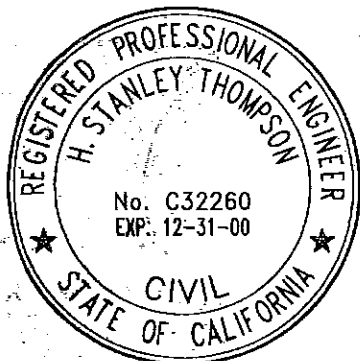
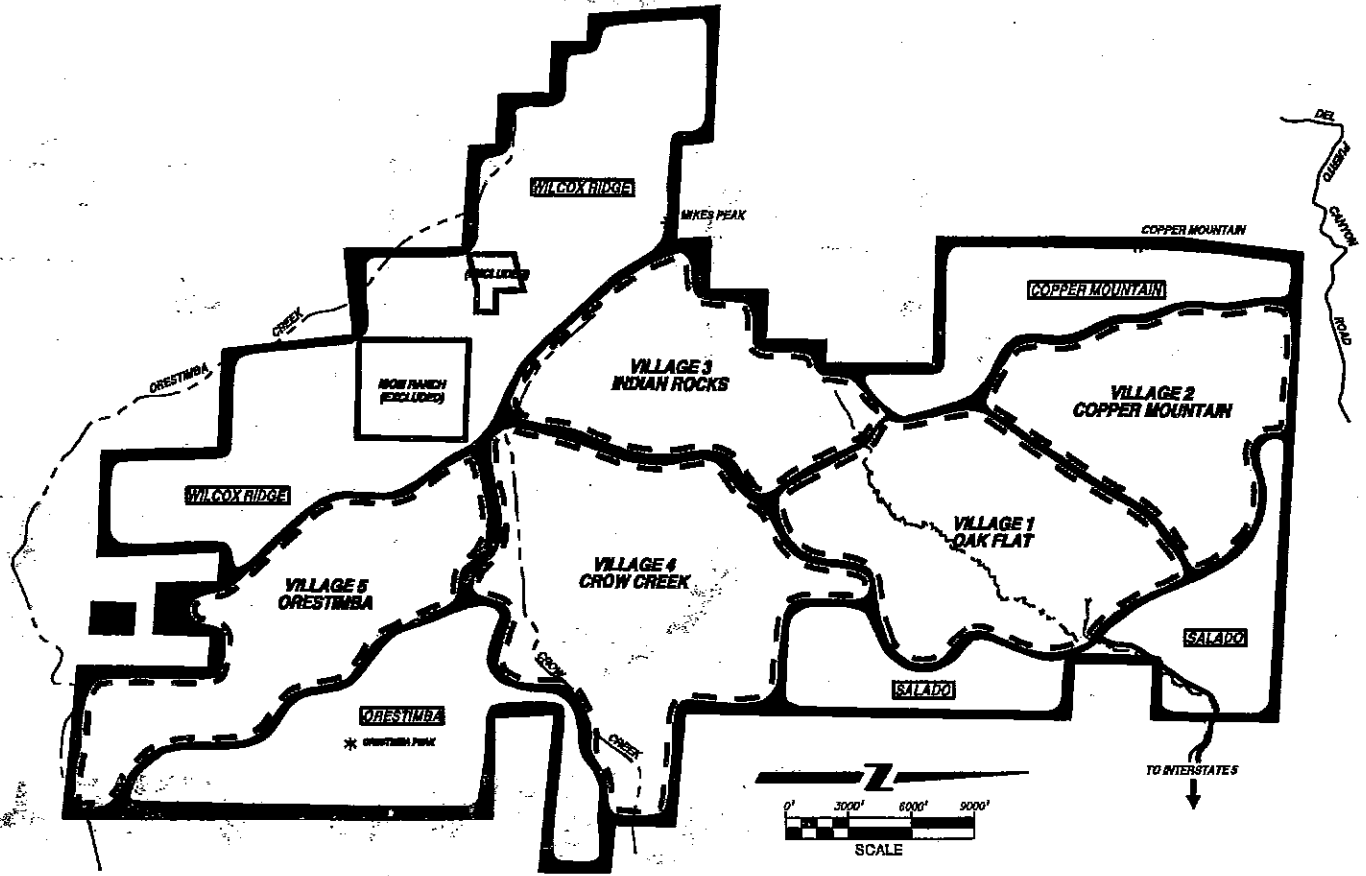


# Western Hills Water District



## Standard Drawings and Specifications



APPROVED:  
WESTERN HILLS WATER DISTRICT

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DATE

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## SECTION 16

### CLEARING AND GRUBBING

**16-1.01 Description.** This work shall consist of removing all objectionable material from within the project area, bridge construction areas, road approaches, material sites within the project areas through which ditches and channels are to be excavated, and such other areas as may be specified in the special provisions. Clearing and grubbing shall be performed in advance of grading operations and in accordance with the requirements specified in these specifications.

**16-1.02 Preservation of Property.** Existing project improvements and facilities, adjacent property, utility and non-project facilities, and trees and plants that are not to be removed, shall be protected from injury or damage resulting from the Contractor's operations. Only trees and plants that are designated or marked for removal by the Engineer shall be removed.

**16-1.03 Construction.** Unless otherwise specified in the special provisions or shown on the plans, the entire length of the project to the widths specified below shall be cleared and grubbed. No payment will be made to the Contractor for clearing and grubbing outside these limits, unless such work is authorized by the Engineer.

The area above the natural ground surface shall be cleared of all vegetable growth, such as trees, logs, upturned stumps, roots of down trees, brush, grass, weeds, and all other objectionable material including concrete or masonry, within the following limits:

- A. Highway construction areas, including structures, frontage roads, or streets, ramps, approaches, ditches and channels having a bottom width of 12 feet or more, and all other accessory roads and connections that are to be constructed. Such areas shall extend to a width of 5 feet outside of structures and excavation and embankment slope lines, except that where slopes are to be rounded, the areas shall extend to the outside limits of slope rounding.
- B. Ditches and channels having a bottom width of less than 12 feet. Such areas shall extend to a width of 2 feet outside the slope lines.
- C. Material sites within the right of way.
- D. Areas enclosed by interchange loops and ramps.

Within the limits of clearing, the areas below the natural ground surface, except in embankment areas where the grading plane is 2 feet or more above the natural ground, shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Such objectionable material shall not be left in or under embankments or dikes.

All trees, existing stumps and roots within embankment areas where the grading plane is 2 feet or more above the natural ground shall be cut off not more than one foot above the natural ground at any point, or completely removed where a structure is to be constructed, piles are to be placed or driven, subdrainage, trenches are to be excavated, unsuitable material is to be removed, or where the slopes of original hillsides, old or new fill, are cut into in accordance with the requirements in Section 19.

Where the construction is to be performed through orchard, vineyard and other cultivated areas, all orchard trees, vines and other vegetable growth shall be removed from the entire right of way area.

If specified by the special provisions or directed by the Engineer that certain shade and ornamental trees and plants shall be preserved, such trees and plants shall be fully protected from injury by the Contractor at his expense. Trees shall be felled in such a manner as not to injure standing trees, plants, and improvements which are to be preserved.

Tree branches extending over the roadway and which hang within 20 feet of finished grade shall be cut off close to the boles in a workmanlike manner. In connection with the removal of tree branches that extend over the new or widened roadway, the Contractor shall remove other tree branches under the direction of the Engineer, in such a manner that the tree will present a balanced appearance. Scars resulting from the removal of branches shall be treated with a heavy coat of an approved tree paint.

## SECTION 19

### EARTHWORK

#### 19-1 GENERAL

**19-1.01 Description.** This work shall consist of performing all operations necessary to excavate all materials, regardless of character and subsurface conditions, from the project area or adjacent thereto; to excavate all materials, of whatever nature, necessary for the construction of foundations for structures and other facilities; to excavate trenches for culverts and other facilities; to excavate drainage and irrigation ditches; to excavate drainage channels; to excavate selected material from the project site and borrow material for use as specified; to construct embankments, including the placing of selected material in connection therewith as specified; to place backfill for structures, culverts, and other facilities; to backfill trenches and depressions resulting from the removal of obstructions; to backfill holes, pits and other depressions within the roadway areas; to apply water; to remove and replace unsuitable material; to excavate and grade road approaches, driveways, and connections; to construct protection dikes; to remove unstable material from the project area, slide material which has come into the project area and material which has slipped from embankments; to prepare basement material for the placing of other material thereon; all as shown on the plans and as specified in these specifications and the special provisions, and as directed by the Engineer, and furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work that may be required to construct and maintain the roadway facilities.

Clearing and grubbing for earthwork operations shall conform to the provisions in Section 16, "Clearing and Grubbing."

**19-1.02 Preservation of Property.** Operations shall be conducted in such a manner that existing project facilities, utilities, railroad tracks, and other non-project facilities which are to remain in place and settlement platforms, slope indication devices, piezometers and Engineer's instrumentation, will not be damaged. The Contractor, at his expense, shall furnish and install sheet piling, cribbing, bulkheads, shores, or whatever means may be necessary to adequately support material carrying such facilities, or to support the facilities themselves and shall maintain such supports until they are no longer needed. Temporary pavements, facilities, utilities and installations shall also be protected until they are no longer required. When temporary supports and other protective means are no longer required, they shall be removed and disposed off-site at the contractor's expense.

When hauling is done over county or private streets, and when directed by the Engineer, the loads shall be trimmed and all material removed from shelf areas of vehicles in order to eliminate spilling of material. If directed by the Engineer, the loads shall be watered after trimming to eliminate dust.

**19-1.03 Grade Tolerance.** Immediately prior to placing subsequent layers of material thereon, the grading plane shall conform to one of the following:

- A. When asphalt concrete or asphalt concrete base is to be placed on the grading plane, the grading plane at any point shall not vary more than 0.05-foot above or below the grade established by the Engineer.
- B. When subbase or base material (other than asphalt concrete base) to be placed on the grading plane is to be paid for by the ton, the grading plane at any point shall not vary more than 0.10-foot above or below the grade established by the Engineer.

**19-1.04 Removal and Disposal of Buried Man-Made Objects.** If a buried man-made object encountered in excavation is to be removed and its removal and disposal is not included in another item of work, such removal and disposal will be paid for at the contract price per cubic yard for the type of excavation in which such object is encountered. However, if the presence of the object is not indicated on the plans or in the special provisions and its presence could not have been ascertained by visual inspection, the removal and disposal of such object will be paid for as extra work.

## 19-2 ROADWAY EXCAVATION

**19-2.01 Description.** Roadway excavation shall consist of all excavation involved in the grading and construction of the roadway, except structure excavation, ditch excavation and any excavation separately designated and paid for as a separate item.

**19-2.02 Unsuitable Material.** Unsuitable material encountered below the natural ground surface in embankment areas or below the grading plane in excavation areas shall be excavated and disposed of as directed by the Engineer. Unsuitable material is defined as material the Engineer determines to be:

- A. of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content; or
- B. too wet to be properly compacted and circumstances prevent suitable in-place drying prior to incorporation into the work; or
- C. otherwise unsuitable for the planned use.

The presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable.

The removal and disposal of such unsuitable material will be paid for as roadway excavation for the quantities involved if the removal of such material is shown on the plans or specified in the special revisions.

If the removal of such unsuitable material is not shown on the plans or specified in the special provisions, the removal and disposal of such unsuitable material will be paid for at the contract price for roadway excavation for the quantities involved unless either the Engineer, prior to removal of any such material, orders the unsuitable material to be removed and disposed of and paid for as extra work. Or the Contractor, prior to performing any such work, requests in writing that the removal and disposal of such unsuitable material be paid for as extra work.

When unsuitable material is removed and disposed of, the resulting space shall be filled with material suitable for the planned use. Such suitable material shall be placed and compacted in layers as hereinafter specified for constructing embankments.

**19-2.03 Blasting.** Excessive blasting will not be permitted. Any material outside the authorized cross section which may be shattered or loosened because of blasting shall be removed by the Contractor at his expense. The Contractor shall discontinue any method of blasting which leads to overshooting or is dangerous to the public or destructive to property or to natural features.

**19-2.04 Slides and Slipouts.** Material outside the planned roadway or ditch slopes which is unstable and constitutes potential slides in the opinion of the Engineer, material from slides which has come into the roadway or ditch, and material which has slipped out of new or old embankments shall be excavated and removed. The material shall be excavated to designated lines or slopes either by benching or in such manner as directed by the Engineer. Such material shall be used in the construction of the embankments or disposed of as directed by the Engineer.

The removal, haul and disposal of slide and slipout material, as above specified, will be paid for at the contract price for roadway excavation for the quantities involved unless the Engineer, prior to the removal of any such material, orders the slide or slipout material to be removed and disposed of and paid for as extra work. Or the Contractor, prior to performing any such work, requests in writing that the removal and disposal of any such slide or slipout material be paid for as extra work.

Where slopes previously have been completed by the Contractor, the cost of resloping required in areas where unstable or stable material is removed at the direction of the Engineer will be paid for as extra work.

The cost of pioneering work necessary to make slide or slipout areas accessible to normal excavation equipment and the cost of necessary clearing and grubbing will be paid for as extra work.

Only slide or slipout material which is actually removed as ordered by the Engineer will be paid for.

The above provisions shall not be so construed as to relieve the Contractor from the duty of maintaining all slopes true and smooth. Erosion, regardless of amount or extent, caused by the action of the elements which results in damage to the work or materials, shall in no case be considered a slide or slipout.

Any damage to work resulting from slides or slipouts shall be repaired or restored by the Contractor as directed by the Engineer.

**19-2.05 Slopes.** Excavation slopes shall be constructed in conformance with the lines and grades established by the Engineer. When completed, the average plane of the slopes shall conform to the slope indicated on the plans and no point on the completed slopes shall vary from the designated slopes by more than 0.5-foot measured at right angles to the slope, except where excavation is in rock no point shall vary more than 2 feet from the designated slope. In no case shall any portion of the slope encroach on the roadbed.

The tops of excavation slopes and the ends of excavations shall be rounded as shown on the plans.

Embankment slopes shall be constructed in conformance with the lines and grades established by the Engineer. The completed slopes within 4 feet of shoulder grade shall not vary more than 0.5-foot from the designated slope, measured at right angles to the slope. slopes below 4 feet shall not vary more than one foot from the designated slope, measured at right angles to the slope.

Median and side slopes which are on 6 to 1 or flatter slope, whether in excavation or embankment, shall be finished in conformance with the lines and grades established by the Engineer. The completed slopes shall not vary more than 0.2-foot from the designated slope, measured at right angles to the slope. Flowlines within medians shall be graded to drain and shall not vary more than 0.1-foot from the grade line established by the Engineer.

If the slope is to be cultivated or straw is to be incorporated into the surface, all loose rocks larger than 2½ inches in maximum dimension, roots and other debris on the surface of the slope shall be removed and disposed of prior to cultivation or incorporation of straw.

