STANDARD SPECIAL PROVISIONS
AND
TECHNICAL SPECIFICATIONS

JUNE 2003

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SPECIAL PROVISIONS

Section 1

Definitions

1.01 General – The work embodied herein shall be done in accordance with the appropriate provisions of the State Standard Specifications entitled "State of California, Department of Transportation, Standard Specifications", dated July 1992, insofar as the same apply and in accordance with the following Special Provisions.

Whenever in said Standard Specifications and these Specifications, the following terms are used, they shall be understood to mean and to refer to the following:

"Department" or "Department of Transportation" – The Department of Public Works of the City of Live Oak.

"Engineer" or "Director" – The City Engineer or the Director of Public Works of the City of Live Oak or their authorized agents.

"Laboratory" – The laboratory designated by the Engineer.

"State" – The City of Live Oak.

Other terms appearing in the Standard Specifications, and these Specifications, shall have the intent and meaning specified in Section 1, "Definition of Terms", of the Standard Specifications.

In the case of conflict between the Standard Specifications and these Specifications, these Specifications shall take precedence over and be used in lieu of such conflicting portions.

Section 2

Proposal and Contract Requirements

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Section 3

Control of Work

3.01 General – Attention is directed to the provisions of Section 5 of the Standard Specifications and the following provisions:

3.02 Survey Markers – Special attention is directed to Section 5-1.07 of the Standard Specifications. In the event of careless or willful destruction of survey stakes or marks, the Engineer shall determine the rates for the cost of replacement.

3.03 Intent of Plans and Specifications – These Specifications, the Plans, the Standard Specifications, and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be cooperative, to describe and to provide for a complete work. Plans shall govern over Standard Specifications, and Technical Specifications shall govern over both Plans and Standard Specifications.

3.04 Final Inspection – The Contractor shall notify the Engineer in writing of the completion of the work, and the Engineer will promptly inspect the work. The Contractor will be notified in writing of any defects or deficiencies to be remedied. When notified that this work has been completed, the Engineer will again inspect the work and when satisfied that all work has been done in accordance with the contract drawings and these Specifications, he will recommend to the City Council that they formally accept the contract as complete. The completion date, for the purposes of computing "Time for Completion" and liquidated damages, if any, will be considered to be the date of the Contractor's first written notice that the work is complete, provided that, in the Engineer's judgment, the work is substantially complete and operational at that time.

Section 4

Legal Relations and Responsibility

4.01 General – The Contractor's attention is directed to Section 7 of the Standard Specifications regarding his legal obligations and responsibilities.

4.02 Laws to be Observed – The Contractor shall keep himself fully informed of all existing State and National laws and all municipal ordinances and regulations of the City of Live Oak which in any manner affect those engaged or employed in the work, or the materials used in the work, or which in any way affect the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same.

4.03 Prevailing Wages – (BLANK)

4.04 Permits and Licenses – The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the work. There will be no charge for the permits from the City.

4.05 Insurance – Contractor shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors.

Minimum Scope of Insurance
Coverage shall be at least as broad as:

1. General Liability and Umbrella or Excess Liability Insurance covering all operations by or on behalf of the Contractor providing insurance for bodily injury liability, and property damage liability for the limits of liability indicated below and including coverage for premises, operations and mobile equipment; products and completed operations; broad form property damage (including completed operations); explosion, collapse and underground hazards; personal injury; and contractual liability.

2. Automobile Liability Insurance, including coverage for all owned, hired and non-owned automobiles.

3. Workers' Compensation Insurance as required by the State of California and Employer's Liability Insurance.

Minimum Liability Limits of Insurance
Contractor shall maintain limits no less than:

1. General Liability:
    a) $1,000,000.00 per occurrence (combined single limit for bodily injury and property damage).
    b) $2,000,000.00 aggregate for products-completed operations.
    c) $2,000,000.00 general aggregate. This general aggregate limit shall apply separately to the Contractor's work under this Contract.
    d) $5,000,000.00 umbrella or excess liability. Umbrella or excess policy shall include products liability and completed operations coverage. Further, the umbrella or excess policy shall contain a clause stating that it takes effect (drops down) in the event the primary limits are impaired or exhausted.

2. Automobile Liability: $1,000,000.00 combined single limit each accident for bodily injury and property damage. The umbrella or excess liability coverage required above shall also apply to automobile liability.

3. Employer's Liability:
    a) $1,000,000.00 per accident for bodily injury by accident.
    b) $1,000,000.00 policy limit for bodily injury by disease.
    c) $1,000,000.00 for each employee for bodily injury by disease.

Deductibles and Self-Insured Retention

Any deductibles or self-insured retention must be declared to and approved by the City of Live Oak. At the option of the City of Live Oak, either the insurer shall reduce or eliminate such deductibles or self-insured retention as respects the City of Live Oak, its officers, officials, employees and volunteers: or the Contractor shall procure a bond guaranteeing payment of losses and related investigations, claim administration and defense expenses.

Other Insurance Provisions

The general liability and automobile liability policies are to contain, or be endorsed to contain, the following provisions:

1. The City of Live Oak, its officers, officials, employees, agents and volunteers are to be covered as insureds as respects: liability arising out of activities performed by or on behalf of the Contractor, products and completed operations of the Contractor; premises owned, occupied or used by the Contractor; or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the City of Live Oak, its officers, officials, employees, agents or volunteers.

2. For any claims related to this project, the Contractor's insurance coverage shall be primary insurance as respects the City of Live Oak, its officers, officials, employees, agents and volunteers. Any insurance or self-insurance maintained by the City of live Oak, its officers, officials, employees, agents or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.

3. Any failure to comply with reporting or other provisions of the policies including breaches of warranties shall not affect coverage provided to the City of Live Oak, its officers, officials, employees, agents or volunteers.

4. Coverage for such additional insureds shall not extend to liability:
    a) arising from any defective or substandard condition of a City roadway which existed prior to the time the Contractor commenced work, unless such condition has been changed by the work or the scope of the work requires the Contractor to maintain existing City roadway facilities and the claim arises from the Contractor's failure to maintain; or,
    b) for claims occurring after the work is completed and accepted unless these claims are directly related to alleged acts or omissions of the Contractor which occurred during the course of the work; or,
    c) to the extent prohibited by Section 11580.04 of the Insurance Code.

5. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

6. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the City of Live Oak.

Acceptability of Insurers

Insurance is to be placed with insurers that are acceptable to the City of Live Oak.

Verification of Coverage

Contractor shall furnish the City of Live Oak with original endorsements effecting coverage required by this clause. The endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. The endorsements are to be on forms provided by the City of Live Oak, all endorsements are to be received and approved by the City of Live Oak before work commences. As an alternative to the City of Live Oak's forms, the Contractor's insurer may provide complete, certified copies of all required insurance policies, including endorsements effecting the coverage required by these specifications.

Subcontractors

Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverages for subcontractors shall be subject to all of the requirements stated herein.

If the Contractor fails to maintain such insurance, the City of Live Oak may take out such insurance to cover any damages for which the City of Live Oak might be held liable on account of the operations under this contract, and deduct and retain the amount of the premiums for such insurance from any sums due the Contractor under the contract. Nothing herein contained shall be construed as limiting in any way the extent to which the Contractor may be held responsible for payment of damages resulting from his operations, or those of any subcontractor under him.

4.06 No Personal Liability – Contractor shall indemnify and hold harmless City and its officers, officials, employees and volunteers from and against all claims, damages, losses and expenses including attorney fees arising out of the performance of the work described herein, caused in whole or in part by any negligent act or omission of the contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, except where caused by the active negligence, sole negligence, or willful misconduct of the City.

4.07 Responsibility of City – The City of Live Oak shall not be held responsible for the care or protection of any materials or parts of the work prior to final acceptance, except as expressly provided in these Specifications.

4.08 Domestic Materials – Only such materials shall be used in the performance of this contract as conform to the requirements of Chapter 4 of Division 5 of Title 1 of Government Code of the State of California except as otherwise provided in certain treaties and general trade agreements of the United States.

4.09 Subcontracting – (BLANK)

Section 5

Watering and Dust Control

5.01 Water – Water, if obtained from a City fire hydrant, shall be metered and paid for at the rates set forth by the City. A service charge and deposit will be required for each meter installation required for said metering. The Contractor shall nor leave any hose attached to a fire hydrant except when actually drawing water therefrom, and shall keep hydrants clear for possible use by the Fire Department.

5.02 Dust Control – Dust control measures shall conform with Section 10 of the Standard Specifications and to the standards adopted by the Sutter County Air Quality Management District. Fugitive dust emissions related to construction must be controlled at all times. Contractor shall water the construction site at sufficient intervals to preclude the nuisance of dust caused by the Contractor's operations and/or wind and traffic, at no additional compensation. All clearing, grading, earth moving or excavation activities shall cease during periods of wind exceeding 15 miles per hour averaged over one hour.

Section 6

Progress of Work, Liquidated Damages and Contract Time

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Section 7

Payment

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Section 8

Quantities and Materials

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Section 9

Safety Precautions

9.01 Preservation of Property – Due care shall be exercised to avoid injury to existing improvements, utility facilities, adjacent property, and roadside trees and shrubbery that are not to be removed or relocated. Concrete surfaces including curbs and sidewalks that are not to be removed shall not be defaced or damaged in any manner, including markings with paint, asphalt overspray, etc. Any such damage or defacement shall be cleaned, repaired, or replaced as necessary to restore such area as nearly as possible to its original condition.

Trees and shrubbery that are not to be removed, and pole lines, fences, signs, markers and monuments, buildings and structures, conduits, pipelines under or above ground, sewer and water lines, all facilities and any other improvements or facilities within or adjacent to the work shall be protected from injury or damage, and if ordered by the Engineer, the Contractor shall provide and install suitable safeguards to protect such objects from injury or damage. If such objects are injured or damaged by the contractor's operations, they shall be replaced or restored at the Contractor's expense, to a condition as good as when the Contractor entered upon the work, or as good as required by the Specifications accompanying the contract, if any such objects are a part of the work being performed under the contract. Damaged sanitary sewer services and storm drain laterals shall be repaired at Contractor's expense, as shown on the detail sheet on the plans. The Engineer may make or cause to be made such temporary or permanent repairs as are necessary to restore to service any damaged facility. The cost of such repairs shall be borne by the Contractor and may be deducted from any monies due or to become due the Contractor under the contract.

Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in protecting or repairing property as specified in these Specifications shall be considered as included in the prices bid for the various contract items of work and no additional compensation will be allowed therefor.

9.02 Obstructions – The location of underground utilities shown on the plans represent the best information available to the City but should be considered as being approximate only. Utility lines may exist that are not shown on the plans. The exact locations of underground facilities and improvements within the construction area shall be ascertained by the Contractor before using equipment that may damage such facilities or interfere with their service. The Contractor will be held liable to the owners of such facilities for any damage or interference with service resulting from his operations.

9.03 Interruption of Service – No valves or other controls on existing utility systems shall be operated for any purpose by the Contractor without prior approval of the Engineer and/or the utility company.

9.04 Safety Devices – Sufficient and adequate signs, lights, barricades and cones shall be furnished, placed, and maintained throughout the construction project as may be deemed necessary by the Engineer to adequately protect the public from injury or unnecessary inconvenience due to the construction operations. When traffic is to be interrupted or detoured,

flagmen, adequately equipped and instructed, shall be provided by the Contractor as deemed necessary by the Engineer. Payment to the Contractor for all costs incurred by him in conforming to this section and "Maintaining Traffic", below, shall be considered as included in the prices bid for other items of the work and no additional compensation shall be paid therefor.

9.05 Maintaining Traffic - Attention is directed to Section 4-1.04 and 7-1.09 of the Standard Specifications. The Contractor will be required to furnish the City with a work schedule sufficiently detailed so that the City may ascertain therefrom what effect the Contractor's proposed construction program will have on traffic through the construction area.

The Contractor shall conduct his operations so as to offer the least obstruction and inconvenience to the public, and he shall have under construction no greater amount of work than he can prosecute properly with due regard to the rights of the public. Temporary approaches at private driveways shall be provided as needed and when ordered by the Engineer, and shall be kept in good condition.

Spillage resulting from hauling operations along or across a public traveled way shall be removed immediately at the Contractor's expense.

Attention is directed to the following special traffic control provision:

1. Closing of any street to through traffic by prior permission of the City only. Prior notification of desired street closing requires seven (7) days advance notice.

Section 10

Description of the Work

The work to be done consists in general of _____ and such other items of work as required by the plans and specifications. All are to be constructed, furnished, or installed as shown on the plans, as specified herein, and as directed by the Engineer.

TECHNICAL SPECIFICATIONS

A. SCOPE

This heading covers all work required to remove existing street facilities and all objectionable material from the project site within the limits of the proposed construction.

B. WORKMANSHIP

Removal of existing concrete curbs, gutters, driveways and sidewalks shall be performed by the Contractor in accordance with Section 15 of the State Standard Specifications and these Contract Documents.

Clearing and grubbing shall be performed by the Contractor in advance of grading operations and in accordance with Section 16 of the State Standard Specifications and these Contract Documents.

The area shall be cleared of all vegetable growth, such as trees, logs, upturned stumps, roots of down trees, brush, grass, weeds and all other objectionable material, including concrete or masonry and fencing.

