

**LAKE HEMET
MUNICIPAL WATER DISTRICT**

**Technical Specifications
And Standards**

For Sewer Lines and Appurtenances

February 2007

Updated July 2009

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July 2009

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TECHNICAL SPECIFICATIONS AND STANDARDS FOR SEWER LINES AND APPURTENANCES

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Sewer

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LAKE HEMET MUNICIPAL WATER DISTRICT

PREFACE TO THE TECHNICAL SPECIFICATIONS – SEWER

1. Supplemental Definitions to the Technical Specifications

In these Technical Specifications, whenever the following terms, or pronouns are used, the intent and meaning shall be interpreted as defined in the Ordinance and Rules and Regulations of the District which regulates the use and construction of sewer facilities. These supplemental definitions shall apply only to the interpretation of these Technical Specifications.

Contract – The written agreement covering the performance of the work and the furnishing of labor, materials, tools and equipment in the construction of the work. The contract shall include the Notice to Contractors, Proposal, Plans, Specifications and Contract Bonds; also, any and all written supplemental agreements amending or extending the work in a substantial and acceptable manner. Supplemental agreements are written agreements covering alterations, amendments or extensions to the contract and include contract change orders.

Contractor – The individual, partnership, corporation, joint venture or other legal entity entering into a contract with the District to perform the work. In case of the work being done under a permit issued by the District, the Permitted shall be construed to be the Contractor.

District – The Political Subdivision within which “The Work” is to be accomplished and in all cases refers to the Lake Hemet Municipal Water District.

Engineer – That person (or firm) that represents the District on engineering matters related to “The Work”.

Guarantee – Giving security for the carrying out of assurance.

Inspector – Personnel appointed by the Engineer or District to inspect construction of “The Work” for engineering and technical completeness. An inspector shall be limited to the particular duties entrusted to him.

Or Equal – Where used with brand names or specific manufactured products, shall mean the named commodity is a standard or quality. Items of equal quality may be substituted. However, the decision as to what constitutes “or equal” is the responsibility of the Engineer. Approval in writing from the Engineer must be obtained prior to making any substitutions.

Pipe Zone – Is considered to extend to twelve inches (12”) above the top of the water pipe.

Plans – The official project plans, profiles, typical cross sections, general cross sections, working drawings and supplemental drawings, or reproductions thereof, submittals, approved by the Engineer, which show the locations, character, dimensions and details of the work to be performed, and which are to be considered as part of the Contract.

Project Area – The real extent within which “The Work” will be accomplished.

Specifications – Portions of the contractual documents delineating descriptions, particulars and terms of the Contract as well as details for completeness of “The Work” now shown on the plans.

“The Work” – That which is to be accomplished by the Contractor to make the contents of the plans a reality.

2. Work Schedule

One week prior to starting construction, the Contractor shall submit to the District, Engineer, and Inspector, a work schedule which shall describe the sequence, time and method of operations he plans to use on the job. The Engineer may recommend alteration of this schedule where he feels the intent of the contract cannot be carried out.

It shall be the Contractor’s responsibility to update this schedule once a month showing work completed and work in progress. The Contractor shall provide the District, Engineer and Inspector copies of this updated schedule.

3. Notification

The Contractor shall notify the District, Engineer and Inspector one week in advance of when he plans to start construction.

EARTHWORK

1.1 General

Earthwork includes all labor, materials, tools, equipment, and incidentals as required or necessary to clear, grub, remove and replace unsuitable materials, excavate, trench, fill, backfill, compact and grade for the construction of all structures, pipelines, ditches, embankments and graded areas as shown and specified.

1.2 Obstructions

The Contractor shall remove, or cause to be removed, at his expense, all trees, shrubs and brush, including stumps and roots, fences and all structures as and when required by the plans or where the proper construction and completion of the work require their removal. The Contractor shall also remove, at his expense, all rock, stones, debris, deleterious material and all obstructions of whatsoever kind or character, whether natural or artificial, encountered in the construction of the work.

In the installation of pipelines outside of public rights-of-way or in easements, trees shall not be removed unless otherwise authorized in writing by the Engineer, and all fences, structures and landscaping which are removed or damaged by the Contractor shall be restored to their original condition at the Contractor's expense without any compensation therefore. Any damage done to private property by reason of work on easements shall be the responsibility of the Contractor for restoration of their preconstruction condition at Contractor's expense.

Material that is removed as hereinabove specified, and is not to be incorporated in the improvement being constructed, shall be disposed of at a legal disposal site, away from the construction site at the Contractor's expense.

The Contractor's attention is directed to the possible existence of pipe and other underground improvements which may or may not be shown on the plans. All reasonable precautions shall be taken to preserve and protect any such improvements whether shown on the plans or not. Where it is necessary to remove and replace or to relocate such improvements in order to prosecute the work, they shall be removed, maintained and permanently replaced by the Contractor. Unless otherwise provided, the cost for said removal and replacement, or relocation, shall be considered included in the prices names for the various items of work on the bid sheets.

1.3 Earthwork in City, County, State and Railroad Rights-of-Way

Earthwork within the rights-of-way of the State Division of Highways, the County Road Department, Railroads and any City having jurisdiction, shall be done in accordance with the requirements and the provisions of the permit issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these specifications. The requirements of these Technical Specifications shall be the minimum requirements.

1.4 Safety Precautions

All excavations shall be performed, protected and supported as required for safety and in the manner set forth in the operating rules, orders and regulations prescribed by the Division of Industrial Safety of the Department of Industrial Relations of the State of California. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to prevent accidents. Blinking barricades shall also be placed along excavations at intervals not exceeding 100 feet from sunset each day to sunrise of the next day until such excavation is entirely smooth and made safe for the traveling public. The Contractor shall furnish such watchman, guards, fences, warning signs, walks, and lights as shall be necessary and shall take all other necessary precautions to prevent damage or injury to persons and property. All provisions for excavation safety are to be made at the Contractor's expense.

In advance of any excavation of any trench or trenches five (5) feet or more in depth, the Contractor shall submit for acceptance of the District, or by a registered civil or structural engineer, employed by the District, to whom the authority to accept has been delegated, a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches. If such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared by a registered civil or structural engineer. Nothing herein contained shall be deemed to allow the use of shoring, sloping or protective system less effective than that required by the Construction Safety Orders of the State Division of Industrial Safety. Shoring shall be in compliance with Section 6707 of Chapter 9, Part 1, Division 5, of the Labor code of the State of California.

Nothing contained in this Specification shall be construed to impose tort liability on the District, Engineer or any of their employees.

Section 6424 of the Labor Code requires a permit for trenches five (5) feet or more in depth. The District will not issue a permit for trenching operations. The Contractor, prior to beginning construction, shall obtain from the State Division of Industrial Safety a permit authorizing said construction.

Safety rules and regulations required by CAL-OSHA standards will be practiced and enforced by the Contractor and those working for the Contractor. Failure of Contractors or persons working for Contractors to comply with CAL-OSHA standards required by State law may lead to termination of the contract by Lake Hemet Municipal Water District.

The District will see that OSHA standards are practiced by the Contractor and those working for the Contractor and will determine if OSHA standards are being followed. Inspector should be what CAL-OSHA defines as a “competent person”. Contractor should have person(s) that meet CAL-OSHA competent person definition. A “competent person” is one who has specific training in, and is knowledgeable about soils analysis, the use of protective systems, and the requirements of this standard. One who does not have such training or knowledge cannot possibly be capable of identifying existing and predictable hazards in excavation work or taking prompt corrective measures. Contractor shall sign a release form relieving the District of all liability for Contractor or those working for Contractor for property damage or personal injury caused by failure to enforce safety standards set by CAL-OSHA and required by the District.

1.5 Excavated Material

Arrangements for disposing of excess excavated material at a legal disposal site shall be made by the Contractor. Excavated material suitable for backfill shall be stored temporarily in such a manner as will facilitate work under the Contract. Contractor shall provide written acceptance by private property owner when their property is restored to its pre-storage condition.

1.6 Shoring, Sheet piling and Bracing

Where sheet piling, shoring, sheeting, bracing, or other supports are necessary, they shall be furnished, placed, maintained and removed by the Contractor. Sheet piling and other supports shall be withdrawn in such a manner as to prevent additional backfill on pipelines which might cause overloading. At all times the rules of the Division of Industrial Safety of the Department of Industrial Relations of the State of California with respect to excavation and construction shall be strictly observed.

1.7 Clearing and Grubbing

Areas, where construction is to be performed, shall be cleared of all trees, shrubs, brush, rubbish, and other objectionable material of any kind which, if left in place, would interfere with the proper performance or completion of the contemplated work, would impair its subsequent use, or form obstructions therein. Trees and other natural growths outside the actual lines of construction operations shall not be destroyed and such measures as are necessary shall be taken by the Contractor for the protection thereof.

Organic material from clearing and grubbing operations will not be permitted for use as excavation backfill.

It shall be the Contractor's responsibility to remove and dispose of all excess material resulting from clearing and grubbing operations at his own expense. The Contractor shall make his own arrangements for disposal sites at his own expense, at which said material may be wasted.

If said material is to be wasted on private property, evidence of the appropriate permits and written consent of the property owner shall be submitted to the District prior to the start of construction.

1.8 Control of Water

The Contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and dispose of all water entering the excavations or other parts of the work. No concrete footings or floors shall be laid in water nor shall water be allowed to rise over them until the concrete or mortar has set at least eight hours. Water shall not be allowed to rise unequally against walls for a period of twenty-eight (28) days. Ground water shall not be allowed to rise around pipe installations until jointing compound in the joints has set.

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

Dewatering for structures and pipelines shall commence when ground water is first encountered, and shall be continuous until such time as water may be allowed to rise in accordance with the provisions of this section. Dewatering shall be accomplished by well points or some other method which will ensure a dry hole and preservation of final lines and grade of the bottoms of the excavations, all subject to the approval of the Engineer.

At all times the trenches shall be braced and drained so that workmen may work therein safely and efficiently.

1.9 Pipeline Excavation

1.9.01 Excavation

Excavation for pipelines, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the same, as shown on the plans, or as otherwise directed by the Engineer, except where another method is specifically called for on the plans or in these Specifications.

1.9.02 Limit of Excavation

Except with specific approval of the Engineer in writing, no more than four hundred (400) feet of open trench, or the permit whichever is more restrictive, shall be excavated in advance of laying of pipe. All operations shall be carried out in an orderly fashion. Backfilling and clean-up work shall be accomplished as sections of the pipe installations are approved. Public travel through the work area shall be impeded or obstructed as little as possible. At the end of each working day, there shall be a maximum of fifty (50) feet of open trench or the permit whichever is more restrictive for each operation. The remainder of the trench excavated that day shall be backfilled, compacted and the roadway opened to the public.

At the end of each week all trenches, shall be backfilled, compacted and the roadway opened to the public on Saturday and Sunday.

With prior written approval of the District, substantial steel plates may be used to bridge across trenches where trench backfill has not been completed at the end of the working day. Prior to the approval of the use of steel plating, Contractor shall submit structural calculations, signed and sealed by a registered engineer. These calculations shall substantiate that given the span, the steel plate is of adequate strength and thickness to support all vehicular loads and that the bearing capacity of the trench walls in relation to the required bracing will provide adequate support.

1.9.03 Tunneling

Tunneling will be permitted only where native earth is of such firmness that it will remain in its original position, without sloughing off. Throughout the work of excavation and backfilling, if sloughing occurs, the roof of the tunnel shall be broken down and the trench excavated as an open trench as herein specified.

1.9.04 Trench Width

Bank of open cut trenches shall be kept as nearly vertical as possible. Where necessary in order to maintain the banks nearly vertical and/or provide workman safety, the trench shall be properly sheeted and braced. The overall trench width shall not be more than sixteen inches (16") or less than twelve inches (12") wider than the largest outside diameter if the pipe to be laid therein, measured at a point twelve inches (12") above the top of the pipe to be laid therein, measured at a point twelve inches (12") above the top of the pipe exclusive of branches. Excavation and trenching shall be true to line so that a clear space of not more than eight inches (8") or less than six inches (6") in width is provided on each side of the largest outside diameter of the pipe in place. For the purpose of this article, the largest outside diameter shall be the outside diameter of the coupling.

1.9.05 Correction of Faulty Grades

Should the excavation for the pipeline be carried below grade without instruction from the Engineer, it shall be refilled to proper grade with pipe zone material or class two aggregate base and shall be compacted to ninety percent (90%) relative compaction, at the expense of the Contractor. If compaction tests are required, they shall be at the expense of the Contractor.

1.10 Pipe Foundation and/or Subgrade

1.10.01 Foundations in Good Soil

The trench shall have a flat or semi-circular bottom conforming to the grade to which the pipe is to be laid.

With bell and spigot pipe, bell holes shall be excavated in the firm foundation to insure the pipe barrel resting for its entire length upon the firm foundation.

1.10.02 Foundations in Poor Soil

All soft, spongy or unstable material in the bottom of the trench shall be removed and replaced with approved material to a depth as determined in the field by the Engineer. The approved material shall be compacted to ninety percent (90%) relative compaction to provide an unyielding foundation for the pipe. The removal and replacement of material from depths greater than two feet (2') below the grade shown on the plans will be considered as extra work.

1.10.03 Foundations in Rock

Where rock is encountered, it shall be removed below grade and the trench shall be backfilled and compacted to 90% relative compaction with suitable material to provide a compacted thickness under the pipe of not less than one-half inch (1/2") per inch of nominal diameter of the pipe to be installed with a minimum allowable thickness of six inches (6").

1.11 Trench Backfill

1.11.01 General

All trenches shall be backfilled after pipe, fillings, valves, and appurtenances have been installed. Whenever a relative compaction requirement value is specified hereunder, the optimum moisture content and density shall be determined in accordance with the California Test Method 216, or ASTM Designations D 1557 and D 1556.

All wood and waste material shall be removed from excavation preparatory to backfilling. Backfill material shall be approved in all cases by the Engineer and shall be free of trash, wood, rock, and other objectionable debris. Backfilling shall include the refilling and compacting of the fill in trenches or excavations up to the subgrade of the street or to the existing ground surface in unpaved areas.

1.11.02 Procedure in Pipe Zone

The pipe zone shall be considered to extend twelve inches (12") above the top of the water pipe. Selected backfill material consisting of granular material free from stone, clods, clay, or other deleterious material shall be placed in the trench simultaneously on each side of the pipe for the full width of the trench in maximum lifts of six inches (6"). Each layer shall be thoroughly compacted to a relative density of ninety percent (90%) by tamping, or where the material is sufficiently granular in nature as determined by the Engineer, by water settling. Where water settling is allowed by the Engineer, each lift shall be thoroughly wetted layer by layer. Granular backfill with a minimum sand equivalent of 20 for steel or DIP pipe and a sand equivalent of 30 for PVC pipe, when tested in accordance with the California Test Method 217 or ASTM D-2419, shall be required in the pipe zone and the water densification method shall be used to densify the material in the pipe zone. When the excavated material is not granular as specified above, the Contractor shall import at his own expense, and place a suitable granular backfill material. Particular attention is to be given to the underside of the pipe and fittings to provide a firm bedding support along the full length of the pipe. Care shall be exercised in backfilling to avoid damage to the pipe.

1.11.03 Procedure Above Pipe Zone

From the top of the selected backfill to the subgrade of the street or to the existing ground surface, the material for backfill shall be clean and free of rock and other materials that may cause damage to the pipeline. In the absence of clean backfill, Class II aggregate base may be substituted.

1.11.04 Compaction Above Pipe Zone

Where it is important that the backfill be made safe for vehicular traffic or for the support of structures, the backfill above the "Pipe Zone" shall be thoroughly compacted by approved methods to obtain a minimum relative density of ninety percent (90%), except that in the State Highway or where pavement is to be placed directly on the subgrade or backfill material, ninety-five percent (95%) shall be required.

1.11.05 Compaction in Easements

In easements and open terrain where the degree of compaction is less important, the backfill, if sufficiently granular in nature (sand equivalent of 20 or greater for steel or DIP and SE of 30 or greater for PVC), shall be consolidated by a water settling method as described in Section 1.11.08 of these specifications. If the backfill is not sufficiently granular in nature, the backfill shall be consolidated by a method approved by the Engineer. Backfill in easements and open terrain shall be compacted to a minimum 85 percent (85%) relative compaction.

1.11.06 Mechanically Compacted Backfill

Mechanically compacted backfill shall be placed in horizontal layers (lifts) of such depth (not exceeding those specified herein) compatible to the material being placed and the type of equipment being used. All such equipment shall be of a size and type approved by the Engineer. Each layer shall be evenly spread, moistened (or dried, if necessary), and then tamped or rolled until the specified relative compaction has been attained. Permission to use specific compaction equipment shall not be construed as a guarantee or an implication that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the contract. The Contractor shall make his own determination in this regard. Any damage which results shall be the responsibility of the Contractor and shall be repaired or replaced at the Contractor's expense.

Material for mechanically compacted backfill shall be placed in lifts which, prior to compaction, shall not exceed the depths specified below for the various types of equipment.

- A. Impact, free-fall, or “stomping” equipment – maximum lift depth of three (3’) feet.
- B. Vibratory smooth-wheel rollers, and vibratory pneumatic-tired roller – maximum lift depth of two (2’) feet.
- C. Rolling equipment, including sheepsfoot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels – maximum lift depth of one (1) foot.
- D. Hand directed mechanical tampers – maximum lift depth of six (6”) inches.

1.11.07 Water Densified Backfill

As used in these Specifications, flooding shall mean the inundation of backfill with water, puddled with poles or bars to insure saturation of each lift of the backfill material for its full depth. Jetting will not be allowed.

1.11.08 Requirements for Densification by flooding

Densification by flooding shall be subject to all of the following requirements:

A. Application of Water

The Contractor shall apply water in a quantity and at a rate sufficient to thoroughly saturate the entire thickness of the lift being densified. Water shall also be applied while the backfill material is being placed in the trench.

B. Use of Vibration

Where densities are required which cannot be attained by flooding alone, the Engineer may direct the Contractor to supplement the flooding process with the application of vibrating compacting equipment to the backfill.