If embankments are constructed of large rock, the Engineer may permit the slopes more than 4 feet below shoulder grade to vary from the designated slope more than one foot, but in no case more than 2 feet, if the size of the rock makes it impracticable to construct the slopes within one foot of the designated slope.



**19-2.06 Surplus Material.** Unless otherwise shown on the plans or specified in the special provisions, surplus excavated material shall be used to widen embankments uniformly or to flatten slopes or it shall be disposed of along the roadway or in other locations as directed by the Engineer. No surplus material shall be disposed of above the grade of the adjacent roadbed nor shall the Contractor borrow or waste material unless authorized in writing by the Engineer.

If the quantity of surplus material is shown on the plans or specified in the special provisions, the quantity shown or specified is approximate only. The Contractor shall satisfy himself that there is sufficient material available for the completion of the embankments before disposing of any material inside or outside the right of way. Any shortage of material, caused by premature disposal of any material by the Contractor, shall be replaced by him and no compensation will be allowed the Contractor for such replacement.

**19.2.065 Deficiency Material.** If the quantity of acceptable material from excavation is not sufficient to construct the embankment required by the work, the quantity of material needed to complete the embankments shall consist of local borrow or imported borrow, as determined by the Engineer.

The Contractor shall obtain the local borrow or imported borrow in accordance with the provisions in Section 19-7, "Borrow Excavation."

**19-2.07 Selected Material.** Selected material shall be defined as material which is excavated from a location within the right of way as specified in the special provisions or shown on the plans, and the Contractor shall have no choice in the selection.

Selected material shall be used for topsoil or as a specified layer shall be placed in the roadway prism in accordance with the provisions in Section 19 "Earthwork," for placing embankment material or structure backfill.

When selected material is shown on the plans or designated in the special provisions as a specified layer, spreading and compacting the material shall conform to the provisions in Section 26, "Aggregate Subbases."

When practicable, and processing is not specified, selected material shall be hauled directly from excavation to its final position in the roadway prism and compacted in place and such work will be paid for at the contract price for roadway excavation.

Selected material shall remain in place until it can be placed in final position as provided above. No additional compensation will be allowed for any delay or inconvenience in excavation operations, except that if ordered in writing by the Engineer, selected material may be excavated and stockpiled at locations designated by him and later placed in final position in the roadway prism.

Excavating selected material and stockpiling, if required, will be paid for at the contract price for roadway excavation. Removing the selected material for stockpiles and placing it in final position in the roadway prism will again be paid for at the contract price for roadway excavation, except that the quantities to be paid for will be determined from measurements of the material in the stockpiles prior to removal. No payment for stockpiling of selected material will be made, unless such stockpiling is ordered by the Engineer.

Topsoil placed along the tops of slopes in connection with erosion control work will not be considered as stockpiled material when determining quantities of earthwork to be paid for.

## 19-3 STRUCTURAL EXCAVATION AND BACKFILL

**19-3.01 Description.** Structure excavation shall consist of excavation for the construction of foundations for structures; excavation of trenches for the construction of culverts, pipes, rods, deadmen, cutoff walls and other facilities; other excavation designated on the plans or in these specifications or in the special provisions as structure excavation; the control and removal of water and the construction or installation of all cofferdams and other facilities as necessary to accomplish construction of the work; and the subsequent removal of such facilities, except when they are required or permitted by the plans and specifications to remain in place.

Structure backfill shall consist of furnishing, placing and compacting backfill material around structures to the lines designated on the plans or specified or directed by the Engineer.

Structure excavation and structure backfill may be classified on the plans or in the Engineer's Estimate into various types or classifications. When there is a contract pay item for structure excavation (Type A), such excavation shall include all excavation for footings where seal courses are shown on the plans. The requirements of the specifications pertaining specifically to earthwork which is classified on the plans as structure excavation (culvert) and structure backfill (culvert).

Material from structure excavation not used as structure backfill shall be deposited in roadway embankments as provided in Section 19-6, "Embankment Construction," or disposed of as directed by the Engineer.

**19-3.02 Excavations for Culverts.** When the plans require embankment construction prior to the required excavation the embankment shall first be constructed to the required height as shown on the plans, and for a distance each side of the culvert of not less than 5 times the diameter or height of the culvert, after which the trench shall be excavated and the culvert installed. Where such embankments are to be constructed on a steep slope or at a difficult location, the height of new embankments may be varied as directed by the Engineer before installing culverts.

**19-3.025 Culvert Beddings.** Culvert beddings shall consist of shape bedding, sand bedding, or soil cement bedding and shall be constructed, where shown or specified, in accordance with the details shown on the plans and these specifications. When more than one type of bedding is permitted, the same bedding shall be used throughout the length of the culvert.

Culvert beddings shall conform to the following requirements:

**19-3.025A Shape Bedding.** The trench bed shall be shaped to fit the bottom of the culvert, as shown on the plans, and shall provide uniform support throughout the entire length of the culvert. The trench may be excavated below the bottom of the culvert and the shaped bedding constructed by backfilling and compacting culvert backfill material to the required line, grade and shape. Shaping shall be accomplished by use of a template conforming to the outside shape of the culvert established by the Engineer. Such headers may be left in place.

**19-3.025B Sand Bedding.** Sand shall be free from clay or organic material, suitable for the purpose intended, and shall be of such size that 90 -100% will pass a No. 4 sieve and not more than 5% will pass a No. 200 sieve.

**19-3.025C Soil Cement Bedding.** Portland cement used in soil cement bedding shall conform to the provisions in Section 90, "Portland Cement Concrete," except that testing will not be required.

Water used for soil cement bedding shall be free from oil, salts and other impurities which would have an adverse effect on the quality of the bedding material.

Aggregate for soil cement bedding shall be either material selected from the excavation, imported material, or a combination thereof; be free from organic material and other deleterious substances; and meet the following grade requirements:

Sieve Sizes	Percentage Passing
1 1/2"-----	100
1"-----	80 - 100
3/4"-----	60 - 100
3/8"-----	50 - 100
No. 4-----	40 - 80
No. 100-----	10 - 40

The aggregate, cement and water shall be proportioned either by weight or by volume. Not less than 282 pounds of cement shall be used for each cubic yard of material produced. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

Materials for soil cement bedding shall be thoroughly machine-mixed in a pugmill, rotary drum, or other approved mixer. Mixing shall continue until the cement and water are thoroughly dispersed throughout the material. Soil cement bedding shall be placed in the work within one hour after mixing.

Soil cement bedding shall be placed in a uniform manner that will prevent voids in, or segregation of, the bedding, and will not float or shift the culvert. Foreign material which falls into the trench prior to or during placing of the soil cement bedding shall be immediately removed.

Backfilling with earth on culverts set in soil cement bedding shall not commence until 8 hours after the soil cement bedding has been placed.

**19-3.03 Cofferdams.** Cofferdams for foundation construction shall be carried well below the bottom of the footings and shall be well braced and as watertight as practical. The interior dimensions of cofferdams shall provide sufficient clearance inside the wales for constructing forms and driving piles and to permit pumping outside the forms.

If in the judgment of the Contractor, the clearance provided on the plans between the outside line of the footing and pile or interior wall or surface is not sufficient to permit the driving of piles or building of forms, he may provide such necessary clearance as he may deem necessary. Any such enlargement in excess of one foot outside the dimensions of the footing as shown on the plans shall be considered as being for the sole purpose of expediting the work of the Contractor, and the quantities of such excavation and backfill will not be included in the quantities to be paid for.

Cofferdams which are tilted or moved out of position by any cause during the process of sinking shall be righted or enlarged so as to provide the necessary clearance and proper pier location and such work shall be done by the Contractor at his expense.

In streams at a time of probable flood, cofferdam walls shall be vented at low water elevation to insure equal hydrostatic head both inside and outside of the cofferdam during the period of placing and setting of seals.

No shoring will be permitted in cofferdams which will induce stress, shock, or vibration in the permanent structure.

When permitted by the Engineer, cross struts or bracing may extend through foundation concrete. Such struts or bracing below water will be permitted to remain in place, except in navigable streams or when specified in the special provisions or shown on the plans, to be removed.

Struts or bracing above low water shall be removed and the resulting space filled with concrete of the same mix as that specified for the surrounding concrete.

The Contractor shall submit to the Engineer, for approval, drawings showing his proposed method of cofferdam construction and other details left open to his choice or not fully shown on the plans. The drawings shall be submitted at least 3 weeks in advance of the time the Contractor begins construction of the cofferdams.

After completion of the substructure, the cofferdams with all sheeting and bracing shall be removed to at least 2 feet below the level of the streambed, by the Contractor at his expense, and such removal shall be performed in a manner that will not disturb or mar the finished concrete or masonry.

**19-3.06 Structure Backfill.** Backfill material shall be placed in uniform layers and shall be brought up uniformly on all sides of the structure or facility. The thickness of each layer of backfill shall not exceed 0.67-foot before compaction except that when compaction is done by ponding and jetting, said thickness shall not exceed 4 feet.

Compaction equipment or methods which may cause excessive displacement or may damage structures shall not be used.

Structure backfill shall not be placed until the structure footings or others portions of the structure or facility have been inspected by the Engineer and approved for backfilling. No backfill material shall be deposited against the back of concrete structures until the concrete has developed a strength of not less than 2,500 pounds per square inch in compression, or until the concrete has been in place for 28 days, whichever occurs first.

Backfill at the inside of bridge wingwalls and abutments shall be placed before curbs or sidewalks are constructed over the backfill and before railings on the wingwalls are constructed.

Compaction of structure backfill by ponding and jetting will be permitted when, as determined by the Engineer, the backfill material is of such character that it will be self-draining when compacted and that foundation materials will not soften or be otherwise damaged by the applied water and no damage from hydrostatic pressure will result to the structure. Ponding and jetting of the upper 4 feet below finished grade will not be permitted. The work shall be performed without damage to the structure and embankment, and in such a manner that water will not be impounded. Ponding and jetting methods shall be supplemented by the use of vibratory or other compaction equipment when necessary to obtain the required compaction.

Unless otherwise shown on the plans or specified in these specifications or the special provisions, structure backfill shall be compacted to a relative compaction of not less than 95 percent.

Structure backfill placed at the following locations shall be compacted to a relative compaction of not less than 90 percent:

1. Oversize drains.
2. Footings for slope protection, slope paving, and aprons.
3. All headwalls, endwalls, and culverts.
4. Retaining walls, except for portions under any surfacing.
5. Inlets in median areas or in traffic interchange loops.
6. Footings and pumping plants not beneath any surfacing.

Unless otherwise shown on the plans or specified in these specifications or the special provisions, material for structure backfill to be compacted to a relative compaction of not less than 95 percent and material to be placed behind retaining walls shall have a Sand Equivalent value of not less than 20 and shall conform to the following grading:

Sieve Sizes	Percentage Passing
3"-----	100
No. 4-----	35 - 100
No. 30-----	20 - 100

Unless otherwise shown on the plans or specified in these specifications or the special provisions, material for structure backfill to be compacted to a relative compaction of not less than 90 percent, except material to be placed behind retaining walls, shall consist of material free of stones or lumps exceeding 3 inches in greatest dimension, organic, or other unsatisfactory material.

At locations where directed by the Engineer, the material used to backfill the outer 2-foot portion of structure backfill adjacent to pipe and culvert inlets and outlets, and structure backfill placed within 2 feet of finished grade around abutments, abutment wingwalls, retaining walls, and other portions of structure shall be compacted impervious material. The impervious backfill shall be an earthy material, as determined by the Engineer to be suitable for such purpose. The Sand Equivalent requirement shall not apply to such material used for structure backfill.

The cells formed by the crib members of crib walls and the space between the crib wall and the limits designated for structure excavation, as shown on the plans or specified, including any space due to material being shown on the plans or specified, including any space due to material being removed outside said limits, shall be backfilled with material conforming to the following grading, quality, placement and compaction requirements:

Structure backfill placed for crib walls shall be of such character that it will not sift or flow through the openings in the wall and shall conform to the type or types listed below for the height of wall.

Backfilling shall progress simultaneously with the erection of the crib wall. Backfill material shall be so placed as to not disturb or damage the crib members, shall be placed in uniform layers before compaction not exceeding the thickness listed in the following table, and shall be compacted by hand tamping, mechanical compaction or other means approved by the Engineer.

Wall Height	Backfill Material Type	Loose Thickness of each Layer of Backfill Material Before Compaction
Under 10 feet-----	C, D, or E	1 foot
10-25 feet-----	D or E	2 feet
Over 25 feet-----	E	4 feet

Backfill Material Type	Grading		Sand Equivalent	Relative Compaction
	Sieve Size	Percentage Passing		
C	3"	100	None	90% Min.
D	3"	100	30 Min.	90% Min.
E	No. 4	35-100	None	90% Min.
	3"	100		
	No. 4	25-70		
	No. 50	5-20		
	No. 200	0-5		

Structure backfill placed at bridge piers in waterways and water channels, not beneath any embankment, pavement or slope protection, need not be compacted, shall consist of soil which is free of organic matter, trash or other unsatisfactory material, and shall be placed to the level of the original ground or finished grade.

Where structure excavation is performed and material is removed outside the pay limits designated for structure excavation, as shown on the plans or specified in these specifications or the special provisions, all backfill material placed in said excavation areas shall conform to the backfill.

Material for structure backfill shall be furnished by the Contractor except that the Contractor may use material found in excavation if acceptable by engineer. When there is an item for imported borrow, imported borrow meeting the requirements of structure backfill may be used as structure backfill and no deduction in the quantities of imported borrow to be paid for will be made provided that an equivalent amount of material conforming to the requirements of imported borrow is replaced by the Contractor. Material from structure excavation which is not suitable for use as structure backfill may be used to replace imported borrow or other excavated material.

**19-3.065 Pervious Backfill Material.** Pervious backfill material shall be placed behind bridge abutments, wingwalls and retaining walls as shown on the plans and in accordance with the following requirements.

Pervious backfill material shall consist of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations thereof. Pervious backfill material, except for sacked material at wall drain outlets, shall conform to the following grading requirements:

Sieve Sizes	Percentage Passing
2".....	100
No. 50.....	0-100
No. 100.....	0-8
No. 200.....	0-4

Wall drain outlets shall be backed with sacked pervious backfill material, except that the grading for the sacked material shall conform to the grading for the 1½" X ¾" primary aggregate size.

Pervious backfill material shall be placed in layers along with and by the same methods specified for structure backfill. Pervious backfill material at any one location shall be approximately the same grading, and at locations where the material would otherwise be exposed to erosion shall be covered with at least a one foot layer of earthy material approved by the Engineer.

