a single pump's capacity.

Calculations shall include the time required to completely drain the detention pond after the design storm event has ended.

**Temporary Basin Criteria**

	<b>Detention</b>	<b>Retention</b>
<i>Basin Capacity:</i>	Volume calculated from Section 30.4.4	Volume calculated from Section 30.4.4
<i>Basin Side Slope (max):</i>	2:1	2:1
<i>Basin Depth (max):</i>	Depth to Groundwater or 5.0 feet	Depth to Groundwater or 5.0 feet
<i>Landscaping:</i>	None	None

<b>Permanent Basin Criteria</b>	<b>Detention</b>	<b>Retention</b>
<i>Basin Capacity:</i>	Volume calculated from Section 30.4.4	Volume calculated from Section 30.4.4
<i>Basin Side Slope (max):</i>	3:1	3:1
<i>Basin Depth (max):</i>	Depth to Groundwater or 5.0 feet	Depth to Groundwater or 5.0 feet
<i>Landscaping:</i>	Irrigated Grass	Irrigated Grass

#### *30.5.4 Storm Drainage Basins in an RA Zone*

Storm drainage retention ponds on private property in a RA (residential acreage) zone district shall conform to the standards for retention as above, except that fencing is not required.

Maximum design water surface elevation shall be 0.5 feet below the lowest hydraulic gradeline of the incoming pipes

## **31. Painting**

### **31.1 General**

These specifications designate the requirements for the preparation of surfaces, and manufacture and application of paints. Contractor shall furnish all labor, materials, tools, and equipment necessary to provide finished painted surfaces as indicated.

### **31.2 Materials and Application**

#### *31.2.1 Paints*

Paints shall be those designated. All colors are to be selected by City's Representative. Materials shall be unadulterated and shall be delivered to the job site in original, unbroken packages bearing the brand and the manufacturer's name. They shall be opened and mixed at the job site and shall comply with the latest revision of AWWA D102.

#### *31.2.2 Workmanship*

Workmanship shall be of quality meeting the requirements of the best standards of the painting industry. All work shall be done by skilled and experienced painters. Surfaces to be painted shall first be thoroughly cleaned to remove dirt, loose scale, rust, oil, grease, and/or other foreign matter immediately prior to painting. Cleaning shall be done with abrasives, scrapers, wire brushes, and/or other means approved by City's Representative. Each coat shall be applied in such a manner as to assure an even, smooth, uniform adhering coat free from dirt, runs, brush marks, and laps, and shall be applied as recommended by the manufacturer. Painting will not be permitted when freshly painted surfaces may become damaged by rain, fog, or condensation, or when inclement weather can be anticipated. Fresh paint damaged by the elements shall be replaced by Contractor at his expense. Drop cloths shall be used to protect floors, equipment, piping and other exposed surfaces from spattering and spillage. Paint shall be allowed to dry thoroughly between applications of successive coats. The manufacturer's recommended time between coats will be used as a guide by City's Representative as to when the next coat of paint may be applied. City's Representative must give approval before successive coats are applied. Spray painting will not be permitted unless specifically authorized by City's Representative.

#### *31.2.3 Colors*

Colors of finish coats shall be noted on the Plans and Specifications or as selected by the City's Representative.

#### *31.2.4 Acceptable Equivalents*

Acceptable equivalents of certain of the paint products specified are manufactured by Koppers, Amercoat, and Engard. Substitution can be made upon written approval of City's Representative.

### **31.3 Metal Surfaces**

After cleaning, metal surfaces shall receive primer coats, or equivalent conditioning or seal coats, and finish coats of the thickness specified. Coating thickness specified is in mils dry film thickness (MDFT).

### **31.4 Brass, Bronze, and Aluminum**

Brass, bronze, and aluminum shall be cleaned but not painted unless it forms a small part of an entire installation that is being painted. If in non-submerged locations, etch with Koppers' 40 Passavator after cleaning. Remove excess residue and coat with Koppers' Ponkote 300 (epoxy ester). Finish coats for exterior locations shall be two coats of Koppers' Glamortex #501 Enamel (alkyd).

### **31.5 Galvanized Metal**

Galvanized metal in non-submerged locations shall be carefully degreased, then given one coat of Koppers' 30 Metal Conditioner. After removing the excess residue with a mixture of 50% water and 50% denatured ethyl alcohol, one coat of Koppers' PUG primer shall be applied. Finish coats in inside locations, except meter vaults, shall be two coats of Koppers' Ponkote 300 (epoxy ester). Finish coats for exterior locations shall be two coats of Koppers' Glamortex #501 Enamel (alkyd).