C. Lift Thickness

The lift of backfill shall not exceed that which can be readily densified by the flooding procedure, but in no case shall the undensified lift exceed six inches (6") for flooding.

D. Character of Material

The material being used with the water settling methods to backfill the trenches in street rights-of-way shall have a sand equivalent of at least 20 for steel and DIP and an SE of 30 for PVC when tested in accordance with the California Test Method 217 or ASTM D 2419 and having a maximum of ten percent (10%) passing a two hundred (200) mesh standard sieve. Where the nature of the material excavated from the trench is generally unsuitable for densification with water, the Contractor may, at no cost to the District, import suitable material for flooding, or densify the excavated material by other methods. If water densification methods are employed in such cases, the Contractor shall, at his expense, provide free-draining bedding material under the pipe and all structures to permit the unimpeded movement of excess water to the downstream end of the construction where the Engineer may require the Contractor to provide a sump and pump to remove the accumulated water.

E. Damage to Adjacent Improvements

The Contractor shall make his own determination that the use of flooding methods will not result in damage to existing improvements. Permission to employ such methods in densifying backfill shall not be construed as guaranteeing or implying that adjacent ground and improvements will be unaffected.

1.11.09 Compaction Testing

The Contractor when providing water or sewer facilities within a development shall engage the services of a testing laboratory (approved by the District) to test the degree of compaction attained in the backfill as required by these Specifications. All compaction tests shall be at the Contractor's expense without any compensation therefore.

The compaction tests of the backfill for a District project which meet the specified requirements shall be at the Owner's expense. All compaction tests which do not meet the specified requirements shall be at the Contractor's expense without any

compensation therefore. These latter costs will be paid by the Owner and deducted from the progress payments to the contractor.

Compaction shall be tested in accordance with the methods specified by the California Test Method 216, or ASTM Designations D 1556 and D 1557.

A compaction test of the backfill will be required as directed by the Engineer or approximately every two hundred fifty to three hundred feet (250' to 300') or more often if tests indicate the need, along the alignment on the main pipeline and, in addition, a minimum of twenty percent (20%) of all laterals within the street rights-of-way. It is possible that the Engineer will require up to every other lateral to be tested. The tests shall be made at varying depths and locations as directed by the Engineer or the agency having jurisdiction.

The Contractor, at his expense, shall excavate the holes for all of the tests, backfill the holes and compact this backfill, and pave the surface, if required, after the test.

1.11.10 Excess Excavated Material

The Contractor shall make the necessary arrangements for and shall remove and dispose of all excess or waste material at a legal disposal site. All costs for the disposal of excess or waste material shall be borne by the Contractor.

It is the intent of these Specifications that all surplus material not required for backfill be disposed of by the Contractor outside the limits of the public rights-of-way, and in accordance with the requirements of the County Grading Ordinance or ordinance of any other agencies having jurisdiction at no cost to the District.

Excavated material shall not be deposited on private property unless written permission from the owner thereof is secured by the Contractor. Copies of said written permission, duly signed by the owner of the private property involved, shall be furnished to the Engineer by the Contractor before such material is placed on private property. A post construction letter of acceptance from the owner shall be required before Final Release.

In open terrain, surplus material may be disposed of within the rights-of-way by spreading and rolling, provided that such surplus material does not contain any rocks or lumps which cannot be readily covered by spreading.

1.11.11 Imported Backfill Material

Whenever the excavated material is unsuitable for backfill, the Contractor shall arrange for and furnish imported backfill material per sections 1.11.02, 1.11.03 and 1.11.08 at his own expense. He shall dispose of the excess trench excavation

as specified in Section 1.11.10. Backfilling with imported material shall be done in accordance with the methods described herein.

1.12 Structural Earthwork

1.12.01 Structural Excavation

The site shall be cleared of all natural obstructions, pavements, utilities and other items which will interfere with construction. Any method of excavation may be employed which, in the opinion of the Contractor, is considered best. Ground shall not be dug by machinery nearer than three inches (3") from any finished subgrade without the express approval of the Engineer. The last three inches (3") shall be removed without disturbing the subgrade. Should the excavation be carried below the lines and grades indicated on the plans, the Contractor shall, at his own expense, refill such excavated space to the proper elevation in accordance with the procedures specified for backfill, or, if under footings, the space shall be filled with concrete, as directed by the Engineer.

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

1.12.02 Structural Backfilling

After completion of foundation footings and walls, and of other construction below the elevation of the final grade, and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all debris. Unless otherwise shown, material for backfilling shall consist of excavated material, or imported sand, gravel or other material approved by the Engineer and shall be free of trash, lumber or other debris. Backfill shall be placed in horizontal layers not exceeding nine inches (9") in thickness, and shall have a moisture content such that the required degree of compaction may be obtained. Each layer shall be compacted by hand or machine tampers, or by other suitable equipment or means, to a relative compaction of at least ninety percent (90%) of maximum. Dewatering shall be maintained during the placement of compacted clay backfill.

1.12.03 Stripping

All vegetation, such as roots, brush, heavy sods, heavy growths of grass and all decayed vegetable matter, rubbish, and other unsuitable material within the area of the work, shall be stripped or otherwise removed before fill is started. Surfaces under paved areas, dikes, and elsewhere as directed by the Engineer shall be wetted and compacted prior to placing fill.

1.12.04 Grading

After stripping has been done, excavation of every description and of whatever substance encountered within the grading limits of the work shall be performed to the lines and grades indicated on the plans. All suitable excavated material shall be transported to and placed in the fill area within the limits of the work. All excavated materials which are considered unsuitable by the Engineer, and any surplus of excavated material which is not required for fill shall be known as waste and shall be disposed of as directed in Section 1.11.10 above. During construction, excavation and filling shall be performed in a manner and sequence that will provide drainage at all times.

Ditches shall be cut accurately to the cross-sections and grades indicated. Any excessive ditch excavation shall be backfilled to grade either with suitable, thoroughly compacted material, or with Class II Aggregate Base to form an adequate paving subgrade.

1.12.05 Fill

Fills or embankments shall be constructed at the locations and to the lines and grades indicated on the plans. Suitable material from excavations may be used for fill. Material shall be placed in horizontal layers of from eight to twelve inches (8" to 12") in loose depth for the full width of the cross section and compacted as specified.

For general fill areas, the fill shall be compacted to ninety percent (90%) relative compaction.

For roadways and all areas to be paved, the fill shall be compacted, by means of tamping roller or three-wheel power roller, to at least ninety percent (90%) relative compaction at optimum moisture content. In the State Highway, or where pavement is to be placed directly on the subgrade or backfill materials, ninety-five percent (95%) relative compaction shall be required.

Dikes and embankments shall be compacted by the use of compaction rollers or three-wheel power rollers to ninety percent (90%) relative compaction so that subsequent settlement shall be negligible.

Relative compaction shall be as determined in accordance with the California Test Method 216, or ASTM Designations D 1556 and D 1557.

1.12.06 Finish Grading

All areas covered by the work, including excavated and filled sections and transition areas, shall be graded uniformly to the elevations shown on the plans. The finished surface shall be reasonably smooth, compacted, and free from any irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations. The finished surface shall be not more than two tenths foot (0.2') above or below the established grade. Ditches shall be paved to drain readily. The surface of areas to be paved, on which a surface course is to be placed, shall not vary more than five hundredths foot (0.05') from established grade and approved cross-section.

1.12.07 County and City Grading Ordinances

In addition to the requirements herein set forth for structural earthwork, all work shall be in accordance with the requirements of the County Grading Ordinance of ordinance of any other agencies having jurisdiction.

1.13 Drilling and Blasting

1.13.01 Use of Explosives

All operations, storage and handling of explosives shall be according to provisions of Division II, Part I, of the Health and Safety Code, State of California, and shall comply with all State, County and local laws.

1.13.02 Skilled Workmen

Drilling and blasting are to be done only by personnel skilled in rock techniques.

1.13.03 Safety

All necessary precautions shall be taken for protection of life and property. Warnings shall be given to nearby property owners that blasting is in progress. Safety mats shall be used to restrict flying particles. The Contractor shall size each "shot" to minimize nuisance and reduce the possibility of damage to local structures.

1.13.04 Site Documentation

Prior to commencing any activity associated with the drilling and blasting operation, photographs and a video tape will be made of structures in the immediate blasting area.

1.14 Final Cleanup

After all earthwork operations have been completed, the rights-of-way and all other areas shall be dressed smooth and left in a neat and presentable condition to the satisfaction of the Engineer and District.

1.15 Traffic Plan

The Contractor or Developer's Engineer shall provide a traffic plan approved by the Agency issuing the Encroachment Permit to the District for review.

CONCRETE CONSTRUCTION

2.1 Scope

The Contractor shall furnish all labor, materials, tools, equipment and incidentals necessary to complete construction of Portland cement concrete as shown on the plans and as specified herein.

2.2 Composition

Concrete shall consist of Portland cement, sand, coarse aggregate, water and admixtures as specified or approved, all well mixed and brought to the proper consistency suitable for the specified conditions of placement and in accordance with the requirements of this specification.

2.3 Classes of Concrete

All Portland cement used on the work shall be one of the classes described below. Unless otherwise stated, each class shall be used in the locations as listed:

2.3.01 Class I

Compressive Strength – 3000 psi min.
Mix - 6 sack minimum, test required
7 sack, test not required
Use - Walls, beams, slabs, footings
Equivalent California State Highway Designation
(1969) - Class D (for 7 sack min.)

2.3.02 Class IV

Compressive Strength – 2500 psi min.
Mix - 5 sack, test not required
Use - Paving, cradles, curbs, gutters, sidewalks, thrust blocks,
manhole bases, pipe encasement, or where specified
Equivalent California State Highway Designation (1969) Class B

2.4 Portland Cement

Unless otherwise specific, Portland cement shall be Type I or Type II complying with ASTM Designation C-150, and shall have a total alkali content not exceeding 0.6 percent (0.6%) when calculated as sodium oxide as determined by methods given in ASTM Designation C-114.

2.5 Sand

Sand shall be washed, natural sand having hard, strong and durable particles and which does not contain more than 2 percent (2%) by weight of such deleterious substances as clay lumps, shale, schist, alkali, mica, coated grains, or soft and flaky particles. Sand shall be graded uniformly from fine to coarse such that the combined grading of coarse aggregate and sand set forth in paragraph 2.6 will be met. Nor more than 3 percent (3%) shall pass the No. 200 screen as determined by ASTM Designation C-117.

2.6 Coarse Aggregate

Coarse aggregate shall be a clean, hard, fine grained, uncoated sound crushed rock, or washed gravel or combination of both. It shall be free from oil, organic matter or other deleterious substances and shall not contain more than 2 percent (2%) by weight of shale or cherty materials; and shall show a loss of not more than 10 percent (10%) when tested for soundness in sodium sulfate solution in accordance with ASTM Designation C-88. Coarse aggregate shall be graded uniformly from one-quarter inch size to maximum size. The combined grading of coarse and fine aggregate shall fall within the following percentages by weight.

<u>Percentage Passing Sieves</u>			
<u>Sieve Size</u>	<u>1-1/2" Max.</u>	<u>1" Max.</u>	<u>3/4" Max.</u>
2"	100		
1-1/2"	90 - 100	100	
1"	50 - 86	90 - 100	100
3/4"	45 - 75	89 - 90	90 - 100
3/8"	38 - 55	65 - 85	60 - 80
No 4	30 - 45	35 - 50	40 - 60
No 8	23 - 35	25 - 40	30 - 45
No 16	12 - 27	19 - 30	20 - 35
No 30	10 - 17	12 - 20	13 - 23
No 50	4 - 9	5 - 10	5 - 15
No 100	1 - 3	1 - 4	1 - 5
No 200	0 - 2	0 - 2	0 - 2

2.7 Mixing Water

Mixing water shall be clean and free from deleterious amounts of acids, alkalis, salts or organic materials.

2.8 Air Entrainment

Unless otherwise specified or directed by the Engineer, water reducing and plasticizing admixtures shall be used to reduce the required mixing water, for equivalent slump in plain concrete, at least 10 percent (10%) without entraining air in excess of 2 percent (2%) by volume. If the admixture used entrains more than 2 percent (2%) air, the water reduction shall be an additional 2 percent (2%) of air entrained over 2 percent (2%), but in no case shall air entrained exceed 5 percent (5%). Admixtures containing more than 25 percent (25%) by weight of calcium chloride will not be approved. Acceptable water-reducing and plasticizing admixtures are Maracon and Pozzolith or approved equal. All admixtures shall be used in strict accordance with manufacturer's recommendations.

2.9 Pozzolan

Pozzolan shall conform to ASTM Designation C-618, except that minimum compressive strength for the lime-reactivity test shall be one thousand (1000) psi at seven (7) days. Acceptable pozzolans are Airox, Colton or approved equal.

2.10 Other Admixtures

No other admixtures shall be used without the Engineer's approval.

2.11 Reinforcing Steel

Reinforcing steel shall consist of deformed bars of the size called for on the plans. Reinforcing steel shall conform to ASTM A-615; longitudinal reinforcing steel for columns shall be hard grade; all other reinforcing steel shall be either intermediate or hard grade. Deformations shall conform to ASTM A-615, A-616, A-617, and A-305. Mill certificates showing conformity with these requirements shall be furnished to the Engineer for each melt if so requested. Wire reinforcement shall conform to ASTM A-82.

2.12 Test on Concrete

From each day's placing of each class of concrete, at least one set of three standard test cylinders shall be made and cured in accordance with ASTM Designation C-31. The cylinders shall be dated, numbered, and marked to indicate the location from which the sample was taken. The result of the slump test shall be noted on the cylinder. Not more than two cylinders shall be made from any one point or batch of concrete. The average of three cylinders crushed at the required age shall constitute one standard test, except that

occasional additional cylinders may be made for crushing at early ages to determine the approximate strength of the concrete for form stripping or other purposes.

Specimens shall be tested in accordance with ASTM Designation C-39.

The standard age of test shall be 28 days.

Should more than one in ten laboratory control strength test cylinders for any structure falls below the specified compression strength, the Engineer shall have the right to order a change in proportions or the water content of the concrete for the remaining structures. If the strength of any job cured cylinders falls below the specified compressive strength, the Engineer shall have the right to require the necessary changes in temperature and moisture content to secure the required strength and may require additional tests in accordance with ASTM Designation C-42, or order load tests to be made on the structures so affected if preliminary testing with the Schmidt Impact Hammer indicates the concrete to be defective.

2.13 Mix Design

Before beginning concrete work, the proper proportions of materials for each class of concrete shall be determined by the Contractor and/or his supplier. The mix design shall be prepared at the Contractor's expense, by a recognized inspection and testing laboratory, approved by the Engineer, and shall show the expected strengths and corresponding slumps, and all ingredient weights and other physical properties necessary to check the design mix. A trial batch shall be made for each class of concrete to be used on the job and from each batch four standard test cylinders shall be cast, cured and tested, as specified for the job concrete. Certified copies of all laboratory reports shall be sent promptly to the Engineer directly from the testing laboratory stating whether the items reported meet the Specifications. A final report shall be submitted at the completion of all concreting summarizing all findings concerned with concrete used in the project.

If more than one supplier of concrete is used by the Contractor, each supplier shall submit their design mix as directed above.

2.14 Mixing

Job mixing of structural concrete will not be permitted unless otherwise specified. When allowed, concrete shall be mixed in a batch mixer of approved type which will insure a uniform distribution of the materials throughout the mass, so that the mixture is uniform in color and homogenous. All concrete shall be placed within one (1) hour after water is first added to the batch. The mixer shall be equipped with a suitable charging hopper, a water storage and water measuring device controlled from a case which may be kept locked and so constructed that the way may be discharged only while the mixer is being charged. The entire contents of the mixing drum shall be discharged before recharging.

The mixer shall be cleaned at frequent intervals while in use. The volume of mixed materials per batch shall not exceed the rated capacity of the mixer. Transit mixed concrete shall be batched, mixed and delivered in accordance with ATM Designation C-94, except that truck agitators may not be used. All concrete shall be deposited in place not more than forty-five (45) minutes after water is added when the temperature of the concrete exceeds 85° F and not more than one and one-half (1-1/2) hours after water is added when the temperature of the concrete is less than 85° F. Certified public weigh master tickets shall be delivered to the Engineer or his representative in the field prior to placing the concrete to which the ticket applies.

2.15 Consistency

The quantity of water required for the proper consistency of the concrete shall be determined by the slump test, in accordance with ASTM Designation C-143. Unless otherwise stated, slump allowances shall be as follows:

Vertical Wall Sections, Columns – Maximum four-inch (4”) plus or minus one-inch (1”).

Floor Slabs, Beams, Footings – Maximum three-inch (3”) plus or minus one-half inch (1/2”).

2.16 Retempering

Retempering of concrete which has partially hardened, that is, mixing with or without additional cement, aggregate, or water, will not be permitted.

2.17 Joint Filler

Pre-formed fillers shall be of the type indicated on the plans and shall be installed as indicated on the plans.

2.18 Shop Drawings

Placing sheets and bending schedules shall be submitted to the Engineer for approval.

2.19 Waterstops

Waterstops shall be installed where so indicated on the plans. Waterstops shall be of polyvinyl chloride plastic, “Burke Vinylok type RB”, medium duty or approved equal. Proper care in placing of waterstops in forms shall be exercised so that the center bulb coincides with the construction joint. When concrete is being placed, it shall be properly vibrated to insure density at waterstop location. Waterstops shall be made continuous at splices and intersections (horizontal and/or vertical) by “welding” with a polyvinyl chloride splicing iron.