## SECTION 20

### EROSION CONTROL AND PROJECT PLANTING

#### 20-1 GENERAL

**20-1.01 Description.** This work shall consist of performing erosion control, planting, and other work necessary for improving the appearance of the roadside, and project site.

Erosion control and planting shall be performed in accordance with these specifications, the special provisions, the details shown on the plans, and as directed by the Engineer.

#### 20-2 MATERIALS

**20-2.01 Topsoil.** Topsoil obtained from sources within the project shall be excavated to the lines and depths as directed by the Engineer. All lumps or clods shall be broken up before the topsoil is spread.

Imported topsoil shall consist of material obtained from sources outside the limits of the project. Unless designated in the special provisions, the Contractor shall make his own arrangements for obtaining imported topsoil and he shall pay all costs involved.

Imported topsoil shall consist of fertile, friable soil of loamy character, and shall contain an amount of organic matter normal to the region. It shall be obtained from well-drained arable land and shall be reasonably free from subsoil, refuse, roots, heavy or stiff clay, stones larger than one inch in size, coarse sand, noxious seeds, sticks, brush, litter, and other deleterious substances. Imported topsoil shall be capable of sustaining healthy plant life.

**20-2.02 Commercial Fertilizer.** Commercial fertilizer shall conform to the requirements of the California Food and Agriculture Code.

Commercial fertilizer for erosion control work shall be in pelleted or granular form and shall have a guaranteed chemical analysis of 16 percent nitrogen, 20 percent phosphoric acid, and 0 percent water soluble potash, and shall contain a minimum of 12 percent sulfur.

Commercial fertilizer for highway planting work shall be in pelleted, granular, or tablet form and shall have the chemical analysis specified in the special provisions.

**20-2.03 Soil Amendment.** Soil amendment shall be a wood or bark product, treated to absorb water quickly, or a relatively dry organic compost derived from sewage sludge or rice hulls; shall be friable and pass a one-inch sieve and shall comply with the requirements in the California Food and Agricultural Code.

Rice hull compost shall not contain living vegetation, dirt or other objectional material, pathogenic viruses, fly larvae, insecticides, herbicides, fungicides nor poisonous chemicals that would inhibit plant growth.

All soil amendment shall be packaged so that compliance can be readily determined, or shall be accompanied by a Certificate of Compliance.

**20-2.05 Iron Sulfate.** Iron sulfate shall be ferrous sulfate in pelleted or granular form containing not less than 18.5 percent iron expressed as metallic iron. Iron sulfate shall conform to the requirements of the California Food and Agriculture Code.

**20-2.06 Straw.** Straw shall be derived from wheat, rice, or barley. The Contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw obtained from outside the county in which it is to be used is delivered to the site of the work. Straw that has been used for stable bedding shall not be used.

**20-2.07 Fiber.** Fiber shall be produced from natural or recycled (pulp) fiber, such as wood chips or similar wood materials or from newsprint, chipboard, corrugated cardboard or a combination of these processed materials, and shall be free of synthetic or plastic materials. Fiber shall not contain more than 7 percent ash as determined by the Technical Association of the Pulp and Paper Industry (TAPPI) Standard T 413, shall contain less than 250 parts per million boron, and shall be otherwise nontoxic to plant or animal life.

Fiber shall have a water-holding capacity by weight of not less than 1,200 percent as determined by the procedure used in the Department's Final Report, CA-DOT-TL-2176-1-76-36, "Water-Holding Capacity of Hydromulch," available at the Transportation Laboratory, 5900 Folsom Boulevard, Sacramento, CA 95819.

Fiber shall be of such character that the fiber will disperse into a uniform slurry when mixed with water. Water content of the fiber before mixing into slurry shall not exceed 15 percent of the dry weight of the fiber. The percentage of water in the fiber is to be applied, and shall not stain concrete or painted surfaces.

A Certificate of Compliance for fiber shall be furnished to the Engineer.

**20-2.08 Mulch.** Unless otherwise specified in the special provisions or shown in the plans, mulch shall consist of wood chips, tree bark, or shredded bark, or any combination thereof, at the Contractor's option.

Mulch materials produced from pine trees grown in Alameda, Monterey, Santa Clara, Santa Cruz, or San Mateo Counties shall not be used.

Wood chips shall be manufactured from clean wood. The particle size of the chips shall be between 1/2 inch and 3 inches in length, and not less than 3/8 inch in width and 1/16 inch in thickness.

At least 85 percent, by volume, of wood chips shall conform to the sizes specified.

Chips produced from tree trimmings which contain leaves or small twigs will not be accepted.

Tree bark shall have a particle size between 1/2 inch and 1 1/2 inches and shall be free of salt and foreign materials such as clods, coarse objects, sticks, rocks, weeds or weed seeds.

Shredded bark shall be a mixture of shredded bark and wood; shall have a particle size between 1/8 inch and 1 1/2 inches in thickness and one inch to 8 inches in length; and shall be free of salt and deleterious materials such as clods, coarse objects, and rocks. At least 75 percent, by volume, of shredded bark shall conform to the sizes specified.

A Certificate of Compliance for mulch shall be furnished to the Engineer.

**20-2.10 Seed.** Seed required to be labeled under the California Food and Agricultural Code, shall be labeled by the vendors supplying such seed. Seed shall have been tested for purity and germination not more than 15 months prior to the application of such seed. The test results from such seed testing shall be delivered to the Engineer prior to applying the seed. Seed labels furnished by the seed vendors supplying such seed shall indicate the purity and germination as determined by such seed testing.



Before seeding, the Contractor shall furnish written evidence (seed label or letter) to the Engineer that seed, not required to be labeled under the California Food and Agricultural Code, has been tested for purity and germination by a seed laboratory certified by the Association of Official Seed Analysts, or a seed technologist certified by the Society of Commercial Seed Technologists.

The percentage of seed germination shall include the germination percentage of any hard seed.

Seed with less than the specified purity or germination may be used under the following conditions:

- A. The application rate for such seed shall be increased to compensate for the less than specified purity or germination.
- B. Prior to using such seed, the Contractor shall submit to the Engineer the purity and germination percentages, and the proposed increased application rate for such seed.
- C. No such seed shall be used before the Engineer has approved, in writing, the use of such seed and the increased application rate.
- D. The additional seed required because of the increased application rate shall be furnished and applied at the Contractor's expense.

Seed specified without a purity or germination requirement shall be labeled to include the name, date (month and year) collected, and the name and address of the seed supplier. Said seed, at the time of sowing, shall be from the previous or current year's harvest.

All shipments of seed not accompanied by a valid California Nursery Stock Certificate shall be reported to the County Agricultural Commissioner at the point of destination for inspection and shall be held until released by the Commissioner.

Seed treated with mercury compounds shall not be used.

Legume seed shall be pellet inoculated with a viable bacteria compatible for use with that species of seed. All inoculated seed shall be labeled to show the weight of seed, the date of inoculation, and the weight and source of inoculant materials.

Legume seed shall be pellet-inoculated in accordance with the provisions in Bulletin 1842, "Range-Legume Inoculation and Nitrogen Fixation by Root-Nodule Bacteria," of the University of California Division of Agriculture and Natural Resources. Inoculant shall be added at the rate of 2 pounds of inoculant per 100 pounds of legume seed.

**20-2.11 Stabilizing Emulsion.** Stabilizing emulsion shall be a concentrated liquid chemical that forms a plastic film upon drying and allows water and air to penetrate. The film shall be nonflammable and shall have an effective life of at least one year.

Stabilizing emulsion shall be nontoxic to plant or animal life and nonstaining to concrete or painted surfaces. In the cured state, the stabilizing emulsion shall not be re-emulsifiable. The material shall be registered with and licensed by the State of California, Department of Food and Agriculture, as an "auxiliary soil chemical".

A Certificate of Compliance for stabilizing emulsion shall be furnished to the Engineer.

**20-2.12 Lumber.** Lumber shall be construction grade cedar, pressure treated Douglas fir, or heart redwood, rough cut, from sound timber, and shall be straight and free from loose or unsound knots, shakes in excess of 1/3 thickness of the lumber, splits longer than the thickness of the lumber, or other defect which would render the lumber unfit structurally for the purpose intended. Knots in all lumber shall be sound, tight, well spaced, and shall not exceed 2 inches in size on any face. Sweep shall not exceed 0.08 foot in 6 feet.

**20-2.13 Plants.** Plants shall be the variety and size shown on the plans or in the special provisions and shall conform to the requirements of these specifications.

No plant shall be transported to the planting area that is not thoroughly wet throughout the ball of earth surrounding the roots. Any plant that, in the opinion of the Engineer, has a damaged root ball or is dry or in a wilted condition when delivered to the planting area will not be accepted, and shall be replaced by the Contractor at his expense.

Each plant shall be handled and packed in the approved manner for that species or variety, and all necessary precautions shall be taken to insure that the plants will arrive at the site of the work in proper condition for successful growth. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn.

All plants furnished by the Contractor shall be true to type or name as shown on the plans and shall be tagged identifying the plants by species or variety; however, determination of plant species or variety will be made by the Engineer and his decision shall be final. Plants shall be individually tagged or tagged in groups by species or variety. Carpobrotus cuttings need not be tagged.

All plants shall comply with Federal and State laws requiring inspection for plant diseases and infestations. Inspection certificates required by law shall accompany each shipment of plants, and certificates shall be delivered to the Engineer.

The Contractor shall obtain clearance from the County Agricultural Commissioner, as required by law, before planting plants delivered from outside the County in which they are to be planted. Evidence that such clearance has been obtained shall be filed with the Engineer.

Plants furnished by the Contractor shall be healthy, shapely, and well-rooted, and roots shall show no evidence of having been restricted or deformed at any time. Plants shall be well-grown, free from insect pests and disease, and shall be grown in nurseries which have been inspected by the State Department of Food and Agriculture and have complied with the regulations thereof.

Root condition of plants furnished by the Contractor in containers will be determined by removal of earth from the roots of not less than 2 plants nor more than 2 percent of the total number of plants of each species or variety, except when container-grown plants are from several sources, the roots of not less than 2 plants of each species or variety from each source will be inspected by the Engineer. In case the sample plants are found to be defective, the State reserves the right to reject the entire lot or lots of plants represented by the defective samples. Any plants rendered unsuitable for planting because of this inspection will be considered as samples and will not be paid for.

The Contractor shall notify the Engineer when plants are to be shipped to the project site. Such notification shall be given not less than 10 days prior to the actual shipment date.

**20-2.14 Water.** Water shall be of such quality that it will promote germination of seeds and growth of plants.

## SECTION 71

### SANITARY SEWERS

**71-1.01 Description.** This work shall consist of laying sewer pipe and constructing sewer structures as shown on the plans, in accordance with these specifications, the special provisions and as directed by the Engineer.

The type of sewer pipe and sewer structures will be designated in the contract items.

**71-1.01A Right of Way.** All privately owned and maintained sanitary sewers with slopes less than 1/8" per foot and subject to inspection by the Public Works Department shall be installed within a 10' (min.) wide easement which shall have been dedicated to the Western Hills Water District.

**71-1.02 Materials.** Pipe, fittings, miscellaneous materials and the most common joint materials are described in this Section 71-1.02.

Portland cement used in the production of concrete products set forth in this Section 71-1.02 shall be Type II Modified cement conforming to the provisions in Caltrans Section 90, "Portland Cement Concrete."

**71-1.02A Reinforced Concrete Sewer Pipe.** Reinforced concrete pipe shall conform to A.S.T.M. Designation C-76 for the size and classes indicated on the plans.

**71-1.02A (1) Plastic Lining.** The full three hundred and sixty degree (360°) of the interior circumference of all reinforced concrete pipe shall be sealed and protected with a polyvinyl chloride resin lining. Copolymer resins will not be permitted.

The plastic liner shall be impermeable to sewage gases and liquids and shall be nonconductive to bacterial or fungus growth. The lining shall be impact resistant, flexible, and shall have an elongation sufficient to bridge up to 1/8" settling cracks which may take place in the pipe or in the joint after installation without damage to the lining.

The lining shall be of a type that is permanently and physically embedded into the concrete pipe wall by the T-lock mechanism and shall not rely on an adhesive bond between the lining and pipe wall.

The lining at all pipe joints, and at all joints between individual sheets or sections of lines shall be continuously heat welded by the use of welding strips of the same kind and equivalent thickness of the material as the lines.

The contractor shall submit for the Engineer's consideration written information as to the type, size, workmanship and other specifications for the plastic liner he proposes to use on any installation. Approval of this submission by the Engineer shall be obtained prior to any material being delivered to the job site.

**71-1.02B Clay Sewer Pipe.** Vitrified clay pipe shall conform to the specifications for extra strength pipe of A.S.T.M. Designation C-700 and C-301.

**71-1.02C Cast Iron & Ductile Iron Pipe.** Cast iron pipe shall comply with ANSI A 21.6 (AWWA C106) for pipe cast in metal molds or ANSI A21.8 (AWWA C 108) for pipe cast in sand lined molds.

Ductile iron pipe shall comply with ANSI A21.51 (AWWA C151).

**71-1.02E Acrylonitrile-Butadiene-Styrene.** (ABS) Sewer Pipe - Pipe sizes four (4) and six (6) inch diameter shall conform to ASTM D2751-80 with minimum wall thickness determined by SDR 35.

Pipe sizes eight (8) through fifteen (15) inch diameter shall conform to ASTM D2680 with Type OR Type SC joints.

**71-1.02F Polyvinyl Chloride (PVC) Sewer Pipe.** All solid wall pipe and fittings in 4" through 15" diameters shall be type PSM SDR-35 PVC, ASTM 3034; 18" through 24" shall be type PS 46 PVC, ASTM F679. Pipe and fittings shall be marked as per ASTM requirements.

**71-1.02G Resilient Joint Material.** Flexible compression joints in bell and spigot clay pipe and resilient joint materials to be used therein shall conform to the requirements of A.S.T.M. Designation C 425.

**71-1.02H Rubber Gasketed Joints.** Rubber gasketed joints shall conform to the provisions in Caltrans Section 65-1.06B, "Rubber Gasketed Joints".

**71-1.02I Miscellaneous Iron and Steel.** Miscellaneous iron and steel items shall conform to the provisions in Caltrans Section 75, "Miscellaneous Metal".

**71-1.02J Reinforcement.** Reinforcement shall conform to the provisions in Caltrans Section 52, "Reinforcement".

**71-1.02K Concrete.** Concrete shall conform to the provisions in Caltrans Section 51, "Concrete Structures, " and Caltrans Section 90, "Portland Cement Concrete".