All materials removed shall become the property of the Contractor and shall be removed from the site by the Contractor. The Contractor shall be responsible for obtaining a suitable disposal site in accordance with the Special Conditions.

C. MEASUREMENT AND PAYMENT

No measurement of quantities will be made. Payment will be made at the lump sum contract price, which shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in removal of existing street facilities and clearing and grubbing.

A. SCOPE

This heading covers the removal and disposal of existing asphalt pavement and the excavation and disposal of roadway excavation materials. Roadway excavation includes the removal of all materials to the design subgrade elevation, based upon the design structural section and the design cross-slopes.

B. WORKMANSHIP

Paving and other materials within the roadway prism shall be completely removed from the site. Care shall be exercised in removal of all items to avoid damage to existing improvements including but not limited to existing curb and gutter, utility lines, and utility boxes.

All pavement shall be neatly cut along the limits of reconstruction and as directed by the City Engineer.

Roadway excavation shall be performed in accordance with Section 19-2 of the State Standard Specifications.

The roadway subgrade shall be compacted to at least 95 percent of the maximum density as determined by ASTM Test D-1557, for a minimum depth of 0.5 feet below subgrade. Field density tests will be performed in accordance with ASTM Test D-1556 or ASTM Test D-2992, Method B.

If unsuitable subgrade material is encountered, the Contractor shall remove the unsuitable material as directed by the Engineer at a negotiated unit price and replace with Class 2 aggregate base at the unit price bid in the Proposal.

C. MEASUREMENT AND PAYMENT

No measurement of quantities will be made. Payment for roadway excavation will be made at the lump sum price bid in the Proposal, and shall include full compensation for performing all roadway excavation work completely as shown on the Plans and as specified herein.

Payment for removal and disposal of existing asphalt pavement shall be included in the lump sum price bid in the Proposal for roadway excavation, and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in removal and disposal of existing asphalt pavement.

A. SCOPE

This section covers trench excavation and backfill for water mains, storm drain pipelines, sewer pipelines, and excavation and backfill at water system appurtenances, storm drain drop inlets and storm drain manholes.

B. MATERIALS

IMPORTED BEDDING MATERIAL shall be clean, washed sand or Class 2 aggregate base.

IMPORTED BACKFILL MATERIAL shall be Class 2 aggregate base.

LEAN CONCRETE BACKFILL shall consist of a fluid, workable mixture of the following ingredients:

WEIGHTS PER CUBIC YARD (SATURATED, SURFACE-DRY)

		YIELD, CU. FT.
ASTM C-150 / TYPE II CEMENT, LB	94	0.48
CONCRETE SAND, LB	1,500	8.84
3/8" BY #8 GRAVEL, LB	1,704	10.19
WATER, LB	100	1.60
TOTAL AIR, %	21.8 ± 3.0	5.88
TOTAL		27.00

WATER/CEMENT RATIO, LBS/LB	1.07
CONCRETE UNIT WEIGHT, PCF	125.90

The final mix design and mix consistency shall be subject to the approval of the Caltrans inspector.

SLURRY CEMENT BACKFILL shall consist of a fluid, workable mixture of commercial quality concrete sand, cement and water. Not less than 94 pounds of cement shall be used for each cubic yard of material produced. Cement shall be portland cement conforming to Section 90-2.01 of the State Standard Specifications, except that testing will not be required.

AGGREGATE BASE shall be as specified under Section 6 of these Technical Specifications.

ASPHALT CONCRETE shall be as specified under Sections 7 of these Technical Specifications.

TEMPORARY ASPHALT PAVING shall conform to Sections 39 and 93 of the State Standard Specifications. Aggregate shall be **2**" maximum size, Type B. Bituminous binder shall consist of SC800 liquid asphalt.

CONCRETE for concrete collars shall be Class B concrete and concrete for thrust blocks and/or encasing pipe shall be Class C concrete in accordance with Section 90 of the State Standard Specifications.

C. EXCAVATION

GENERAL: The Contractor shall excavate whatever substance encountered to the lines and grades shown on the Plans. All material suitable for use as backfill shall be piled in an orderly manner a sufficient distance from the side of the trench to avoid overloading and to prevent sliding into the trench. The Contractor shall do such grading as is necessary to prevent surface water from entering the excavation.

Except with the specific approval of the Engineer, no more than 200 feet of open trench shall be excavated in advance of laying the pipe. Not more than 50 feet of trench excavation shall remain unbackfilled at the end of each day's work. The remainder of the trench shall be backfilled, compacted, and opened to traffic. All operations shall be carried out in an orderly fashion. Backfilling, compacting, and cleanup work shall be accomplished as sections of the pipe installation are approved and traffic through the work shall be impeded or obstructed as little as possible.

Where it is necessary to cross fences, temporary gates or other barriers, or satisfactory obstructions shall be installed by the Contractor as required to keep livestock and/or household pets from entering or leaving the property. All cut fences shall be restored to original condition upon completion of backfilling of the trench.

Where it is necessary to cross irrigation or drainage ditches, the backfill in the bottom and banks of such ditches shall be carefully placed and compacted to avoid settlement. Shape of the banks and bottom shall be restored and left in good condition.

If explosives are used for excavation, the Contractor shall obtain the necessary permits and comply with all local regulations. The utility companies or agencies supplying either sewer service, water, electricity, telephone service, or gas shall be informed if blasting is to be done in the vicinity of their facilities.

WIDTH OF TRENCH: Except where otherwise specifically permitted, banks of trenches shall be vertical, and shall be of uniform width from top to bottom. Trenches shall be a minimum of 12 inches wider than the external diameter of the pipe. The maximum width of the trench, measured at the top of the pipe, shall not exceed the width allowed for various strengths of pipe as may be specified elsewhere in the applicable sections of these Standard Specifications.

If no maximum width is elsewhere specified, the width measured at the top of the pipe shall not exceed the external diameter of the pipe, exclusive of bells and collars, plus 24 inches.

STRIPPING OF TOPSOIL: Where the trench crosses cultivated, residential, or meadow land not in a roadway, the top 12 inches of soil shall be stripped and stockpiled separately from the balance of the excavated material so that later it may be placed in the top of the trench backfill.

BRACING OF TRENCHES: Where required to prevent caving of the trench, the Contractor shall furnish and install bracing and sheeting as necessary to protect the excavation and to meet safety regulations. If required by the Engineer, the Contractor shall install sheeting and bracing as required to permit the Engineer safe access to the trench for inspection of the work. However, this requirement does not relieve the Contractor of the responsibility for maintaining the trench to meet safety regulations.

DEPTH OF TRENCH: The bottom of the trench shall be carried to the lines and grades shown on the Plans with proper allowance for the thickness of the pipe and for the type of bedding specified. Any part of the trench excavated below the proper grade shall be corrected with approved bedding material compacted to 95 percent relative density, at the Contractor's expense.

APPURTENANCES: Excavations for valve vaults and other similar structures shall be large enough to provide proper working room. Any over-depth in excavation shall be corrected with concrete or other approved material.

REMOVAL OF WATER: The Contractor shall remove and dispose of all water entering the excavation. Disposal of water shall be done in a manner to prevent damage or nuisance to adjacent properties. Straw bales, sediment traps, or other devices shall be provided to prevent silt and sediment from entering storm drainage facilities. Sufficient pumping equipment shall be provided to maintain the trench in a dry condition during the bedding and initial backfilling of the pipe.

D. TYPES OF BEDDING

NATIVE BEDDING AND SHADING: Native materials shall not be used as pipe bedding or pipe shading.

IMPORTED BEDDING: Imported bedding material shall be installed in a layer the full width of the trench and of proper thickness to form the bed for the pipe. After the imported bedding has been placed and spread, it shall be compacted to proper grade to not less than 95% relative density.

CONCRETE ENCASEMENT: Shall be installed at the locations and in the manner shown on the Plans. The pipe shall be temporarily supported on masonry blocks. Supports shall be set accurately to grade with a minimum of two supports per joint of pipe. After the pipe has been laid and approved for covering, the pipe shall be bedded and encased in concrete as detailed on the Plans. Great care shall be taken not to float or shift the pipe during the concreting operation.

E. BACKFILLING

GENERAL: No backfilling shall be done until the installation to be covered has been inspected and approved for covering. Backfilling shall be carried out in an orderly fashion and, in general, shall be done as soon as approval has been given to cover the pipe. Compaction of the backfill shall proceed simultaneously with backfilling operations.

All excess backfill material shall be removed from within the right-of-way and disposed of by the Contractor. The location of the disposal site shall be the responsibility of the Contractor and shall be subject to approval of the Engineer. Removal of excess material shall be done immediately following backfilling.

Where trenches cross city streets, backfilling shall be completed immediately following excavation. No trenches across streets shall remain open overnight. All crossings shall be backfilled, compacted, and open to traffic at the end of each day's work. Major road crossings shall be excavated and backfilled in half widths of the traveled way so that at least one-half of the roadway is open to controlled traffic at all times during the work.

BEDDING AND COVERING PIPE: The bed for the pipe shall be final-graded by hand to the line and grade to which the pipe is to be laid, making proper allowance for the thickness of the pipe. The bed shall be hand-raked ahead of the pipe laying operation to remove any stones or lumps which will interfere with smooth and proper bedding. Bell holes shall be hand-dug at the location of the joints and shall be of sufficient size to allow proper making of the joint and to prevent the collar or bell of the pipe from bearing on the bottom of the trench. After the pipe has been laid and approved for covering, backfill shall be placed evenly on both sides of the pipe the full width of the trench. This material shall be placed by hand in layers and each layer shall be compacted to 95% relative compaction by use of approved tampers. For pipe 10 inches in nominal diameter or less, the first layer shall be half the outside diameter in thickness, and shall be tamped by hand. The thickness of the next layer shall be half of the diameter of the pipe plus 12 inches. For pipe 12 inches and larger in nominal diameter, the backfill material shall be placed in layers not more than 8 inches thick. Particular care shall be taken to attain the required compaction in the material supporting the underside of the pipe. Compaction by jetting or ponding shall not be permitted.

TRENCH BACKFILL ABOVE THE PIPE COVER:

BACKFILL WITHIN STATE HIGHWAY 99: All work within the Highway 99 right-of-way shall be in accordance with the Caltrans encroachment permit. All backfill above the pipe envelope shall be lean concrete backfill as shown on the Plans.

BACKFILL WITHIN PRIVATE DRIVEWAYS, ROADS, AND CITY STREETS: In public roads, backfill and compaction shall be done in accordance with the terms of the City Improvement Standards. The following requirements are minimums and do not relieve the Contractor of the responsibility of complying with any more stringent requirements of the City Standards.

The trench shall be backfilled in layers with suitable imported material which may be placed by machine. Material shall be placed in 8-inch thick layers and compacted by machine.

Prior to commencing backfilling operations, the Contractor shall notify the Engineer of the method of compaction which he intends to use. No method will be approved until the Contractor has demonstrated, under actual field conditions, that such method will produce the degree of compaction required.

The trench backfill shall be compacted to a relative density of not less than 95 percent.

SLURRY CEMENT BACKFILL: Where shown on the Plans, and at locations approved by the Engineer, the trench shall be backfilled with slurry cement from the top of the pipe bedding envelope to the bottom of the trench resurfacing structural section.

Immediately after backfilling, all excess material shall be removed and disposed of in an approved disposal area.

F. TESTS

Where a degree of relative compaction is specified, compaction tests will be made in accordance with the Standard ASTM D 1557, Method C. All densities shall be expressed as a relative compaction in terms of the maximum density obtained in the laboratory by the foregoing standard procedure.

Field density tests shall be performed in accordance with ASTM D 2922, Method B, and ASTM D 3017, using nuclear methods, or ASTM D 1556, using the sand cone. The Owner will pay for compaction tests to verify that the Contractor has met all compaction requirements. However, the cost of all failing tests required due to the Contractor's failure to meet the specifications shall be paid for by the Contractor.

G. PROTECTION OF PAVING

During the entire construction period, the Contractor shall protect existing pavement. Track-laying equipment shall be equipped with pavement pads when used on pavement. Any pavement damaged, cracked, or broken by the Contractor's operation shall be removed and replaced to at least the original condition. Damaged pavement shall be restored to the satisfaction of the Engineer.

H. REMOVAL AND REPLACEMENT OF PAVING AND BASE

GENERAL: Only such paving shall be removed as is necessary to excavate the trench and install the pipe. Cuts at valve vaults shall be no larger than necessary to install the structure.

REPLACEMENT OF PAVING: Paving shall be replaced in accordance with the Specifications, the City Improvement Standards, and the details shown on the Plans. Pavement shall be replaced in all streets and highways as soon as possible after completion of backfilling. In no case shall any section of trench in public roads remain unpaved more than one week from the date that the excavation was made. Where trenches cross roadways, pavement shall be replaced the same day the excavation was made.

TEMPORARY PAVEMENT: Where weather conditions or time preclude placing permanent pavement, temporary pavement will be installed. Temporary paving will consist of a

one-inch thick layer of premixed asphaltic surfacing material and shall be installed flush with the existing surface. Temporary pavement shall be maintained in a smooth and uniform condition, and shall be removed prior to placing permanent pavement.

PLACING AGGREGATE BASE: Where base material is required, the aggregate base shall be placed and compacted in one even layer to the depth shown on the Plans, and extending the full width of the trench. Segregation shall be avoided and extra care shall be taken in compacting the base near the sides of the trench. Relative compaction shall be not less than 95 percent.