### **31.6 Cast Iron**

Cast iron and other bitumen-coated metals located above ground and/or in vaults shall receive two coats of Koppers' Inertol Tar Stop (synthetic resin). Forty-eight (48) hours drying time is required between coats. Finish coats in indoor locations, except meter vaults, shall be two coats of Koppers' Ponkote 300 (epoxy ester). Finish coats for outside locations shall be two coats of Koppers' Glamortex #501 Enamel (alkyd).

Cast metals to be buried shall receive two exterior coats of heavy-duty coat tar equal to Koppers' Bitumastic No. 505. Minimum thickness shall be 15 mils per coat. The coating shall be applied after the surface has been sandblasted to "commercial" standard as defined by SSPC Specification No. 6. The paint manufacturer's application recommendations shall be followed.

### **31.7 Steel Surfaces**

Steel surfaces shall receive one shop coat of rust-penetrating Koppers' #622 and one field coat of PUG primer. Finish coats in indoor locations, except meter vaults, shall be two coats of Koppers' Ponkote #300 (epoxy ester). Finish coats for outside locations shall be two coats of Koppers' Glamortex #502 Enamel (alkyd).

### **31.8 Wood Surfaces**

Wood surfaces shall be cleaned of dirt, oil, or other foreign substances with scrapers, sandpaper, or wire brushes. Finished surfaces exposed to view shall, if necessary, be made smooth by planing or sanding. Mill work shall be sanded where necessary, and given a coat of the specified primer on all sides before installation. Small, dry, seasoned knots shall be surface scraped, sanded, thoroughly cleaned, and given a thin coat of WP-578 Western Pine Association Knot Sealer before application of the priming coat. Large, open, unseasoned knots and all beads or streaks of pitch shall be scraped off. If the pitch is still soft, it shall be removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with Knot Sealer. After priming, all holes and imperfections shall be filled with putty or plastic wood (colored to match the finish coat), allowed to dry, and sanded smooth. Painting of interior wood surfaces shall proceed, insofar as practicable, only after masonry work has dried. Existing wood shall be cleaned of all loose or flaking paint and sanded as required.

#### *31.8.1 Interior and Exterior Locations*

Interior and exterior locations shall receive one primer coat and two finish coats. Primer shall be Tnemec 151 at 1.5 to 2.0 MDFT. Finish shall be Tnemec 156 Enviro-Crete at 6.0 MDFT per coat.

### **31.9 Concrete and Masonry Surfaces**

Concrete and masonry surfaces must be dry at time of paint application.

#### *31.9.1 Exterior Surfaces*

Exterior surfaces shall receive one coat of Koppers' Block Sealer, or Dutch Boy Block Coater No 30W01; one coat of Dutch Boy Nalprep No. 019; and one coat of Dutch Boy Nalcrete, or two coats Koppers' #600 Exterior (acrylic emulsion).

#### *31.9.2 Exterior Surfaces Below Ground*

Exterior surfaces below ground shall receive two coats of Koppers' Bitumastic Super Service Black, 12 mils per coat.

#### *31.9.3 Interior Above-Ground Surfaces*

Interior above-ground surfaces shall receive one coat of Dutch Boy Masonry Vinyl Speed Primer No. 30W10 or Koppers' Surfacer, and one coat of Dutch Boy Masonry Vinyl No. 32W11, or Koppers' #601 Interior.

#### *31.9.4 Interior Surfaces Below Ground*

Interior surfaces below ground, such as in lift stations, shall receive a cementitious seal coat of XYPEX Concrete Waterproofing by Crystallization. After at least three days, a primer coat of Tnemec 69-AA90 (white) Epoxiline II at 3.0 to 4.0 MDFT shall be applied. Finish coat shall be two coats of Tnemec 69 Epoxiline II at 7.0 to 9.0 MDFT per coat.

## **32. Submersible Pumps for Sanitary Sewer**

## and Storm Drain Lift Stations

### 32.1 General

These specifications designate the requirements for the installation of submersible pumps in sanitary sewer and storm drain lift stations.