**71-1.02L High Density Polyethylene Pipe (HDPE).** HDPE pipe and fittings shall be made of high density, high molecular weight, Type III, Class C, Category 5, Grade P34 polyethylene meeting the requirements of ASTM D1248 and ASTM F894 unless specified otherwise herein. Wall configurations and thickness shall meet the deflection requirements of this section. Crushing and buckling strengths shall exceed that required from the loads anticipated. Pipe selection and deflection design shall also be based upon a pipe stiffness not less than 20 psi and a modulus of soil reaction no greater than 1400. Pipe stiffness shall be tested prior to installation in accordance with ASTM D2412 with a 5% deflection at a rate of 1.2 inches per minute.

**71-1.03 Excavation and Backfill.** Excavation and backfill shall conform to the provisions shown on the Western Hills Water District Standard Plans U-7 and U-8.

The pipe shall be laid in a trench excavated to the lines and grades designated by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel.

Suitable excavation shall be made to receive the bell of the pipe and the joint shall not bear upon the bottom of the trench. All adjustment to line and grade shall be made by scraping away or filling in with sand, gravel, or granular material under the body of the pipe, and not by wedging or blocking.

Trenches shall not be left open farther than 500 feet in advance of pipe laying operations or 500 feet to the rear thereof, unless otherwise permitted by the Engineer.

The excavation shall be supported so that it will be safe and that the ground alongside the excavation will not slide or settle and all existing improvements, either on public or private property, will be fully protected from damage.

All supports shall be removed after construction is completed, unless otherwise directed by the Engineer, and shall be withdrawn in a manner that will prevent the caving of the sides of the excavation. All openings caused by the removal of supports shall be filled with suitable material properly compacted.

**71-1.04 Bedding.** Bedding shall be defined as that material supporting, surrounding and extending to one foot above the top of the pipe. Where it becomes necessary to remove boulders or other interfering objects at subgrade for bedding, any void below such subgrade shall be filled with the bedding material designated on the plans. Where concrete is specified to cover the pipe, the top of the concrete shall be considered as the top of the bedding.

If soft, spongy, unstable, or other similar material is encountered upon which the bedding material or pipe is to be placed, this unsuitable material shall be removed to the depth specified by the Engineer and replaced with bedding material suitably densified.

Bedding material shall first be placed so that the pipe is supported for the full length of the barrel with full bearing on the bottom segment of the pipe equal to a minimum of 0.5 times the outside diameter of the barrel. Densification of bedding for pipe shall be accomplished after the sheeting or shoring has been removed from the bedding zone. Alternate methods of pipe laying which are recommended by the pipe manufacturer may be used if approved by the Engineer. Bedding zone for PVC, ABS and HDPE pipe shall be mechanically compacted before the remainder of trench is compacted.

Bedding material shall be sand, gravel, crushed aggregate, native free-draining granular material having a sand equivalent of not less than 20 as specified on Standard Plan U-7 and U-8 for trench backfilling.

Pea gravel is not acceptable. No aggregate shall exceed 1".

In cases where native material is suitable for use as bedding, the trench may be excavated to a point above the invert grade and the trench bottom hand-shaped so that the bottom segment of the pipe is firmly supported on undisturbed material.

Unless otherwise specified, special pipe bedding will not be required for steel or cast iron water pipe, and the trench bottom need not be shaped to the outside diameter of the pipe. However, the trench bottom shall provide firm and uniform bearing.

Bedding material for HDPE pipe shall be 3/4" crushed rock. The portion of the material that is larger than will pass 3/8" sieve shall contain at least 50% of particles having three or more fractured faces. Not over 5% shall be pieces that show no such faces resulting from crushing. The gradation of the crushed rock shall be as follows:

<u>Sieve Sizes</u>	<u>3/4"</u>
1 1/2".....	---
1 ".....	100
3/4".....	90-100
1/2".....	30-60
3/8".....	0-20
No. 4.....	0-20
No. 8.....	0-5

This material shall be compacted to the density and level shown on Drawing U-8.

**71-1.05 Pipe Laying.** Pipe shall be protected during handling against impact shocks and free fall. Pipe will be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be subject to rejection. Any corrective work shall be approved by the Engineer and shall be at no cost to the Western Hills Water District.

When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for, and expose, the existing pipe improvement before laying any pipe or conduit. The Engineer shall be given the opportunity to inspect the existing pipe or conduit before connection is made. When the new facilities interfere with the existing flow of sewage, The Contractor shall provide satisfactory bypass facilities at his expense.

The pipe shall be laid without break upgrade from structure to structure, with bell end upgrade, unless otherwise permitted by the Engineer.

All joints shall be cleaned and then sealed with the type of materials specified or required by the Western Hills Water District. In the absence of such requirements the pipe shall be jointed with materials recommended by the pipe manufacturer for the purpose intended, and approved by the Engineer, in order to obtain a watertight joint against leakage and infiltration under all conditions of expansion, contraction, and settlement.

Whenever the work ceases for any reason, the end of the pipe shall be securely closed with a tight fitting plug or cover.

Whenever existing pipes are to be cut or abandoned, the open ends of said pipes shall be securely closed by a tight fitting plug or wall of concrete not less than 0.5 foot thick, or by a tight brick wall 0.67 foot thick with cement mortar joints.

Where ground water occurs, the bottom of the trench shall be kept entirely free of water during the pipe laying, filling the joints, and as long thereafter as directed by the Engineer.

All joints shall be carefully cleaned on the inside.

Stoppers for pipes and branches left unconnected shall be made of the same material as the pipe or of resilient joint material conforming to Section 71-1.02J, "Resilient Joint Material." After placing the stopper, it shall be covered with a layer of sealant. The sealant shall be sufficiently fluid to insure free flow around the stopper.

Concrete pipe with elliptical reinforcement shall be laid with the minor axis of the reinforcement cage in a vertical position.

Pipe shall be laid true to line and grade. Any pipe which is not in true alignment or shows any undue settlement after laying shall be taken up and relaid at the Contractor's expense.

Pipe sections shall be laid and joined in such a manner that the offset of the inside of the pipe at any joint will be held to a minimum at the invert. The maximum offset at the invert of pipe shall be 1 percent of the inside diameter of the pipe or 3/8 inch (9.5 mm), whichever is smaller.

In joining socket and spigot pipe, the spigot of each pipe shall be so seated in the socket of the adjacent pipe as to give a minimum of 3/8 inch (9.5 mm) annular space all around the pipe in the socket. Unavoidable offsets shall be distributed around the circumference of the pipe in such a manner that the minimum offset occurs at the invert.

When pipe is laid in a sheeted trench, all sheeting against which concrete cradle is to be placed shall be faced with at least one thickness of building paper and the sheeting shall be withdrawn without displacing or damaging the cradle.

After the joints have been made, the pipe shall not be disturbed in any manner.

During installation, linear expansion and contraction shall be kept below the manufacturer's recommendations. Strutting shall be mandatory for sizes 36" and larger. A strutting detail shall be approved by the District Engineer prior to installation. Pre-deflecting the pipe shall only be permitted subsequent to approval from the Western Hills Water District.

#### **71-1.06 Pipe Joints.**

**A. Vitrified Clay Pipe.** Either polyvinyl chloride or polyurethane compression joints may be used. Materials shall conform to A.S.T.M. Designation C-425.

Joints shall contain two sealing components, one bonded to the outside of the spigot and the other bonded to the inside of the socket. Sealing components shall be a plasticized polyvinyl chloride compound or polyurethane elastomer bonded to pipes and fittings at the pipe factory, and shall be cured to a uniform hardness and compressibility. The sealing components shall be shaped, sized, bonded, and cured in such a manner as to form a tight, dense, and homogeneous compression coupling when the joint is assembled. Any imperfection in the sealing components will be cause for rejection.

Upon installation, the meeting surfaces shall be wiped clean of dirt and foreign matter, then an approved lubricant shall be applied to the joint surfaces. The spigot shall be positioned inside the socket and the joint shoved home. For large diameter pipe, a lever attachment or bar cushioned with a wooden block shall be used to shove the joint into place.

In no case shall a bar be used on an unprotected joint surface. Mating surfaces shall be in tight contact with each other upon completion of the joint installation.

Polyvinyl chloride joints may be used on curves, provided that the radius of curvature is not less than shown in the following table, unless beveled pipe or shorter lengths are provided:

Pipe Size Inches	Maximum Pipe Length Feet	Minimum Radius of Curvature	Maximum Deflection
6	5	100	2° 00'
8	5	100	2° 00'
8	6	115	2° 00'
10	5	185	1° 33'
10	6	220	1° 33'
12	6	215	1° 20'
12	6	260	1° 20'
15	5	275	1° 03'
15	6	330	1° 03'

Polyurethane joints may be permitted for use on curves, provided that the radius of curvature is not less than shown in the following table, unless beveled pipe or shorter lengths are provided:

Pipe Size Inches	Maximum Pipe Length Feet	Minimum Radius of Curvature	Maximum Deflection
6	5	100	2° 00'
8	5	100	2° 00'
8	6	115	2° 00'
10	5	170	1° 41'
10	6	205	1° 41'
12	5	150	1° 54'
12	6	180	1° 54'
15	5	190	1° 32'
15	6	225	1° 32'
18	5	225	1° 16'
18	6	275	1° 16'
21	5	265	1° 06'
21	6	315	1° 06'
24	5	240	1° 12'
24	6	290	1° 12'
27	5	270	1° 04'
27	6	325	1° 04'
30	5	300	0° 58'
30	6	360	0° 58'
33	5	275	1° 03'
33	6	330	1° 03'
36	5	295	0° 59'
36	6	355	0° 59'
39	5	325	0° 54'
39	6	385	0° 54'
42	5	345	0° 50'
42	6	415	0° 50'

**B. Reinforced Concrete.** All reinforced concrete sanitary sewer pipe shall be joined with rubber gasketed joints.

Rubber gasketed joints shall conform to the requirements of A.S.T.M. Designation: C443 and shall be flexible and able to withstand expansion, contraction and settlement.

All rubber gaskets shall be stored in as cool a place as practicable, preferably at 70° or less, and in no case shall the rubber gaskets be exposed to the direct rays of the sun for more than 72 hours.

Rubber gaskets, of the type requiring lubrication, shall be lubricated with the lubricant recommended and supplied by the manufacturer of the pipe.

The ends of the pipe shall be so formed that when the pipes are laid together and joined, they shall make a continuous and uniform line of pipe with a smooth and regular surface.

Joints shall be water-tight and flexible. Each joint shall contain a solid gasket of rubber or other material approved by the Engineer, which shall be the sole element responsible for water-tightness of the joint. This gasket shall be of circular cross section unless otherwise approved by the Engineer. The length and cross sectional diameter of the gasket, and all other joint details shall be such as to produce a water-tight joint. The slope of the longitudinal gasket contact surfaces of the joint with respect to the longitudinal axis of the pipe shall not exceed 2 degrees.



Under ordinary laying conditions, the work shall be scheduled so that the socket end of the pipe faces in the direction of laying. Prior to placing the spigot into the socket of the pipe previously laid, the spigot groove, the gasket and the inside of the socket shall be thoroughly cleaned. Then the spigot groove, the gasket and the first 2 inches (50.8mm) of the inside surface of the socket shall be lubricated with a soft vegetable soap compound.

The gasket shall be uniformly stretched when placing it on the spigot so that the gasket is distributed evenly around the circumference. The gasket shall be lubricated as per manufacturer's recommendations.

For pipe in which the inside joints are to be pointed, suitable spacers shall be placed against the inside shoulder of the socket to provide the proper space between abutting ends of the pipe.

After the joint is assembled, a thin metal feeler gage shall be inserted between the socket and the spigot and the position of the gasket checked around the complete circumference of the pipe. If the gasket is not in the proper position, the pipe shall be withdrawn, the gasket checked to see that it is not cut or damaged, the pipe relaid, and the gasket position again checked.

- C. Cast Iron or Ductile Iron Pipe.** Cast and ductile iron pipe joints shall comply with the following requirements for the types specified on the plans or in the Special Provisions:

<u>Type of Joint</u>	<u>Specification</u>
Rubber Gasket Push-on-Joint	ANSI A21.11 (AWWA C111)
Mechanical Joint	ANSI A21.11 (AWWA C111)
Flanged Joint	ANSI B16.1, B. 16.2, and A21.10 (AWWA C110)
Flanged Joint (Threaded Flanges)	ANSI B2.1.

All rubber gasket, push-on, mechanical and flanged joint fittings for cast iron or ductile iron pipe shall be manufactured in accordance with ANSI A21.10 (AWWA C110).

**Slip-on Joint.** The gasket and gasket seal inside the socket shall be wiped clean before the gasket is inserted. A thin film of soft vegetable soap compound shall be applied to the gasket and the outside of the spigot end of the pipe. The spigot shall then be positioned inside the socket and shoved home. Lubricant other than that furnished with the pipe shall not be used unless approved by the Engineer.

**Mechanical Joints.** The outside of the spigot and the inside of the socket shall be thoroughly cleaned of foreign matter. The gland and gasket shall then be slipped onto the spigot end of the pipe. The gasket shall be pressed evenly into the socket only after the spigot is seated in the socket. The gland shall be brought up evenly by tightening alternately the nuts spaced 180 degrees apart. Bolts and nuts shall be coated with mastic following tightening.

**Flanged Joints.** Flanged joints shall be firmly and fully bolted with machine bolts of proper size. Full circle reinforced neoprene rubber gaskets 1/16" thick shall be used at all flanged joints. Bolts and nuts shall be coated with mastic following tightening.

**D. ABS Sewer Pipe**

1. Pipe lengths and fittings shall be joined by utilizing elastomeric gaskets as referenced in A.S.T.M. D-2680 and D-2751 and meeting the requirements of A.S.T.M. D-3212 "Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals," or solvent weld joints.

Solvent weld joint or usage shall conform to A.S.T.M. F-402 "Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings," and the following requirements:

a. All ABS pipe joints, fittings and surfaces to be joined by solvent welding shall be connected with adhesive cement conforming to A.S.T.M. D2680 for ABS composite sewer pipe or to A.S.T.M. D2751 for 4-inch and 6-inch ABS solid wall pipe. (Solid wall ABS limited to 4-inch and 6-inch pipe with a minimum wall thickness determined by SDR 35.)

b. Prior to joining ABS pipe joints, fittings and surfaces, dirt, mud or any other foreign material shall be thoroughly removed and cleaned from the joints, fittings and surfaces to be joined.

c. A coat of adhesive cement shall be liberally and thoroughly applied to the joints, fittings and surfaces to be joined. After application of the adhesive cement, the pipe joints, fittings, and surfaces to be joined shall be immediately fitted and joined without interruption.

For bell and spigot connections, the spigot end of each pipe shall be fitted to the full depth of the bell socket.

d. When the temperature is below 40 degrees F., a primer shall be applied to the pipe surface to be cemented and joined.

**2. Reducing Wyes:**

a. Reducing wyes for service laterals shall be either saddle type wyes or in-line bell and spigot type wye fittings. All reducing wyes shall be premoulded and factory fabricated.

b. Saddle Fittings:

1. In addition to the solvent welding of the saddle to the main pipeline, the saddle type wye shall be attached to the main pipeline with a stainless steel clamp.