2.20 Depositing

Concrete shall not be placed until the forms and reinforcement have been approved by the Engineer. Concrete shall be conveyed from the mixer to the place of final deposit as rapidly as possible by methods which will prevent the separation or loss of ingredients. It shall be deposited in the forms as nearly as practicable in its final position with lifts not over one and one-half (1-1/2) feet high, so as to maintain a plastic surface approximately horizontal. Concrete shall not be dropped more than eight feet (8') unless a suitable chute or tube is used. Forms for walls, or other sections of considerable height, shall be provided with openings, or other devices shall be used which will permit the concrete to be placed in a manner which will avoid accumulations of hardened concrete on the forms or metal reinforcement. Under no circumstances shall concrete that has partially hardened be deposited in the work. Temporary joints shall not remain exposed for more than forty-five (45) minutes before adjacent concrete is placed. Concrete shall be continuously inspected by the inspector who shall be afforded an opportunity to check the forms for accuracy, cleanliness and position of reinforcing before the pour is started.

2.21 Subgrade Preparation

Subgrade for slabs over native earth or fill shall be finished to the exact location and section of the bottom of the slab and shall be maintained in a smooth, compacted condition, until concrete is placed. Sub-grade shall be thoroughly moistened but not muddy, at the time concrete is placed.

2.22 Compacting

Concrete during and immediately after depositing shall be thoroughly worked around the reinforcement and embedded fixtures and into corners of the forms. Internal vibrators shall be used for all walls, and self-supporting beams or slabs. Vibrators shall be handled by experienced workmen and care shall be taken to avoid separation of aggregate due to over vibration. At least one vibrator shall be used for each fifteen (15) cubic yard per hour of concrete placed. Standby vibrators shall be kept on hand.

2.23 Construction Joints

Concrete in each unit of construction shall be placed continuously, and the Contractor shall not be permitted to begin work on any part unless his facilities and forces are sufficient to complete the unit without interruption. All joints in concrete shall be located as indicated on the drawings and as approved by the Engineer.

The Contractor shall submit to the Engineer for approval, drawings marked to show the location and sequence for pours.

All construction joints shall be made as watertight as possible. Waterstops shall be provided where called for on the plans or where deemed necessary by the Engineer. Where these methods fail, joints shall be grouted under pressure after the concrete has set and forms have been removed.

The surfaces of construction joints in any location shall be thoroughly cleaned and roughened by dry method sandblasting to remove all laitance and expose aggregate solidly embedded in the mortar matrix.

2.24 Bonding

Before new concrete is deposited on or against concrete which has set, the form shall be retightened, the surface of the set concrete shall be roughened, thoroughly cleaned of foreign matter and laitance, as specified under Section 2.23 "Construction Joints", and sprayed with water so that the concrete is saturated but no free water is left on the surface. The new concrete placed in contact with hardened or partially hardened concrete shall contain an excess of mortar to insure bond. To insure this excess mortar at the juncture of the hardened and newly deposited concrete on vertical and inclined surfaces, the cleaned and saturated surfaces of the hardened concrete shall first be slushed with a coating of neat cement grout against which the new concrete shall be placed before the grout has attained its initial set. For horizontal surfaces, a layer at least one inch (1") thick of cement mortar composed of one (1) part cement and two (2) parts sand shall be placed before depositing the concrete.

2.25 Curing

2.25.01 Water Curing

Uniformed concrete surfaces shall be covered with wet burlap mats as soon as the concrete has sufficiently set, and shall thereafter be kept wet under burlap until backfilled or for fourteen (14) days after the concrete is placed. Where drying conditions are severe, as determined by the Engineer; fog sprays shall be employed to prevent checking of the fresh concrete surface. Immediately following the first leveling, the fog spray shall be applied whenever the concrete surface will absorb moisture and shall be discontinued when the applied moisture is rejected. Fog spraying shall be continued as specified until the finished surface has attained sufficient strength to permit flooding or covering with burlap mats.

Formed surfaces, both interior and exterior, shall be water cured under burlap mats or by water sprays beginning as soon as the forms are stripped. Prior to stripping of forms, the concrete shall be kept moist by the water sprays.

2.25.02 Curing Compounds

With the written approval of the Engineer, concrete surfaces may be cured by curing compounds as defined below. Any concrete curing compound shall be of a nature and composition not deleterious to concrete, and thinned to a working consistency either with a volatile solvent or by emulsification with water. The curing compound shall be of a standard and uniform quality ready for use as shipped by the manufacturer. Curing compound shall form a continuous, unbroken membrane which shall adhere to moist concrete and which will not disintegrate, check, peel from the surface, nor show signs of such deterioration within thirty (30) days after application under actual working conditions. The compound shall be sufficiently transparent and free from color that there will be no permanent change in the color of the concrete. The compound shall contain, however, a temporary dye of sufficient color to make the membrane clearly visible for a period of at least four (4) hours after application. If the contractor applied a deleterious compound to paint, plaster, gunite, or other surface treatment, he shall thoroughly sandblast the surface to remove all vestiges of the compound.

2.26 Protection of Concrete Construction

All surfaces shall be protected against injury. During the first seventy-two (72) hours after placing, wheeling, working, or walking on the concrete shall not be permitted. All slabs subject to wear shall be covered with a layer of sand or other suitable material as soon as the concrete has set, and either shall be cured by the use of a curing compound or shall be kept wet for not less than fourteen (14) days or they shall be kept covered for the same period with Sisalcraft paper or other similar tough waterproof paper. All joints between adjacent strips of paper shall be sealed.

No concrete shall be placed during rain and during such weather; all concrete placed within the preceding twelve (12) hours shall be protected with waterproof canvas or other suitable coverings. These shall be provided and kept ready at hand.

All concrete construction shall be protected from excessive loadings.

2.27 Repair and Patching

After removing forms and before the concrete is thoroughly dry, any pour joints, voids, stone pockets, or other defective areas and all tie holes shall be patched. Defective areas shall be saw cut to a depth of not less than one inch (1") with the edges perpendicular to the surface. The area to be patched and a space at least six inches (6") wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar.

The patch shall be made of the same materials and proportions as used for the concrete, except that the coarse aggregate shall be omitted. The amount of mixing water shall be as little as consistent with the requirements of handling and placing.

The mortar shall be thoroughly compacted into placed and screened, leaving the patch slightly higher than the surrounding surface. After being undisturbed for one or two hours to permit initial shrinkage, the patch shall be finished to match the adjoining surface.

Tie holes left by the withdrawal of form clamp rods or holes left by removal of snap ties shall be filled solid with mortar. For holes passing entirely through the wall, a plunger-type grease gun or other device shall be used to force mortar through the wall, starting at the back face. When the hole is completely filled, the excess mortar shall be struck off with a cloth flush with the surface. Holes not passing entirely through the wall shall be filled with a small tool that will permit packing the hole solid with mortar, with any excess mortar being struck off flush with the surface.

2.28 Placing Reinforcing Steel

Reinforcing steel, before being positioned, shall be cleaned thoroughly of mill and rust scale or other coatings that will destroy or reduce the bond. Reinforcement appreciably reduced in section shall be rejected. Where there is delay in depositing the concrete, reinforcement shall be reinspected and, when necessary, cleaned.

Reinforcement shall be carefully formed as indicated on the plans. Stirrups and tie bars shall be bent around a pin having a diameter of not less than three times the diameter of the bar. Except where specifically indicated otherwise on the plans, bends for other bars shall be made around a pin having a diameter of not less than six (6) bar diameters. All bars shall be bent cold. Reinforcing steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of bars will be permitted only when the entire operation is approved by the Engineer.

Reinforcing steel shall be positioned accurately and secured against displacement by using annealed iron wire or suitable clips at intersections and shall be supported by concrete chairs or spacers, or metal hangers.

In slabs, beams and girders, and walls subject to lateral pressure, splices of reinforcement shall not be made at points of maximum stress without the express approval of the Engineer. Splices, where permitted, shall provide sufficient lap to transfer the stress between bars (bond and shear).

Adjacent bars shall not be spliced at the same point. The minimum allowable lap at points of maximum stress shall be thirty (30) times the diameter of the larger bar of the

splice, but in no case shall the lap be less than eighteen inches (18"). Minimum allowable lap distances for masonry wall reinforcement shall be forty (40) times the diameter of the larger bar of the splice, but in no case less than eighteen inches (18").

2.29 Form Material

2.29.01 Class I

For permanently exposed concrete surfaces where architectural appearance is important, Class I forms shall be constructed with particular care to assure a high type of architectural finish of uniform texture, free from visible irregular ties, patch marks and discolorations. Forms shall be of synthetic resin bonded plywood specially made for concrete work or nonwarping hardboard. The entire surface shall be lightly sanded if necessary.

2.29.02 Class II

This class shall be used for unplastered interior of all rooms and for all surfaces in contact with water, such as interior walls of channels and tanks. These forms shall be of hardboard, steel or waterproof synthetic resin bonded plywood specially made for concrete work.

The Contractor shall be permitted to use the most advantageous panel sizes and panel joint location. Class II forms for painted concrete surfaces shall be free of all surface imperfections. Neat patches and minor surface imperfections will be permitted in forms for unpainted concrete provided the finished surface conforms to the requirements specified hereunder.

2.29.03 Class III

This class shall be used for formed surfaces not exposed to view such as footings, backfilled walls and pipe trenches. These forms shall be of metal or of smooth placed boards in good condition free from large or loose knots.

2.30 Form Construction

Exposed edges of concrete on the outside and inside of structures shall be chamfered or beveled at an angle of forty-five (45 °) degrees, such bevel being one inch (1") on a side. If so directed by the Engineer, however, the Contractor shall provide square edges for any portions of the work.

All dirt, chips, sawdust and other foreign matter shall be removed from within the forms before any concrete is deposited therein. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being used. Before concrete is

deposited within the forms all inside surfaces of the forms shall be thoroughly coated with an approved oil.

Bolts, rods or single wires shall preferably be used for internal ties and if so used shall be so arranged that when the forms are removed, no metal shall be within one inch (1") of any surface. Twisted wire ties will not be permitted in the forms for any wall later to be subjected to water pressure. The Contractor shall take due precaution to prevent future leakage or seepage along ties used in all walls which will be subjected to water pressure. Ties used in all such walls must be cut back into the face of the wall at least one inch (1") and the resulting holes pointed up with 1:3 mortar.

Temporary openings shall be provided at the base of column and wall forms and at other points where necessary to facilitate cleaning and inspection immediately before depositing concrete.

Forms, bracing and shoring shall be kept in place until their removal is approved by the Engineer, and in no case shall removal commence earlier than the following schedule:

Sides of footing	1 Day
Walls above ground	3 Days
Walls below ground	7 Days
Columns	10 Days
Slabs	14 Days
Beams	21 Days

Members subject to additional loads during construction shall be adequately reshored to support both member and construction loads in a manner that will protect the member from damage.

2.31 Finish of Formed Surfaces

All finished or formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown on the plans or prescribed by the Engineer. Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing or roughness of any kind, and shall present a finished, smooth, continuous hard surface. All sharp angles, where required, shall be rounded or beveled.

Where Class I forms are required, the surface of the concrete shall be given the following finish: After wetting the surface, a grout shall be rubbed in using a rubber float or burlap.

The grout shall be made by mixing one part of cement and one and one-half (1-1/2) parts of fine sand with sufficient water to give it the consistency of thick paint. After the grout hardens sufficiently, it shall be scraped from the surface with the edges of a steel trowel without disturbing the grout in the air holes. After further drying, the surface shall be rubbed with burlap to remove all surface grout. The entire surface shall be finished to secure a uniform texture.

2.32 Finish of Slabs

Floors and flat roof surfaces, all exterior concrete floors, sidewalks and flat surfaces where drains are to be provided, the Contractor shall be particularly careful to provide an adequate slope to the drains or to suitable points of disposal. The direction of slope and the amount of crowing generally are shown on the Plans; otherwise they shall be subject to the approval of the Engineer.

2.32.01 Float Finish

The forms shall be completely filled with concrete with as little working as possible. All high or low spots exceeding one-quarter inch (1/4") in ten feet (10') shall be eliminated. The surface shall then be floated until it is smooth and free from blemishes. Only clean floats will be permitted.

2.32.02 Broomed Finish

Surfaces to receive a broomed finish shall be wood floated as specified above, followed by steel troweling. After steel troweling and before initial set, the surface shall then be slightly roughened by means of a broom or a burlap mat to produce an even textured surface finish.

2.33 Inserts

Where pipes, castings, or conduits are to pass through the walls, the Contractor shall place such pipes or castings in the forms before pouring the concrete, or in special cases, with the express consent and approval of the Engineer or as specified herein, he shall build approved boxes in the forms to make openings for subsequent insertion of such pipes, casting, or conduits. To withstand water pressure and to insure water-tightness around the openings so formed, the boxes or cores shall be provided with continuous keyways all the way around and shall have a slight flare to facilitate grouting and the escape of entrained air during grouting. The grout shall contain Embecco or similar material and shall be mixed and placed in accordance with the manufacturer's instructions.

Additional reinforcement shall be provided around openings to meet the approval of the Engineer. The space around pipes, castings, or conduits, as specified, shall be filled by

pouring grout under a head of at least four inches (4"). The grout shall be poured, rammed or joggled into place to fill completely the space between the pipes, castings, or conduits, and the sides of the openings so as to obtain the same water tightness as through the wall itself. The grouted castings shall then be water cured. The grouting material so placed shall be surfaced when the forms are removed to give a uniform appearance to the wall if such wall will be exposed to view.

The Contractor shall set accurately and hold in exact position in the forms until the concrete is poured and set, all gate frames, gate thimbles, special castings, channels, or other metal parts that are to be embedded in concrete, and he shall furnish and set accurately all inserts and anchor or other bolts necessary for the attaching of piping, valves, metal sash, and equipment. All nailing blocks, plugs, strips, and the like, necessary for the attachment of trim, finish and similar work and all wires for suspending ceilings will be furnished and placed by the Contractor.

2.34 Gunite

When the use of gunite is proposed, the Contractor's design engineer shall submit his gunite design and the specification proposal to the Engineer for approval.

2.35 Prestressed Concrete

When the use of prestressed concrete is proposed, the Contractor's design engineer shall submit his prestressed concrete design and specification proposal to the Engineer for approval.

2.36 Miscellaneous Concrete Mixes

Miscellaneous concrete mixes shall be as listed below:

<u>Use</u>	<u>28-Day Strength</u>	<u>Mix</u>
Grout	-----	7 sacks with pea gravel
Mortar	1800 psi	1 part cement, ¼ part lime putty, 3 parts sand
Grout for filling masonry blocks and for bond beams	2000 psi	1 part cement, 3 parts sand, 2 parts pea gravel

2.37 Cold Weather Requirements

Adequate equipment shall be provided for heating the concrete during freezing or near freezing weather. No frozen materials or materials containing ice shall be used.

All concrete materials and all reinforcement, forms, fillers and ground which the concrete is to come in contact with shall be free from ice and frost. Whenever the temperature of the surrounding air is below forty degrees (40°)F, all concrete placed in the forms shall have a temperature of between seventy degrees (70°)F and eighty degrees (80°)F and adequate means shall be provided to maintain a temperature of between fifty degrees (50°)F and eighty degrees (80°)F during the curing period.

The housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heating is disconnected. The use of salt or chemicals for the prevention of freezing is prohibited.

When heating of concrete materials is required, the mixing of water and aggregate shall be heated to not more than 90°F prior to being placed in the mixer so that the temperature of the mixed concrete shall be not less than 70°F nor more than 80°F. Aggregates shall be heated either by steam or by dry heat, and the heating apparatus shall be of a type which will heat the mass uniformly and in such a manner as to preclude the possible occurrence of over-heated areas, or hot spots, which will burn the materials. Flame throwers, or other similar direct heating devices will not be allowed.

PIPELINE MATERIALS AND INSTALLATION

3.1 General

This portion of the work shall include the furnishing and installation of all materials necessary to result in a first-class sewer installation true to line and grade to produce a “full moon” when mirrored and free from leaks, cracks, and obstructions in conformance with the Plans and Specifications.

Where choices are allowed, the Contractor shall select such materials and construction methods as will result in a satisfactory completed project. Materials and equipment used in the work shall be new and unused unless otherwise specified. In case a reference is not clear as to which of several grades is desired, the highest quality material shall be used. Materials and strength of pipe shall be as shown on the plans. Unless two or more materials are mentioned as equals, the Contractor shall not substitute another material for the one specified.

The only acceptable pipe line materials are Vitrified Clay Pipe (VCP), Armco / Contech Polyvinyl Chloride (PVC) or Acrylonitrile-Butodiene Styrene (ABS) truss pipe are considered acceptable for mainline construction. Similarly, SDR 23.5 solid wall PVC per ASTM D 3034 is considered acceptable for lateral construction.

3.2 Vitrified Clay Pipe (VCP) and Clay Fittings

3.2.01 Materials

Vitrified Clay Pipe (VCP) and Clay Fittings shall be extra strength, durable, first quality, well burned clay pipe in accordance with the ASTM C-700. Crushing strength shall be determined by the three edge bearing method of ASTM-C-301, and hydrostatic testing shall be at ten (10) psi as described in the Clay Pipe Engineering Handbook. Sampling and testing frequency are covered in a subsequent paragraph.

Each pipe and fitting shall be marked with the name of the manufacturer or his trademark.

The Engineer or Inspector may reject any pipe or fitting which contain excessive dimensional distortion as defined by the ASTM C-700, foreign matter fused into pipe, breaks which would effect the water tightness of the pipe and cracks which extend thorough the entire thickness of the pipe barrel.

3.2.02 Compression Joint for VCP

(1) Molded Compression Joint

When molded compression type joints are used to join VCP, the joint shall be manufactured in accordance with ASTM Specification C-425. The joints shall be “Wedge-Lock”, “Speed Seal”, or approved equal.

(2) Mechanical Compression Joint

When mechanical compression type joints are used to join VCP, the joint shall be manufactured in accordance with ASTM Specification C594-66T, “Test Condition 2”. The joint shall be as manufactured by Mission Clay Products Corp., “Band-Seal Type II Mainline Joint”, with a stainless steel shear ring, or approved equal.

3.2.03 Hot Pour Joints

Hot pour joints will not be permitted.

3.3 Composite Sewer Main and Lateral

Composite Sewer Main and Lateral specified is defined as an internally braced, double-walled pipe for use in gravity sanitary sewers. Six inch diameter and smaller shall be solid-walled pipe.