Pumps shall be designed and guaranteed for continuous service handling of raw sewage or urban storm drainage runoff. They shall feature a clog-resistant impeller/volute design and shall be suitable for operation in water having a temperature range of 40° F to 80° F. Pumps shall be easily removable for inspection or service, without removal of bolts, nuts or other fasteners, and without the need for personnel to enter the wet well. Sealing of the submersible pumping unit to the discharge elbow shall be accomplished by a simple downward motion of the pump and shall provide a water tight connection.

Pumps, motor, wiring, etc. shall be approved by a nationally approved testing agency (Underwriters Lab or Factory Mutual) for explosion-proof service in the State of California. The system shall be rated for Class 1, Division 1, Group C and D, service as determined by the National Electrical Code, latest edition.

### 32.2 Pump Station Design

Pump stations shall be designed to lift the design peak flow as determined using the aforesaid criteria for computing sewage flow. Pump for sanitary sewer stations shall be equipped with two identical pumps, each capable of discharging the peak flow. Pumps must be able to alternate. Pump stations with three or more pumps may be considered where dual pump stations are infeasible, subject to the approval of the City Engineer. Said facilities shall be capable of passing the peak flow with any one pump out of service.

Wet well capacity shall be sized using the following formula:

$$V = \frac{\phi Q}{4}$$

Where V = volume in gallons

$\phi$  = cycle length (taken as ten minutes for pump station with two pumps)

Q = pumping capacity of single pump

- Wet wells shall be precast concrete, seventy-two inch diameter, unless otherwise approved by the City.
- Pump stations shall be located outside street right-of-way in dedicated easements.
- Minimum pump horsepower shall be five HP.

- The pump station shall be designed in full compliance with the City's Sanitary Sewer Lift Station Standard Plan (S-8), or Storm Sewer Lift Station Standard Plan (S-10), and these Standard Specifications.
- Pumps shall be Flygt or approved equal, unless flow volumes require propeller pump installation.

### **32.3 Pump Components**

#### *32.3.1 Volute and Impeller*

The pump volute and impeller shall be gray cast iron per ASTM A48, Class 25 or better, with smooth surfaces free of blow holes and irregularities. Where water tight sealing is required, O-rings of nitrile rubber or equivalent material shall be used. All exposed nuts and bolts shall be made of 304 stainless steel. The interior of the unit shall be coated with a PVS epoxy primer and the exterior sprayed with an epoxy primer and chloric rubber finish coat.

Vortex non-clog design impellers, such that the pumpage does not pass through the impeller, are acceptable, as are single-vane, non-clog-type impellers. Dual-vane impellers will not be accepted. Impeller shall pass three-inch solids.

Impellers shall be dynamically and hydraulically balanced, and shall be securely fastened to the shaft with keys or appropriate locking devices.

#### *32.3.2 Mechanical Seals*

Pumps shall be equipped with a double mechanical seal system, mounted in tandem, with an oil chamber between the seals. The lower seal unit, between the pump and oil chamber, shall contain one stationary and one rotating tungsten-carbide ring. The upper seal unit, between the oil sump and motor casing, shall contain one stationary tungsten-carbide ring and one rotating carbon ring. Remaining seal components shall be stainless steel and buna-n rubber.

### **32.4 Motor Components**

#### *32.4.1 Design*

Pump motors shall be a squirrel-cage induction, shell-type construction designed to NEMA B Standards. Motor housing shall be water tight and shall be air or dielectric oil-filled.

The combined service factor of the motor shall be 1.10 or greater. The motor supplied must be adequate throughout the full range of the published pump curve without overloading and without considering the service factor.

Motors shall be designed for continuous duty and shall be capable of sustaining a minimum of 10 starts per hour. The stator windings and stator leads shall be insulated with moisture-resistant Class F materials, which shall be rated at 310°F.

#### *32.4.2 Watertight Seals*

Power and sensor cable entries into the motor junction box shall be effectively sealed. The entry seal shall consist of either a close-tolerance system consisting of a single cylindrical elastomer grommet, stainless steel washers, and a ferrule. Alternately, it shall be epoxy-potted with a buna-n grommet or compression-fitted out seal.

Power and sensor leads from the junction chamber into the motor housing must also be sealed watertight. Epoxy-potted systems or terminal board and O-ring systems are acceptable.

All joints in the housing, junction box, seal chamber, and pump shall be carefully machined and equipped with O-ring seals.