PREPARATION FOR ASPHALT CONCRETE PAVING: Edges of existing paving shall be neatly cut along straight lines, and cut edges shall be vertical. All loose pieces or cracked sections of existing paving shall be removed. All vertical edges shall be coated with liquid asphalt-emulsion.

INSTALLING ASPHALT CONCRETE: Rolling equipment shall consist of power rollers equivalent to tandem rollers weighing not less than 8 tons.

The asphalt concrete shall be spread at a temperature suitable for workability and to a depth that will compact to the required thickness as shown on the Plans. No material shall be spread when the outside temperature is less than 40° Fahrenheit. After spreading, the material shall be thoroughly compacted, smooth, and free of irregularities.

FOG SEAL: Asphalt concrete shall be sealed with a fog seal coat in accordance with Section 37 of the State Standard Specification. Fog seal coat shall be applied at a rate such that the original emulsion will be spread at a rate of 0.10 gallons per square yard.

I. CLEAN UP

The Contractor shall clean up and dispose of all trash, debris, and excess material, and shall remove his equipment from the site of the work as completed.

J. GUARANTEE

The Contractor shall guarantee the work against settlement for a period of one year.

K. MEASUREMENT AND PAYMENT

No separate measurement of trench excavation and backfill will be made. Payment for all work under this section shall be included in the prices bid in the Proposal for the bid items.

A. SCOPE

This heading covers the furnishing, placement and compaction of aggregate subbase material, complete.

B. MATERIALS

All aggregate subbase material shall be Class 1 or Class 2, conforming to the requirements of Section 25 of the State Standard Specifications.

C. WORKMANSHIP

Aggregate subbase material shall be spread, watered, compacted and finished in accordance with requirements of Section 25 of the State Standard Specifications and these Contract Documents.

The maximum compacted thickness of any one layer shall not exceed 0.5-foot. The aggregate subbase shall be compacted to at least 95 percent of the maximum density, as determined by ASTM Test D-1557. Field density tests will be performed in accordance with ASTM Test D-1556 or ASTM Test D-2992, Method B.

D. MEASUREMENT AND PAYMENT

Measurement of aggregate subbase material will be made on the basis of weight, as determined by scale weight of each load of material. Materials shall be weighed in accordance with the provisions of Section 9-1.01 of the State Standard Specifications. The weight of water in the material at the time of weighing, in excess of one percentage point over the optimum moisture as determined by ASTM Test D-1557, will not be paid for. The actual moisture content of the material will be determined by ASTM Test D-2216.

Payment will be made at the contract price per ton, which shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing, placing, shaping, compacting and finishing the aggregate subbase material.

A. SCOPE

This heading covers the furnishing, placement and compaction of aggregate base material, complete.

B. MATERIALS

All aggregate base material shall be Class 2, 3/4-inch maximum, conforming to the requirements of Section 26 of the State Standard Specifications.

C. WORKMANSHIP

Aggregate base material shall be spread, watered, compacted and finished in accordance with requirements of Section 26 of the State Standard Specifications and these Contract Documents.

The maximum compacted thickness of any one layer shall not exceed 0.5-foot. The aggregate base shall be compacted to at least 95 percent of the maximum density, as determined by ASTM Test D-1557. Field density tests will be performed in accordance with ASTM Test D-1556 or ASTM Test D-2992, Method B.

D. MEASUREMENT AND PAYMENT

Measurement of aggregate base material will be made on the basis of weight, as determined by scale weight of each load of material. Materials shall be weighed in accordance with the provisions of Section 9-1.01 of the State Standard Specifications. The weight of water in the material at the time of weighing, in excess of one percentage point over the optimum moisture as determined by ASTM Test D-1557, will not be paid for. The actual moisture content of the material will be determined by ASTM Test D-2216.

Payment will be made at the contract price per ton, which shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing, placing, shaping, compacting and finishing the aggregate base material.

A. SCOPE

This heading covers the furnishing and placement of prime coat and paint binder, complete.

B. MATERIALS

PRIME COAT shall be grade SC-250 liquid asphalt conforming to the requirements of Section 93 of the State Standard Specifications.

PAINT BINDER shall be an asphaltic emulsion, Type and Grade SS1, conforming to the requirements of Section 94 of the State Standard Specifications.

C. WORKMANSHIP

Paint binder shall be applied to all vertical surfaces of existing pavement, curbs, gutters, construction joints and to pavement to be resurfaced. Application shall be in conformance with the provisions of Section 39 of the State Standard Specifications and shall be applied at the rate of not less than 0.10 gallons per square yard.

Prime coat shall be applied to all aggregate base surfaces to receive asphalt concrete. Application shall be in conformance with the provisions of Section 39 of the State Standard Specifications and shall be applied at the rate of not less than 0.15 gallons per square yard.

A fog seal coat shall be applied to the finished surface of the asphalt concrete. Paint binder, SS1, shall be applied to the surface of the pavement in conformance with the provisions of Section 37 of the State Standard Specifications. The application rate shall be 0.10 gallons per square yard. Provisions shall be made by the Contractor, to keep traffic from "tracking" the fresh fog seal until it has cured.

D. MEASUREMENT AND PAYMENT

No measurement of liquid asphalt (prime coat) or asphaltic emulsion (paint binder) will be made. Payment for furnishing and applying liquid asphalt and asphaltic emulsion shall be included in the prices bid for asphalt concrete, and no separate payment therefor will be made. Payment will be made at the contract prices per ton for asphalt concrete, which shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and applying prime coat and paint binder, and in furnishing, spreading and compacting asphalt concrete, and applying a fog seal.

A. SCOPE

This heading covers the furnishing, placement and compaction of asphalt concrete paving material, complete.

B. MATERIALS

ASPHALT CONCRETE shall be 1/2-inch maximum size, medium grading, Type B, conforming to the requirements of Section 39 of the State Standard Specifications.

C. WORKMANSHIP

Asphalt concrete shall be placed, spread and compacted in conformance with the provisions of Section 39 of the State Standard Specifications. Asphalt concrete shall be spread in one operation with a self-propelled spreader ready for compaction without further shaping. Compaction shall be performed with power rollers equivalent to tandem rollers weighing not less than 8 tons.

Asphalt concrete shall be finished 0.02-foot above existing gutters. In no case shall the asphalt concrete be lower than the edge of the gutter.

At lines of conformance to existing paving the finish course shall be feather-edged to provide a smooth transition to existing paving.

A fog seal coat shall be applied to the finished surface of the asphalt concrete. Paint binder, SS1, shall be applied to the surface of the pavement in conformance with the provisions of Section 37 of the State Standard Specifications. The application rate shall be 0.10 gallons per square yard. Provisions shall be made by the Contractor, to keep traffic from "tracking" the fresh fog seal until it has cured.

D. MEASUREMENT AND PAYMENT

Measurement of asphalt concrete will be made on the basis of weight, as determined by scale weight of each load of material, in accordance with the provisions of Section 9-1.01 of the State Standard Specifications.

Payment for furnishing and applying liquid asphalt and asphaltic emulsion shall be included in the prices bid for asphalt concrete, and no separate payment therefor will be made. Payment will be made at the contract prices per ton for asphalt concrete, which shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and applying prime coat and paint binder, and in furnishing, spreading and compacting asphalt concrete, and applying a fog seal.

A. SCOPE

This heading covers concrete work, complete.

B. MATERIALS

PORTLAND CEMENT shall be Type II and conform to ASTM Specification C150. All cement shall be protected from moisture until used.

CONCRETE AGGREGATES:

GENERAL: Concrete aggregate shall conform to ASTM Specification C33. The sieves used in Sieve Analysis shall be square mesh wire cloth. Both coarse and fine aggregate shall be tested for soundness by ASTM Method C88 when in the judgment of the Engineer such tests are necessary to determine the quality of the materials.

FINE AGGREGATE shall consist of natural sand having hard, strong and durable particles. It shall not contain more than 2 percent by weight of clay, shale, schist, alkali, or other deleterious substances. The grading of fine aggregate shall range uniformly from coarse to fine.

COARSE AGGREGATE shall consist of clean, hard, sound crushed rock or washed gravel. It shall not contain more than 2 percent by weight of clay, shale, schist, alkali, or other deleterious substances. The grading of coarse aggregate shall range uniformly from coarse to fine.

STORAGE: Fine and coarse aggregate shall be stored and measured separately. Aggregate shall be stored on the job so that various sizes do not become intermixed. They shall be protected from contamination with dust, dirt, or other foreign materials.

MOISTURE CONTENT of aggregate shall be such that no visible separation of moisture and aggregate will take place during transportation from the proportioning plant to the point of mixing. Aggregate containing excess moisture shall be stockpiled prior to use and sufficiently dried.

VARIATIONS in moisture content shall not exceed one percent of the weight of the aggregate in a saturated surface dry condition. Variations in specific gravity of any group of sizes shall not exceed one percent. Variations in grading of separate groups of sizes of aggregate shall not exceed 5 percent. Variations exceeding these maximums shall constitute cause for delaying the use of the materials until batch weights and mixing water can be adjusted.

AGGREGATE SIZE: The primary size of aggregate specified and used on any project shall be the maximum consistent with the dimensions and form of the section being placed, the location and spacing of the reinforcing bars, and with the method of compaction, but shall not be less than 3/4 inch.

WATER shall be clean and free of oil, acid, alkali, organic matter or other deleterious substances.

REINFORCING STEEL:

BARS shall be of intermediate grade steel and shall conform to ASTM Specification A615. All bars shall be deformed and deformations shall conform to ASTM Specification A615.

WELDED WIRE FABRIC OR MESH shall conform to ASTM Specification A185.

ADMIXTURES shall be used only where specifically required or where written approval has been granted by the Engineer. Concrete for curbs, gutters and sidewalks shall contain 0.5 pound of lampblack per cubic yard.

EXPANSION JOINT FILLER shall be of the preformed nonextruding type and shall conform to ASTM Specification D544, Type V, bituminous fibre, and shall be the full depth of the abutting concrete.

C. WORKMANSHIP

REINFORCING STEEL:

PLACEMENT: Unless an exception is made in writing by the Engineer, the Contractor shall submit for approval detailed drawings showing bending and placing of all reinforcing steel and shall not begin work until the drawings have been approved by the Engineer.

Steel reinforcement shall be accurately placed and positively secured and supported by concrete blocks, metal chairs, spacers, or by metal hangers. The clear spacing between parallel bars shall not be less than 1.50 times the nominal diameter for round bars, but in no case shall the clear distance be less than 1.50 inches nor less than 1.33 times the maximum size aggregate. Reinforcing steel shall be in position before concreting is begun.

Steel shall not be bent nor straightened in a manner that will injure the materials. Kinked bars shall not be used. Heating of steel for bending shall not be permitted.

All steel dowels must be placed and securely anchored before concrete is poured.

Reinforcing shall not be placed in slabs and beams until after the concrete in the walls and columns has been placed, unless specifically indicated on drawings.

SPLICING: In slabs, beams, and girders, splices at the points of maximum stress shall be avoided. Bars in horizontal members shall have a maximum lap at splices sufficient to develop the strength of the bars. Wherever possible, splices of adjacent bars shall be staggered. Unless stress governs, the splice of wire fabric shall be at least one mesh wide. Spliced bars in walls may be either separated or wired together. Deformed bars shall be lapped 24 bar diameters.

CLEANING REINFORCEMENT: Steel shall be cleaned of any oil, grease, rust, concrete or other deleterious substances before it is placed in the forms. Any deleterious substances that get on the steel after placing shall be removed before pouring concrete.

CONCRETE PROPORTIONING AND MIXING:

PROPORTIONS: Amounts of cement and water and strength requirements shall be as follows:

(1) Class of Concrete	Class A	Class B	Class C
(2) Minimum Cement per cubic yard concrete	6 Sks.	5 Sks.	4.2 Sks.
(3) Maximum total water per sack of cement including free moisture	54 Lbs.	62 Lbs.	
(4) Minimum compressive strength at 28 days	3000 psi	2500 psi	2000 psi

The class of concrete used shall be specified on the drawings. However, if no class is shown, Class A concrete shall be used.

Concrete to be used for curbs, gutters and sidewalks shall contain 0.5 pound of lampblack per cubic yard of concrete.

Cement shall be measured in the sack or weighed; broken sacks will not be allowed unless cement is batched by weight. Aggregate shall be proportioned by weight.

Proportions of fine and coarse aggregate shall be furnished by the Engineer or by an approved testing laboratory, and may be varied from time to time by the Engineer to produce a smooth, dense, workable mixture that will work readily into corners and angles without excessive spading or vibrating.

AMOUNT OF WATER AND SLUMP TEST: The amount of water required for the proper consistency of concrete shall be determined by means of the slump test, made in accordance with ASTM Method C143.

The amount of water given in the above table is a maximum. The maximum allowable slump shall be as follows:

(1) Thin sections and columns	Not more than 5"
(2) Heavy sections, footings & slabs	Not more than 3"
(3) Concrete placed under water	Not more than 8"
	Not less than 6"

The amount of water may be varied in accordance with the dampness of the materials and the requirements of the workability of the aggregate within the limits of the slump tests given above.