3.3.01 Materials

Truss sewer pipe shall be manufactured by extruding of either polyvinyl chloride (PVC) or Acrylonitrile – Butadiene – Styrene (ABS) into a truss with inner and outer walls connected by webs.

The pipe and joints shall conform to the requirements of ASTM D 2680.

3.3.02 Joints

Chemically welded joints (PVS and ABS) or gasketed PVC joints shall be made in conformance with the pipe manufacturer’s recommendations. Both primer and a cement shall be of the composition recommended by the manufacturer.

3.3.03 Couplings and Fittings

Couplings and fittings shall be manufactured of materials having equal or superior chemical and physical characteristics as the pipe itself. Each solvent weld-type coupling shall be accurately formed to as to have the proper dimension necessary to assure a leak-proof joint. One (1) coupling shall be furnished with each standard length of pipe.

3.3.04 Installation

Pipe and fittings shall be delivered and installed in accordance with the pipe manufacturer's recommendations.

3.3.05 Manholes and Special Structures

An O-ring coupling and water stop shall be installed at the point of entry and exit of the sewer, through manholes and special structures. The coupling shall be placed so that the flared end will be flush with the outside wall of the structure. No concrete shall be placed past the flared diameter of the coupling.

3.3.06 Allowable Vertical Deflection

The allowable initial (after backfilling and compaction) vertical deflection shall not exceed five percent of the average inside diameter of the pipe in an unloaded condition.

3.3.07 Marking

Each length of pipe shall be marked at least once by the manufacturer, with trade name, lot identification, nominal size, the ASTM number, and the type and grade.

3.4 Ductile Iron Pipe (DIP) - NOTE: The use of ductile iron pipe shall be subject to the construction drawings and the approval of the District.

3.4.01 Ductile Pipe and Fitting (DIP)

All ductile iron pipe shall be manufactured in accordance with ANSI A 21.51 and AWWA C151. Ductile iron pipe for 12-inch and smaller shall be Class 51 thickness; 14-inch and larger shall be class 52 thickness minimum.

All cast iron or ductile iron pipe and fittings shall be manufactured in accordance with ANSI A21.10 and AWWA C110.

All cast iron or ductile iron pipe and fittings shall have cement mortar lining per ANSI A21.4 and AWWA C104.

Bolts, nuts and washers for flanged joints shall conform to the recommendations of the pipe manufacturer and shall be uniformly tightened. Ring gaskets shall be uniformly tightened. Ring gaskets shall be lubricated and installed in accordance with the manufacturer's recommendation.

Ductile iron pipe may, at the Contractor's option (if not noted in plans), have push-on, mechanical or flange joints. Where flexibility of joints is a factor, such as where piping enters or exits a structure a flexible coupling shall be used.

All ductile iron pipe and fittings installed underground shall be protected with an 8 mil polyethylene tube encasement.

Ductile iron pipe shall be used where water and sewer mains cross with less than 3 foot vertical separation at right angle crossing.

3.4.02 Flanged Joints

Bolts, nuts and washers for flanged joints shall conform to the recommendations of the pipe manufacturer and shall be uniformly tightened. Ring gaskets shall be one-sixteenth inch (1/16") rubber or neoprene lubricated and installed in accordance with the manufacturer's recommendations.

3.4.03 Mechanical Joints

Mechanical joints shall consist of a stuffing box into which an endless rubber ring is compressed by a follower gland. The gasket must be fully confined and under constant compression. Mechanical joint pipe shall be installed in accordance with manufacturer's recommendations. Gasket shall conform to American Standards Association Specification A21.11.

3.4.04 Victaulic Couplings

Cast iron pipe for Victaulic Couplings shall have either grooved or shouldered ends. An endless rubber gasket of C-shaped cross section shall be used in each coupling. Couplings shall be installed in accordance with manufacturer's recommendations and be subject to the Engineer's approval.

3.5 Ductile Iron Force Main

The standards laid down in Section 3.4 will apply as the minimum. Higher standards may be specified by the Engineer depending upon the design requirements of a particular job.

3.6 Shop Drawings

If requested by the Engineer, shop drawings of all pipe and/or fittings shall be provided by the manufacturers.

3.7 Installation of Pipelines

Pipe laying shall proceed up-grade and, in the case of bell and spigot pipe, with the spigot ends pointing in the direction of the flow. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe, following manufacturer's instructions for the specific jointing method being used.

3.8 Pipe Joints

The Contractor, upon the Engineer's request, shall furnish for approval pipe manufacturer's drawings showing dimensions and manufacturing tolerances of pipe and joint to be used on the work.

3.9 Testing Frequency and Final Acceptability of Pipe

The Engineer may call for crushing and hydrostatic testing of up to five-tenths percent (0.5%) of the total pieces of nonmetallic pipe of each size to be used in the work. If any of these tests fail to meet the tabulated design strength and/or the listed hydrostatic test, the testing frequency shall be increased so that two percent (2%) of the total pieces of each size are being tested for bearing and bursting strength. If consistent failures occur, the entire lot of pipe with the samples represent shall be rejected. Notwithstanding prior factory or yard inspection, the Engineer shall have the right to reject any damaged or defective pipe found on the job which in its opinion will affect the durability of the installation, and the Engineer may order its removal from the work.

3.10 Cleanouts

The pipe for the cleanouts shall be of the same size and material as the sewer main. The cleanouts shall be constructed as shown on the District's Standard Drawing No. 2 and 2A and installed at the locations indicated on the Plans.

3.11 Wyes

Wyes shall be of the same material as the sewer main and the longitudinal barrel of the wyes shall be of the same size as the sewer main. Wyes of the size called for on the Plans shall be installed at approximately the locations shown on the plans. The exact location will be determined in the field by the Engineer or the District to best serve the property in question. A suitable plug shall be provided and installed prior to backfilling operations to provide a watertight joint. Unless otherwise specified, the branch of wyes fittings shall be inclined upward at an angle not greater than forty-five degrees (45°) and not less than ten degrees (10°) from a horizontal line.

3.12 Chimneys

The installation of chimneys is discouraged by the District. However, in extreme cases, this type of installation will be given consideration. Approval of the installation, and location, will be given by the General Manager, or his representative, upon completion of a field review.

3.13 Laterals

The building laterals shall be constructed as shown on the District's Standard Drawing No. 1 and shall be constructed of the type of material shown on the approved plans, or as approved by the Engineer. Building laterals of the size called for on the plans shall be installed at the locations shown on the Plans. The exact location will be determined in the field by the Engineer to best serve the property in question. A suitable plug shall be provided and installed prior to backfilling operations to provide a watertight joint. Building lateral pipe material shall be as specified in Section 3, "Pipeline Materials and Installation", of these Specifications. A cleanout shall be constructed on the lateral at the location shown, per Standard Drawing No. 1 and per the requirements of Standard Drawing No. 2 and 2A, and be constructed of the same diameter and type of material as the sewer lateral.

3.14 Bedding

Unless otherwise called for in the Plans and Specifications "bedding material per manufacturer's recommendations" of pipe in the trench will be satisfactory. Granular bedding material to provide special or normal bedding shall mean coarse granular material acceptable to the Engineer with a maximum particle size of ½ inch. Reference is made to Standard Drawing No. 6.

3.15 Excavation and Backfill

The Contractor is directed to Section 1, "Earthwork", of these Specifications for all items pertaining to excavation and backfill.

3.16 Pavement Removal and Replacement

The Contractor is referred to Section 8, "Removing and Replacing of Paved Surfaces", of this Specifications.

3.17 Pipe in Casing

The Contractor is referred to Section 5, "Concrete Blankets and Conductor Pipe", of these Specifications.

MANHOLES AND CLEANOUTS

4.1 General

All manholes shall be constructed in conformance with the District's Standard Drawings No. 3 and No. 4. All such structures shall be built into the sewer lines at the locations shown on the Plans. Pipe for future lateral sewer lines shall be built into the structures as shown on the Plans, and the outer ends closed with a cap securely fixed in place. The caps shall be so fixed as to be easily removed in the future and shall be watertight. Diameter noted on the Plans is the inside diameter of precast sections.

4.2 Precast Manholes

Precast manhole sections will be manufactured in a plant designed for this type of work. All units will conform to the details on the above-referenced drawings with eccentric cone top sections. Concrete used in the precast sections shall be manufactured of approved and selected materials in such proportions to produce a Class I concrete as per Section 2, "Concrete Construction", of these Specifications, with a minimum compressive strength of three thousand (3,000) psi. Sections will be compacted by vibration or centrifugal force and cured according to approved practice, either by steam sprinkling, membrane solution or a combination of these methods. Manholes shall conform with ASTM Designation C-478.

All sections shall be "tongue and grooved" as shown on the Standard Drawings, with a minimum depth of three-quarters inch (3/4"). All edges shall be true and even to enable a close fit when sections are placed together. A maximum tolerance of one-quarter inch (1/4") will be permitted when two sections are placed together in either a lateral or vertical direction.

4.3 Manhole Base

Manhole bases shall be monolithic construction of Class IV concrete and shall be poured to the size, line and grade as shown on the Plans and on the District's Standard Drawing NO. 4. A minimum nine inch (9") thickness shall be maintained from bottom of base to the pipe bottom. Drop manholes shall be constructed as detailed on the Plans. Drop manholes are considered undesirable and will be allowed only in situations where no other alternative is viable. The Contractor is referred to Section 2, "Concrete Construction", of these Specifications.

In laying the pipe up to structures, no pipe shall be allowed to project beyond the inside of the wall of the structure, and in no case shall the bell of a pipe be built to project beyond the outside of a structure. Flexible joints shall be provided in all VCP sewer pipes outside of manholes but within 24-inches on the concrete base.

Where the line and grade of a sewer run through a manhole enabling a continuous run, the sewer pipe may be laid continuously through the manhole, and after the concrete base and invert have been poured and thoroughly set, the top half of the pipe within the manhole shall be broken off and carefully trimmed to conform to the base of the manhole.

A notch or groove conforming to the precast manhole section shall be formed on top of the base section.

4.4 Precast Manhole Joints

Precast manhole sections shall be tongue and grooved alternately on both ends of the sections and shall be laid with the grooved portion facing up. Each section shall be set so as to enable the manhole to rise vertically above the base.

An acceptable concrete waterproof mortar conforming to ASTM Standards shall be placed on the top of each ring completely covering the groove portion prior to the installation of the next precast section. Excess mortar should flow out equally on both sides of the joint for the complete circumference of the ring. Finish mortar joint should have a minimum thickness of one-quarter inch (1/4"). All grout shall be freshly mixed and no mortar shall be applied that has been allowed to stand affording it a chance to become hard or begin its initial set.

Mortar shall consist of one (1) part by volume of cement and three (3) parts by volume of sand. Mortar shall be mixed in a suitable mixer in a water-tight mixing box. The materials must be thoroughly mixed dry until the mass assumes a uniform color and then sufficient water added to bring the mixture to a workable consistency. No mortar which has begun to set shall be used and no retempering thereof will be permitted. Mortar shall conform to Section 2.36 of these Specifications.

Each section of manhole may be joined to another section or to the concrete base by a one-inch (1") diameter polyethylene foam rope (2 lbs.) laid continuously in the joint at the option of the Contractor. After joining sections together, the joint on the inside of the manhole shall be "battered" with a cement mortar to give a smooth finished surface. Cement mortar shall be used for joining grade rings above the concrete. A satisfactory lubricant as recommended by the manufacturer shall be applied to the foam rope prior to its installation. The Engineer has determined that the foam rope seal conforming to the provision of this section

4.5 Grade Rings

Precast grade rings shall be used to reach desired height of the manhole cover. Minor adjustments shall be made by the use of “shims” under the frame. Grade rings are required for manholes constructed in easements as needed for adjustment to finish grade.

4.5.1 Shims

“Shims” to be used under any manhole frame shall be manufactured from a nondeteriorating metal. Wood, metal or other corrodible material will be rejected.

4.6 Manhole Steps

Steps shall be standard steel Reinforced Copolymer Polypropylene Manhole Steps (1/2 inch diameter Grade 60 rebar). Steps will be installed, at the time of manufacture for precast manholes, with a minimum width of fourteen (14) inches between legs at 15 inches on center. The distance between rungs and the top space at the center of the step to the inside wall shall be as shown on the Plans.

4.7 Cleanouts

Cleanouts shall be constructed as shown on the District’s Standard Drawing No. 2 and 2A, and in conformance with the notes contained therein.

4.8 Castings

All castings shall be of the type shown on the Plans and shall be securely seated and fit in the top of the manhole structure to the grade shown on the Plans or called out by the Engineer. Where waterproof pans have been called out, these shall be installed to a tight fit and tested for leakage to the satisfaction of the Engineer. All castings shall be of tough gray iron, free from cracks and swells. The iron shall conform to the requirements of ASTM Standard A-48, Class 30.

4.8.01 Manhole Frames and Covers

Manhole frames and covers to be constructed shall be by the Alhambra Foundry Co., Type A-1254-6 for 24” diameter and Type A-1251-6 for 36” diameter or approved equal.

Covers shall be diamond thread finish per District Standard No. 3. All frames and covers to be machined to fit (non-rocking).

4.8.02 Cleanout Frames and Covers

Cleanout frames and covers shall be by the Alhambra Foundry, number A-1241 or approved equal.

4.8.03 Nameplate

The nameplates on each and every sanitary sewer manhole cover shall read as follows "Sewer" (upper) "L.H.M.W.D." (lower), see Standard Drawing No. 3 for removal hole location.

CONCRETE BLANKETS AND CONDUCTOR PIPE

5.1 Concrete Blanket

5.1.01 General

The Contractor shall install Concrete Blankets in accordance with the District's Standard Drawing No. 7, at the locations shown on the plans and in conformance with these Specifications. A Type I blanket is to be used at locations where pipe is to be protected from surcharge and wheel loadings. A Type II blanket is to be used at locations where the pipe installation is to be protected from erosion due to the flow of water over the pipe. Concrete shall be Class IV.

5.2 Excavation and Backfill

The Contractor is referred to Section 1, "Earthwork", of these Specifications.

5.3 Conductor Tubing by Boring

5.3.01 General

The Contractor shall comply with the California Labor Code Section 7955 and Title 8 CCR Section 8422 when working on a tunnel (jacking operation). The Contractor shall provide a copy of the Tunnel Classification to the District. The Contractor shall submit details of jacking pit bracing, casing and jacking head for approval to the Engineer. Only workmen experienced in the jacking of conduit shall be used in performing the work.

The methods and equipment used in jacking conduit shall be optional with the Contractor, provided that the proposed method is approved by the Engineer and the agency granting the permit. The use of water or air will not be allowed in the jacking or boring operations. Any approval, however, shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein.

The leading section of conduit shall be equipped with a jacking head securely anchored thereto to prevent any wobble or variation in alignment during the jacking operation. Excavation shall be performed entirely within the jacking head and no excavation in advance thereof shall be permitted. Every effort shall be made to avoid any loss of earth outside the jacking head. Excavated material

shall be removed from the conduit as excavation progresses, and no accumulation of such material within the conduit will be permitted.

Once the jacking operation has commenced, it shall be continued uninterrupted around the clock until the conduit has been jacked between the specified limits.

Upon completion of the jacking operations, all voids around the outside face of the conduit shall be filled by grouting. Grouting equipment and material shall be filled be on the jobsite before jacking operations are started in order that grouting operations may be started immediately after the jacking operation have finished.

Should appreciable loss of ground occur during the jacking operation, the voids shall be backpacked promptly to the extent practicable with soil cement consisting of a slightly moistened mixture of 1 part cement to 5 parts granular material. Where the soil is not suitable for this purpose, the Contractor shall import suitable material at this expense. The soil cement shall be thoroughly mixed and rammed into place as soon as possible after the loss of ground.

5.3.02 Material

Steel casing pipe (1/4-inch minimum thickness) shall be butt welded sheets of any grade conforming to the specifications of ASTM A570 or A611, or of plate conforming to ASTM A283. The Contractor shall be fully responsible to see that the grade of steel conforms to the above standards of the casing provided. The joints of sections of casing to be jacked shall be welded with a continuous circumferential weld. It shall be the Contractor's responsibility to provide stress transfer forces involved. Variations from theoretical alignment and grade shall not exceed one percent (1%) of the distance from the jacking point.

5.3.03 Grouting

All voids around the jacked pipe or casing shall be filled by grouting through holes drilled through the casing in such a manner so as to permit escape of air. Grout shall be placed by means of pumps of positive displacement of pneumatic type and capable of placing grout at pressures up to 100 psi unless otherwise approved by the Engineer. Grout shall be placed at pressures up to 100 psi unless otherwise approved by the Engineer. Grout shall be placed at pressures which are requisite for the conditions encountered, and will ordinarily be less than 10 psi except in cases where large cave-ins or other adverse conditions may require higher pressures.

5.3.04 Pipe Installation in Jacked Casing

Pipe installation shall conform to the applicable provisions of those sections of the specifications for installation of the pipe and shall be adequately braced and supported to prevent shifting, sagging and flotation in such a manner as to relieve pipe bells from all load and bearing and shall conform to the details shown on the Drawings unless otherwise approved by the Engineer.

Prior to backfilling, sewer carrier pipe shall pass the hydrostatic and leakage test as provided in Section 6, "Cleaning and Testing" of these specifications for pipe hydrostatic or leakage testing. After pipe installation, ends of the casing shall be sealed as shown on the plans or as approved by the Engineer.