#### *32.4.3 Shaft*

The motor shaft on which the impeller is mounted shall be stainless steel. The impeller shall be slip-fit to the shaft, key driven, and attached with stainless steel fasteners.

#### *32.4.4 Bearing*

The pump-motor shaft shall rotate within two ball bearing assemblies. Bearings shall be permanently lubricated and shall have an AFBMA computed B-10 life rating of not less than 18,000 hours.

#### *32.4.5 Thermal Overload Protection*

To protect the motor from overheating, each phase winding shall be equipped with automatic-reset, normally closed thermal switches embedded in the end coils of the stator winding. These shall be used in conjunction with and supplemental to the external motor overload protection, and wired to the panel.

#### *32.4.6 Power/Sensor Cables*

All power and sensor cables shall be of sufficient length to reach the control panel without requiring a splice. Cables shall be hypalon-jacketed and be water tight to a depth of 65 feet. Wicking fillers shall not be used. Cables shall be restrained and routed so as not to interfere with the raising and lowering of the pumps within the sump.

#### *32.4.7 Seal Failure System*

At the option of the manufacturer, a seal failure deterioration system may be supplied with the pumps to detect the presence of moisture in the seal chamber.

### **32.5 Disconnect System and Guide Rail Construction**

#### *32.5.1 General*



The design of the disconnect system shall permit the easy removal of the pumping unit for inspection or service. The pump, when lowered into place, shall be automatically connected to the discharge piping. There shall be no need for personnel to enter the wet well to inspect or service the pump.

#### *32.5.2 Guide Bracket*

Pumps shall be securely attached to a sliding guide bracket designed for use with at least two guide rails. Stainless steel pipe rails shall be furnished as part of the pump installation. Guide rail support brackets shall be installed approximately midway between the pump station ceiling and floor. Each sliding guide bracket shall have non-sparking materials at the point of contact with the guide rails to prevent spark ignition of explosive pump station gases during pump installation and removal.

#### *32.5.3 Discharge Elbow*

A cast iron discharge elbow, located on the floor of the wet well, shall receive the pump discharge when the pump is lowered into place. The receiving edge of the discharge elbow shall be fitted with non-sparking material to prevent spark ignition of explosive pump station gases during pump installation and removal.

#### *32.5.4 Base Plate*

The lower guide rail brackets for the pump shall be mounted by the pump manufacturer on a steel base plate, in alignment for proper operation of the disconnect system. The base assembly shall provide stable support of the pumping unit during pump operation.

#### *32.5.5 Lifting Cables*

Each pump shall be supplied with stainless steel lifting cables of sufficient length and mounted in such a way as to allow removal of pump without requiring personnel entry into the wet pit.

#### *32.5.6 Access Hatches*

Access hatch frame assemblies shall have separate hinged covers for removal of the pump. Duplex pump lift stations require dual access hatches. The frame shall have upper guide rail brackets and shall support the float switch bracket. Covers shall be provided with lifting handles, safety latches to hold covers in the open position, and recessed, locking hasps. Frame and covers shall be fabricated from aluminum.

### **32.6 Pump Station Panel**

The control panel and all the electrical components shall be the standard product of a manufacturer engaged in the assembly of motor control equipment. The control panel shall bear the Underwriters Laboratory (UL) label.

All controls shall be mounted in a NEMA 3R rainproof, metal enclosure. The design shall include a tamper-proof door enclosing all control operators, which shall be mounted on an inner hinged door over the control equipment compartment. All circuit breakers and motor starter overload resets shall have operations mounted on the inner door.

Short circuit protection for each pump circuit shall be provided by an adjustable, instantaneous magnetic trip circuit breaker designed for motor circuit protection.

Each pump circuit shall include a full voltage non-reversing motor starter with ambient compensated, manually reset overload relays with quick trip heaters.

The pump control circuit shall include a door interlock switch to de-energize the control circuit when the enclosure door is open, a control circuit transformer with fused 115-volt secondary, a door-mounted control circuit disconnect switch, and an emergency generator disconnect switch.

### **32.7 Level Sensors and Hour Meters**

Pump operation shall be controlled by four (4) bulb-type liquid level sensors each. Two shall serve as pump-on (primary, secondary) and pump-off controls. A third level sensor shall indicate high water alarm condition. An intrinsically-safe pilot circuit shall be provided for each level sensor to reduce the power to the sensor to a level incapable of releasing sufficient electrical or thermal energy to ignite explosive gases. High water alarm shall be indicated by an alarm light with a minimum 40-watt lamp and red polycarbonate lens or globe, mounted above the control panel.