2. Tapping hole for saddle fittings shall be cut with a cutting instrument. The hole shall be of the same size and shape of the lateral pipe and shall provide a smooth and continuous interior pipe surface.

**3. Exposed Pipe Cross-Sections:**

Exposed cross-sections of the ABS composite sewer pipe shall be coated with adhesive cement prior to connection of pipe joints, fittings and surfaces.

**4. Manhole Connections:**

At manhole connections, a manhole water stop shall be attached to the ABS pipe with a stainless steel clamp. The water stop shall be centered to the manhole wall with gasket fingers pointed to the outside of the wall.

## E. PVC Sewer Pipe

1. All joints shall be integral wall bell and spigot configuration, factory formed. All rubber rings shall conform to A.S.T.M. F-477.
2. Reducing wyes for service laterals shall be in line bell and spigot type, factory moulded.
3. Assembly of all joints shall conform to A.S.T.M. P3212.
4. Saddle fittings for lateral connection will be permitted; solvent welded.
5. Manhole connections shall be by rubber ring water stop installed on pipe and cast in center of manhole wall or four (4) inches from outside face of manhole base. Pipe section on water stop at manhole shall have bell flush with outside of manhole or no more than ten (10) inches outside manhole.

Joints for HDPE shall be bell and spigot or butt-fusion type. Bell and spigot types shall have an elastomeric gasket which will be compressed radially to form a watertight seal. The joint shall be designed to avoid displacement of the gasket when installed according to the manufacturer's recommendation.

**71-1.07 Deformation Testing.** Following the placement and compaction of backfill and prior to placement of permanent pavement, the Contractor shall perform a deflection test on the pipe. If the pipe should fail the deflection test, the Contractor shall uncover the pipe and make adjustments in the bedding and/or backfill conditions that will be necessary to achieve a passing test. The trench shall be backfilled and street subgrade shall be recompacted and the pipe retested. Any corrective measures found necessary to meet the deflection requirements, including recompaction and regrading of the street subgrade, shall be provided by the contractor at no additional cost.

See Section 71.1.11 for method and extent required.

- a. Maximum deflection for ABS composite sewer pipe installed is 4%.

**71-1.08 Existing Manholes.** Existing manholes shall be adjusted to grade, remodeled or abandoned as shown on the plans.

When designated on the plans, or directed by the Engineer, existing manhole frames and covers shall be reset on new structures. Upon completion of the adjustment of existing manholes to grade, the manhole cover shall conform to the planned surface as specified for the finished asphalt concrete surface.

Unless otherwise specified on the plans, all existing manholes, lampholes and terminal cleanout frames and covers that are removed become the property of the Western Hills Water District.

**71-1.09 Sewer Structures.** New manholes, lampholes, terminal cleanout structures, and pipe chimneys for sewers shall be constructed in accordance with the details shown on the plans, as specified in this Section 71-1.09 and as directed by the Engineer.

Precast manhole, pipe manholes shall conform to The Western Hills Water District Standard Drawings and as shown on the plans as well as to the applicable sections in Cal Trans Section 70, "Miscellaneous Facilities" except for measurement and payment.

Manhole frames shall be secured to the manhole cover or riser barrels with full mortar bed or full circle concrete collar that will effectively secure the frame to the manhole structure and provide a uniform bearing for the frame.

Concrete for sewer structures shall be Class A as described in Section 90-1.01 unless otherwise shown on the plans.

When the manhole is located in the pavement area, it shall not be constructed to final grade until pavement has been completed.

When new work is jointed to the surface of unfinished work, the latter shall be thoroughly cleaned.

All joints on the inside of structures and sewers shall be neatly struck and pointed where plastering is not specified on the plans.

The inside bottoms of existing manholes, where new connections are made, and of new manholes shall be shaped to provide channels conforming to the size and shape of the lower portion of the inlets and outlets of the manholes. The channels shall vary uniformly in size and shape from inlet to outlet.

No pipe shall project more than 0.17 foot into a manhole and in no case shall the bell of a pipe be built into the wall of a manhole or structure.

All concrete shall be cured for a period of not less than 10 days after being placed and shall be protected from damage.

#### **71-1.09A Coating Manholes.**

**General** - All new manholes, as defined below, downstream from hydrogen sulfide producing structures, to the point of connection into the Western Hills Water District maintained system, shall receive polyurethane coating. In addition, any existing manholes downstream from new hydrogen sulfide producing sewer systems that the District Engineer determines may be affected by new sewer systems shall receive polyurethane coating. At a minimum, all sanitary sewer manholes downstream from all pump stations, drop manholes, and manhole pumping stations shall be coated. All manholes, and manhole pumping stations shall be coated. All manholes constructed on sewer lines 24-inches and larger, and any other structure where the District Engineer determines that hydrogen sulfide gas may be a problem, shall receive a polyurethane coating.

**Material** - The coating shall be a high build, two-component, 100% solids, non-solvented, hybrid polyurethane material. The flash point of the individual components and the fluid mixture shall be a minimum of 415° F (COC). Application shall be 125 mils in thickness.

The cured coating shall have a Shore D hardness of 57 at 77° F and shall be capable of passing the flexibility test as prescribed by ASTM D-1737 using an 8 mm diameter mandrel. The coating shall have a minimum tensile strength of 2,500 PSI and a recoverable elongation of 30% minimum. It shall have good impact resistance and shall be able to bridge up to 1/8 inch settling crack, which may take place in the concrete structure, without damage to the coating. The coating shall be capable of repair at any time during its life.

The coating shall be resistant to attack from the following: Oxidizing agents such as bleaches, sulfuric, acetic, hydrochloric, phosphoric, nitric, chromic, oleic, and stearic acids; sodium and calcium hydroxides, ammonium, sodium, calcium, magnesium, and ferric chlorides; ferric sulfate, petroleum oils and greases, vegetable and animal oils, fats, greases, soaps and detergents. The coating shall be impermeable to sewage gases and liquids and shall be nonconductive to bacterial or fungus growth.

**Surface Preparation** - New concrete shall be aged 30 days. All foreign matter shall be removed from the surface of old concrete using solvents (no alcohol shall be used) if necessary to remove grease. For old concrete all surfaces to be coated will be sandblasted or waterblasted to remove all residue, loose grout or loose brick. Surfaces of new concrete shall be washed with ten percent muriatic acid solution and flushed with water to remove lime. Surfaces which have retained a glossy smooth surface shall be abrasive waterblasted, sandblasted or power wire brushed to produce a satisfactory anchor for the coating. The surface must be dry when applying the coating. Cracks shall be sealed by spraying directly into the crack and then overcoating while still tacky.

Any steel surfaces in the area to be coated will be prepared and primed as required.

After blast cleaning the surface as described above, the surfaces of the concrete shall be dried by air blowing for four hours.

Application - The polyurethane coating shall be applied by high pressure airless spray with the two components mixing just before the spray gun. During application the applicators, including any persons in the immediate area, shall wear protective clothing including face masks, and anyone in the manhole during spraying shall be supplied respiration air.

**71-1.10 Trench Resurfacing.** Trenches in existing streets, except streets which are to be closed or abandoned, shall be resurfaced with the type and thickness of bases, surfacing or pavement shown on the plans or designated by the Engineer. Unless otherwise specified, trench resurfacing shall be accomplished in accordance with drawings of these Standard Specifications.

The contractor shall proceed immediately to resurface any part of any excavation upon notice from the Engineer without waiting for completion of the full length of the sewer.

All trenches shall be backfilled and patched at the end of each working day. Any temporary trench patching shall be subject to the approval of the District Engineer.

### **71-1.11 Testing.**

**71-1.11A Cleaning.** Prior to performing tests, the pipe installation shall be thoroughly cleaned. Cleaning shall be performed by the Contractor by means of an inflatable rubber ball. The ball shall be of a size that will inflate to fit snugly into the pipe to be tested. The ball shall be controlled with a tag line. The ball shall be placed in the last lamphole or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the pressure of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cement or wedged debris or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction.

**71-1.11B Deflection Test for ABS, PVC AND HDPE Sewer Pipe.** The Contractor shall furnish all equipment needed to complete this test. The cost for the deflection test shall be included in the unit price bid for the sanitary sewer pipe. Deflection test shall be conducted by the contractor after the placement and densification of backfill at no additional cost to the Western Hills Water District.

For PVC Pipe - See Table.

For ABS Pipe - All mainline pipe shall be cleaned and then mandrelled to measure for obstructions (deflection, joint offsets, lateral intrusions, etc.). A rigid mandrel with a circular cross-section having a diameter at least 96% of the specified average inside diameter shall be pulled through the pipe. The method of measuring the deflection shall be approved by the District Engineer. Any pipe through which the mandrel will not pass shall be said to have failed and will be repaired by the Contractor at his expense.

For HDPE pipe-maximum long term deflection for HDPE pipe shall be no more than 5%. Long-term deflection shall be calculated as the short-term deflection multiplied by a deflection lag factor based upon the average inside diameter of the pipe. In no case shall a deflection lag factor of less than 1.5 be accepted. Short-term deflection shall be measured with a mandrel no sooner than 30 days following installation. Mandrel deflection tests may be required during installation as specified by the District Engineer. Mandrels used in testing shall have an odd number of legs totaling no less than nine. Pipe sections not meeting the deflection requirements shall be excavated, re-installed, and subject to an additional 30-day deflection test.

At his option the Engineer may require that a sample of ten percent (10%) of the laterals randomly selected by the inspectors shall also be tested for deflection. If difficulty is encountered in passing the mandrel test, the inspector may direct that a larger sample of laterals be tested up to including one-hundred percent (100%) of all laterals.

The Contractor shall furnish properly sized mandrels for size and type of pipe installed. Certification of proper mandrel size shall be required and mandrel shall be identified in a manner consistent with certification requirements.

The following table lists minimum pipe I.D. deflections: i.e. O.D. of mandrel:

**Table of Allowable Deflections for PVC**

<u>Pipe Size &amp; Type</u>	<u>Base I.D.</u>	<u>Min. Allowable I.D.</u>
4" PVC	3.966	3.66
6" PVC	5.742	5.36
8" PVC	7.665	7.18
10" PVC	9.563	8.98
12" PVC	11.361	10.69
15" PVC	13.898	13.08

At the contractor's expense, all locations with deflection greater than allowable shall be excavated, repaired or replaced, backfilled and retested.

**71-1.11C General** - All leakage tests shall be completed and approved following the placement and densification of the backfill, but prior to placing of permanent surfacing.

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

1. Gravity Sanitary Sewer - 24" (610mm) or less in diameter where difference in elevation between inverts of adjacent manholes is 10 feet (3.05M) or less) - Water exfiltration tests or water infiltration test as directed. The Engineer may allow substitution of an air pressure test for the water exfiltration test.
2. Gravity Sanitary Sewers - 24" (610mm) or less in diameter where difference in elevation between inverts of adjacent manholes is greater than (10 feet (3.05M) - Air pressure test.
3. Gravity Sanitary Sewers - greater than 24" (610mm) in diameter - Air pressure test or water infiltration test as directed.
4. Pressure Sewers (force mains) - Water pressure test at 50 psi (345 kPa) over pipe pressure classification or designation.

**71-1.11D Water Exfiltration Test.** Each section of sewer shall be tested between successive manholes by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers. The pipe and manhole shall be filled with water to a point 4 feet (1.22m) above the invert of the sewer at the center of the upper manhole; or if ground water is present, 4 feet (1.22m) above the average adjacent ground water level.

The allowable leakage will be computed by the formulae:

$$E = 0.0001 LD \sqrt{H} \text{ for mortared joints.}$$

$$E = 0.00002 LD \sqrt{H} \text{ for all other joints.}$$

Where:

- L is length of sewer and house connections tested, in feet.
- E is the allowable leakage in gallons per minute of sewer tested.
- D is the internal diameter of the pipe in inches.
- H is the difference in elevation between the water surface in the upper manhole and the invert of the pipe at the lower manhole; or if ground water is present above the invert of the pipe in the lower manhole, the difference in elevation between the water surface in the upper manhole and the ground water at the lower manhole.

However, the maximum shall not exceed 200 gallons per inch of internal diameter per mile per day.

The contractor shall, at his expense, furnish all water, materials and labor for making the required test. All tests shall be made in the presence of the Engineer.

**71-1.11E Water Infiltration Test.** If, in the opinion of the Engineer, ground water is encountered in the construction of a section of the sewer, he may require the pipe be tested by the Water Infiltration Test as follows:

The end of the sewer at the upper structure shall be closed sufficiently to prevent the entrance of water, and pumping of ground water shall be discontinued for at least 3 days, or until the ground water has recovered its normal status level, after which the section shall be tested for infiltration.

The infiltration into each individual reach of sewer between adjoining manholes shall not exceed that allowed by the formula in Section 71-1.11D where H is the difference in the elevation between the ground water surface and the invert of the sewer at the downstream manhole.

Unless otherwise specified, infiltration will be measured by the Engineer using measuring devices furnished by the Western Hills Water District.

All visible leaks shall be repaired by the contractor regardless of volume involved.

**71-1.11F Air Pressure Test.** The contractor shall furnish all materials, equipment and labor for making an air test. Air test equipment shall be approved by the Engineer unless otherwise provided on the plans or in the Special Provisions.

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

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

1. Clean pipe to be tested by propelling snug fitting inflated rubber ball through the pipe with water.
2. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
3. If the pipe to be tested is submerged in ground water, insert a pipe probe by boring or jetting, into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test should be increased by this amount.
4. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
5. After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
6. When pressure decreases to 3.5 psig, start stop watch.
- 6a. The following applies to all pipes other than PVC and ABS (see 6b):

Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding times are indicated by the following formula and table in seconds:

$$t = k \left( \frac{d}{g} \right)$$

where t = minimum required time in seconds

k = constant 0.22

d = nominal pipe diameter in inches

g = allowable air loss rate per unit area,  
0.33 cu. ft./min./ sq. ft. of (internal) surface area.



MINIMUM HOLDING TIME IN SECONDS REQUIRED FOR PRESSURE  
TO DROP FROM 3 1/2 TO 2 1/2 PSIG

PIPE DIAMETER

	4"	6"	8"	10"	12"	15"	18"	21"	24"	27"	30"	33"	36"	39"
25	4	10	18	28	40	62	89	121	158	200	248	299	356	418
50	9	20	35	55	79	124	178	243	317	401	495	599	713	837
75	13	30	53	83	119	186	267	364	475	601	743	898	1020	1105
100	18	40	70	110	158	248	356	485	634	765	851	935		
125	22	50	88	138	198	309	446	595	680					
150	26	59	106	165	238	371	510							
175	31	69	123	193	277	425								
200	35	79	141	220	317									
225	40	89	158	248	340									
250	44	99	176	275										
275	48	109	194	283										
300	53	119	211											
350	62	139	227											
400	70	158												
450	79	170												
500	88													
550	97													
600	106													
650	113	170	227	283	340	425	510	595	680	765	851	935	1020	1105

- NOTE: (1): TO BE USED WHEN TESTING ONE DIAMETER ONLY
- (2): The above air pressure test procedure is based on ASTM C828. Any special situations or conditions shall conform to this ASTM Standard.