5.3.05 Casing Grouting – Annular Space

- A. Description. Provide grouting of the annular space between the carrier pipe and the casing pipe. The annular space (void between the carrier pipe and the casing pipe) shall be completely grouted to support the carrier pipe and provide long term stability. The Contractor shall provide testing of materials and methods for compliance with the requirements which follow. All proposals shall be submitted to the Engineer.
- B. Materials.
 - 1) Grout. The grout materials shall consist of portland cement (portland cement and fly ash) and/or additives.
 - 2) Compressive Strength. The grout shall have a minimum penetration resistance of 100 psi in 24 hours when tested in accordance with ASTM C 403 and a minimum compressive strength of 300 psi in 28 days when tested in accordance with ASTM 495 or C 109.
 - 3) Performance Requirements. The Contractor shall submit the proposed grout mixes, methods, plans, and criteria of the grouting operations. The grouting system shall have sufficient gauges, monitoring devices, and tests to determine the effectiveness of the grouting operation and to ensure compliance with the pipe specifications and design parameters.
 - 4) Mix Designs. One or more mixes shall be developed to completely fill the annular space based on the following requirements:

- a. Size of the annual void
 - b. Sufficient strength and durability to prevent movement of the carrier pipe
 - c. Provide adequate retardation, and
 - d. Provide less than 1 percent shrinkage by volume
- 5) Density. The Contractor shall design a grout mix with the density to meet the requirements to prevent floating of the pipe. The apparent viscosity shall not exceed 35 seconds in accordance with ASTM C 939.
- C. Qualifications. The Contractor shall provide references of previous projects demonstrating to the Engineer its capabilities of filling the annular space and performing work in conformance with the Plans and the Specifications.
- D. Mixing Equipment. The materials shall be mixed in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation. The equipment shall be capable of mixing the grout at densities required for the approved procedure and shall also be capable of changing density as dictated by field conditions any time during the grouting operation.
- E. Injection Procedure and Pressure. The gauged pumping pressure shall not exceed the liner pipe manufacturer's approved recommendations. Pumping equipment shall be of a size sufficient to inject grout at a velocity and pressure relative to the size of the annular space. Gauges to monitor grout pressure shall be attached immediately adjacent to each injection port. The gauge shall conform to an accuracy of no more than one-half percent error over the full range of the gauge. The range of the gauge shall not be more than 100 percent greater than the design grout pressure. Pressure gauges shall be instrument oil filled and attached to a saddle-type diaphragm seal (gauge saver) to prevent clogging with grout. All gauges shall be certified and calibrated in accordance with ANSI B40, Grade 2A.
- F. Onsite Test Equipment. Density shall be verified by ASTM C 138 or by other methods as approved by the Engineer. Viscosities shall be checked with a flowcone provided by the Contractor and tested per ASTM C 939.

G. Test Section. The Contractor may be required to perform an above ground test on each type of grout and grout system proposed to be used. The test section to be grouted and the size of the annular space considered for each type of grout system shall be determined by the Contractor and approved by the District.

H. Submittals and Required Calculations. The Contractor shall submit the following to the Engineer at least 20 working days prior to the start of the grouting operation.

- 1) The proposed grouting mix
- 2) The proposed densities and viscosities
- 3) Initial set time of the grout
- 4) The proposed grouting method
- 5) The maximum injection pressures
- 6) The 24-hour and 28-day minimum compressive strength
- 7) Proposed grout volumes
- 8) Bulkhead designs
- 9) Buoyant force calculations
- 10) Flow control
- 11) Pressure gauge certification
- 12) Vent location plans

These shall be submitted as a complete package for a single or sample section only. The Contractor shall notify the Engineer of any changes to be made in grouting.

5.3.06 Submittals

In addition to submitting required details of the jacking pit bracing and casing and jacking head, the Contractor shall submit to the Engineer and to the agency granting the permit for approval, details of the following in advance of the proposed jacking operation: supports, skids and bracing to prevent pipe shifting or flotation, and grout and sand mix design, placement method, equipment and method of end seals.

5.4 Concrete Construction

The Contractor is referred to Section 2, "Concrete Construction" of these Specifications.

CLEANING AND TESTING

6.1 General

It is the intent of the plans and specifications that the completed sewer pipes of all types, along with manholes and other appurtenances shall be water tight and clean.

Each section of sewer shall be tested subsequent to the last backfill compacting operation in connection therewith, and upon approval and acceptance of necessary soils tests wherein, in the opinion of the Engineer, heavy compaction equipment or any of the operations of the Contractor or others may have damaged or affected the required watertight integrity of the pipe, structure, and appurtenances. The Contractor shall furnish all materials required for the tests and bear all costs in connection therewith. Tests shall be made in the presence of the Engineer.

6.2 Infiltration and Exfiltration Test

Each section of sewer between two successive manholes shall be tested for leakage or, at the option of the Engineer, for infiltration. In general, the leakage test shall be made on all sections of sewer except those where, in the opinion of the Engineer, excessive ground water is encountered, and the infiltration test shall be made.

Even though a section may have previously passed the leakage or infiltration test, each section of sewer shall be tested subsequent to the last backfill compacting operation in connection therewith; wherein, in the opinion of the Engineer, heavy compaction equipment or any of the operations of the Contractor or others may have damaged or affected the required water tight integrity of the pipe, structure, and appurtenances. The Contractor shall furnish all materials required for the tests and bear all costs in connection therewith. Tests shall be made in the presence of the Engineer. All tests must be completed before street or trench is resurfaced, unless otherwise directed by the Engineer.

Unless excessive ground water is encountered, each section of sanitary sewer, between two successive structures, shall be tested by closing the lower end of the sewer to be tested and the inlet sewer of the upper structure with plugs or stoppers, and filling the pipe and structure with water to a point four feet (4') above the invert of the open sewer in the upper structure.

Where the difference in elevation between the invert of the upper structure and the invert of the lower structure is more than fifteen feet (15'), an air test per Section 6.3 hereof shall be used in lieu of the water test.

The total leakage shall be the decrease in volume of water in the upper structure. The leakage shall not exceed one-tenth (0.1) gallons per minute per inch of nominal diameter of pipe per one thousand feet (1000') of sewer pipe being tested.

If the leakage, as shown by the test, is greater than allowed, the pipe shall be overhauled and, if necessary, replaced and relaid until the joints and pipe shall hold satisfactorily under this test. All tests must be completed before street or trench is resurfaced, unless otherwise directed by the Engineer. The Contractor shall furnish all labor and materials for making these tests required at his own expense.

If, in the construction of a section of the sewer between structures, excessive ground water is encountered, the test for leakage described above shall not be used, but instead, the end of the sewer at the upper structure shall be closed sufficiently to prevent the entrance of water. Pumping of ground water shall be discontinued for at least three days, after which the section shall be tested for infiltration. The infiltration shall not exceed one-tenth (0.1) gallons per minute, per inch of diameter, per one thousand feet (1000') of main line sewer being tested and does not include the length of house laterals entering that section. Where any infiltration in excess of this amount is discovered before completion and acceptance of the sewer, the sewer shall be immediately uncovered and the amount of infiltration reduced to a quantity within the specified amount of infiltration before the sewer is accepted, at the expense of the Contractor. Should, however, the infiltration be less than the specified amount, the Contractor shall stop any individual leaks that may be observed when ordered to do so by the Engineer. The Contractor shall furnish all labor, materials, equipment and water for making the test required at his own expense.

If the exfiltration or infiltration rate as shown by the tests specified herein is greater than the amount specified, the pipe joints shall be repaired, or if necessary, the pipe shall be removed and relaid by the Contractor at his expense. The sewer will not be considered acceptable until the leakage or infiltration rate, as determined by test, is less than allowable.

All tests must be completed before street or trench is resurfaced, unless otherwise directed by the Engineer.

6.3 Air Testing

The Contractor shall test all sections of sewers that cannot be tested hydrostatically by means of the air test specified herein, unless otherwise directed by the Engineer. The length of the line tested at one time shall be limited to the length between adjacent manholes. Air test procedure shall be as follows:

- A. Plug ends and openings of test section and brace plugs to prevent sudden release.

- B. Pressurize the test section to 4.0 psi and hold at 4.0 psi for not less than two minutes. Add air if necessary to keep the pressure at 4.0 psi. Disconnect air supply. When pressure decreases to 3.5 psi, start stopwatch. Determine the time in seconds that is required for the internal pressure to reach 2.5 psi. This time interval shall be greater than time given in the following table. The section of pipe shall not have passed if the time is less than shown in the table.

Sewer Size (inches)	Minimum Time (seconds)
4	113
6	170
8	226
10	283
12	340
15	425
18	510
21	595
24	680

- C. When the prevailing ground water is above the sewer being tested, air pressure shall be increased 0.43 psi for each foot the water table is above the flow line of the sewer.

If the test is not passed, the leak shall be found and repaired to the satisfaction of the Engineer.

Building laterals shall be considered part of the lateral to which they are connected and no adjustment of test time shall be allowed to compensate for the small diameter of the house sewers.

The pressure gauge used shall be supplied by the Contractor, shall be minimum divisions of 0.10 psi, and shall have an accuracy of 0.04 psi. Accuracy and calibration of the gauge shall be certified by a reliable testing firm at six month intervals or when requested by the Engineer.

When the air pressure test is used for testing of the pipe, the MANHOLES SHALL BE WATER TESTED. Each manhole shall be filled with water four feet (4') zero inches (0'') above flow line of the manhole with the inlet and outlet of each manhole plugged. The maximum leakage rate shall be ten (10) gallons per hour per manhole test to be run for a minimum of thirty (30) minutes. For reference one-eighth inch (1/8'') of depth equals one (1) gallon in four foot (4') diameter manhole shaft.

6.4 Testing – Force Main

Upon completion of the laying, jointing, and backfilling, the pipeline or portions thereof shall be hydrostatically tested for a period of four (4) hours. For convenience of testing, the pipeline shall be divided into sections with maximum elevation difference for each test section of 80 feet not exceeding 3,000 lineal feet and each section tested separately. Bulkheads shall be constructed to safely withstand the hydraulic pressures imposed upon them. No payment will be made expressly for the work and materials required for the bulkheads, closing sections, or other appurtenances needed for testing sections and any compensation desired by the Contractor for this work shall be included in the price bid for the installation of pipe.

The test pressure shall be the maximum working pressure of the pipe plus 75 psi. The duration of the test shall be four (4) hours, unless otherwise specified. Each section of the pipeline shall be slowly filled with water and all air expelled by means of taps (contractor's responsibility) at high points.

Care shall be taken to expel all air from the pipeline as the line is filled with water for the test. The water necessary to maintain this pressure shall be measured through a meter or other means satisfactory to the Engineer. The leakage shall be considered as the amount of water entering the pipe during the test, less measured leakage through the valves and bulkheads. Leakage shall not exceed the rate of 12 gallons per inch of diameter per 24 hours per mile of pipe. Any noticeable leaks shall be stopped and any defective pipe shall be repaired or replaced with new sections retested, as specified above, before final approval and acceptance of the work by the Engineer. All labor, materials, equipment and water for tests shall be furnished by the Contractor.

6.5 Cleaning

Before final acceptance of sewer facilities or prior to putting any sewer into service, all sewer facilities shall be visually checked and all foreign objects, materials or obstructions removed from the facilities. If dirt, silt or other materials are found in the facilities, the Engineer may require that the facilities be cleaned by flushing, balling, rodding or other means so that the materials may be removed from the system.

6.6 Pipe Testing

Tests of pipe for strength, straightness and durability shall be as required in Section 3, "Pipeline Materials and Installation", of these Technical Specifications.

Where truss pipe is installed, the Contractor shall be required to pull a four (4) percent (%) mandrel through the entire length of mainline installed.

6.7 Slope Test for Gravity Sewers

When the water ex-filtration test is used for testing the pipe, the pipeline slope shall be water-tested by pumping the water from the downstream manhole. If water remains in any section of the pipeline, the Contractor shall uncover the sewer section and reconstruct to the slope shown by plans.

When the air pressure test is used for testing of the pipe, the pipeline slope shall be water tested. Water from the manhole tests shall be released by removing the manhole outlet plug. The water shall be caught at the downstream manhole by temporarily plugging the manhole outlet. Water shall be removed from the downstream manhole by pumping. If water remains in any section of the pipeline, the Contractor shall uncover the sewer section and reconstruct to the slope shown by plans.

Upon approval of the Engineer, the afore described slope tests may be replaced by the mirror and light test on short straight sewer sections. If the light in the downstream manhole is not clearly visible in the upstream manhole, the slope shall be water-tested.

6.8 T.V. Inspection

During the performance of the work, the Contractor shall secure the services of a firm for viewing and recording on video tape, newly installed sewer pipelines. The sections to be viewed and the time to perform the work shall be as determined by the District. The total length of pipeline shall be tested after backfill is complete and in-place density tests approved, but prior to final AC paving cap operations. The firm doing the T.V. inspection shall be approved by the District.

T.V. testing shall include a verbal tape and a written log of condition encountered at various locations along the pipeline and digital readouts of locations of any laterals or tees. Particular attention shall be given to the magnitude of offsets at joints. The maximum allowable vertical offset between the inverts of adjacent pipes shall be 3/8-inch for 8-inch through 12-inch pipe and 1/2-inch for 15-inch through 24-inch pipe.

Where, in the opinion of the District excessive offset exist, the Contractor will identify and repair each location by the use of methods acceptable to the District. After any repair is made, the Contractor shall have the section of sewer main between manholes re-televised as specified above.

The cost for providing the above service (including re-televising, if necessary) and furnishing tapes and logs to the Owner shall be included in the unit prices bid for the various sizes of sewer pipeline and no additional allowance will be made therefore.

6.9 Acceptance

Prior to the facilities being accepted by the District, the following shall occur.

The Contractor shall submit evidence of the execution, to the District or Engineer, of two leakage tests by the applicable method described above. The initial test shall occur subsequent to the installation of all mainline, laterals and structures, and passing results for final compaction. The final test shall occur after the installation of all underground utilities is complete. Additional testing may be required if any underground utilities are installed after paving, the Contractor is responsible for all the costs. Contractor is responsible for restoration of all improvements which are disturbed by his remedial modifications to a failed sewer and are to be made at Contractor's expense.

EROSION CONTROL

7.1 General

The Contractor shall provide erosion control measures as defined herewith on all areas where the natural vegetation has been disturbed by the installation of water facilities. If a ground cover other than natural vegetation has been disturbed, this section does not apply; and the Contractor shall replace said ground cover in kind.

7.2 Preparation

After the backfill has been compacted and the pipeline tested, the Contractor shall remove and dispose of rocks and debris from the area to be reseeded. No seeding shall be performed during windy weather or when the ground is too wet or in an untellable condition. The fertilizer and seed shall be spread before the straw cover material is applied. Commercial fertilizer shall not be applied until after the seed has been sown.

7.3 Material

Materials shall consist of the following:

7.3.01 Seed

The seed shall consist of the following mixture: Crested Wheatgrass, forty-seven percent (47%); Intermediate Wheatgrass, twenty-seven percent (27%); Wimmera Ryegrass, thirteen percent (13%). The seed shall be spread at the rate of one hundred (100) pounds per acre and shall be applied by the use of a "Cyclone Seed Sower) or equal.

7.3.02 Fertilizer

The fertilizer shall be Ammonium Phosphate (16-20-0) spread at the rate of three hundred (300) pounds per acre and shall be applied by the use of a "Cyclone Seed Sower" or equal.

7.3.03 Mulch

After the application of the seed and fertilizer, new straw (stable bedding straw shall not be used) shall be uniformly spread at the approximate rate of four tons

per acre. The straw shall then be “mulched” into the ground by the use of a “wire” roller or other approved equipment.

7.4 Protection for Steep Slopes

In cases where the grade over the pipeline exceeds twenty-five percent (25%) slope, the Contractor shall provide additional erosion control measures to stabilize the backfill material. The Contractor shall submit to the District, for their approval, special engineering details of the method to be used.

REMOVAL AND REPLACEMENT OF PAVED SURFACES

8.1 General

Street pavement and surfaces shall be removed and replaced in all areas of construction excavation in conformance with details shown on the plans and as specified herein. Resurfacing of existing pavement and surfaces damaged or removed in connection with the construction of the improvements, including all appurtenances, shall conform to the provisions of these technical specifications unless the provisions or permits issued by controlling jurisdictions include more stringent requirements. In that case, the work shall conform to the more stringent requirements.

8.2 Excavation and Backfill

The Contractor is directed to Section 1 – Earthwork, of these Technical Specifications for all items pertaining to excavation and backfill.

8.3 Pavement Removal

8.3.01 General

Street pavement, existing road surfacing, or other surfacing materials shall be removed within the limits of all construction excavations prior to proceeding with excavation operations of any nature. Surplus material shall be removed as provided in Section 1 – Earthwork, of these Technical Specifications.

Prior to removal of existing surfacing, pavement cuts shall be made as shown on the plans and as specified herein. All pavement cuts shall be neat and straight along both sides of the trench, and approximately parallel to the alignment of the pipe, to provide an unfractured and level pavement joint. When large irregular surfaces are removed, such trimming or cutting as hereinafter provided shall be parallel with, or at right angles to, the roadway centerline. All cut edges shall provide clean, solid and vertical faces free from loose material and debris.

8.3.02 Plant-Mix Surfacing (Asphalt Concrete Pavement)

Streets and alleys surfaced with asphalt Concrete pavement shall be cut at the limits of the trench and/or excavation prior to removal of existing surfacing. Cuts shall be made with pneumatic tools or other methods as approved by the Engineer.

8.3.03 Road-Mixed Surfacing

Streets and alleys surfaced with road-mixed surfacing shall be cut at the limits of the trench and/or excavation prior to removal of existing surfacing. Cuts shall be made with pneumatic tools or other methods as approved by the Engineer.

8.4 Replacement

8.4.01 General

In all streets or areas in which the surface is removed, broken or damaged by equipment, or in which the ground has caved in or settled due to the Contractor's operations, the surface shall be restored to the original grade and crown section by the contractor. In the absence of specific designation of the plans, and where the street has been improved with roadway surface, base course, curb, sidewalk or gutter, trenches or damaged sections shall be restored with the type of improvement conforming to the standards of the agency having jurisdiction over the right-of-way at the Contractor's expense.

Prior to resurfacing, the existing surfacing shall be removed as provided above. All work shall match the appearance of the existing improvements and finish pavement shall not deviate from existing grade by more than one-eighth inch (1/8") in ten feet (10') and shall be free from ruts, depressions and irregularities.

8.4.02 State Highway Right-of-Way

Construction of water facilities within State Highway rights-of-way shall be subject to the Department of Transportation utility encroachment permit, a copy of which shall be supplied to the District, 5 working days prior to the start of construction. All work done within highway rights-of-way shall conform to the "Terms and Conditions Relating to Utility Encroachments" as issued by the Department of Transportation and as indicated on the plans.