As an alternative to the liquid sensors, a solid state level sensor rod equivalent to that manufactured by Multitrode may be installed. This sensor shall be programmed to provide equivalent on, off, and high water alert functionality as the liquid switches.

Each pump starter shall also be equipped with a non-resettable cyclometer-type running time meter and a running pilot light.

### **32.8 Operational Testing**

Pumps shall be tested separately and in combination. Equipment shall be operated under full load conditions. Motors shall be tested for correct rotation. Start up and cycle all systems to demonstrate proper operation. Testing shall be performed in accordance with the manufacturer's recommendations.

### **32.9 Electrical Service**

Electrical service for lift stations shall conform to all applicable NEC and PG&E standards. All required conduit from the service drop to the transformer, and from the transformer to the service entry on the pump control panel shall be provided. All work shall be completed to the satisfaction of City's Representative and PG&E's field representative.

### **32.10 Discharge Piping**

Discharge piping from the pumps shall be fusion epoxy lined, ductile iron pipe. The pipe shall be coated per Section 31 of the Standard Specifications. A valve box shall be installed and meet the requirements shown on Standard Detail S-9 of these Standard Specifications.

## **33. Propeller Pumps for Storm Drain Lift Stations.**

### **33.1 General**

These specifications designate the requirements for the installation of propeller pumps in storm drain lift stations, where submersible pumps are found to be not suitable, not cost effective, or both. Propeller pumps will be allowed in lieu of submersible pumps only at the option of the City Engineer.

Pumps shall be designed and guaranteed for continuous service handling urban storm drainage runoff, and shall be suitable for operation in water having a temperature range of 40°F to 80°F. Pumps must be able to alternate. Pumps shall be oil-lubricated, and include a bowl assembly, strainer, column and enclosed lineshaft, above-ground elbow and pedestal, and an adequately-sized drive.

### **33.2 Propeller Pump Components**

#### *33.2.1 Discharge Elbow*

The discharge elbow shall be above-base construction. It shall be of fabricated steel, with welded motor mounting stand and be of sufficient size and weight to accommodate the driver. The discharge elbow shall be of welded construction with no joint having an angle of more than 45°. The radius of the discharge elbow shall not be less than two times the diameter of the pipe used for construction and shall contain no guide vanes or deflection vanes. The downstream end of the discharge elbow shall be grooved for a Victaulic 77 (or equal) grooved coupling.

#### *33.2.2 Pump Mounting Plate*

The pump mounting plate shall be welded to the discharge elbow and of sufficient size and weight to support the full weight of the pump unit and driver. Unless otherwise approved by the City Engineer, minimum plate size is 36" x 36" and minimum thickness is 1 inch.

#### *33.2.3 Pump Column*

The pump column shall be flanged, and the same size as the pump unit. The pump column shall have butt joint connections.

#### *33.2.4 Enclosing Tube and Lineshaft*

A shaft enclosing tube shall be provided to protect the lineshaft and contain the oil lubricant and discharge bowl connector bearing. The enclosing tube shall be enclosed in an inner column of extra heavy pipe and supported by bronze coupling bearings having a minimum length of 4.0 inches. The bottom section of the shaft enclosing tube shall be directly connected to the discharge bowl connecting bearing. The top enclosing tube shall be fitted with a tube tensioning nut to maintain tension on the enclosing tube. The lineshaft shall be sized per ANSI B58.1 to provide satisfactory operation without undue vibration or distortion, and furnished in sections of uniform length not exceeding 10 feet.

The lineshaft(s) shall be coupled with threaded steel shaft couplings machined from solid bar stock.

#### *33.2.5 Pump Bowls*

Pump bowls shall be of close-grain cast iron, flanged, with no sand holes, blow holes or other imperfections. The suction bell shall be of the flared inlet type with a grease-packed lower bearing. It shall be provided with at least three guide vanes designed to minimize entrance losses and reduce vortexing. Guide vanes shall be rounded to reduce accumulation of fibrous material.

A discharge bowl bearing by-pass shall be provided in the bearing cavity for drainage and pressure relief. The connector bearing shall be externally threaded along its entire length. The first-stage propeller seal surface shall be in the suction bell.