MEASURING WATER: The equipment for measuring and supplying the water to the mixer shall be so constructed and arranged that the amount of water to be added to the mixture can be measured positively and that the predetermined quantity of water required can be discharged rapidly in one operation into the mixing drum. The equipment shall be designed so that water from the source of supply cannot enter the measuring tank while the water is being discharged from the measuring tank into the mixer. Tanks or other equipment for measuring and discharging water into the mixer shall be sufficiently accurate that the amount of water delivered to the mixer for any batch shall not vary more than one percent from the required quantity of water for any position of the mixer. The tanks or other equipment shall be arranged to permit checking the amount of water delivered by discharging into measured containers.

JOB MIXING: The capacity of the mixer shall be adequate to handle one or more full sack batches. No split sack batches will be permitted, unless all materials are weighed. At no time shall the mixer be loaded beyond its capacity. The capacity of the mixer shall be considered to be the rated capacity as given in the manufacturer's catalog, provided that a quantity equal to the rated capacity can be thoroughly mixed in the prescribed time period and that there is no loss of ingredients during the mixing. Each batch shall be mixed not less than 1.50 minutes after all ingredients are in the mixer and until the mixture is uniform and homogeneous. It shall be completely discharged. The peripheral speed of concrete mixing drums shall be approximately 200 feet per minute. The mixer shall be equipped with an automatic time lock on the discharge control arranged to start the time cycle on the stroke of the material skip or on the closing of the hopper gate.

TRANSIT MIXING: Transit-mixed concrete shall be in accordance with ASTM C94 and be of not less than 10 minutes at a peripheral drum speed of approximately 200 feet per minute. Mixing shall be continued until discharge is complete. At least three minutes of the mixing period shall be at the job site. The transit mixer shall be equipped with water measuring devices consisting of either accurately calibrated water tanks or water meters. Transit-mixed concrete will be rejected if not placed within 1.50 hours after water is first added to the batch.

Should the Contractor elect to utilize transit mixing equipment he shall make advance arrangements to prevent delays in delivery and placing of the concrete. An interval of more than 45 minutes between any two consecutive batches or loads, or a delivery and placing rate of less than 8 cubic yards of concrete per hour, shall constitute cause for shutting down the work for the remainder of the day, and if so ordered by the Engineer, the Contractor shall make, at his own expense, a construction joint at the location and of the type directed by the Engineer in the concrete already placed.

FORMS shall conform to the shape, lines and dimensions called for on the Plans and shall be substantial and mortar tight. All vertical surfaces shall be formed, except where specifically authorized to the contrary. Temporary openings at the bottom of the wall forms and temporary openings at the base of all columns and piers shall be provided as required for cleaning and to facilitate inspection.

Drip beads, feature grooves and other concrete details shall be carefully formed with surfaced material which shall be thoroughly coated with oil or other approved products before concrete is poured. Method of forming shall be selected for ease of stripping without damage to details. All exterior corners shall be chamfered 3/4 inch unless otherwise specifically shown.

Bolts or form clamps shall be of sufficient strength and number to prevent spreading of forms. They shall be of a type which can be entirely removed or cut back one inch below the finished surface of the concrete. All forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten to such wales. Forms shall be so constructed that side forms where surface finishing is required can be removed without disturbing supporting forms.

Where woodwork comes into contact with concrete, proper anchors shall be provided. End studs of frame walls shall be bolted and dovetailed nailing blocks shall be provided for trim and other woodwork. Anchors in jambs of openings shall be spaced not more than two feet on centers.

Anchor bolts shall be positively positioned and anchored in the forms with templates and checked by the Engineer before concrete is poured.

If there is any question regarding the strength of forms, the recommendations of the manufacturer of the form ties shall be followed.

Non-supporting forms may be removed in 48 hours and supporting forms in not less than 21 days unless approval for earlier removal is granted by the Engineer. Forms shall be carefully removed so as not to endanger the structure or damage the surface.

CONCRETE CONVEYING AND DEPOSITING: Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation or loss of material. Concrete shall not be deposited in a manner which shows segregation to occur, and shall be deposited as nearly as practicable in its final position to avoid segregation during rehandling.

No concrete which has partially hardened or been contaminated by foreign material shall be deposited on the work, nor shall retempered concrete be used. When concreting is started it shall be carried on as a continuous operation until the section is completed, maintaining the top surface level.

All concrete shall be compacted with mechanical vibrators in a manner satisfactory to the Engineer. At least two satisfactory vibrators shall be on the job during every pour and more if required by the Engineer. If it is deemed necessary by the Engineer, surfaces that are to be exposed shall be spaded and hammered to obtain a good surface. Concrete shall not be permitted to fall from a height greater than 6 feet without the use of adjustable length pipes or "elephant trunks." The use of chutes in conveying and depositing concrete will be allowed only at the discretion of the Engineer, and wherever they are used, they shall be laid at an inclination that will permit the flow of concrete of the required consistency. Where necessary to prevent separation, chutes shall be provided with baffle boards or a reversed section at the outlets. Columns shall be poured through pipes of adjustable length and not less than 6 inches in

diameter. The use of additional water in mixing the concrete to promote free flow in chutes of low inclination will not be allowed.

For columns and walls, concrete shall be allowed to set at least 4 hours before caps, girders, floor slabs, or other connecting members are poured so that the column may obtain its shrinkage before the superstructure is placed.

Where it is necessary to deposit concrete under water, concrete shall be placed by use of a tremie tube. Care shall be exercised to see that the lower end of the tremie tube does not rise above the surface of the concrete during the pour, to avoid contamination with water. Depositing of concrete under water shall be permitted only with the approval of the Engineer, where it is not possible to de-water.

COLD WEATHER WORK: Concrete shall not be mixed nor placed while the atmospheric temperature is at or below 35° Fahrenheit unless means are employed to heat the aggregate and water, and satisfactory provisions have been made for protecting the work. All concrete shall be effectively protected from frost action for a period of five days after placing and will not be accepted before the expiration of a thirty day period during which the temperature of the concrete does not fall below 40° Fahrenheit.

The concrete shall be maintained at a temperature of at least 50° Fahrenheit for not less than 72 hours after placing or until it has thoroughly hardened.

The temperature of the concrete as it leaves the mixer shall not be less than 50° Fahrenheit, nor more than 120° Fahrenheit. Upon written notice from the Engineer, all concrete which may have become damaged by frost action shall be replaced by the Contractor at his own expense.

CONSTRUCTION JOINTS AND EXPANSION JOINTS: Construction joints in structural concrete shall be level or vertical and shall be of the type and location as the Engineer directs or as shown on the Plans. Joints not indicated on the Plans shall be so made and located as to least impair the strength of the structure and shall conform to the typical details.

The horizontal surface of all construction joints shall be cleaned and roughened by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix in accordance with the following procedure. The contact surface must be thoroughly cleaned by chipping or sand blasting the entire surface not earlier than 5 days after initial pour or by an approved method that will assure equal bond such as a thorough hose washing of the surface not less than 2 nor more than 4 hours after the concrete is placed (depending on setting time). All wash and chalklike material shall be entirely cleaned from the surface.

In the event that the contact surface becomes coated with earth, sawdust, etc., after being cleaned, the entire surface so coated shall be recleaned.

All construction joints shall be slushed with neat cement grout immediately ahead of the pour.

Water stops shall be installed in construction joints where shown on the Plans. Where no construction joint is shown on the Plans, but is permitted by the Engineer, water stops shall be installed as directed by the Engineer.

Unreinforced slabs, walks, curbs, etc., shall have construction joints at not to exceed 15-foot centers and expansion joints at not to exceed 30-foot centers. Reinforced slabs, walks, curbs, etc., shall have construction joints at not to exceed 20-foot centers and expansion joints at 40-foot centers. Expansion joint material shall be placed along all walls and around each column and projection.

CONCRETE FINISHING:

STRUCTURES: Forms shall be removed as soon as permissible and, immediately thereafter, tie rod holes, rock pockets, and other defects shall be chipped to expose sound aggregate and mortar and then shall be dashed with neat cement paste and dry packed with moistened 1 to 2 cement sand mortar thoroughly tamped in.

After patches have thoroughly hardened, surfaces that are to be exposed or painted in the finished structures shall be rubbed mechanically or by hand with carborundum stones to eliminate traces of forms and patch work. A brush coat of thin cement mortar consisting of one part cement and one part sand that will pass a No. 16 screen or at the option of the Engineer a neat cement wash shall be applied if necessary to give a uniform appearance. In either case, five percent calcium chloride shall be used. When the cement film has set sufficiently so that the sand particles and cement will not draw out of surface pin holes, but before final set has taken place, the entire surface shall be rubbed with fine carborundum stones (No. 25 to No. 30) until a smooth, even surface of even texture, color and appearance is obtained. No greater amount of mortar shall be applied in advance of rubbing than can be completely rubbed before final setting takes place. Immediately following the rubbing process, the finished surface shall be thoroughly washed with water.

SLABS, WALKS, STEPS, CURBS and GUTTERS: After concrete for slabs or sidewalks has been placed between the side forms, a strikeoff guided by the side forms shall be used to bring the surface to the proper section to be compacted. After screeding off, the surface shall be tamped with a heavy tamper consisting of a grid of metal bars until a layer of mortar not less than 3/8-inch thick has been brought to the surface.

The surface shall be rescreeded to a true surface, worked with a wood float as settling progresses and troweled with a steel trowel a sufficient number of times to produce a smooth, hard finish. After troweling, the surface shall be broomed if required. Care shall be taken to obtain a true surface on slabs, especially at walls and joints. Slab surfaces shall not vary more than 1/4-inch at any point from an 8-foot straight edge. The use of topping or dusting with dry cement and sand shall not be permitted unless it is desired to apply an integral color. No more slabs shall be poured in one day than can be finished to a satisfactory surface.

If colored slabs are called for in the Plans, the finish shall be as specified except that the coloring shall be applied in the finished process in strict accordance with the Manufacturer's directions.

Treads of steps and stairs shall be worked with a wood float to an even surface, troweled to a smooth surface with a steel trowel and given a light brush finish. Use of topping or dry cement and sand will not be permitted. Edges and corners shall be rounded and the tread shall be scored with not less than four grooves the length of all treads near the edge. Forms on risers

and other exposed vertical surfaces shall be removed not more than six hours after concrete has been placed. Risers and vertical surfaces shall be brushed with grout and troweled smooth or finished as directed by the Engineer.

Curbs and gutters shall be screeded to true cross section and grade. The screed shall be operated parallel to the line of the curb. The surface shall then be worked with a wood float as setting progresses, troweled smooth and given a fine brush finish parallel to the line of the curb. Corners shall be rounded. The forms on the face of the curb shall be removed not more than 6 hours after concrete has been placed. The face shall be brushed with grout, troweled smooth and brushed to match the rest of the curb. The face of the finished curb shall be true and straight and the top surface of the curb and gutter shall be of uniform height and free from irregularities. The surface shall not vary more than 1/8-inch from the edge of a 10-foot straight edge except at grade changes and curves.

CURING: All concrete shall be protected from injury and shall be kept continuously wet for a period of ten days after pouring. The use of curing compounds will not be permitted without the approval of the Engineer.

Concrete slabs and walks shall be covered with "Sisal-Kraft" paper, sand, or sawdust as soon as they are hard enough to walk on and shall be kept continuously wet for ten days after pouring. Care shall be taken to prevent exposed slabs from becoming stained.

D. TESTS

During progress of the work, compression tests shall be made at the discretion of the Engineer of samples of the concrete using the molded cylinder method. Materials for the samples will be furnished at the expense of the Contractor. Testing will be done by the City or authorized laboratory at the expense of the Owner.

E. MEASUREMENT AND PAYMENT

No separate measurement of concrete work will be made. Payment for all work under this section shall be included in the payment made for the structure or item containing or constructed of the concrete.

A. SCOPE

This section covers pipe and fittings for storm drains, complete.

B. MATERIALS

REINFORCED CONCRETE PIPE shall be integral bell and spigot pipe conforming to ASTM Specification C76 Class 3 "A" Wall design, with rubber gasket joints conforming to ASTM Specification C443.

Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations compatible with that of the pipe.

CORRUGATED HIGH DENSITY POLYETHYLENE PIPE shall conform to ASTM Specification D2321, D2412, F405 and F667, and Section 64 of the State Standard Specifications. Provision must be made for contraction and expansion at each joint with a neoprene gasket.

Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations compatible with that of the pipe.

Minimum "pipe stiffness" at 5% deflection shall be in accordance with Section 64 of the State Standard Specifications for all sizes when tested in accordance with ASTM Test Method D2412.

Maximum pipe deflection shall not exceed 5% of the nominal manufacturer's average inside pipe diameter, and shall be determined as specified in the paragraph of this specification entitled, "PIPE DEFLECTION TESTING."

DUCTILE IRON PIPE: Pipe shall be Class 50 minimum ductile iron pipe conforming to AWWA Specification C151. Pipe shall be bell and spigot with "push-on" rubber gasket joints conforming to AWWA Specification C111, unless otherwise specified. Pipe shall be cement-mortar lined in conformance with AWWA Specification C104 and bituminous coated.

Fittings shall comply with AWWA Specification C110, and shall be cement-mortar lined and bituminous coated as specified above. Fittings shall be supplied with bell and/or spigot configurations compatible with that of the pipe.