8.4.03 City and County Roads

All asphalt concrete surfaces, including but not limited to pavements, curbs, driveways and sidewalks, which are removed, damaged or broken by the Contractor's activities shall be replaced and/or reconstructed. All asphalt concrete shall be placed on compacted fills or base material as herein specified. Replacement and/or reconstruction shall be to the same dimensions as existing surfaces unless otherwise stated herein or required by the agency having jurisdiction over the roadway.

Materials and workmanship for asphalt concrete shall conform to the requirements of Section 39 "Asphalt Concrete" of the Caltrans Standard Specification, latest edition.

Plant-mix surfacing shall be Type B asphalt concrete and shall conform to the above-referenced Specification.

Mineral aggregate for asphalt concrete shall conform to the grading requirements specified in Section 39-2.02 "Aggregate" of the above-referenced Specifications. Mineral aggregate specified for asphalt concrete to be used for trench repair or as a base paving course shall conform to the grading requirements for ¾-inch maximum, medium aggregate. Mineral aggregate specified for use as overlay or in the final paving cap shall comply with the grading requirements for 3/8-inch maximum aggregate.

Asphalt binder to be mixed with aggregate shall be steam-refined paving asphalt conforming to the provisions of Section 92 "Asphalts" of the Caltrans Specifications, and shall be Grade AR-4000, unless otherwise approved by the Engineer.

Paint binder (Tack Coat) shall be grade RS-1 conforming to the provisions of Section 94 "Asphaltic Emulsions" of the Caltrans Specifications and shall be applied to all vertical surfaces of existing pavement, curbs, gutters and construction joints in the surfacing against which additional material is to be placed. Paint binder shall be applied in one application at a rate of 0.02 to .010 gallons per square yard of surface covered.

8.4.06 Base Pavement

The Contractor shall maintain base pavement in a safe smooth condition, to the satisfaction of the Engineer, until the final paving cap is placed. In the event of inclement weather, or forecast of same, the Contractor shall take immediate steps to backfill all open trenches in paved areas and apply temporary paving. In areas where base material exists and is removed, it shall be replaced with Class II Aggregate Base, as specified herein, to the same thickness as that removed but not less than 6 inches.

Asphalt concrete base pavement shall be placed to a minimum compacted thickness of 3 inches or the thickness of the existing pavement, whichever is greater. The Contractor will be required, where necessary, to construct a leveling course over the trench, base paving and existing paving to provide a smooth and uniform surface prior to placing the final paving cap, as directed by the Engineer.

8.4.07 Cap Pavement

Trenches shall be capped with a machine placed, plant-mixed asphalt concrete overlay. The Contractor shall place 0.1 feet (compacted thickness) of asphalt concrete overlay to limits specified in the applicable encroachment permit. Prior to placing the overlay, all existing pavement shall be broomed, loose pavement removed and paint binder, RS-1 Grade, applied in one application at a rate of 0.05 to 0.10 gallon per square yard of surface covered.

The final overlay shall not be placed until after the Contractor has received, and forwarded to the District, certification that all backfill is compacted to the specified relative density and that all water lines have been tested as specified herein. Said certification or acceptance is meant to be an indication of the effort achieved by the Contractor in compaction and paving operations and shall not release the Contractor of his responsibility in guaranteeing the work for the period of time specified.

8.4.08 Temporary Resurfacing

The Contractor shall furnish, place and maintain temporary resurfacing as herein specified over backfill in paved streets, or as required by State, County or City encroachment permits.

Temporary resurfacing shall be placed to the line and grade of existing surfaces and rolled and compacted no later than the third day after the waterline has been placed and shall be in place on weekends and holidays. The Contractor shall maintain all temporary resurfacing in proper, usable condition until the permanent resurfacing operations are completed. Temporary resurfacing shall be removed and disposed of by the Contractor prior to placing permanent resurfacing.

Temporary resurfacing shall be placed at the locations and of the thickness required by the encroachment permit and/or the Engineer (2-inch minimum thickness) and shall consist of a cold-mix asphalt concrete. Binder shall be liquid asphalt, grade SC-800 or equal.

LAKE HEMET MUNICIPAL WATER DISTRICT

TECHNICAL SPECIFICATIONS

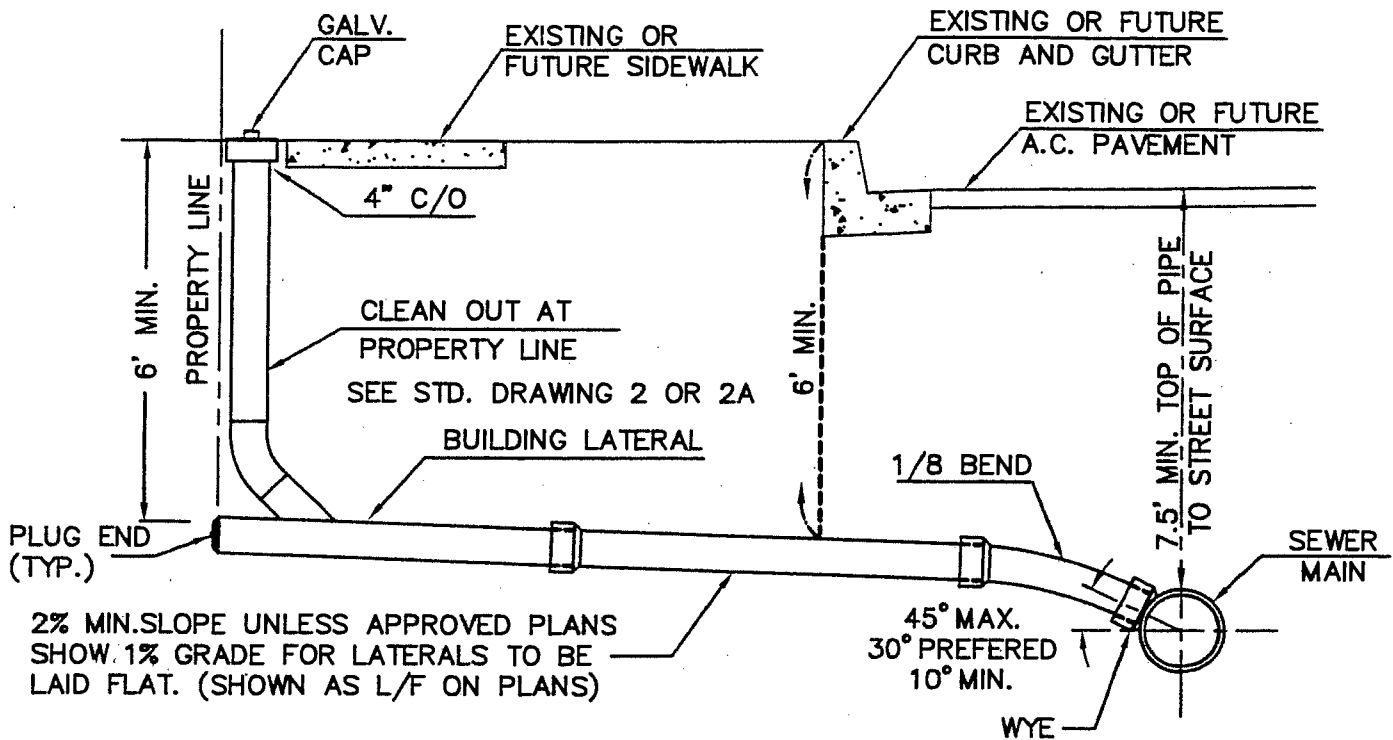
TABLE OF CONTENTS

STANDARD DRAWINGS

SEWER

Drawing
No.

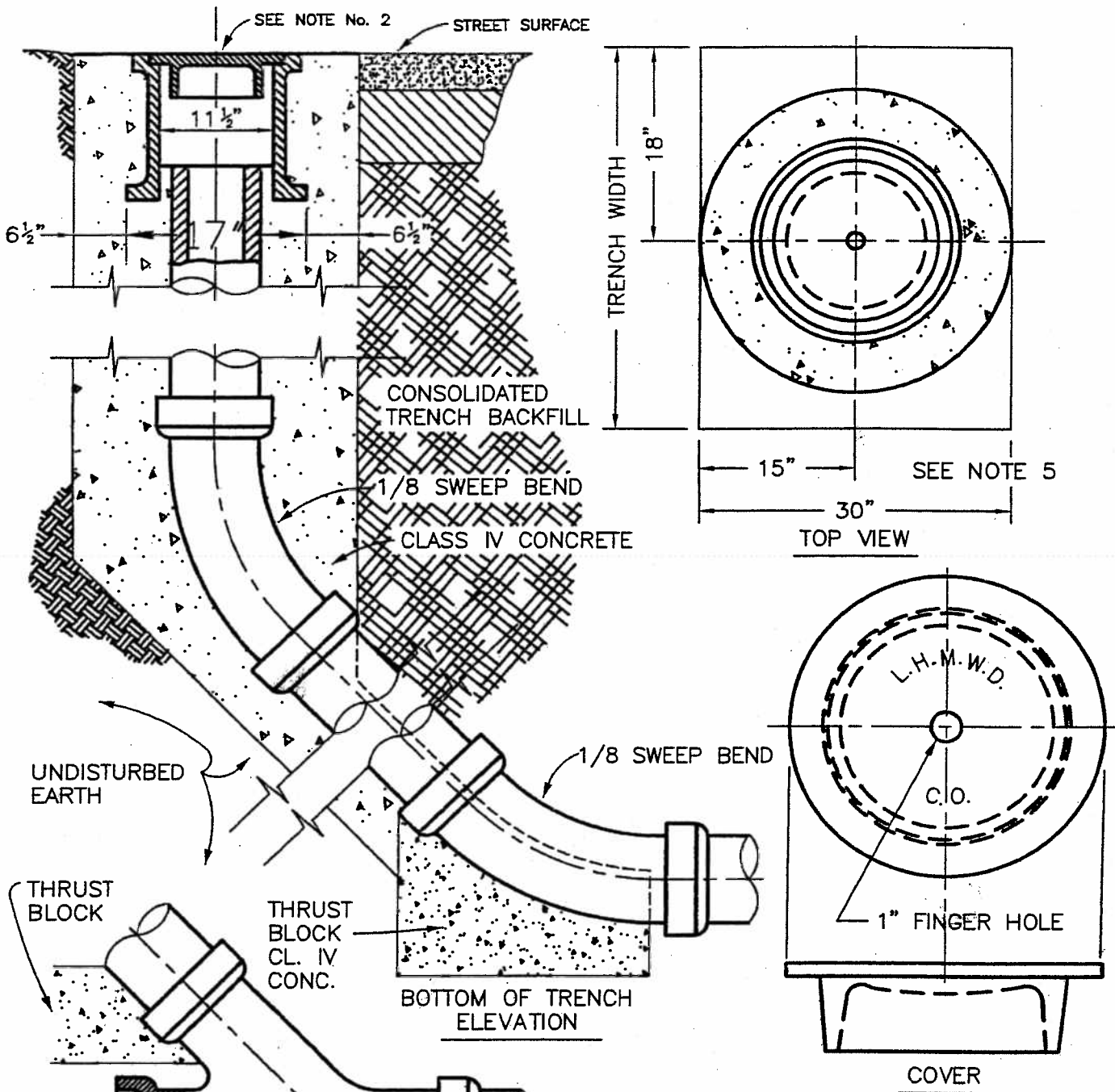
1	Building Lateral
2	Standard Cleanout
2A	Standard Cleanout
3	Standard Manhole Cover
4	Pre-cast Concrete Manhole
5	Chimney and Deep Lateral
6	Pipe Bedding
7	Concrete Blanket
8	Criteria for the Separation of Water Mains and Sanitary Sewers (9 sheets) Deleted
9	Air-Gap
10	Temporary Water Service
11	Debris Catch for Standard Sewer Manhole



2% MIN. SLOPE UNLESS APPROVED PLANS SHOW 1% GRADE FOR LATERALS TO BE LAID FLAT. (SHOWN AS L/F ON PLANS)

1. 4" V.C.P. OR SDR 23.5 SOLID WALL P.V.C./A.B.S. SHALL BE PROVIDED FOR ALL EXISTING SINGLE FAMILY DWELLING UNITS. ALL OTHER CONNECTIONS SHALL BE 6" V.C.P., UNLESS NOTED OTHERWISE ON THE APPROVED PLANS.
2. WHENEVER DEPTH OF COVER OVER LATERAL IS LESS THAN 4'-0", OR LESS THAN 3' VERTICAL CROSSING UNDER WATER MAINS, DUCTILE IRON PIPE SHALL BE USED.
3. LATERAL LOCATIONS AS NOTED ON THE "AS-BUILT" PLANS SHALL BE MEASURED AT RIGHT ANGLES TO STREET CENTERLINE FROM THE CENTERLINE OF THE NEAREST DOWNSTREAM MANHOLE COVER. THE LATERAL END IS RIGHT OR LEFT AT THE PROPERTY LINE.
4. CONTRACTOR SHALL REFERENCE EACH LATERAL IN THE FIELD WITH AN INITIAL "S" OR "L" ON THE CURB FACE.
5. ALL LATERALS SHALL BE INSTALLED AT RIGHT ANGLES TO THE MAINLINE, EXCEPT IN CUL-DE-SAC OR AS APPROVED BY ENGINEER.
6. ALL LATERALS WILL HAVE A CLEAN OUT AT PROPERTY LINE MADE OF THE SAME MATERIAL AND SIZE AS LATERAL PER STD. DRAWING NO. 2 OR 2A.

DATE	REVISION	BY
APPROVED BY <u>Robert L. J. [Signature]</u> 12/17/97		
	GENERAL MANAGER	DATE 12/17/97
	DISTRICT ENGINEER	DATE
LAKE HEMET MUNICIPAL WATER DISTRICT SEWER IMPROVEMENT		
BUILDING LATERAL		
STANDARD No. 1		



ALTERNATE
 FOR LOWER 1/8 BEND WHERE ORDERED BY
 ENGINEER OR SHOWN ON PLANS.

NOTES

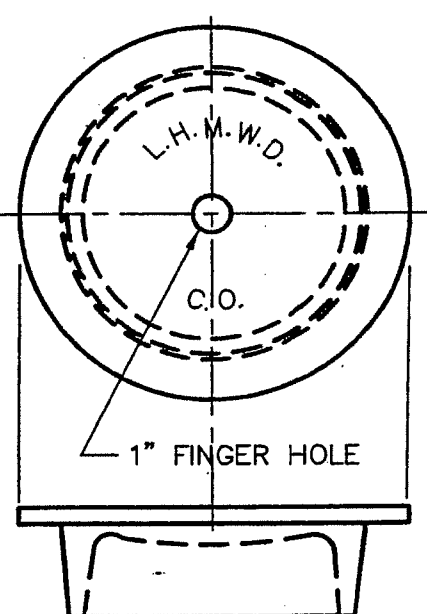
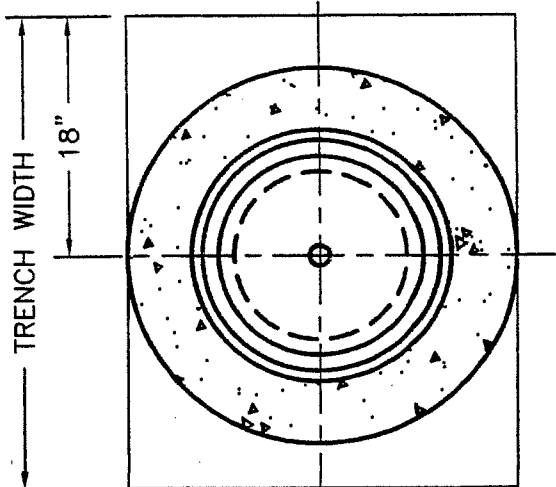
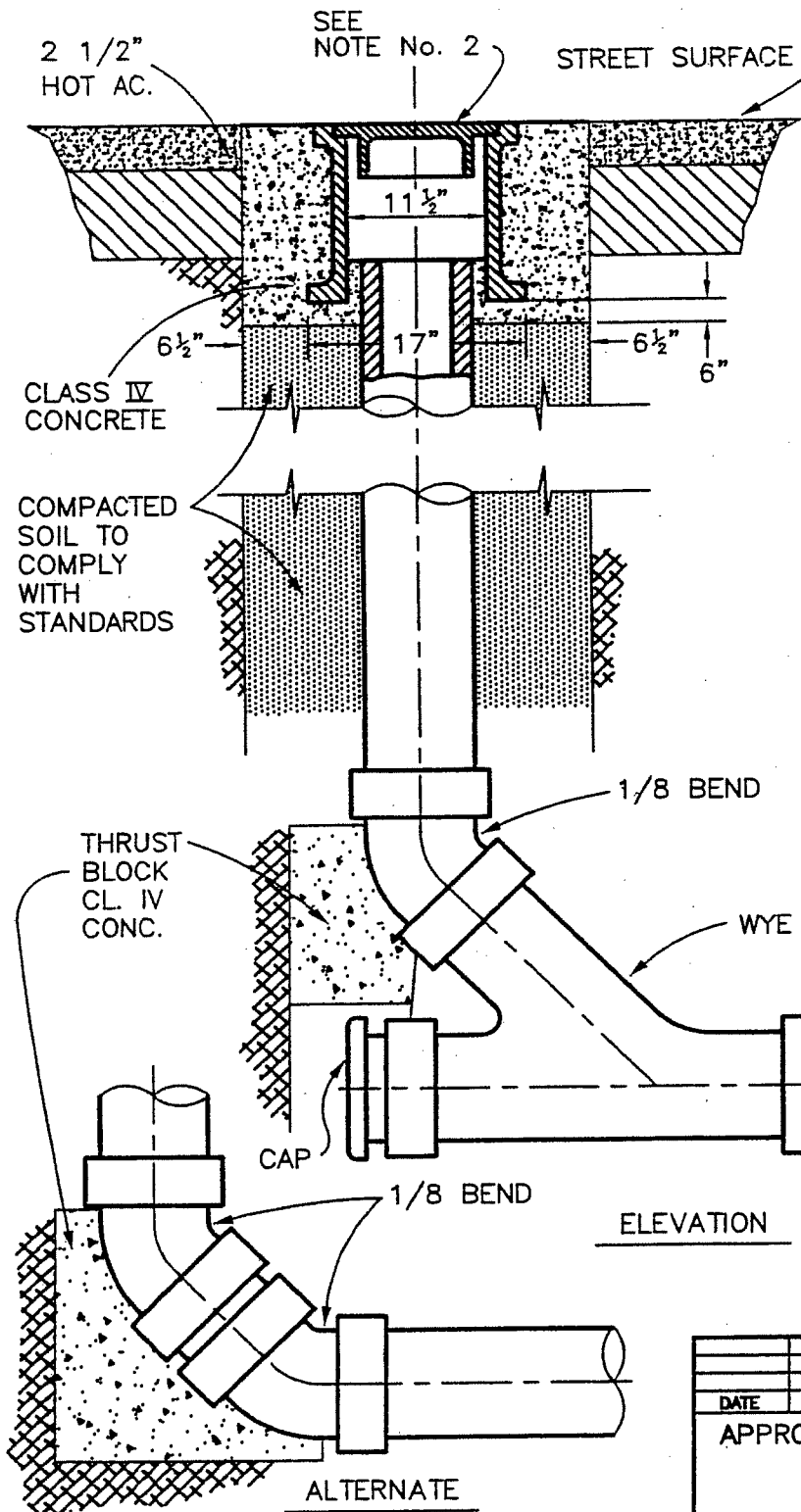
1. CLEANOUT PIPE MUST BE SAME DIAMETER AS MAIN LINE SEWER
2. CASTING SHALL BE ALHAMBRA FOUNDRY NO. A-1241 OR APPROVED EQUAL BY THE ENGINEER.
3. COVER, FRAME, & CONCRETE PAD ARE TYPICAL FOR 8" MAIN LINE SEWERS ONLY.
4. PLUGS SHALL BE CEMENTED IN PLACE WITH CEMENT MOTAR, OR SHALL BE NEOPRENE PLUG OR APPROVED EQUAL.
5. CONCRETE COLLAR ON MAINLINE BUT NOT AT PROPERTY LINE.