The pump bowl shall be equipped with a mixed-flow propeller, three vane or fewer, capable of passing a 2.50-inch solid, minimum.

#### *33.2.6 Propeller*

The pump propeller shall be of one-piece cast bronze, free of sand holes the blow holes or other imperfections. The propeller shall be accurately machined and balanced to ensure vibration-free operation. The propeller shall be securely fastened to pump shaft to prevent axial movement on shaft.

The propeller shall be fitted on the upper side to bronze wear rings in the pump case. This shall be accomplished in such a manner as to reduce pressure within the inner column to suction pressure and to allow leakage past wear rings to return to suction side of impeller.

#### *33.2.7 Miscellaneous*

The pump case shall have a close-fitting wear ring to fit the upper side of the impeller. The ring shall be held securely in case by stainless steel screws.

The pump shall have a convenient method of drive adjustment. Either a three-piece flanged, adjustable driver coupling or a vertical hollow shaft driver shall be provided.

The pump shall be self-lubricating. An automatic oiler, with one-quart oil capacity, shall be installed on the above-ground discharge head.

### **33.3 Motor**

Motors for propeller pumps shall be vertical, solid shaft, with drip-proof enclosures. Motors shall be of sufficient size to drive the pump continually at the required operating conditions without considering service factor. Motor service factor shall be 1.10 minimum.

Motors shall have a thrust bearing as an integral part, which shall be of sufficient capacity to carry the weight of all rotating parts plus hydraulic thrust of the pump at all points in the operating range. The bearings shall be rated for at least 5000 hours continuous normal operation.

The motor shall be labeled "premium efficiency" and shall operate at minimum 92 percent efficiency at 100 percent of rated load.

### **33.4 Pump Station Panel**

The control panel and all the electrical components shall be the standard product of a manufacturer engaged in the assembly of motor control equipment. The control panel shall bear the Underwriters Laboratory (UL) label.

All controls shall be mounted in a NEMA 3R rainproof metal enclosure. The design shall include a tamper-proof door enclosing all control operators, which shall be mounted on an inner hinged door over the control equipment compartment. All circuit breakers and motor starter overload resets shall have operations mounted on the inner door.

Short circuit protection for each pump circuit shall be provided by an adjustable, instantaneous magnetic trip circuit breaker designed for motor circuit protection.

Each pump circuit shall include a full voltage non-reversing motor starter with ambient compensated, manually reset overload relays with quick trip heaters. The pump control circuit shall include a door interlock switch to de-energize the control circuit when the enclosure door is open, a control circuit transformer with fused 115-volt secondary, and a door-mounted control circuit disconnect switch.

### **33.5 Level Sensors and Hour Meters**

Pump operation shall be controlled by three (3) bulb-type liquid level sensors each. Two shall serve as pump-on and pump-off controls. A third level sensor shall indicate high water alarm condition. An intrinsically-safe pilot circuit shall be provided for each level sensor to reduce the power to the sensor to a level incapable of releasing sufficient electrical or thermal energy to ignite explosive gases. High water alarm shall be indicated by an alarm light with a minimum 40-watt lamp and red polycarbonate lens or globe, mounted above the control panel.

As an alternative to the liquid sensors, a solid state level sensor rod equivalent to that manufactured by Multitrode may be installed. This sensor shall be programmed to provide equivalent on, off, and high water alert functionality as the liquid switches.

Each pump starter shall also be equipped with a non-resettable cyclometer-type running time meter and a running pilot light. Each starter shall be supplied with a key-operated hand-off-automatic switch. Two keys shall be supplied to the City.

### **33.6 Operational Testing**

Pumps shall be tested separately and in combination. Equipment shall be operated under full load conditions. Motors shall be tested for correct rotation. Start up and cycle all systems to demonstrate proper operation. Testing shall be performed in accordance with the manufacturer's recommendations.

### **33.7 Electrical Service**

Electrical service for lift stations shall conform to all applicable NEC and PG&E standards. All required conduit from the service drop to the transformer, and from the transformer to the service entry on the pump control panel shall be provided. All work shall be completed to the satisfaction of City's Representative and PG&E's field representative.

### **33.8 Discharge Piping**

Discharge piping from the pumps shall be fusion epoxy lined, ductile iron pipe. The pipe shall be coated per Section 31 of the Standard Specifications. A valve box shall be installed and meet the requirements shown on Standard Detail S-9 of these Standard Specifications.