C. WORKMANSHIP

PREPARATION OF THE TRENCH: The trench shall be prepared to receive the pipe as specified in the section of these specifications entitled, TRENCH EXCAVATION AND BACKFILL. The excavation and preparation of the trench shall be completed a sufficient distance in advance of the pipe laying to prevent dislodged material from entering the pipe.

INSTALLATION OF THE PIPE: Before lowering into the trench, the pipe shall be inspected for defects, and all cracked or broken pipe shall be discarded. The ends and interior of the pipe shall be clean. Handling of the pipe shall be accomplished in a manner that will not damage the pipe.

At manholes, pipe shall be installed so that there is a joint at or not more than two feet from the manhole wall.

After lowering the pipe into the trench, the bell or coupling end and spigot shall be cleaned of any foreign matter and a suitable lubricant applied to the joint. The joint shall be made in the manner recommended by the manufacturer. Care shall be taken not to buckle or disturb previously laid pipe.

Each joint shall be inspected to insure that it is properly made before backfilling. Care shall be taken to prevent any dirt or foreign matter from entering the open end of the pipe. Where it is necessary to cut pipe, such cuts shall be neatly made. **The laid pipe shall be true to line and grade and, when complete, shall have a smooth and uniform invert, within ±0.02 foot vertically and ±0.05 foot horizontally of the Plan alignment and grade.**

BACKFILLING THE TRENCH: After the laid pipe has been inspected and approved by the Engineer, the trench shall be backfilled as required under the section of these specifications entitled TRENCH EXCAVATION AND BACKFILL.

CLEANING STORM DRAINS: The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last inlet or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first inlet or manhole where its presence is noted. In the event cemented or wedged debris, or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction.

D. PIPE DEFLECTION TESTING

If flexible pipe material is used, the pipe installation shall be tested for excessive deflection after all backfill and resurfacing materials have been placed and the line has been cleaned.

A mandrel having an outside diameter of 95% of the average manufactured internal diameter shall be pulled through the pipeline. If the mandrel does not pass freely through the pipe, the pipe shall be re-excavated, bedded and backfilled to adequately support the pipe and reduce the pipe deflection to 5% or less. The pipeline shall then be retested for deflection.

E. MEASUREMENT AND PAYMENT

The length of storm drain pipe and fittings will be measured horizontally in feet, along the centerline of the pipe from the ends of pipes to the centerline of inlets or manholes, or from centerline of inlet or manhole to centerline of inlet or manhole. Payment will be made at the unit prices bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools, and equipment required to excavate and backfill trenches, install storm drain pipe and fittings, and all appurtenances required for a complete installation, including testing, ready to operate.

A. SCOPE

This section covers the construction of storm drain manholes, drop inlets, field inlets, junction drop inlets, and junction boxes complete.

Excavation and backfill at manholes shall conform to the requirements of the section entitled, TRENCH EXCAVATION AND BACKFILL.

B. MATERIALS

CAST-IN-PLACE CONCRETE: All materials used in cast-in-place concrete shall be Class B concrete in accordance with the applicable portions of Sections 51 and 90 of the State Standard Specifications.

PRECAST CONCRETE MANHOLE SECTIONS: All precast sections, including riser sections, cones, grade rings, and flat slab tops, shall conform to ASTM C478, and the dimensions shown on the Standard Details. Cones shall be eccentric. Grade rings shall be a standard product, manufactured particularly for use in manhole construction, sized to fit the cones on which they are to be placed, and the wall thickness shall not be less than that of the cones. Grade rings shall be not less than 2 inches, nor more than 6 inches high. All precast components shall have tongue and groove ends.

All manhole construction materials shall be approved in advance by the Engineer. Precast manhole bases, including connection details, will require specific advance approval. Neoprene "boots" are not acceptable for connections to the manhole bases.

MANHOLE FRAMES AND COVERS: Principal dimensions shall be as shown on the Standard Details. Iron castings shall conform to ASTM A48, Class 30. Each cover shall have the words "STORM DRAIN" cast into the top with 2-inch high letters. Castings shall be of consistently high quality, and shall be free of material and manufacturing defects. Following cleanup and final machining, an asphaltic paint or similar protective coating shall be applied.

Covers shall have at least one blind pick hole or recessed lifting lug. Horizontal bearing surfaces shall be machined to smooth, plane surfaces providing for full contact between the frame and cover.

The minimum weight of the frame shall be 135 pounds.

HEAVY DUTY COVERS: Unless otherwise indicated on the Plans, covers shall be designed for heavy traffic duty and conform to the following minimum requirements:

Cover weight shall be not less than 130 pounds. Strength of the cover shall be verified by load tests. Load testing of covers shall be done by a recognized independent testing laboratory. The cover shall support a minimum load of 40,000 pounds applied at the center of the cover over a maximum bearing area of 50 square inches. During testing, the cover shall be supported in the same way as it would be under normal service conditions.

LIGHT DUTY COVERS: Light duty covers shall be bolt-down, pressure manhole type, and shall be used only where specifically called for on the Plans. Covers shall be fastened to the frame with a minimum of four stainless steel bolts and shall be gasketed for a watertight seal. Cover weight shall not be less than 125 pounds.

DROP INLET FRAMES AND GRATES: Frame and grate assemblies for drop inlets and field inlets shall conform to the Standard Details.

JOINT SEALING COMPOUND COMPONENTS shall be RAM-NEK primer and joint sealing compound, KENT-SEAL primer and joint sealant, or approved equal.

MANHOLE WATER STOPS shall be installed on PVC or ABS sewer pipe with stainless steel bands to make a watertight seal between the pipe wall and the concrete manhole base.

MORTAR shall be proportioned with one part portland cement to two parts clean, well-graded sand which will pass a 1/8-inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: Hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the surfaces. Mortar mixed for longer than 30 minutes shall not be used.

C. WORKMANSHIP

CAST-IN-PLACE CONCRETE: Concrete work shall conform to the Standard Details and the applicable portions of Sections 51 and 90 of the State Standard Specifications.

GENERAL CONSTRUCTION: Manholes and drop inlets shall be constructed only when the temperature is above 32° Fahrenheit. All work shall be protected against freezing. Water shall be removed from the excavation and the excavation maintained "dry" during construction of the manhole and during the time required for the concrete or mortar to develop sufficient strength to resist rupture by groundwater pressure. All pipes connected to manholes or drop inlets shall have a joint within 2 feet of the structure wall.

The subgrade for the manhole or drop inlet base shall be carefully prepared to provide a firm support for the structure, and prevent future settlement of the manhole or drop inlet. Particular care shall be taken with deep manholes and structures located in wet locations.

Pipe invert grades at storm drain manholes and drop inlets shall be set as shown on the Plans with an acceptable tolerance of ± 0.02 foot.

A groove shaped to match the tongue of the first precast concrete riser section of the manhole or drop inlet shall be formed in the base slab. A circular metal form suited to the particular precast manhole manufacturer's joint shall be used to form the groove.

Except as specified herein, all precast manhole sections shall be set in joint sealing compound. Joint sealing compound components shall be applied in the field. One brush coat of primer shall be applied to the tongue and groove surfaces to be sealed, then the preformed strip of sealing compound shall be pressed firmly to the dry, clean, primed joint surface (groove portion).

Precast sections shall be set evenly in a full bed of sealing compound. After the precast sections have been placed, the interior joint surface shall be trimmed smooth with a trowel or sharp tool to remove any excess joint compound projecting into the manhole.

Grade rings may be set with mortar if necessary for adjustment of the final frame elevation. Mortar joints shall not be more than 3/4-inch thick. Excess mortar shall be trimmed flush. The outside of each mortar joint shall be sealed with an approved bituminous sealing compound.

MANHOLE LEAKAGE TESTING: All manholes shall be tested for leakage by filling with water. Leakage shall not be greater than 0.15 gallons per day per square foot of interior surface area. All visible leaks shall be repaired.

INSTALLATION OF FRAMES AND COVERS NOT IN ROADWAYS: Frames and covers shall be joined to the top of the manhole or structure so that the cover or grate, when placed, will be at the proper elevation as shown on the Plans. The finish grade at the tops of manholes or field inlets will be established after the excavation has been backfilled and compacted to true subgrade.

INSTALLATION OF FRAMES AND COVERS IN ROADWAYS: Roadways are defined as the paved part of all roads, driveways, and parking areas, public or private, and in addition, the unpaved shoulders of public roads. Concrete collars shall be installed around frames of manholes in roadways. Installation shall be as shown on the Standard Details.

After completion of the manhole, all plugs shall be completely removed from the pipes and all loose material shall be removed from the manhole.

PIPE STUBS for future connections shall be not more than 2 feet long and shall be plugged with standard gasketed plugs.

D. MEASUREMENT AND PAYMENT

Measurement of storm drain manholes and drop inlets will be based upon the number of each installed.

Payment for storm drain manholes and drop inlets will be made at the unit prices bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools and equipment required to install the storm drain manholes and drop inlets, complete as shown on the Plans and as herein specified.

A. SCOPE

This section covers pipe and fittings for sanitary sewers, complete.

B. MATERIALS

PVC GRAVITY SEWER PIPE shall be integral bell and spigot pipe conforming to ASTM Specification D3033 or D3034, with a maximum dimensional ratio (DR) of 35. Provision must be made for contraction and expansion at each joint with a rubber ring gasket conforming to ASTM F477 and/or ASTM D3212.

Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations compatible with that of the pipe. As shown on the Plans, all laterals shall be either 4-inch or 6-inch diameter. All laterals shall be furnished with end caps which shall be adequately installed and/or braced to resist blowout or leakage during the watertightness tests.

Minimum "pipe stiffness" at 5% deflection shall be 46 psi for all sizes when tested in accordance with ASTM Test Method D2412.

Maximum pipe deflection shall not exceed 5% of the nominal manufacturer's average inside pipe diameter, and shall be determined as specified in the paragraph of this specification entitled, "PIPE DEFLECTION TESTING."

CONNECTIONS: Connections to pipe stubs of a different pipe material, if any, shall be made with a suitable connector. Connectors shall be equivalent to full-circle stainless steel repair clamps with appropriate adaptors, and must be approved by the Engineer prior to installation.

C. WORKMANSHIP

PREPARATION OF THE TRENCH: The trench shall be prepared to receive the pipe as specified in the section of these specifications entitled, TRENCH EXCAVATION AND BACKFILL. The excavation and preparation of the trench shall be completed a sufficient distance in advance of the pipe laying to prevent dislodged material from entering the pipe.

INSTALLATION OF THE PIPE: Before lowering into the trench, the pipe shall be inspected for defects, and all cracked or broken pipe shall be discarded. The ends and interior of the pipe shall be clean. Belled ends shall be laid upgrade. Handling of the pipe shall be accomplished in a manner that will not damage the pipe.

At manholes, pipe shall be installed so that there is a joint at or not more than two feet from the manhole wall.

After lowering the pipe into the trench, the bell or coupling end and spigot shall be cleaned of any foreign matter and a suitable lubricant applied to the joint. The joint shall be made in the

manner recommended by the manufacturer. Care shall be taken not to buckle or disturb previously laid pipe.

Each joint shall be inspected to insure that it is properly made before backfilling. Care shall be taken to prevent any dirt or foreign matter from entering the open end of the pipe. Where it is necessary to cut pipe, such cuts shall be neatly made. The laid pipe shall be true to line and grade and, when complete, the sewer shall have a smooth and uniform invert, within ±0.02 foot vertically and ±0.05 foot horizontally of the Plan alignment and grade.

Connections to pipe stubs of a different pipe material, if any, shall be made with a suitable connector. Connectors shall be equivalent to full-circle stainless steel repair clamps with appropriate adaptors, and must be approved by the Engineer prior to installation.

WYES AND LATERALS: The exact location of new laterals, if any, will be set in the field by the Engineer. Wye branches shall be fully supported by firm material. Pipe and bends shall be installed to the same standards as specified above. Plugs shall be installed at the ends of all laterals, and be adequately braced to withstand the watertightness tests without being dislodged or leaking. Lateral locations shall be marked with a redwood stake as shown on the Plans.

PLUGGING EXISTING SEWER: Existing sewers which are shown on these plans as PLUG END OF EXISTING SEWER PIPE, shall be cut to a neat straight perpendicular end and be plugged watertight with concrete and must be approved by the Engineer prior to installation and backfilling and be subject to all requirements of these specifications.

BACKFILLING THE TRENCH: After the laid pipe has been inspected and approved by the Engineer, the trench shall be backfilled as required under the section of these specifications entitled TRENCH EXCAVATION AND BACKFILL.

CLEANING SEWERS: The pipe shall be cleaned in the following manner:

The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris, or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction.

D. WATERTIGHTNESS TEST

GENERAL: Tests for watertightness shall be made by the Contractor in the presence of the Engineer. The Contractor shall furnish all labor, tools, materials, and equipment required to make the tests. No testing for final acceptance of pipe will be done until the trench has been fully backfilled and acceptably compacted to finish grade, or if the sewer is under pavement, to the pavement subgrade.

All sections of pipe shall be tested, and tests shall be made from manhole to manhole. The sewer shall be complete with laterals installed, lateral plugs adequately braced, and trenches backfilled prior to testing.

Where leakage is in excess of the specified rate, the sewer shall immediately be uncovered and the amount of leakage reduced by the Contractor to a quantity within the specified rate before the sewer is accepted. In addition, the Contractor shall repair all visible leaks.