DATE	REVISION	BY
APPROVED BY <i>Robert V. Linder Jr.</i> 12/17/97		
	GENERAL MANAGER	DATE 12/17/97
	DISTRICT ENGINEER	DATE

LAKE HEMET MUNICIPAL WATER DISTRICT
 SEWER IMPROVEMENT

**STANDARD CLEANOUT
 TYPE VCP**

STANDARD No. 2



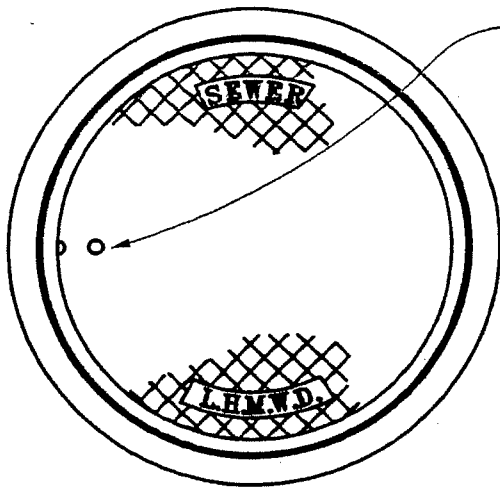
ELEVATION

COVER

NOTES

1. CLEANOUT PIPE MUST BE SAME DIAMETER AS MAIN LINE SEWER
2. CASTING SHALL BE ALHAMBRA FOUNDRY NO. A-1241 OR APPROVED EQUAL BY THE ENGINEER.
3. COVER, FRAME, & CONCRETE PAD ARE TYPICAL FOR 8" MAIN LINE SEWERS ONLY.
4. CONCRETE COLLAR ON MAINLINE, BUT NOT AT PROPERTY LINE.

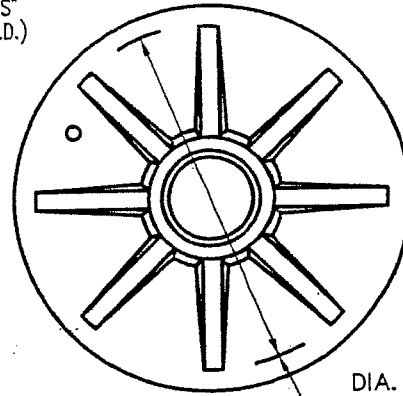
DATE	REVISION	BY
APPROVED BY <i>R. J. L. S.</i>		12/17/97
GENERAL MANAGER		DATE
<i>J. M. B.</i>		12/12/97
DISTRICT ENGINEER		DATE
LAKE HEMET MUNICIPAL WATER DISTRICT SEWER IMPROVEMENT		
STANDARD CLEANOUT TYPE ABS OR PVC		
STANDARD No. 2A		



TOP VIEW

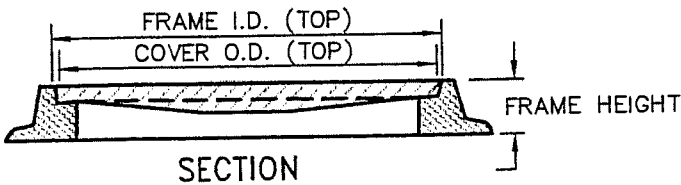
1" DIA. REMOVAL HOLES TO BE LOCATED 3" APART AND CENTERED ON THE LEFT SIDE BETWEEN THE "S" IN (SEWER) & THE "L" IN (L.H.M.W.D.)

COVER DETAIL

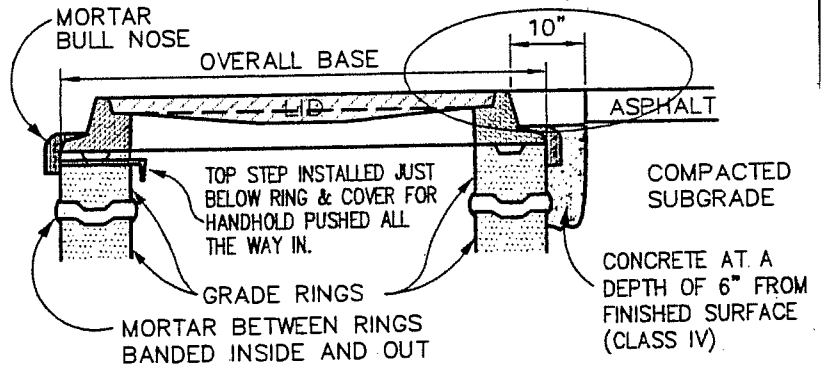
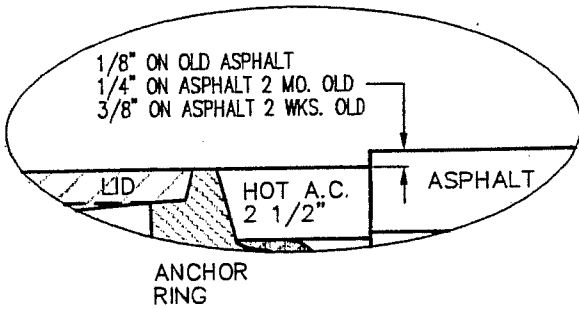


BOTTOM VIEW

DIA. OF CLEAR OPENING



SECTION



SECTIONS THRU FRAME SHOWING TYPICAL INSTALLATIONS

1. Manhole cover shall be designed for A.A.S.H.O. H-20 loading.
2. Cast iron shall have minimum tensile strength of 30,000 p.s.i.
3. Manhole cover shall be Alhambra Foundry Co. Type A-1254-6 for 24" dia. and Type A-1261-6 for 36" dia. or approved equal.

DATE	REVISION	BY
APPROVED BY <i>R. V. [Signature]</i> 12/17/97		
GENERAL MANAGER		DATE 12/12/97
DISTRICT ENGINEER		DATE

LAKE HEMET MUNICIPAL WATER DISTRICT
SEWER IMPROVEMENT

STANDARD MANHOLE COVER

STANDARD No. 3

MANHOLE COVER AND FRAME
REQUIRED DIMENSIONS

CLEAR OPENING	COVER O.D.	FRAME I.D.	FRAME HEIGHT	OVERALL BASE	TOTAL WT.
24"	25 1/4"	25 1/2"	6"	36"	425 lbs.
36"	30"	38 1/4"	6"	44"	650 lbs.

CAST IRON MANHOLE FRAME & COVER
PER STD. NO. 3, SET TO FINISH GRADE.
CLASS IV CONCRETE

NATURAL GROUND

10"
1/4" A.C.

STREET SURFACE

TOP STEP SHALL BE
PLACED IMMEDIATELY
BENEATH MANHOLE
FRAME.

2 1/2" A.C.

ADJUSTING RINGS AS REQ'D.
MAX. = 15", MIN. = 9"
TOP 9" = 3-3" RINGS

NOTE:

PLACE ECCENTRIC COVER
& STEPS UPSTREAM.
STEPS SHALL BE STEEL
REINFORCED COPOLYMER
POLY PROPYLENE MAN-
HOLE STEPS, PLACED
SYMMETRICAL OR OFFSET
DESIGN WITH SPACING
NOT TO EXCEED 15" O.C.

ALL JOINTS SHALL BE
BANDED INSIDE AND
OUT.

NOTE:

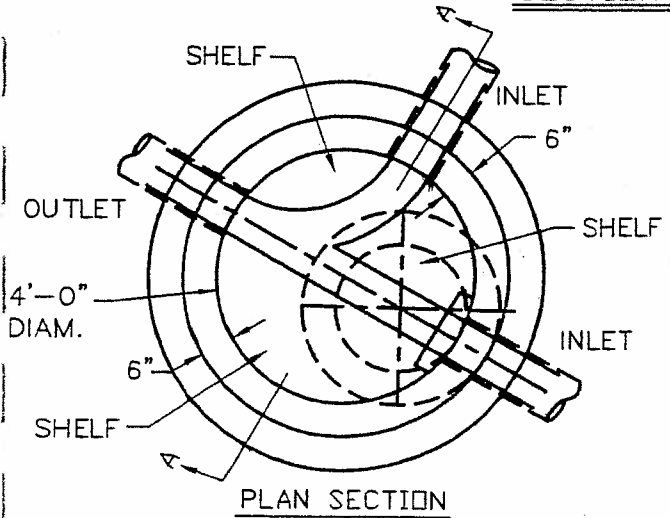
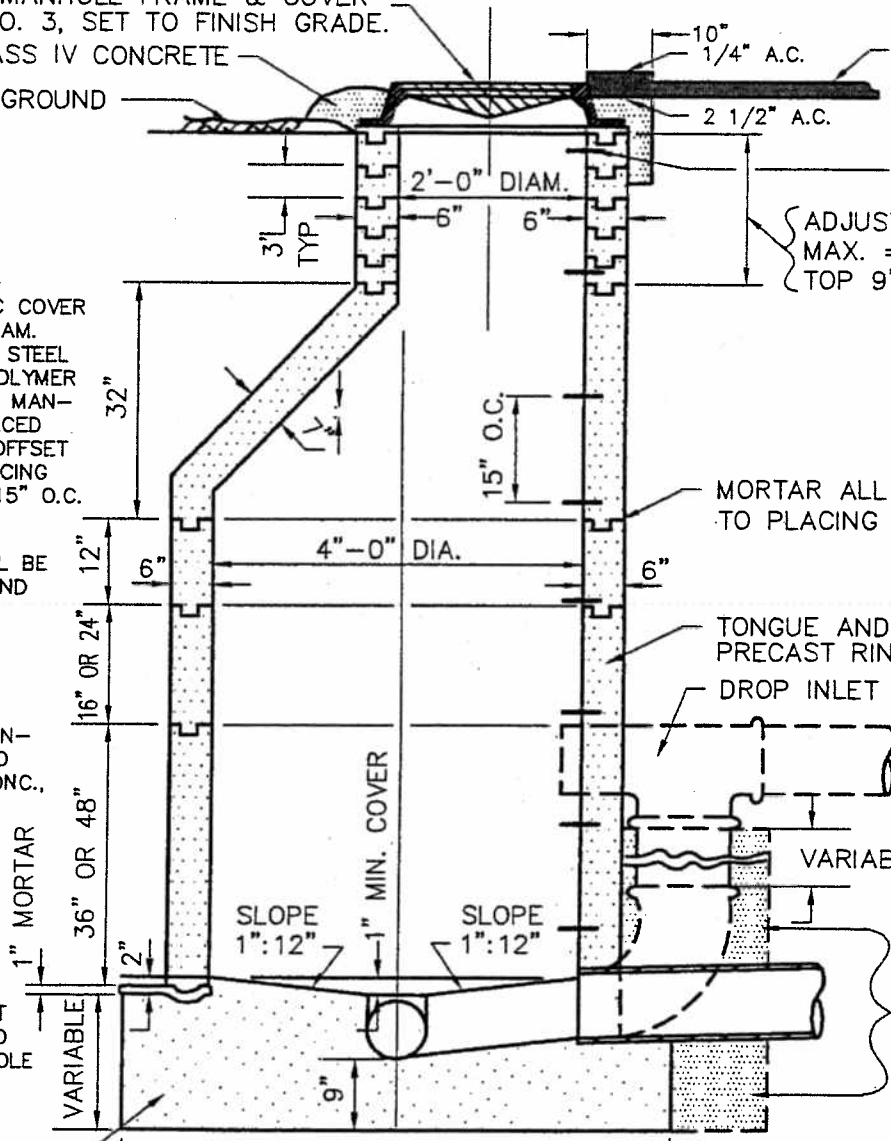
CHANNELS OF MAN-
HOLE BOTTOMS TO
BE FORMED IN CONC.,
AND SIDE INLETS
TO HAVE CHAN-
NELS CURVED IN
THE DIRECTION
OF FLOW.

NOTE:

BASE SHALL BE
POURED AT LEAST
24 HRS. PRIOR TO
INSTALLING MANHOLE
RINGS - BROOM
FINISH

CLASS IV CONCRETE

6'-0" DIA.
SECTION A-A

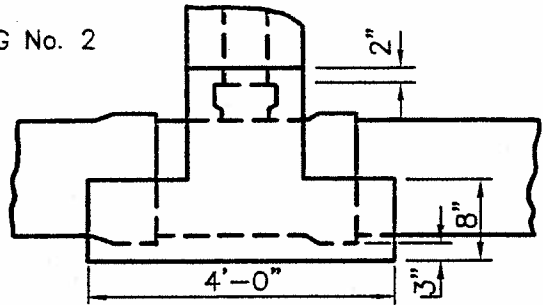


DATE	REVISION	BY
APPROVED BY	<i>[Signature]</i>	12/17/97
	GENERAL MANAGER	DATE
	<i>[Signature]</i>	12/12/97
	DISTRICT ENGINEER	DATE
LAKE HEMET MUNICIPAL WATER DISTRICT SEWER IMPROVEMENT		
PRE-CAST CONCRETE MANHOLE		
STANDARD No. 4		

WYE OR DOUBLE WYE, SEE PLANS FOR INDIVIDUAL REQUIREMENTS

FRAME & COVER PER STD. DRAWING No. 2

SEE STANDARD DRAWING NO. 1 FOR BUILDING LATERAL DETAIL



SECTION A-A

SEE STANDARD DWG. NO. 1 FOR BUILDING LATERAL DETAIL

ALTERNATE METHOD

4" MIN.(TYPICAL)

8" MIN.