6b. For PVC and ABS lines the following table lists the minimum times allowed for a pressure drop from 3.3 psi to 3.0 psi in excess of the ground water pressure at the top of the pipe.

1 Pipe Dia. (in)	2 Min. Time (min. sec)	3 Lgth. for Min. Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1:187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1:709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02

**SAFETY NOTE:**

The air test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blow outs. Inasmuch as a force of 250 lbs. is exerted on an 8" plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

As a safety precaution, pressurizing equipment should include a regulator set at perhaps 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

IF THE TIME LAPSE IS LESS THAN THAT SHOWN IN THE TABLE, THE CONTRACTOR SHALL MAKE THE NECESSARY CORRECTIONS TO REDUCE THE LEAKAGE TO ACCEPTABLE LIMITS.

**71-1.11G Televising of Sanitary Sewers.** Following the placement and compaction of backfill and completion of other required testing, but prior to the placing of pavement, the Contractor shall televise all sewer lines for conformance to the plans and specifications. A tape of the televising shall be delivered to the Engineer within a week of televising. If defective pipes or conditions are discovered they shall be corrected at no cost to the Western Hills Water District. Any corrective work proposed shall be approved by the Engineer.

Western Hill Water District may also televise sewer lines prior to the expiration of the one year warranty. If a defective condition is unaccountably found, it shall be presumed to be caused by defective workmanship or materials. The developer and/or contractor shall be notified and shall correct the work in a manner approved by the Engineer.

**SECTION 72**  
**CAST-IN-PLACE CONCRETE PIPE**

**72-1 DESCRIPTION**

Cast-in-place concrete pipe shall consist of Portland Cement concrete placed in a prepared trench at the locations shown on the Plans and as specified in these Specifications. The Engineer may deny the use of cast-in-place concrete pipe, if in his judgment local conditions make the use of such pipe undesirable.

**72-2 PIPE MAKING EQUIPMENT**

The pipe shall be constructed with equipment specially designed for constructing cast-in-place concrete pipe. The equipment shall be acceptable to the Engineer and the Contractor may be required to furnish evidence of successful operation on other work of the equipment he proposes to use. Equipment not suitable to produce the quality of work required for the pipeline will not be permitted to operate on the work.

**72-3 TRENCH EXCAVATION**

The trench shall be excavated to the lines and grades necessary so that the lines and grades of the completed pipe will be as shown on the Plans and within the tolerance specified in these Specifications. The trench shall be of the proper width and the bottom of the trench shall be shaped to the external diameter of the pipe to be constructed. The bottom of the trench shall be prepared to provide full, firm, uniform support by undisturbed earth or compacted fill over a minimum of the bottom 180° of the outside of the pipe.

At the end of each working day, the maximum amount of trench open on any one portion of the project shall be 1-1/2 times the length of open trench necessary for placing pipe the next working day, plus the trench in which pipe was placed during the previous 24 hours, unless otherwise directed by the Engineer. The remainder of the trench shall be backfilled and compacted.

**72-4 SPECIAL FOUNDATION TREATMENT**

Whenever the bottom of the trench is soft, rocky, or in the opinion of the Engineer otherwise unsuitable as a foundation for the pipe, the unsuitable material shall be removed to a depth such that when replaced with a suitable material, it will provide a stable and satisfactory foundation. Suitable materials for backfilling the trench below the pipe shall consist of select material approved by the Engineer, compacted to a relative compaction of not less than 90 percent. Alternate backfill materials and methods may be used with the approval of the Engineer.

## 72-5 CONCRETE

Concrete shall be Class "A" and shall conform to the requirements of Section 90 of the State Specifications, as modified herein. Type II cement shall be used.

1. Maximum Aggregate Size:

<u>Pipe Size</u>	<u>Maximum Aggregate</u>
48" or less	1"
Over 48"	1-1/2"

Graduation for combined aggregates shall conform to Section 90-3.04 of the State Specifications.

2. Slump shall not exceed 2 inches as determined by the slump cone method of ASTM Designation C143 or an equivalent slump as determined by California Test 533, unless otherwise permitted by the Engineer.
3. The minimum wall thickness for the various sizes of pipe shall conform to the following table:

<u>Internal Diameter</u>	<u>Maximum Wall Thickness</u>
24" thru 30"	3"
33" and 36"	3-1/2"
42"	4"
48"	5"
54"	5-1/2"
60"	6"
66"	6-1/2"
72"	7"
78"	7-1/2"
84"	8"
90"	8-1/2"
96"	9"
108"	10"
120"	12"
132"	14"
144"	15"

4. Compressive strength of the concrete shall not be less than 700 psi at 1 day, not be less than 1,400 psi at 3 days, not less than 2,100 psi at 7 days, and not less than 3,500 psi at 28 days, as determined by moist-cured test cylinders.

## 72-6 PLACING CONCRETE

Prior to placing any pipe, the Contractor must secure the Engineer's approval of the excavated trench. The applicable provisions of Section 51-1.09 of the State Specifications shall govern the placing and vibration of the concrete. All surfaces against which concrete is to be placed shall be free from standing water, mud, and debris, and shall be firm enough to prevent contamination of the concrete by earth or other foreign material. Absorptive surfaces against which concrete is to be placed shall be moistened thoroughly so that the moisture will not be drawn from the freshly placed concrete.

An approved method or device shall be used when placing invert concrete to insure that thickness is maintained at not less than minimum wall thickness at any point. Approval of this method or device must be obtained from the Engineer prior to commencement of work.

The cast-in-place pipe shall be constructed in one placement around the complete periphery.

The temperature of concrete when it is being placed shall be not more than 90°F and not less than 40°F in moderate weather, or not less than 50°F in weather during which the mean daily temperature in the vicinity of the work site falls below 40°F for more than 1 day the concrete shall be maintained at a temperature not lower than 50°F for at least 72 hours after it is placed. Concrete shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50°F. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90°F, the Contractor shall employ effective means, such as precooling of aggregates and mixing water and placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90°F.

## 72-7 START AND CLOSE SECTIONS

A starter section may be used at the beginning of each run of cast-in-place concrete pipe, such as beginning from an existing structure, or from a manhole, at a change in size or from a manhole at an angle point. Starter sections shall be approximately 6 feet in length and of the same inside diameter as the cast-in-place concrete pipe, unless otherwise approved by the Engineer. The strength of the reinforced concrete starter section shall be as indicated on the Plans and shall be placed in accordance with the requirements of these Specifications.

A closing section shall be used when directed by the Engineer or where it is not possible to complete a run of cast-in-place concrete pipe because of lack of clearance ahead in the trench.

## 72-8 CONSTRUCTION JOINTS

If construction of the pipe stops short of a manhole or for a period of time exceeding 20 minutes, the resulting construction joint shall be reinforced with a concrete collar. This collar shall extend 1 foot either side of the joint and shall be a minimum thickness equal to that of the pipe. The resulting end of pipe shall be securely closed by a heavy canvas or equal to prevent excessive dehydration of the concrete already placed.

Joints shall be clean and damp when covered with fresh concrete or mortar. Cleaning of construction joints shall consist of removing all laitance, loose or defective concrete, coating and foreign material.

## 72-9 FINISH

Flowline elevations of the complete pipe shall not vary more than 0.05 feet from the design grade. Variations in the internal diameter shall not exceed 1/32 inch per diameter inch. (Example: for 24 inch pipe  $1/32 \times 24$  inches = 3/4 inch variation). Offsets at form laps shall not exceed the limits specified in the following table:

<u>Pipe Diameter</u>	<u>Maximum Offset</u>
24" thru 30"	3/8"
33" thru 42"	1/2"
48" thru 66"	5/8"
72" thru 90"	7/8"
96" and 108"	1"
120" and larger	1-1/8"

The finished surface of the concrete pipe shall be substantially free of fractures, cracks, and interior surface roughness.

The Contractor will be required to hand trowel the bottom 90° of the inside of the pipe unless alternate provisions are made to provide a smooth interior surface satisfactory to the Engineer. The remaining interior surface of the pipe not covered by forms shall be equivalent to a steel screeded finish. All extraneous concrete shall be removed from the interior surface as soon as possible after placing. Any additional finish work or repair work required to be done on the pipe shall be completed within 5 days after the pipe is placed.

If obvious segregation or honeycombing or inadequate wall thickness are encountered during inspection, the pipe may be rejected by the Engineer.

## 72-10 FORMS

Forms shall be strong enough to withstand the vibrating of the concrete and to permit workmen to place the concrete without causing distortion at any point. Form support systems shall be constructed so that previously placed concrete shall not be damaged. Form structure bearing plate indentations shall not exceed 1/8 inch and care shall be taken when removing the forms to prevent damage to the pipe. After removal of the forms the inside of the pipe shall be inspected by the Engineer, and any repairs made promptly, at the expense of the Contractor.

## 72-11 CURING

Immediately after finishing exposed exterior surfaces, the curing of these surfaces shall be undertaken by any one or a combination of the following methods:

1. Pigmented sealing compound, blanketing, cotton mat, polyethylene film, or spraying methods as specified in Section 90-7.01 of the State Specifications.
2. A 6 inch layer of moist earth may be backfilled over the pipe. Care must be taken to avoid damage to the fresh concrete while placing the backfill. This backfill shall be kept moist for not less than 7 days.

During the curing period following placement of the concrete, the ends of the pipeline shall be securely closed with heavy canvas or by other methods approved by the Engineer.

## 72-12 QUALITY CONTROL

Field quality control for construction of a cast-in-place concrete pipe will be exercised by means of a representative of the Engineer being present for testing and inspection at all times while pipe is being constructed. No cast-in-place pipe may be constructed unless such representative of the Engineer is present.

A slump test will be made of each truck load of concrete before it is permitted to be placed in the pipe casting machine.

Any load whose slump exceeds the specified slump by more than 1/2 inch will be wasted. At least 3 compressive test cylinders will be cast from representative portions of each load of concrete. Each cylinder shall have recorded the line, station number, date, and batch ticket number. Compression tests will be made at the City's expense. Concrete compressive strength shall be determined from 6 inch by 12 inch cylinders conforming to ASTM Designation C31, tested in conformance with ASTM Designation C39.

One cylinder of each set will be tested after curing for 2 days and 7 days, at the option of the Engineer. The other cylinder of the set will be held for testing in the event that the Engineer wishes to retest any batch.

If more than two cylinders tested in any day's pour fall more than 10 percent below the minimum specified compressive strength, cores will be taken from the pipe and tested for compressive strength at the expense of the Contractor. If cores indicate concrete strength more than 20 percent below the minimum specified compressive strength, that portion of pipe shall be removed and replaced with precast concrete pipe at the expense of the Contractor.

#### 72-13 BACKFILL

1. **Initial Backfill** – Initial backfill shall be the material placed between the top of the pipe shoulder in contact with the trench and a point 12 inches above the top of the pipe. Initial backfill may be selected from job excavated material so as to be finely divided and free from debris, organic matter, and pieces larger than 1 inch. The material shall be placed immediately after the pipe has been completed, inspected, and passed by the Engineer and permission to backfill has been obtained from the Engineer. The material shall be carefully placed so as not to disturb or damage the pipe and shall be brought up evenly on both sides.

The material shall be compacted to a relative compaction of at least 90 percent as determined by ASTM Designation D1557. Jetting will not be allowed during placement of initial backfill.

As an alternate to job excavated material, initial backfill may consist of imported crushed rock, of which 100 percent shall pass a 3/4 inch sieve and which shall have a minimum Cleanliness Value of 50 as determined by California Test 227.

2. **Intermediate and Final Backfill** – Intermediate and final trench backfill shall conform to Section 26-6 of these Specifications.

#### 72-14 LOADING DURING CURING

No backfill other than a 6 inch layer permitted for curing purposes shall be placed until the tests designated have been made and permission to backfill has been obtained from the Engineer. Depth of backfill over the top of the pipe shall not exceed 12 inches until the concrete compressive strength reaches 700 psi or the pipe has been in place 24 hours, whichever is longer. Light traffic (axle load less than 6,000 pounds) may be routed over the pipe when loosely backfilled and prior to jetting. Unrestricted traffic may be permitted over the pipe when the concrete strength reaches 1,400 psi or the pipe has been in place for 72 hours, whichever is longer. In all cases, the Contractor shall be responsible for correcting any damage to cast-in-place concrete pipe caused by premature or excessive loading prior to the end of a 7 day curing period.

#### 72-15 OTHER REQUIREMENTS

Unless otherwise noted herein, the placement of cast-in-place concrete pipe shall conform to the requirements of Section 26 of these Specifications.



## 72-16 PAYMENT FOR CAST-IN-PLACE CONCRETE PIPE

Pipe will be at a price per lineal foot which shall include full compensation for excavation, bedding material, backfill, special foundation treatment, furnishing equipment, materials, construction of pipe, and all other work necessary to construct the cast-in-place concrete pipe as shown on the Plans.

**SECTION 74**

**PUMPING PLANT EQUIPMENT**

Specifications for Pumping Plant Engineer Equipment shall be prepared on an individual project basis and approved by the Western Hills Water District.

## SECTION 76

### DOMESTIC WATER FACILITIES

**76-1.01 Description.** This work consists of furnishing and installing pressure water pipe control valves, thrust blocks, fire hydrant tees, fire hydrants and service lines, all as shown on the plans or as directed by the Engineer, and as specified in these specifications and the special provisions.

**76-1.01A Right of Way.** All Western Hill Water District owned domestic water facilities located on private property shall be installed within a 10' (min.) wide easement which shall have been dedicated to the Western Hills Water District.

**76-1.02 Materials.** All pipes and fittings (except valves) shall have a minimum working pressure of one hundred twenty-five (125) pounds and conform to the following requirements:

**76-102B Cast Iron & Ductile Iron Pipe.** Cast iron and ductile iron pipe for water and other liquids shall be furnished in the sizes; classes, grades or nominal thicknesses; and joint types designated on the plans or in the Special Provisions.

Cast iron pipe shall comply with ANSI A21.6 (AWWA C106) for pipe cast in metal molds or ANSI A21.8 (AWWA C108) for pipe cast in sand lined molds.

Ductile iron pipe shall comply with ANSI A21.51 (AWWA C151).