The Engineer will determine whether the test is to be by exfiltration or by infiltration. In most instances an exfiltration test will be required. Exfiltration tests shall be made with air except where the use of water is approved by the Engineer.

EXFILTRATION TEST:

AIR TESTING shall be done immediately following cleaning of the pipe. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 psi greater than the average back pressure of any groundwater that may submerge the pipe. At least 2 minutes shall be allowed for temperature stabilization.

The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease from 3.0 to 2.5 psi greater than the average back pressure of any groundwater that may submerge the pipe.

The pipeline shall be considered acceptable when tested at an average pressure of 2.75 psi greater than the average back pressure of any groundwater that may submerge the pipe, if the section under test does not lose air at a rate greater than 0.0010 cubic feet per minute per square foot of internal pipe surface. Test time in seconds = 36.3 times the internal diameter of the pipe in inches.

TESTING WITH WATER shall be done by filling the upper manhole with water to a depth of at least 3 feet over the top of the pipe or groundwater level, whichever is higher, with the end plugged at the lower manhole. The rate of leakage shall be determined by measuring the amount of water required to maintain the water level in the upper manhole. The test shall be maintained for a period of at least 2 hours. The Engineer may, at his discretion, require a longer test period. Leakage shall not be in excess of the rate of 20 gallons per inch of pipe diameter per 1,000 feet of pipe per day.

INFILTRATION TEST: In the event that sufficient groundwater is present, an infiltration test may be made. In this case, the pipe shall be tested for watertightness by installing plugs at the upper end of the pipe and at the lower end on the exit side of a manhole. The rate of leakage will be determined by periodically removing and measuring the water accumulated at the lower manhole. Leakage shall not be in excess of the rate specified for water testing by exfiltration.

E. PIPE DEFLECTION TESTING

If flexible pipe material is used, the pipe installation shall be tested for excessive deflection after all backfill and resurfacing materials have been placed and the line has been cleaned.

A mandrel having an outside diameter of 95% of the average manufactured internal diameter shall be pulled through the pipeline. If the mandrel does not pass freely through the pipe, the pipe shall be re-excavated, bedded and backfilled to adequately support the pipe and reduce the pipe deflection to 5% or less. The pipeline shall then be retested for both deflection and watertightness.

F. MEASUREMENT AND PAYMENT

The length of sewer pipe and fittings will be measured horizontally in feet, along the centerline of the pipe from the ends of pipes to the centerline of manholes, or from centerline of manhole to centerline of manhole. Payment will be made at the unit prices bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools, and equipment required to locate existing sewer laterals, excavate and backfill trenches, install sewer pipe and fittings, and all appurtenances required for a complete installation, including testing, ready to operate.

The number shall be determined and payment for connection to existing sewer pipe shall be at the unit prices bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools, equipment, fittings and all appurtenances required for a complete connection, including testing, ready to operate.

A. SCOPE

This section covers sewer lateral pipe and fittings, complete.

B. MATERIALS

PVC LATERAL SEWER PIPE shall be integral bell and spigot pipe conforming to ASTM Specification D3033 or D3034, with a maximum dimensional ratio (DR) of 35. Provisions must be made for contraction and expansion at each joint with a rubber ring gasket conforming to ASTM F477 and/or ASTM D3212.

Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations compatible with that of the pipe.

CONNECTIONS: Connections to pipe stubs of a different pipe material, if any, shall be made with a suitable connector. Connectors shall be stainless steel repair clamps with appropriate adaptors, similar and equal to Romac Industries, Inc., SS1 Transition Clamp Coupling for Sewer.

C. WORKMANSHIP

PREPARATION OF THE TRENCH: The trench shall be prepared to receive the pipe as specified in the section of these specifications entitled TRENCH EXCAVATION AND BACKFILL. The excavation and preparation of the trench shall be completed a sufficient distance in advance of the pipe laying to prevent dislodged material from entering the pipe.

INSTALLATION OF THE PIPE: Pipe installation shall be in strict accordance with the manufacturer=s instructions and recommendations, the Plans and this Section.

Before lowering into the trench, the pipe shall be inspected for defects, and all cracked or broken pipe shall be discarded. The ends and interior of the pipe shall be clean. Handling of the pipe shall be accomplished in a manner that will not damage the pipe.

After lowering the pipe into the trench, the bell or coupling end and spigot shall be cleaned of any foreign matter and a suitable lubricant applied to the joint. The joint shall be made in the manner recommended by the manufacturer. Care shall be taken not to buckle or disturb previously laid pipe.

Each joint shall be inspected to insure that it is properly made before backfilling. Care shall be taken to prevent any dirt or foreign matter from entering the open end of the pipe. Where it is necessary to cut pipe, such cuts shall be neatly made. The laid pipe shall be true to line and grade and, when complete, the sewer lateral shall have a smooth and uniform invert, within 0.02 foot vertically and $\pm$0.05 foot horizontally of the Plan alignment and grade. Where it is necessary to cut pipe, such cuts shall be neatly made. Connections to pipe stubs of a different pipe material, if any, shall be made with a suitable connector. Connectors shall be equivalent to

full-circle stainless steel repair clamps with appropriate adaptors, and must be approved by the Engineer prior to installation.

BACKFILLING THE TRENCH: After the laid pipe has been inspected and approved by the Engineer, the trench shall be backfilled as required under the section of these specifications entitled TRENCH EXCAVATION AND BACKFILL.

D. MEASUREMENT AND PAYMENT

Measurement of existing sewer laterals removed and replaced will be based upon the number removed and replaced. Payment for all work under this section shall be made at the unit price bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools, and equipment required to excavate trenches, remove existing sewer lateral pipe and fittings, install new sewer lateral pipe and fittings, backfill trenches and install all appurtenances required for a complete installation, ready to operate.

A. SCOPE

This section covers the construction of sewer manholes and rodholes, complete.

Excavation and backfill at manholes shall conform to the requirements of the section entitled, TRENCH EXCAVATION AND BACKFILL.

B. MATERIALS

CAST-IN-PLACE CONCRETE: All materials used in cast-in-place concrete shall be Class B concrete in accordance with the applicable portions of Sections 51 and 90 of the State Standard Specifications.

PRECAST CONCRETE MANHOLE SECTIONS: All precast sections, including riser sections, cones, grade rings, and flat slab tops, shall conform to ASTM C478, and the dimensions shown on the Standard Details. Cones shall be eccentric. Grade rings shall be a standard product, manufactured particularly for use in manhole construction, sized to fit the cones on which they are to be placed, and the wall thickness shall not be less than that of the cones. Grade rings shall be not less than 2 inches, nor more than 6 inches high. All precast components shall have tongue and groove ends.

All manhole construction materials shall be approved in advance by the Engineer. Precast manhole bases, including connection details, will require specific advance approval. Neoprene "boots" are not acceptable for connections to the manhole bases.

MANHOLE FRAMES AND COVERS: Principal dimensions shall be as shown on the Standard Details. Iron castings shall conform to ASTM A48, Class 30. Each cover shall have the word "SEWER" cast into the top with 2-inch high letters. Castings shall be of consistently high quality, and shall be free of material and manufacturing defects. Following cleanup and final machining, an asphaltic paint or similar protective coating shall be applied.

Covers shall have at least one blind pick hole or recessed lifting lug. Horizontal bearing surfaces shall be machined to smooth, plane surfaces providing for full contact between the frame and cover.

The minimum weight of the frame shall be 135 pounds.

HEAVY DUTY COVERS: Unless otherwise indicated on the Plans, covers shall be designed for heavy traffic duty and conform to the following minimum requirements:

Cover weight shall be not less than 130 pounds. Strength of the cover shall be verified by load tests. Load testing of covers shall be done by a recognized independent testing laboratory. The cover shall support a minimum load of 40,000 pounds applied at the center of the cover over a maximum bearing area of 50 square inches. During testing, the cover shall be supported in the same way as it would be under normal service conditions.

LIGHT DUTY COVERS: Light duty covers shall be bolt-down, pressure manhole type, and shall be used only where specifically called for on the Plans. Covers shall be fastened to the frame with a minimum of four stainless steel bolts and shall be gasketed for a watertight seal. Cover weight shall not be less than 125 pounds.

RODHOLE FRAME AND COVER shall be cast iron, conforming to ASTM A48, Class 30. The frame and cover shall be similar and equal to Phoenix Iron Works PL1005-Q, or approved equal and shall have the word "SEWER" cast into the cover with prominent letters.

JOINT SEALING COMPOUND COMPONENTS shall be RAM-NEK primer and joint sealing compound, KENT-SEAL primer and joint sealant, or approved equal.

MANHOLE WATER STOPS shall be installed on PVC or ABS sewer pipe with stainless steel bands to make a watertight seal between the pipe wall and the concrete manhole base.

PIPE, BENDS AND FITTINGS used in rodholes and drop manhole construction as well as manhole stubs shall conform to the applicable sections of these Standard Specifications for sewer pipe.

MORTAR shall be proportioned with one part portland cement to two parts clean, well-graded sand which will pass a 1/8-inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: Hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the surfaces. Mortar mixed for longer than 30 minutes shall not be used.

C. WORKMANSHIP

CAST-IN-PLACE CONCRETE: Concrete work shall conform to the Standard Details and the applicable portions of Sections 51 and 90 of the State Standard Specifications.

GENERAL CONSTRUCTION: Manholes shall be constructed only when the temperature is above 32° Fahrenheit. All work shall be protected against freezing. Water shall be removed from the excavation and the excavation maintained "dry" during construction of the manhole and during the time required for the concrete or mortar to develop sufficient strength to resist rupture by groundwater pressure. All pipes connected to manholes shall have a joint within 2 feet of the manhole wall.

The subgrade for the manhole base shall be carefully prepared to provide a firm support for the manhole, and prevent future settlement of the manhole. Particular care shall be taken with deep manholes and manholes located in wet locations.

Manhole inverts shall be formed as shown on the Standard Details, either by laying pipe through and cutting out the top portion before completion of the base of the manhole, or by forming a "U" shaped channel in the concrete base slab. Cut edges of pipe laid through the manhole shall be fully covered by concrete when the manhole invert is complete. The finished invert shall be smooth and true to grade. No mortar or broken pieces of pipe shall be allowed to enter the sewer pipe.

A groove shaped to match the tongue of the first precast concrete riser section of the manhole shall be formed in the base slab. A circular metal form suited to the particular precast manhole manufacturer's joint shall be used to form the groove.

Except as specified herein, all precast manhole sections shall be set in joint sealing compound. Joint sealing compound components shall be applied in the field. One brush coat of primer shall be applied to the tongue and groove surfaces to be sealed, then the preformed strip of sealing compound shall be pressed firmly to the dry, clean, primed joint surface (groove portion). Precast sections shall be set evenly in a full bed of sealing compound. After the precast sections have been placed, the interior joint surface shall be trimmed smooth with a trowel or sharp tool to remove any excess joint compound projecting into the manhole.

Grade rings may be set with mortar if necessary for adjustment of the final cover elevation. Mortar joints shall not be more than 3/4-inch thick. Excess mortar shall be trimmed flush. The outside of each mortar joint shall be sealed with an approved bituminous sealing compound.

MANHOLE LEAKAGE TESTING: All manholes shall be tested for leakage by filling with water. Leakage shall not be greater than 0.15 gallons per day per square foot of interior surface area. All visible leaks shall be repaired.

INSTALLATION OF FRAMES AND COVERS NOT IN ROADWAYS: Frames and covers shall be joined to the top of the manhole or structure so that the cover, when placed, will be at the proper elevation and so that no ground or surface water may enter the manhole or structure. The finish grade at the tops of manholes will be established after the excavation has been backfilled and compacted to true subgrade.

INSTALLATION OF FRAMES AND COVERS IN ROADWAYS: Roadways are defined as the paved part of all roads, driveways, and parking areas, public or private, and in addition, the unpaved shoulders of public roads. Concrete collars shall be installed around frames of manholes in roadways. Installation shall be as shown on the Standard Details. Portland cement concrete shall be primed with an asphalt emulsion before it is overlaid with asphalt concrete.

After completion of the manhole, all plugs shall be completely removed from the sewers and all loose material shall be removed from the manhole.

LATERAL SEWER CONNECTIONS: Direct connections of laterals to manholes shall be installed only at terminal manholes, where specifically shown on the Plans, or where directed by the District Manager. The top of the lateral sewer pipe shall be a minimum of 0.2 feet higher than the top of the downstream main sewer pipe. The manhole invert shall be channeled for lateral sewers in the same manner as for main sewers.

PIPE STUBS for future connections shall be not more than 2 feet long and shall be plugged with standard gasketed plugs.

RODHOLES shall be constructed as shown on the Standard Details. The end of the bottom wye shall be tightly plugged. The frame shall be joined to the riser pipe so that groundwater will be prevented from entering the sewer.

DROP CONSTRUCTION AT MANHOLES shall be installed as shown on the Standard Details. Particular care shall be taken to support the entering pipe on well-compacted material.

D. MEASUREMENT AND PAYMENT

Measurement of sewer manholes and rodholes will be based upon the number of each installed.

Payment for sewer manholes and rodholes will be made at the unit prices bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools and equipment required to install the sewer manholes and rodholes, complete as shown on the Plans and as herein specified.