45°

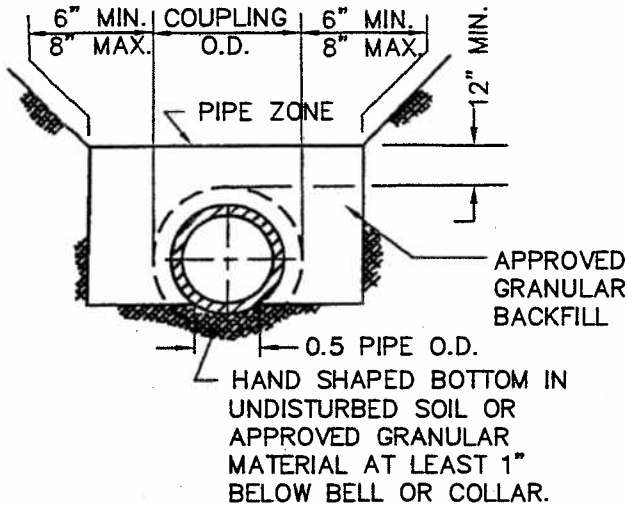
BEDDING SHALL BE UNDISTURBED SOIL OR CONCRETE CRADLE PER STANDARD DWG. NO. 6

CLASS IV CONCRETE

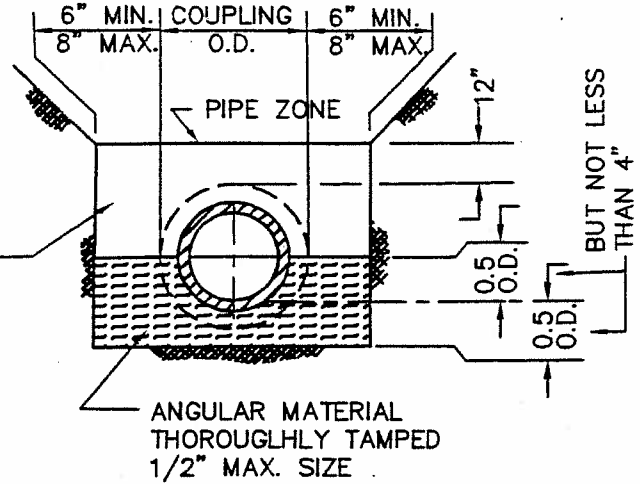
NOTES:

1. SEE CONSTRUCTION DRAWINGS FOR LOCATION AND SIZE OF LATERALS AND CHIMNEYS.
2. NOT TO BE USED UNLESS AUTHORIZED BY THE DISTRICT

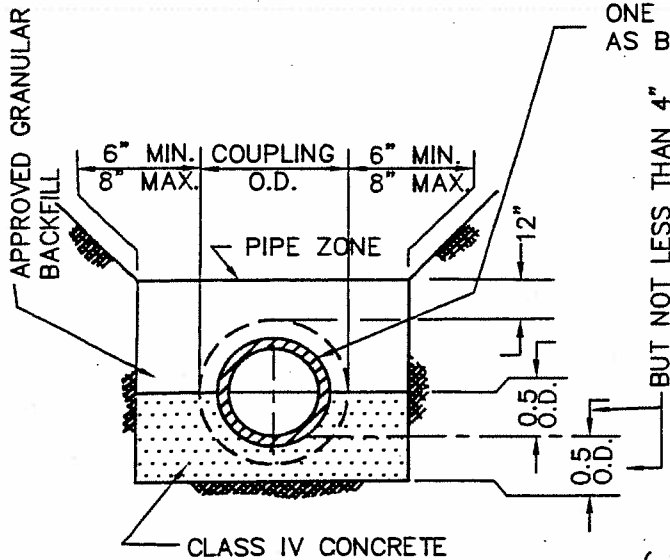
DATE	REVISION	BY
APPROVED BY <i>Robt. V. L. S. Jr.</i> 12/17/97		DATE
GENERAL MANAGER		12/12/97
DISTRICT ENGINEER		DATE
LAKE HEMET MUNICIPAL WATER DISTRICT SEWER IMPROVEMENT		
CHIMNEY AND DEEP LATERAL		
STANDARD No. 5		



NORMAL BEDDING
(LOAD FACTOR = 1.5)

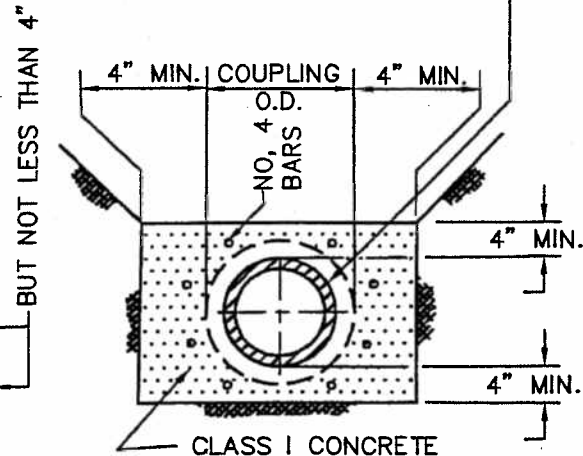


SPECIAL BEDDING
(LOAD FACTOR = 1.9)



CONCRETE CRADLE
(LOAD FACTOR = 3.0)

ONE LAYER OF 15 lb. BUILDING PAPER AS BOND BREAKER AROUND PIPE AND COUPLINGS

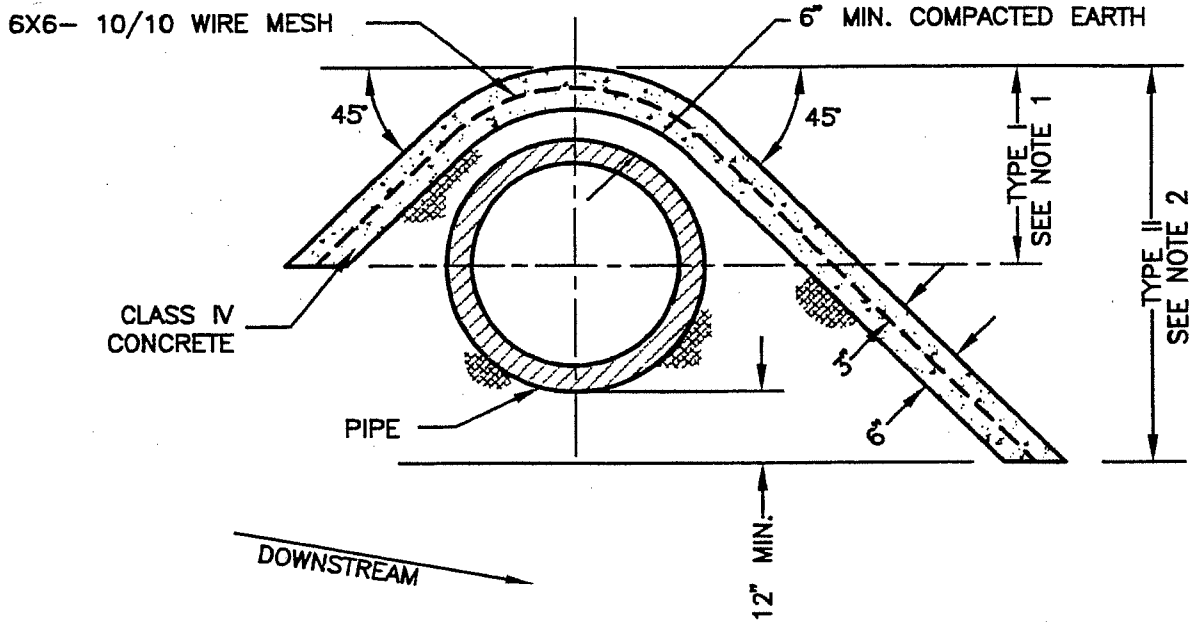


(PIPE OVER 15" REQUIRES SPECIAL DESIGN)
CONCRETE ENCASEMENT
(LOAD FACTOR = 4.5)

NOTE:

ALL BACKFILL SHALL BE PLACED IN ACCORDANCE WITH THE SPECIFICATIONS.

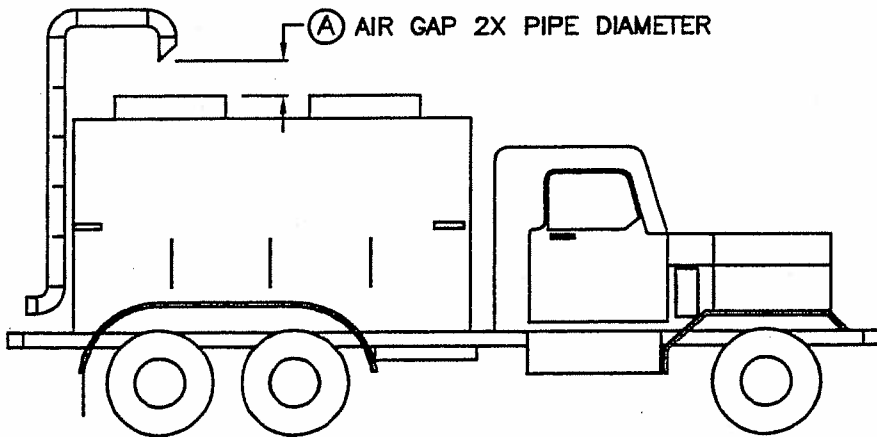
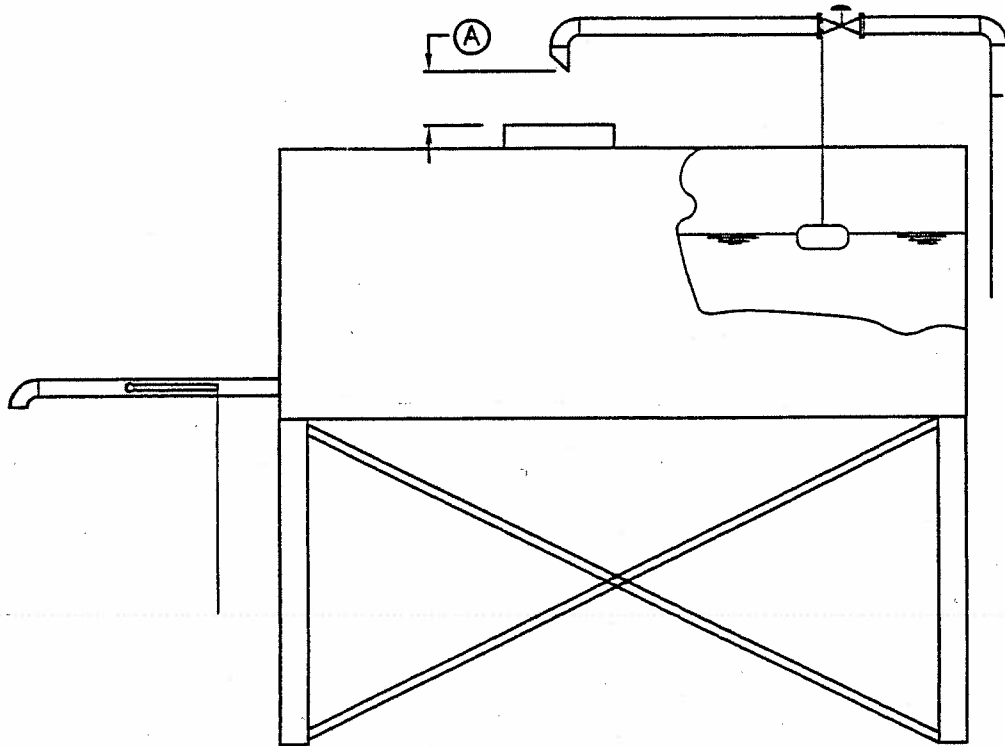
DATE	REVISION	BY
APPROVED BY <i>Robert V. L. L. S. J.</i>		12/17/97
GENERAL MANAGER		DATE
<i>G. M. S.</i>		12/12/97
DISTRICT ENGINEER		DATE
LAKE HEMET MUNICIPAL WATER DISTRICT SEWER IMPROVEMENT		
PIPE BEDDING		
STANDARD No. 6		



NOTES:

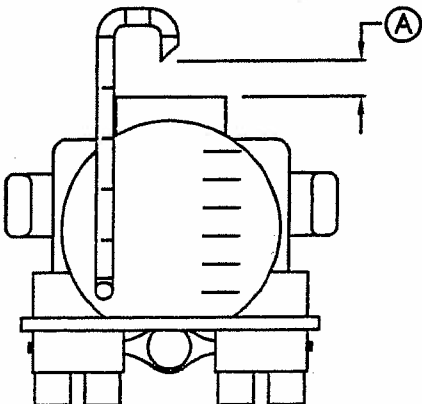
1. THE DOWNSTREAM TOE OF TYPE I CONCRETE BLANKET ENDS AT THE CENTERLINE OF PIPE AS SHOWN ABOVE.
2. THE DOWNSTREAM TOE OF TYPE II CONCRETE BLANKET ENDS 12" BELOW THE BOTTOM OF PIPE AS SHOWN ABOVE.

DATE	REVISION	BY
APPROVED BY <i>R. V. L. S. G.</i>		12/17/97
	GENERAL MANAGER	DATE
	<i>[Signature]</i>	12/12/97
	DISTRICT ENGINEER	DATE
LAKE HEMET MUNICIPAL WATER DISTRICT SEWER IMPROVEMENT		
CONCRETE BLANKET		
STANDARD No. 7		



Ⓐ AIR GAP 2X PIPE DIAMETER

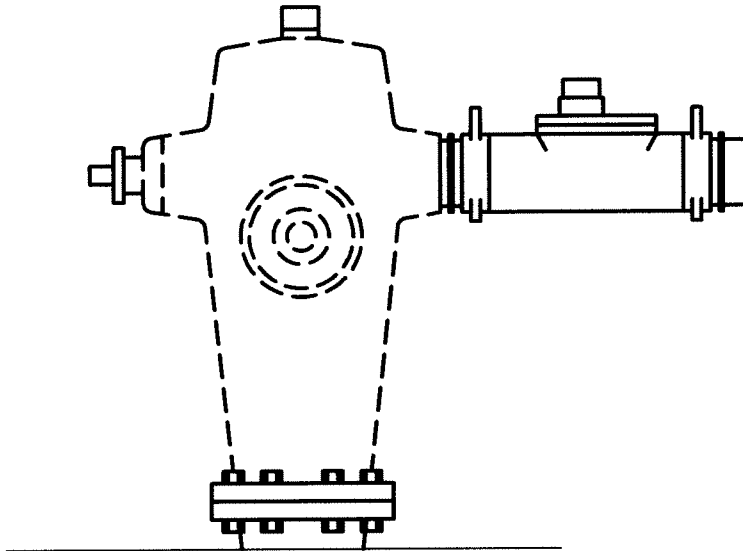
Ⓐ = AIR GAP, MINIMUM CLEARANCE 2 PIPE DIAMETERS



DATE	REVISION	BY
APPROVED BY <i>Robert L. Lish</i> 12/17/97		DATE
GENERAL MANAGER		12/17/97
<i>JMB</i>		DATE
DISTRICT ENGINEER		
LAKE HEMET MUNICIPAL WATER DISTRICT SEWER IMPROVEMENT		
AIR GAP		
APPROVED FOR WATER TRUCKS, TANKS OPERATING WITH L.H.M.W.D. DOMESTIC WATER		
STANDARD No. 9		

CAUTION

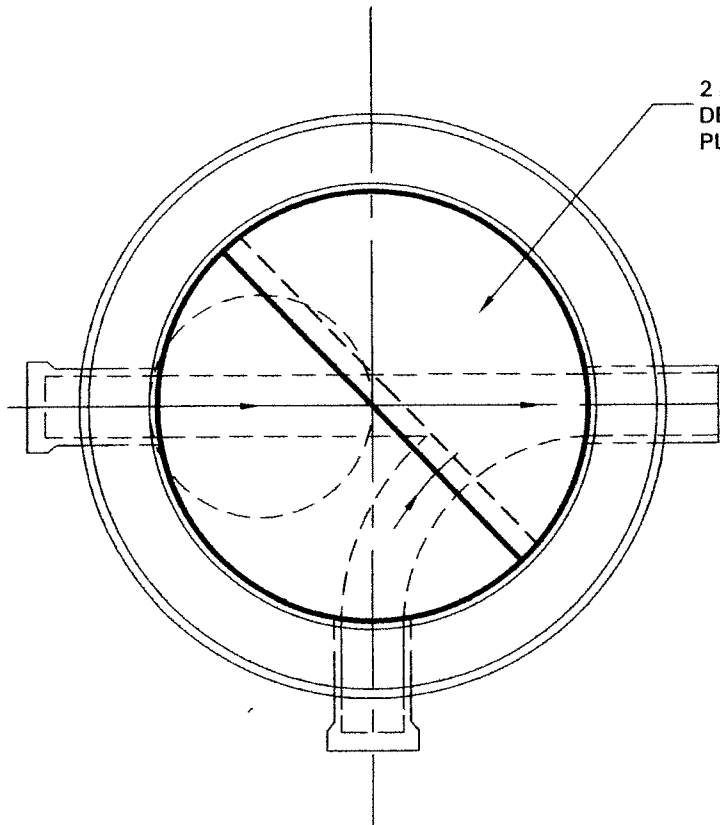
HYDRANTS ARE TO BE TURNED
OFF AND ON SLOWLY TO AVOID WATER
HAMMER DAMAGE



NOTES:

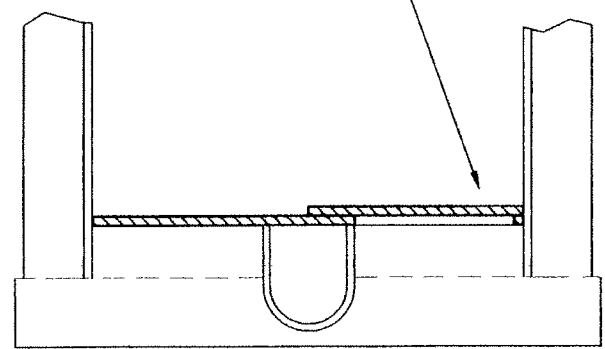
1. OPENING AND CLOSING OF HYDRANT IS PERMITTED ONLY WITH HYDRANT WRENCH.
2. SERVICE MAY BE MOVED FROM ONE LOCATION TO ANOTHER ONLY WITH THE APPROVAL OF THE WATER DISTRICT.
3. BACKFLOW DEVICES MAY BE REQUIRED FOR CERTAIN USES.
4. SERVICE CONNECTIONS MAY BE TERMINATED AT ANY TIME AT THE DISCRETION OF THE WATER DISTRICT.
5. CHARGES FOR LOSS OR DAMAGE TO ANY SERVICE MATERIAL WILL BE BASED UPON CURRENT PRICES.

DATE	REVISION	BY
APPROVED BY	<i>Robert V. Lindquist</i>	12/17/97
	GENERAL MANAGER	DATE
	<i>John M. Brudin</i>	12/12/97
	DISTRICT ENGINEER	DATE
LAKE HEMET MUNICIPAL WATER DISTRICT SEWER IMPROVEMENT		
TEMPORARY WATER SERVICE		
STANDARD No. 10		



PLAN

2 PIECE "FALSE BOTTOM/
DEBRIS CATCH" PER DETAIL "A".
PLACE ON M.H. SHELF.

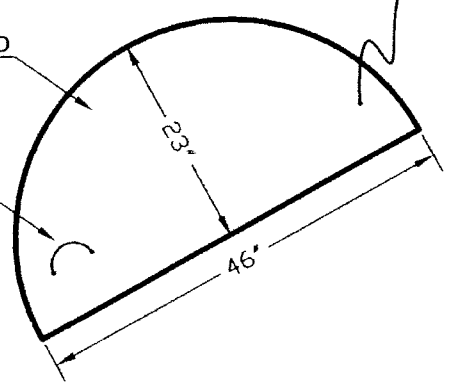


SECTION

3/4" CDX PLYWOOD
(2 PIECES)

1/4" P.E.
ROPE HANDLE

1/4" P.E.
ROPE LEASH



DETAIL "A"

DATE:	REVISION	BY
APPROVED BY <i>Thomas W. Wagner</i> 6/8/09 GENERAL MANAGER DATE:		
<i>W. S. Wall</i> 6/15/09 CHIEF ENGINEER DATE:		
SCALE: NONE		DRAWN BY: S.R.W.
LAKE HEMET MUNICIPAL WATER DIST. WATER IMPROVEMENT		
TEMPORARY FALSE BOTTOM / DEBRIS CATCH FOR STANDARD SEWER MANHOLE		
STANDARD NO.11		