Ductile iron pipe is to be used on all water crossings or where required by State Health Code sanitary sewer water line clearance regulations. Pipe shall utilize either flange, mechanical or push on rubber gasketed joints. Pipe shall be minimum standard thickness Class 50 with standard cement lining (USA Std. A21.4).

Cast and ductile iron pipe joints shall comply with the following requirements for the types specified on the plans or in the Special Provisions.

<u>Type of Joint</u>	<u>Specification</u>
Rubber Gasket Push-on Joint	ANSI A21.11 (AWWA C111)
Mechanical Joint	ANSI A21.11 (AWWA C111)
Flanged Joint	ANSI B161.1, B.16.2 and A21.10 (AWWA C110)
Flanged Joint (Threaded Flanges)	ANSI B2.1.

All rubber gasket, push-on, mechanical and flanged joint fittings for cast iron or ductile iron water pipe shall be manufactured in accordance with ANSI A21.10 (AWWA C110).

Unless otherwise specified, the internal surfaces of cast iron and ductile iron water pipe and fittings shall be lined with a uniform thickness of cement mortar then sealed with a bituminous coating in accordance with ANSI A21.4 (AWWA C104). The outside surfaces of cast iron and ductile iron pipe and fittings for general use shall be coated with a bituminous coating 1 mil (0.0254mm) thick in accordance with ANSI A21.6 or ANSI A21.51.

**76-1.02C Polyvinyl Chloride (PVC) Pipe.** Polyvinyl Chloride pipe shall be furnished in the classes, sizes, and grades designated on the plans and Special Provisions.

Polyvinyl Chloride pipe shall meet the requirements of AWWA C-900 "Polyvinyl Chloride (PVC) Pressure Pipe". Pipe sizes shall be 4" through 12" only - AWWA Class 150 minimum. All Class 150 pipe shall meet the requirements of DR 18 and Class 200 pipe shall meet the requirements of DR 14 with cast iron O.D.

Pipe sizes from 14" through 24" may be used for transmission lines; no house service taps allowed. Pipe shall be DR-18 (235 psi) only conforming to the requirements of AWWA C-905 "Polyvinyl Chloride (PVC) Water Transmission Pipe" in cast iron O.D. sizes. Pipe embedment zone (O.D. plus 12") shall conform to Western Hills Water District Standard Drawing No. U-5.

All pipe shall be suitable for use as a pressure conduit. Provisions shall be made for expansion and contraction at each joint with a "O" ring elastomeric gasket seal meeting the requirements of ASTM D-1869 and F-477. Solvent welded joints will not be permitted. The bell section shall be designed to be at least as strong as the pipe wall.

Fittings for PVC pipe shall be cast iron only.

**76-1.02D Valves.** This specification includes three (3) inch through twelve (12) inch diameter gate valves and twelve (12) inch or larger diameter butterfly valves and operators intended for buried service in a domestic water system.

Gate valves shall be double disc with non-rising stem meeting or exceeding the latest revisions of AWWA C-500 with a design working pressure of one hundred seventy-five (175) psi. Valve pattern shall be Metropolitan or Muller No. A-2380 with valve disc seats of Grade 1 bronze, double disc type with parallel seats. Resilient seated gate valves conforming to AWWA specification C509-80 are acceptable and are required for fire hydrant installations.

Butterfly valves shall meet or exceed the latest revisions of AWWA C-504 with a design working pressure of 150 psi. Operators for butterfly valves twenty (20) inches and smaller shall be Class 150; larger operators will be as specified in the special provisions and designed for actual line conditions as covered in AWWA C-504, Appendix A.

Valve ends shall be mechanical joint or flanged in accordance with AWWA C-500 unless otherwise specified.

Valves for use with flanged pipe shall be cast with Class 125 flanges, dimensions and drilling shall conform to ASA B16.1. Flange bolt holes shall be spot faced if flange fillets interfere with bolt heads and nuts.

Tapping sleeves for A.C. and cast iron water mains shall be full body shell, with full body gasket or split sleeve, end and side gasket seal. Inlet flange and tapping gate valve flanges shall be Class 125 flange. Tapping sleeves shall be M & H 1174 and 1274 (all sizes); Romac SST and Clow 3490-AS (over 12 inch only) or an approved equal. Taps for steel pipe, CMC and/or CML, will require review and approval by the District Engineer.

All stem seals, gate valves and butterfly valves, shall be "O" rings only.

Wrench nuts shall be made of top grade cast iron, fitting the top of the valve stem and secured by nut or key. Wrench nuts shall be one and fifteen sixteenths (1-15/16) inch square at the top and two (2) inches square at the bottom.

Valves requiring operating wrenches exceeding six (6) feet in length shall have extension and guides installed in valve boxes.

The open direction shall be left (counter-clockwise) and the closed direction right (clockwise).

**76-1.02E Cast Iron Fittings.** Cast iron fittings shall be Class D fittings conforming to ASTM Designation 126 and shall be one hundred twenty-five (125) pounds standard. Valves and fittings shall all be flanged.

**76-1.02F Valve Boxes.** Valve boxes and covers shall conform to The Western Hills Water District Standard Plan No. W-8.

**76-102G Gaskets.** Gaskets for flanged joints shall be full circle one-sixteenth (1/16) inch asbestos composition gaskets.

**76-102H Thrust Blocks.** Thrust blocks shall conform to Western Hills Water District Standard Drawings. Concrete for thrust blocks shall be Class B with one and one-half (1½) inch max. size aggregate in accordance with Section 90 of the Standard Specifications.

**76-102I Fire Hydrants.** Fire hydrants shall conform to the requirements of the Stanislaus County Fire Department as shown on the Standard Plan No. W-10 and the following:

- a. All hydrants shall comply with AWWA C502, latest revision
- b. All operating valves shall be located below grade and protected by "break-off" features so that no water flows if hydrant is knocked off.
- c. Hydrant main valve seat shall be a minimum 5¼ inches.
- d. Hydrant valve shall be molded non-swelling rubber.
- e. Hydrant main valve seat shall be threaded into a bronze to bronze subseat.
- f. Hydrant bury shall be 36 inches from connection to ground flange. Materials to extend the length of bury must be readily available.

**76-102J Service Lines.** Service lines up to and including meter connection shall be as detailed in the Western Hills Water District Standard Plan Nos. W-2 and W-3 as applicable for the service intended and with the AWWA Standard C-800, except as hereinafter modified or as modified by the plans and special conditions.

1. Threads for line pipes shall be as specified in the AWWA standard for threads for underground service line fittings.
2. Type of service line pipe shall be limited to the following:
  - a. Copper water tube, Type K or ASTM B-88.
  - b. Ultra High Molecular Weight (UHMW) P.E. 3406, P.E. 3408, CS 255-63, Polyethylene as manufactured by Driscop, Orangeburg or an approved equal in one (1) inch iron pipe sizes only. Plastic pipe larger than one (1) inch and up to and including two (2) inch iron pipe sizes shall be PB 2110 Polybutylene. Connection of plastic pipe shall be made using Mueller 110 compression connections or approved equal.
  - c. Services two (2) inches and larger shall be considered as a special condition and will require prior approval by the Western Hills Water District.
  - d. Six (6) inch PVC pipe may be tapped for ¾" maximum service. Eight (8) inch PVC pipe may be tapped for one (1) inch maximum service. Saddles or service clamps shall be used on all PVC taps and shall be designed specifically for PVC pipe. Saddles or service clamps shall be Rockwell No. 381 or approved equal.

**76-1.02K Water Meters.** Unless otherwise specifically noted, water meters will be purchased and installed by the Western Hills Water District.

For meters larger than two (2) inch it will be the contractor's responsibility to contact the Western Hills Water District prior to installation of meter boxes to ascertain the dimensions of the meters currently in stock.

It shall be the contractor's responsibility to set meter box and service fittings in such a manner that District meter can easily be dropped in place. See Standard Plans for minimum clearance dimensions.

### **76-1.03 Installation.**

#### **76-1.03A Installation of Water Mains.**

**76-1.03A1 Description.** The contractor shall, unless specified otherwise, furnish all material, equipment, tools, and distribute all pipe, castings, fittings, valves, hydrants and accessories. The contractor shall also remove pavement as stipulated; excavate trenches and pits to the required dimensions; excavate bell holes; construct and maintain all bridges for traffic control sheet, brace, and support to adjoining ground or structures where necessary; handle all drainage or ground water, provide barricades, guards, and warning lights; lay and test the pipe, castings, fittings, valves, hydrants, and accessories; backfill and consolidate the trenches and pits; restore the roadway surface unless otherwise stipulated; remove surplus excavated material; clean the site of the work; and maintain the street or other surface over the trenches as specified. All connections to existing lines shall be flanged by fittings with isolation plates.

**76-1.03A2 Excavation.** Trench excavation shall conform to the requirements of the Western Hills Water District Standard Plans U-5 and U-6.

The bottom of the trench shall be carefully graded as indicated in Section 71-1.03 of the specifications.

**76-1.03A4 Pipe Laying.** The pipe shall be handled with care at all times and in a manner that meets the approval of the Engineer. Extreme care shall be exercised in the use of any mechanical devices used in laying the pipe to avoid scarring or other damage.

The Engineer shall be the judge of whether a pipe is seriously damaged and any pipe so classified shall be permanently removed from the site of the work.

The inside of all pipes and couplings shall be free from dirt, grease, or other deleterious materials. The open ends of all pipe previously laid shall be adequately plugged water tight whenever pipe laying operations are suspended at the end of each work day, or for any other reason.

Select fine damp earth shall be placed and thoroughly compacted across the bottom of the trench to provide full support of all the pipe. Bells and/or couplings shall have soil removed to provide a uniform bearing.

In joining asbestos cement pipe, a thin coating of non-toxic and water soluble lubricant shall be applied to the entering level and back to the first machined shoulder of the pipe to be coupled. The rubber rings shall be set in the coupling grooves, and the couplings shall be placed between the pipe ends. The pipe shall be moved so that ends butt snugly against the rubber rings. A representative of the pipe manufacturer shall be present when the pipe laying commences in order to insure the proper installation of the pipe.

**76-1.03A5 Backfilling.** Backfilling shall not be completed until the pipe has been properly installed to the satisfaction of the Engineer.

Backfill materials shall be placed on both sides of the pipe simultaneously to prevent any undue strain on the pipe.

Selected excavated material shall be placed in the trench in six (6) inch layers to a depth of twelve (12) inches above the pipe and shall be hand tamped, or compacted to 85 percent relative compaction.

The balance of the trench shall be backfilled and compacted as shown by mechanical means on Standard Plans U-5 and U-6. This Standard shall be used as a minimum in all new construction unless otherwise noted in the Special Provisions.

Imported backfill material shall be of a granular, sandy nature, free of vegetation, silt, clay and shall have a minimum (S.E.) sand equivalent value of 20 as determined by the State of California, Division of Highways, Standard Test Procedures.

Backfilling and bedding for P.V.C. pipe shall be performed in accordance with Section 71-1.04 Bedding of these Specifications for P.V.C. pipe.

The contractor shall do all excavating, loading, hauling, placing and compacting of the material in place.

All pipe damaged during construction operations shall be replaced by the contractor at his expense to the satisfaction of the Engineer.

**76-1.03A6 Trench Resurfacing.** Trenches in existing streets, except streets which are to be closed or abandoned, shall be resurfaced with the type of thickness of bases, surfacing or pavement shown on the plans and/or Standard Plans.

The contractor shall proceed immediately to resurface any part of any excavation upon notice from the Engineer without waiting for completion of the full length of line.

**76-1.03B1 Testing.** The test for hydrostatic pressure shall commence no sooner than seven (7) days after the last concrete thrust block has been cast with standard cement or at least after thirty-six (36) hours with high early strength cement, and after backfilling and compacting the trench to the plane upon which the asphalt concrete surfacing is to be placed. The contractor shall take the necessary precautions to insure that the pipe fittings, couplings, valves, and other appurtenances are not displaced during the test. The pipe shall be filled with water at least twenty-four (24) hours prior to the time of the test. Each section of the completed pipe under test shall be subjected to a hydrostatic test pressure of one hundred twenty-five (125) pounds per square inch for two (2) hours. During this period of the test, all pipe shall be inspected for leaks, and any leaks, failures, or imperfect construction revealed during the period of test shall be corrected by the contractor at his own cost and expense.

After a satisfactory hydrostatic pressure test, the line shall be tested for leakage. The line shall be maintained at a sixty (60) pound per square inch pressure for seven (7) days. The leakage during this period shall not exceed 0.100 gallons for each inch of diameter for each joint for twelve (12) foot pipe lengths in the section under test in a twenty-four (24) hour period.

It shall be the contractor's responsibility to locate and repair the points of line failure; fill, recompact the trench and retest the section of line in the event the line fails the leakage test.

**76-1.03B2 Interruption of Service.** No valve or other control on an existing system shall be operated for any purpose by the contractor. The Western Hills Water District will operate all valves, hydrants, blowoff and curb stops.

#### **76-1.03C Disinfecting Water Mains.**

**76-1.03C1 General.** The interior of all pipe, fittings, and other accessories shall be kept as free as possible from dirt, foreign material and bacteria at all times. During pipe laying operations, when bacterial contamination of interior pipe surfaces is obvious or suspected by the Engineer he may order said surfaces to be swabbed with an approved bactericidal solution.

**76-1.03C2 Isolation of New Mains.** All new water lines shall be completely isolated from any existing main until they have been tested and disinfected to the satisfaction of the District. New mains may be filled from existing mains only by temporary tap thereto and through a State Department of Health approved backflow prevention unit so as to provide positive backflow prevention.

When new main is properly disinfected and the isolation dam is removed from connection flange or other type connection is made, extreme care shall be exercised to prevent the entry of contamination. Connection fittings shall be thoroughly swabbed with an approved bactericide immediately prior to their installation.

Flush the mains thoroughly at the end of the contact period. The orthotolidine test shall show no more chlorine in the water leaving the main than in the water entering the main.

The District will collect a sample for bacteriological examination in a sterile bottle provided by the laboratory. On the label, give date, address, and the estimate number for the job. Where possible the sample should be taken from a service located near the end of the chlorination section, otherwise, it may be taken through the same blowoff used for flushing the heavily chlorinated water out of the main so that the blowoff is sterilized.

If the bacteriological tests are unsatisfactory, the main shall be re-sterilized using Method No. 2, and the sterilization repeated, if necessary, until satisfactory results are obtained.

**76-1.03C3 Method No. 1-H.T.H. Tablet Method.** This method is preferred for short jobs and for small diameter pipe of any kind. It cannot be used where trench water has entered the main. The main cannot be flushed prior to sterilization, so the method requires that the pipe be kept clean during installation.

Using Permatex No. 1 as an adhesive, fasten the required number of tablets (see Table I) to the inside top of each length of pipe. Tubes of Permatex may be purchased locally at any auto parts store. The tablets may be fastened to the pipe before it is placed in the trench providing the top of the pipe is marked to insure that the tablets are on the top of the pipe after installation.