A. SCOPE

This section covers force main pipe, fittings, and appurtenances.

B. MATERIALS

Force main pipe shall be PVC or ductile iron. Pipe shall be a minimum of Class 100 PVC or Class 50 ductile iron. All pipe shall be National Sanitation Foundation approved. All pipe and fittings shall conform to the following specifications:

POLYVINYL CHLORIDE (PVC) PIPE shall be SR (Schedule Rated) in accordance with ASTM D1785 for Schedule 40 and Schedule 80 pipe, and shall have a maximum SDR of 25 for "Class 100" applications and a maximum SDR of 18 for "Class 150" applications.

Pipe 4-inches and larger shall comply with AWWA Specification C900 and shall be of cast-iron-pipe-equivalent diameters. Pipe 3-inches and smaller in diameter shall have either rubber ring or solvent welded joints. Pipe 4-inches and larger in diameter shall have solid cross-section rubber ring joints in accordance with ASTM F477.

Fittings shall be PVC with the same pressure rating and hydrostatic test pressure as the pipe, or cast iron fittings with rubber gaskets sized for PVC pipe.

DUCTILE IRON PIPE: Pipe shall be Class 50 minimum ductile iron pipe conforming to AWWA Specification C151. Pipe shall be bell and spigot with "push-on" rubber gasket joints conforming to AWWA Specification C111, unless otherwise specified. Pipe shall be cement-mortar lined and bituminous coated.

Fittings shall comply with AWWA Specification C110, and shall be cement-mortar lined and bituminous coated as specified above. Fittings shall be supplied with bell and/or spigot configurations compatible with that of the pipe.

LOCATOR CONDUCTORS for non-metallic pipes shall be No. 6 solid copper wire. The locator shall be installed above the imported bedding directly over the pipeline centerline, and shall be brought to within 6-inches of the top of all valves boxes. Locators within valve boxes shall be installed in 3/4-inch PVC pipe which is wired to the side of the valve box.

GALVANIZED IRON PIPE shall be used only where specifically designated by the Engineer. Pipe shall conform to Federal Specification WW-P-406, Type I, II, or III, Class A, zinc coated. Fittings shall conform to Federal Specification WW-P-521, Type II, zinc coated, except for unions, which shall conform to Federal Specification WW-U-531, Type B, zinc coated.

MECHANICAL COUPLINGS, including flexible couplings and flanged coupling adaptors, shall be as manufactured by Baker, Dresser, or approved equal. All mechanical couplings shall have the longest standard sleeve length.

CONCRETE: Concrete for thrust blocks shall be Class C concrete and shall conform to the applicable portions of Sections 51 and 90 of the State Standard Specifications.

C. WORKMANSHIP

GENERAL: All materials shall be handled in a manner that will not damage the material or it's coating. Before installation, each article shall be inspected and any damaged material shall be discarded. Any damaged coating shall be repaired. The interior and ends of the pipe and appurtenances shall be clean. When it is necessary to cut pipe, such cuts shall be neatly made.

LAYING: All pipe shall be laid on a smooth bed, prepared in accordance with the provisions specified in the section of these Specifications entitled, TRENCH EXCAVATION AND BACKFILL. As soon as possible after the installation of the pipe, sufficient backfill material shall be placed on the pipe to protect it from temperature changes.

JOINTS: Bell and spigot joints shall be made up in accordance with the instructions of the manufacturer. Adjoining pipe sections shall be level and both bell and spigot shall be clean. The bell shall be lubricated and the rubber gasket properly installed. The spigot shall then be inserted and seated in correct position by use of a joint puller or other approved method. After seating, each joint shall be checked with a feeler gauge to ensure that the gasket is not twisted and that the spigot is seated to the proper depth. Any improper joints shall be taken apart and correctly made. The maximum installed deflection at joints shall not exceed that recommended by the manufacturer.

FITTINGS: Joints of bell and spigot fittings shall be made up and sealed as specified for pipe joints. Joints of flanged fittings shall be made up true and square so that there is no strain on the pipe or fitting. Bolts shall be tightened uniformly around the joint.

ANCHORAGE: Concrete thrust blocks shall be provided in accordance with the Plans.

FLEXIBLE COUPLINGS: Flexible couplings shall be installed in accordance with the recommendations of the manufacturer. The finished joint shall be watertight under the test pressure of the pipeline. After completion of the connection, the entire coupling and any exposed steel shall be wrapped with a diaper and poured full so as to be completely encased using either hot asphalt or coal tar. As an alternative, the coupling and all exposed metal may be painted with two coats of coal tar epoxy.

D. HYDROSTATIC TESTS

All parts of the entire pipeline installation shall be tested at a pressure of 50 psi above maximum working pressure or 100 psi minimum, whichever is greater. Tests shall be made in the presence of the Engineer or his representative.

Before the test, the pipeline shall be sufficiently anchored to withstand the test pressure. During the filling of the line with water, precautions acceptable to the Engineer, including but not limited to slowly filling the pipeline from the low end, shall be taken to prevent air pockets at high points.

Water may be allowed to stand in the line for several hours prior to the test. During the test, which shall be conducted for the time period determined by the Engineer, but not less than 30 minutes, the leakage shall not exceed 5 gallons per 24 hours per thousand feet of pipe per inch of nominal diameter. Test sections shall be as short as valve configurations permit. If any valved section of pipe shows greater leakage than specified, the Contractor shall locate and repair the leaks and shall retest that section of line at no additional cost.

The Contractor shall provide all labor, tools, and equipment required to perform the hydrostatic tests.

E. MEASUREMENT AND PAYMENT

The length of force main pipe and fittings will be measured horizontally in feet, along the centerline of the pipe. Payment will be made at the unit prices bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools, and equipment required to excavate and backfill trenches, install force main pipe and fittings, install thrust blocks, and all appurtenances required for a complete installation, ready to operate.

A. SCOPE

This heading covers pumps and motors for pumping equipment, complete.

B. PUMP DATA

Pumps shall be 4-inch minimum discharge, totally submersible, and electrically operated. Each unit shall be equipped with a 208 volt, 3 phase, 60 hertz, explosion-proof motor connected for operation on a 460 volt service, and supplied with a mating cast iron 4-inch (minimum) discharge connection, capable of delivering a minimum of 250 GPM at 65 feet TDH at a maximum speed of 1760 RPM. Motors shall be sized to be non-overloading (excluding service factor) for all pump discharge rates. Shut off head shall be not less than 85 feet. Pumps shall be Model CP-3127 with No. 461 impeller, manufactured by Flygt, or approved equal.

C. GENERAL

All pump motors shall be tested and approved by Underwriter's Laboratory for explosion proof use in Class 1, Division 1, Group C & D locations.

All pumps shall have a minimum solids handling capability of passing a 2.5-inch diameter sphere.

Certified head-capacity curves shall be furnished with the pumps.

PUMP DESIGN: The pumps shall be capable of handling raw, unscreened waste. The design shall be such that the pump unit will be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection, permanently installed in the wet well. The pump shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be disconnected. For this purpose, there shall be no need for personnel to enter the wetwell. Each shall be fitted with a stainless steel chain of adequate strength and length to permit raising and lowering the pump for inspection or removal. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity.

PUMP CONSTRUCTION: All major parts, such as the stator casing, oil casing, and volute shall be of ASTM A-48, Class 30 gray cast iron. All exposed bolts and nuts shall be AISI Type 304 stainless steel or brass. The impeller shall be gray cast iron of non-clogging design with a corrosion resistant coating, capable of handling solids, fibrous material, heavy sludge and other matter found in normal waste applications. The impeller shall be constructed with a long throughlet without acute turns.

The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it. The impeller shall be a slip fit to the shaft and key driven. Non-corroding fasteners shall be used.

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet. A stainless steel impeller wear ring shall be heat-shrink fitted onto the suction inlet of the impeller.

Each pump shall be provided with a tandem mechanical shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated lapped seal faces. The (lower) seal unit between the pump and oil chamber shall contain one stationary and one positively driven rotating tungsten-carbide ring. The (upper) seal unit between the oil sump and motor housing shall contain one stationary tungsten-carbide seal ring and one positively driven rotating carbon seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable.

Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to prevent overfilling and to provide oil expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible for the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection, which when bolted to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps or similar devices.

Installation of the pump unit to the discharge connection shall be the result of a simple linear downward motion of the pump unit guided by two 2-inch minimum diameter guide bars.

No other motion of the pump unit, such as tilting or rotating, shall be required. Sealing of the discharge interface by means of a diaphragm, o-ring or other devices located on the discharge connection shall not be considered acceptable. No portion of the pump unit shall bear directly on the floor of the wet well. There shall be one 90° bend between the volute discharge flange and station piping.

The pump motor shall be housed in an air-filled watertight casing and shall have moisture resistant Class F 155° Centigrade insulation. The motor shall be NEMA Design B and designed for continuous duty handling pumped media at 104° Fahrenheit, and capable of up to 15 evenly spaced starts per hour. The cable entry water seal design shall be such that precludes specific torque requirements to insure a watertight and submersible seal. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones or other sealing systems shall not be considered acceptable.

The pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC and ICEA specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable.

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single roller bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.

All mating surfaces of major parts shall be machined and fitted with nitrile o-rings where watertight sealing is required. Machining and fitting shall be such that sealing is accomplished by automatic compression in 2 planes and o-ring contact made on four surfaces, without the requirement of specific torque limits to affect this.

Tolerances of all parts shall be such that allows replacement of any part without additional machining required to insure sealing as described above. No secondary sealing compounds, greases or other devices shall be used.

PUMP WARRANTY: The pump manufacturer shall warranty the units being supplied to the City against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in printed form and apply to all similar units.

D. WORKMANSHIP

Complete shop drawings shall be submitted as specified in the Special Conditions.

Four copies of complete operation, installation, and maintenance instructions shall be furnished and included as specified in the Special Conditions.

All pumps and motors shall be furnished and installed to conform with the requirements specified in this section, plan details, requirements and recommendations of the Manufacturer.

All equipment shall be set level and plumb.

All piping connections to mechanical equipment shall be such that there are no stresses on the connections.

All electrical connections shall be performed as specified by the City of Live Oak.

E. MEASUREMENT AND PAYMENT

No measurement of quantities will be made. Payment for all work under this section shall be included in the lump sum prices bid in the Proposal.

A. SCOPE

This section covers pipe and fittings for the water system, complete.

B. MATERIALS

Water pipe shall be polyvinyl-chloride (PVC), or ductile iron. All pipe shall be National Sanitation Foundation approved. All pipe and fittings shall conform to the following specifications:

POLYVINYL CHLORIDE (PVC) PIPE shall be SR (Schedule Rated) in accordance with ASTM D1785 for Schedule 40 and Schedule 80 pipe, and shall have a maximum SDR of 18 for "Class 150" applications and a maximum SDR of 14 for "Class 200" applications.

Pipe 4-inches and larger shall comply with AWWA Specification C900 and shall be of cast-iron-pipe-equivalent diameters. Pipe 3-inches and smaller in diameter shall have either rubber ring or solvent welded joints. Pipe 4-inches and larger in diameter shall have solid cross-section rubber ring joints in accordance with ASTM F477.

Fittings shall be PVC with the same pressure rating and hydrostatic test pressure as the pipe, or cast iron fittings with rubber gaskets sized for PVC pipe.

DUCTILE IRON PIPE: Pipe shall be Class 50 minimum ductile iron pipe conforming to AWWA Specification C151. Pipe shall be bell and spigot with "push-on" rubber gasket joints conforming to AWWA Specification C111, unless otherwise specified. Pipe shall be cement-mortar lined in conformance with AWWA Specification C104 and bituminous coated.

Fittings shall comply with AWWA Specification C110, and shall be cement-mortar lined and bituminous coated as specified above. Fittings shall be supplied with bell and/or spigot configurations compatible with that of the pipe.

MECHANICAL COUPLINGS, including flexible couplings and flanged coupling adaptors, shall be as manufactured by Smith-Blair, Baker, Dresser, or approved equal. All mechanical couplings shall have the longest standard sleeve length.

LOCATOR CONDUCTORS shall be No. 12 direct burial insulated solid copper wire. The locator shall be attached to the top of the pipeline centerline. Locators at valve boxes shall be installed in accordance with the Standard Details.

CONCRETE: Concrete for thrust blocks shall be Class C concrete and shall conform to the applicable portions of Sections 51 and 90 of the State Standard Specifications.

C. WORKMANSHIP

GENERAL: All materials shall be stored and handled in a manner that will not damage the material or it's coating, and will keep the materials clean and free of contamination. Before installation, each article shall be inspected and any damaged or contaminated material shall be discarded. Any damaged coating shall be repaired. The interior and ends of the pipe and appurtenances shall be clean. When it is necessary to cut pipe, such cuts shall be neatly made.

LAYING: All pipe shall be laid on a smooth bed, prepared in accordance with the provisions specified in the section of these Specifications entitled, TRENCH EXCAVATION AND BACKFILL. As soon as possible after the installation of the pipe, sufficient backfill material shall be placed on the pipe to protect it from temperature changes. The ends of the pipeline shall be closed with watertight caps or plugs at all times, except when laying pipe. The Contractor shall take all necessary precautions to prevent contaminated water, oil, grease, dirt, rodents, or other contaminants from entering the pipeline.

JOINTS: Bell and spigot or mechanical joints shall be made up in accordance with the instructions of the manufacturer. Adjoining pipe sections shall be level and both bell and spigot shall be clean. The bell shall be lubricated and the rubber gasket properly installed. The spigot shall then be inserted and seated in correct position by use of a joint puller or other approved method. After seating, each joint shall be checked with a feeler gauge to ensure that the gasket is not twisted and that the spigot is seated to the proper depth. Any improper joints shall be taken apart and correctly made. The maximum installed deflection at joints shall not exceed that recommended by the manufacturer.

FITTINGS: Joints of bell and spigot or mechanical joint fittings shall be made up and sealed as specified for pipe joints. Joints of flanged fittings shall be made up true and square so that there is no strain on the pipe or fitting. Bolts shall be tightened uniformly around the joint.

ANCHORAGE: Concrete thrust blocks shall be provided in accordance with the Standard Details included in the Plans. Size of thrust blocks shall be approved by the Engineer. Concrete shall be carefully placed against the valve or fitting to avoid covering or obstructing bolts or connectors at the valve or fitting joints.

FLEXIBLE COUPLINGS: Flexible couplings shall be installed in accordance with the recommendations of the manufacturer. The finished joint shall be watertight under the test pressure of the pipeline. After completion of the connection, any exposed steel shall be painted with two coats of coal tar epoxy.

CONNECTIONS TO EXISTING SYSTEM: Where the new water main connects to existing valves or pipelines, new reducers, flanged coupling adaptors or transition couplings shall be installed to accommodate the new pipeline, as required.

SEWER LATERAL CROSSINGS: Crossings of sewer service laterals shall be made above the sewer lateral wherever possible. Depth of cover over the water main may be reduced to 30 inches where such reduction is necessary to allow crossing above sewer service laterals.

If it is necessary to cross below sewer service laterals, the water main shall be installed with at least 12 inches of vertical separation from the sewer lateral and no joints in the water main shall be placed within nine feet, horizontally, of the sewer service lateral.

D. HYDROSTATIC TESTS

All parts of the entire pipeline installation shall be tested at a pressure of 125 PSI. Tests shall be made in the presence of the Engineer or his representative.

Before the test, the pipeline shall be sufficiently anchored to withstand the test pressure. During the filling of the line with water, precautions shall be taken to prevent air pockets at high points. Water may be allowed to stand in the line for several hours prior to the test. During the test, which shall be conducted for the time period determined by the Engineer, but not less than 30 minutes, the leakage shall not exceed 5 gallons per 24 hours per thousand feet of pipe per inch of nominal diameter. Test sections shall be as short as valve configurations permit. If any valved section of pipe shows greater leakage than specified, the Contractor shall locate and repair the leaks and shall retest that section of line at no additional cost to the Owner.

The Contractor shall provide all labor, tools, and equipment required to perform the hydrostatic tests.

E. FLUSHING AND STERILIZATION OF COMPLETED MAINS

GENERAL: In general, the methods outlined in AWWA C601 entitled, "Disinfecting Water Mains," should be used as a guide in performing this operation where applicable.

FLUSHING COMPLETED LINES: Preliminary flushing of completed lines prior to chlorination shall be accomplished as thoroughly as possible with the water pressure and outlets available. The flushing shall be done after the pressure tests have been made.

CHLORINATION OF COMPLETED LINES: Before being placed in service, the entire line shall be chlorinated. Chlorine shall be applied by one of the following methods: Liquid chlorine, gas-water mixture, fed-chlorine gas, or calcium hypochlorite water mixture, unless another method (such as Chlorine "HTH" Tablets) is approved by the Engineer. The chlorinating agent shall be applied at the beginning of each section adjacent to the feeder connection and shall be injected through a corporation cock, hydrant, or other connection ensuring treatment of the entire line. Water shall be fed slowly into the line with chlorine applied in amounts to produce a dosage of 40-50 parts per million. Portions of the existing mains which have been connected to a new line or otherwise contaminated by construction shall be included in the system sterilized. A residual of not less than 10 parts per million after 24 hours shall be produced in all parts of the line. During the chlorination process, all valves shall be operated.

If disinfection by chlorine "HTH" tablets is permitted by the Engineer, the tablets shall be secured to the top of the pipe with an approved adhesive.

Following chlorination and prior to discharge, the water shall be dechlorinated such that a residual of not more than 0.02 parts per million (instantaneous maximum) of chlorine is present in any water discharged.

FINAL FLUSHING: After chlorination, the water shall be flushed from the lines at the extremities until the replacement water tests are equal, chemically and bacteriologically, to those of the permanent water supply.

F. MEASUREMENT AND PAYMENT

The length of water pipe and fittings will be measured horizontally in feet, along the centerline of the pipe. Payment will be made at the unit prices bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools, and equipment required to excavate and backfill trenches, install water pipe and fittings, install thrust blocks, and all appurtenances required for a complete installation, including testing, ready to operate.

A. SCOPE

This section covers valves, fire hydrants and appurtenances for the water system, complete.

B. MATERIALS

GATE VALVES, 2-INCHES AND LARGER, shall be Resilient Seated Gate Valves conforming to AWWA C509. Valves shall be rated for a minimum working pressure of 150 psi, and shall have end fittings to conform to the pipe or fittings being connected. Valves shall be Waterous "Series 500", Mueller "Resilient Seat", Clow "Resilient Wedge", or approved equal. Valves shall open counter-clockwise and shall be furnished with two-inch square operating nuts when installed underground.

VALVE BOXES shall be provided for all valves placed underground and shall be similar and equal to Brooks Products, Inc., No. 3-RT or Christy G5, with 8-inch PVC pipe extension sleeve; cover to be marked "WATER".

FIRE HYDRANTS shall conform to AWWA C502 and the following requirements: They shall have two 2 **2**-inch hose nozzles and one 4 **2**-inch pumper nozzle. Outlets shall be threaded National Standard and shall be equipped with protective screw-caps, attached to the hydrant barrel with security chains. Outlets shall be individually valved, and operating valve parts shall be brass or bronze, with O-ring seals. The hydrants shall have a National Standard 1-inch (1 **2**-inch Flat to Point) pentagon operating nut turning counter-clockwise to open. The hydrant bury shall be 6-inch heavy cast iron pipe with a machined flange top and a mechanical joint bottom connection. A 6-inch x 6-inch flanged extension riser, with a break-off groove shall be installed below the hydrant. A 6-inch break-off check valve shall be installed below the break-off riser.

Fire hydrants shall be Long Beach Iron Works ÁANACAPÁ@ Model 615, or approved equal. Break-off check valves shall be Long Beach Iron Works Model LB400, or approved equal. Hydrants shall be painted one coat red primer and two finish coats of yellow paint. Each hydrant location shall be marked by a blue reflective pavement marker 6" from street centerline on the side nearest the fire hydrant.

C. WORKMANSHIP

GENERAL: All valves and appurtenances shall be thoroughly cleaned before installation and shall be installed in strict accordance with the manufacturer's recommendations.

SETTING VALVES AND APPURTENANCES: Valves shall be set plumb and inspected in opened and closed positions to insure that all parts are in working condition. All underground valves shall be provided with valve boxes or vaults. Valve boxes in the street shall be anchored in accordance with the Live Oak Improvement Standards.

D. MEASUREMENT AND PAYMENT

Measurement of valves and fire hydrants will be based upon the number of each installed.

Payment for valves and fire hydrants will be made at the unit prices bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools and equipment required to install the valves, valve boxes and fire hydrant assemblies, complete as shown on the Plans and as herein specified.

A. SCOPE

This section covers service connections and appurtenances for the water system, complete.

B. MATERIALS

SERVICE PIPE shall be 3/4-inch PE 3408 polyethylene pipe or Type K “soft” copper tubing. All fittings shall have grip joints. No soldered fittings will be approved.

CORPORATION STOPS shall be manufactured in accordance with AWWA C800, bronze body, full bore, ball-type, sized per service line diameter, Ford Meter Box Company Type FB 1100G, James Jones Type J-1935SG, or approved equal. Only services two-inch and smaller shall have corporation stops; others shall have gate valves at the main.

VALVES, SMALLER THAN 2-INCHES, to be installed with a valve box shall be screwed, bronze bodied "Full-Port" ball valves. Valves shall be James Jones J1900, Mueller 300 Ball Valve, or approved equal.

VALVES, SMALLER THAN 2-INCHES, to be installed in a meter box or vault shall be screwed, bronze bodied "Full-Port" ball valves. Valves shall be NIBCO KT-585-70-UL, WATTS Series B-6000, or approved equal.

ANGLE BALL METER VALVES shall be 1-inch minimum bronze, angle ball valve type, with meter coupling outlet, Ford Meter Box Company BA43-WG or BFA13-W with C84-G or L84-G coupling, James Jones J-1963WSG or J-1975WSG, or approved equal.

SERVICE SADDLES for two inch and smaller service connections shall be as recommended by the manufacturer of the pipe being saddled. For ductile iron pipe the saddles shall be malleable iron tapped for iron pipe, with double steel straps similar and equal to Smith-Blair Type 313 or 323, or Romac Type 202. For PVC C900 pipe the saddles shall be steel, malleable iron or bronze tapped for iron pipe, with wide straps or saddles similar and equal to Smith-Blair Type 352, Romac Type 101S, or Ford Type FS 202. The outlets of all steel or iron service saddles shall be one or two pipe sizes larger than that required for the corporation stop, which shall be the same size as the service pipe. The saddles shall then be fitted with an appropriately sized nylon bushing to accept the corporation stop. This is required to protect the service saddle from galvanic action and corrosion caused by connection of dissimilar metals.

LOCATOR CONDUCTORS shall be No. 12 direct burial insulated solid copper wire. The locator shall be installed above the pipe envelope directly over the pipeline centerline. Locators at valve boxes shall be installed in accordance with the Standard Details.

METERS shall be 3/4-inch and have a hermetically sealed register with magnetic drive, read in cubic feet and shall meet or exceed AWWA Standard C700. Meters shall have a frost-free bottom, designed to operate totally submerged, have an Automated Meter Reading (AMR) system, and shall be Invensys Metering Systems (formerly Sensus Technologies), SR II AMR Touch Read/Pit Lid (TR/PL). Each meter shall be supplied with an Invensys Metering Systems Model 505 Meter Transceiver Unit (MXU).

METER BOXES shall be similar and equal to Christy Concrete Products, Inc. B16 Box with B16P reinforced concrete lid with 1-3/4" hole for reading probe.

C. WORKMANSHIP

New service lines and fittings shall not be less than 3/4-inch diameter.

Service taps shall be made on the new water main opposite all service meter locations as shown on the plans. Saddles and corporation stops shall be installed and new service pipe installed to the meter box. Sufficient length of service pipe shall be provided at each meter box to allow for adjustment during meter setting.

A new angle meter valve shall be installed on the new service pipe at each meter location. The meter and AMR equipment shall be provided to the City of Live Oak Public Works Department, to be installed by the City at the time a Certificate of Occupancy is issued.

D. MEASUREMENT AND PAYMENT

Payment for service connections will be made at the unit price bid in the Proposal, and shall include full compensation for furnishing all materials, labor, tools and equipment required to install new service lines to all meter locations, including excavation, backfill, service taps, service saddles, corporation stops, piping, curb stops, meter, meter box and all required fittings and adaptors.

A. SCOPE

This heading covers grinding of existing asphaltic paving along lines of conformance of the new asphalt concrete to existing concrete gutters and existing paving, complete.

B. MATERIALS

Loose material resulting from pavement grinding will be removed from the work site by the Contractor.

C. WORKMANSHIP

Pavement grinding shall be performed with a self-propelled machine capable of grinding a minimum of 6 feet and a depth of 0.08 foot in a single pass.

Pavement grinding shall be coordinated with cleanup work and with construction of new asphalt concrete to minimize the time during which traffic is routed over ground areas.

Grinding shall be to a depth of 0.08 foot below the gutter or paving to be matched, and shall be uniformly tapered over a width of 6 feet to zero depth.

D. MEASUREMENT AND PAYMENT

Measurement of pavement grinding will be made along the conformance line of gutters or paving to be matched. Payment will be made at the price per lineal foot bid in the Proposal, which payment shall include full compensation for furnishing all labor, materials, tools, equipment, transportation and incidentals, and for doing all work involved in pavement grinding, as shown on the plans and as required by these specifications.

A. SCOPE

This heading covers the pulverizing, grading and compaction of existing asphalt concrete surfacing and underlying base material, complete.

B. WORKMANSHIP

The Contractor shall pulverize the existing asphalt concrete surfacing and underlying base material to a depth of six (6) inches. The pulverized material shall have a maximum size of 1**2** - inches. The pulverized material shall be moisture-conditioned, graded and compacted to at least 95 percent of the maximum density, as determined by ASTM Test D-1557. Field density tests will be performed in accordance with ASTM Test D-1556 or ASTM Test D-2992, Method B.

The Contractor shall schedule pulverizing operations so that no more of the existing roadway surface shall be pulverized in any working day than can be completed and opened to public traffic in that same working day. Completion of pulverizing roadbed includes pulverizing, grading and compaction.

C. MEASUREMENT AND PAYMENT

No measurement of quantities will be made. Payment will be made at the lump sum price bid in the Proposal, and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in pulverizing, grading and compacting existing asphalt concrete surfacing and underlying base materials.