When using dresser or similar couplings, an additional tablet shall be crushed and placed in the annular space between the coupling and the pipe. Fill the pipe very slowly and proceed as outlined under General Instructions.

**76-1.03C4 Method No. 2 - H.T.H. Solution with Hand Pump Method.** This method is general in scope and must be used when it is necessary to re-chlorinate an existing main. When this method is used on a main coupled with dresser or similar couplings, a pinch of H.T.H. powder shall be placed in each coupling as the main is laid.

Equipment required includes an ordinary hand test pump, solution hose, and a five gallon can to contain the chlorine solution.

A compact and convenient assembly can be made by mounting the solution can and the pump on a suitable board with a pipe connection from the tank on the suction side of the pump.

H.T.H. comes as a powder which must be dissolved in water. Strong chlorine solutions should be handled with care since they are irritating to the skin and will damage shoes and clothes.

Make up chlorine solution according to Table II. The quantity required is estimated from Table II. An excess volume should be prepared so as not to empty the container before the job is complete.

Connect pump to main. Use a corporation cock for this purpose and make connection at or ahead of the inlet end of the new line.

After flushing the line thoroughly adjust flow by timing the period required to fill a five gallon can.

Pump chlorine solution into the line at a rate of one gallon of solution in three minutes.

Continue pumping until orthotolidine tests on a sample taken from discharge end of line being treated shows a red color, or until the odor of chlorine is noticed.

After finishing application of chlorine, close valve or blow-off. Disconnect and flush pump thoroughly with fresh water.

Refer to instructions for flushing and sampling.

If the above procedure has to be varied because of some unusual condition, it will be necessary only to regulate the pump, control the water flow, or adjust the strength of the chlorine solution to give a dose of at least 50 ppm.



**TABLE I**  
**NUMBER OF TABLETS REQUIRED FOR**  
**MAIN STERILIZATION**

Length of Section	Diameter of Pipe					
	2"	4"	6"	8"	10"	12"
13' or Less	1	1	2	2	3	5
18"	1	1	2	3	5	6
20'	1	1	2	3	5	7
30'	1	2	3	5	7	10
40'	1	2	4	6	9	14

**TABLE II**  
**CHLORINE SOLUTION STRENGTH**  
**HAND PUMP METHOD OF MAIN CHLORINATION**

Amount of Chemical in 5 Gallons of Solution	
Discharge Rate GPM	H.T.H.
10	0.25 lbs.
20	0.50 lbs.
35	0.75 lbs.
50	1.00 lbs.
75	1.50 lbs.
100	2.00 lbs.

Choose a suitable discharge rate and determine the time required to apply the chlorine from Table III.

Compute the gallons of solution required by dividing this time by 3.

Use the above table to determine the strength of solution required. Example: If the estimate time from Table III is 35 minutes, 11-2/3 gallons will be required; and if the discharge rate is 50 GPM, the solution should contain one pound of H.T.H. in five gallons. Prepare fifteen gallons of solution so as to be sure of having an adequate amount.

Operate the hand pump at a rate of five gallons in fifteen minutes, or one gallon in three minutes.

**TABLE III**

Time in Minutes to Apply Chlorine to 100 Feet of Pipe

Discharge Rate GPM	2"	4"	6"	8"	10"	12"
10	2	7	15	26	41	59
20		3	7	13	20	29
35		2	4	8	12	17
50			3	5	8	12
75			2	4	6	8
100				3	4	6

The above table is used to estimate the time required to apply chlorine. For example: 700' of 8" main can be filled with chlorine solution in 35 minutes with a discharge rate of 50 GPM.

**RESOLUTION 98-10****A RESOLUTION OF THE  
WESTERN HILLS WATER DISTRICT  
INSTITUTING OPERATING RULES FOR A CROSS-CONNECTION  
CONTROL PROGRAM TO PROTECT THE PUBLIC WATER SYSTEM**

**THE WESTERN HILLS WATER DISTRICT DOES ORDAIN AS FOLLOWS:**

**SECTION I****Purpose**

The purpose of this Resolution and the Operating Rules promulgated is (1) to protect the public water supply against actual or potential contamination through cross-connections by isolating sources of contamination that may occur within a water user's premises because of some undiscovered or unauthorized cross connection on the premises; (2) to eliminate existing connections between drinking water systems and other sources of water that are not approved as safe and potable for human consumption; (3) to eliminate cross-connections between drinking water systems and sources of contamination; (4) to prevent the making of cross-connections in the future.

These rules are adopted pursuant to the State of California Administrative Code, Title 17 - Public Health entitled "Regulations Relating to Cross-Connections".

It is unlawful for any person, firm, or corporation at any time to make or maintain or cause to be made or maintained, temporarily or permanently, for any period of time whatsoever, any cross-connection between plumbing pipes or water fixtures being served with water by the Western Hills Water District water department and any other source of water supply or to maintain any sanitary fixture or other appurtenances or fixtures which, by reason of their construction, may cause or allow backflow of water or other substances into the water supply system of the Western Hills Water District and/or the service of water pipes or fixtures of any consumer of the Western Hills Water District.

**SECTION II****Definitions**

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

- B. Approved Backflow Prevention Assembly: The term "approved backflow prevention assembly" shall mean an assembly which has passed laboratory and field evaluation tests performed by a recognized testing organization which has demonstrated their competency to perform such test to the California Department of Health Services.
- C. Approved Water Supply: The term "approved water supply" means any water supply whose potability is regulated by a State or local health agency.
- D. Auxiliary Supply: The term "auxiliary supply" means any water supply on or available to the premises other than the approved water supply.
- E. AWWA Standard: The term "AWWA Standard" means an official standard developed and approved by the American Water Works Association (AWWA).
- F. Backflow: The term "backflow" shall mean a flow condition, caused by a differential in pressure, that causes the flow of water or other liquids, gases, mixtures or substances into the distributing pipes of a potable supply of water from any source or sources other than an approved water supply source. Backsiphonage is one cause of backflow. Back pressure is the other cause.
- G. Contamination: The term "contamination" means a degradation of the quality of the potable water by any foreign substance which creates a hazard to the public health, or which may impair the usefulness or quality of the water.
- H. Cross-Connection: The term "cross-connection" as used in these Operating Rules means any unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water or a substance that is not or cannot be approved as safe, wholesome, and potable. By-pass arrangements, jumper connections, removable sections, swivel or changeover assemblies, or other assemblies through which backflow could occur, shall be considered to be cross-connections.
- I. Double Check Valve Assembly: The term "double check valve assembly" means an assembly of two internally loaded, independently acting check valves, including resilient seated shut-off valves on each end of the assembly and test cocks for testing the water tightness of each check valve.
- J. Health Agency: The term "health agency" means the California Department of Health Services, or the local health agency with respect to a small water system.
- K. Local Health Agency: The term "local health agency" means the county or city health authority.
- L. Person: The term "person" means an individual, corporation, company, association, partnership, municipality, public utility, or other public body or institution.

- M. **Premises:** The term "premises" means any and all areas on a water user's property which are served or have the potential to be served by the public water system.
- N. **Public Water System:** The term "public water system" means a system for the provision of piped water to the public for human consumption that has five or more service connections or regularly serves an average of 25 individuals daily at least 60 days out of the year.
- O. **Reclaimed Water:** The term "reclaimed water" means a wastewater which, as a result of treatment, is suitable for uses other than potable use.
- P. **Reduced Pressure Principle Backflow Prevention Assembly:** The term "reduced pressure principle backflow prevention assembly" means an assembly incorporating two internally loaded, independently operating check valves and an automatically operating differential relief valve located between the two checks, including resilient seated shut-off valves on each end of the assembly, and equipped with necessary test cocks for testing the assembly.
- Q. **Service Connection:** The term "service connection" refers to the point of connection of a user's piping to the water supplier's facilities.
- R. **Water Supplier:** The term "water supplier" means the person who owns or operates the approved water supply system.
- S. **Water User:** The term "water user" means any person obtaining water from an approved water supply system.

### SECTION III

#### Cross-Connection Protection Requirements

- A. **General Provisions**
1. Unprotected cross-connections with the public water supply are prohibited.
  2. Whenever backflow protection has been found necessary, the Western Hills Water District will require the water user to install an approved backflow prevention assembly by and at his expense for continued services or before a new service will be granted.

3. Wherever backflow protection has been found necessary on a water supply line entering a water user's premises, then any and all water supply liens from the Western Hills Water District's mains entering such premises, buildings, or structures shall be protected by an approved backflow prevention assembly. The type of assembly to be installed will be in accordance with the requirements of the Operating Rules.

#### B. Where Protection is Required

1. Each service connection from the Western Hills Water District water system for supplying water to premises having an auxiliary water supply shall be protected against backflow of water from the premises into the public water system unless the auxiliary water supply is accepted as an additional source by the Western Hills Water District, and is approved by the public health agency having jurisdiction.
2. Each service connection from the Western Hills Water District water system for supplying water to any premise on which any substance is handled in such fashion as may allow its entry into the water system shall be protected against backflow of the water from the premises into the public system. This shall include the handling of process waters and waters originating from the Western Hills Water District water system which have been subjected to deterioration in sanitary quality.
3. Backflow prevention assemblies shall be installed on the service connection to any premises having (1) internal cross-connections that cannot be permanently corrected and controlled to the satisfaction of the state or local health department and the Western Hills Water District, or (b) intricate plumbing and piping arrangements or where entry to all portions of the premises is not readily accessible for inspection purposes, making it impracticable or impossible to ascertain whether or not cross-connections exist.

#### C. Type of Protection Required

1. The type of protection that shall be provided to prevent backflow into the approved water supply shall commensurate with the degree of hazard that exists on the consumer's premises. The type of protective assembly that may be required (listing in an increasing level of protection) includes: Double Check Valve Assembly (DC), Reduced Pressure Principle Backflow Prevention Assembly (RP), and an Air-gap separation (AG). The water user may choose a higher level of protection than required by the Western Hills Water District. The minimum types of backflow protection required to protect the approved water supply, at the user's water connection to premises with varying degrees of hazard are given in Table 1. Situations which are not covered in Table 1 shall be evaluated on a

case-by-case basis and the appropriate backflow protection shall be determined by the Western Hills Water District or health agency.

**Table 1**

**TYPE OF BACKFLOW PROTECTION REQUIRED**

Degree of Hazard	Minimum Type of Backflow Prevention
(a) Sewage and Hazardous Substances	
(1) Premises where the public water system is used to supplement the reclaimed water supply	AG
(2) Premises where there are wastewater pumping and/or treatment plans and there is no interconnection with the potable water system. This does not include a single family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and the Western Hills Water District.	AG
(3) Premises where reclaimed water is used and there is no interconnection with the potable water system. A RP may be provided in lieu of an AG if approved by the health agency and the Western Hills Water District.	AG
(4) Premises where hazardous substances are handled in any manner in which the substances may enter a potable water system. This does not include a single family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and the Western Hills Water District.	AG
(5) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected.	RP
(b) Auxiliary Water Supplies	
(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and the Western Hills Water District.	AG

SECTION 90

PORTLAND CEMENT CONCRETE

90-1.01 Description. Portland cement concrete shall be composed of portland cement, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.

Concrete for each portion of the work shall be of the Class, cement content in pounds per cubic yard, 28-day compressive strength, or minor concrete as shown on the plans or specified in these specifications or the special provisions.

Class A concrete shall contain not less than 564 pounds of portland cement per cubic yard.
Class B concrete shall contain not less than 470 pounds of portland cement per cubic yard.
Class C concrete shall contain not less than 376 pounds of portland cement per cubic yard.
Class D concrete shall contain not less than 658 pounds of portland cement per cubic yard.
Minor concrete shall contain not less than 564 pounds of portland cement per cubic yard unless otherwise specified in these specifications or the special provisions.

Unless otherwise designated on the plans or specified in these specifications or the special provisions, the amount of portland cement used per cubic yard of concrete in structures or portions of structures shall conform to the following:

Table with 2 columns: Use and Cement Content in pounds. Rows include concrete designated by compressive strength (roadway deck slabs, roof sections, other portions) and concrete not designated by compressive strength (roadway deck slabs, roof sections, prestressed members, seal courses, other portions).

Whenever the 28-day compressive strength shown on the plans is 3,500 pounds per square inch or greater, the concrete shall be considered to be designated by compressive strength. The 28-day compressive strengths shown on the plans which are less than 3,500 pounds per square inch, are shown for design information only and are not to be considered a requirement for acceptance of the concrete.

Concrete designated by compressive strength shall be proportioned such that the concrete will conform to the strength shown on the plans or specified in the special provisions.

The Contractor shall determine the mix proportions for all concrete to be used in concrete structures. The Engineer will determine the mix proportions for all other concrete.

Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising such mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.

Compliance with cement content requirements will be verified in accordance with procedures described in California Test 518. Batch proportions shall be adjusted as necessary to produce concrete having the specified cement content.

90-2.01 Portland Cement. Unless otherwise specified, portland cement shall be either "Type IP (MS) Modified" or "Type II Modified". "Type IP (MS) Modified" cement shall conform to the specifications for Type IP (MS) cement in ASTM Designation: C 595 and shall be comprised of an intimate mixture of "Type II Modified" cement and not more than 20 percent of a pozzolanic material. "Type II Modified" cement shall conform to the specifications for Type II cement in ASTM Designation: C 150. In addition, "Type IP (MS) Modified" and "Type II Modified" cement shall conform to the following requirements:



A. The cement shall not contain more than 0.60 percent by weight of alkalis, calculated as the percentage of  $\text{Na}_2\text{O}$  plus 0.658 times the percentage of  $\text{K}_2\text{O}$ , when determined by either direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in accordance with the requirements of ASTM Designation: C 114.

B. The autoclave expansion shall not exceed 0.50 percent.

C. Mortar, containing the portland cement to be used and Ottawa sand, when tested in accordance with California Test 527, shall not expand in water more than 0.010 percent and shall not contract in air more than 0.048 percent except that when portland cement is to be used for precast prestressed concrete piling, precast prestressed concrete members or steam cured concrete products, the mortar shall not contract in air more than 0.053 percent.

Type III and Type V portland cements shall conform to the specifications in ASTM Designation: C 150, and the modifications listed above except that when tested in accordance with California Test 527, mortar containing Type III portland cement shall not contract in air more than 0.075 percent.

Mineral admixtures may be used to replace a portion of the required portland cement in accordance with the provisions in Section 90-4, "Admixtures."

All cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same cement mill.

Cement shall be protected from exposure to moisture until used. Sacked cement shall be piled to permit access for tally, inspection, and identification of each shipment.

Adequate facilities shall be provided to assure that cement meeting the requirements specified in this Section 90-2.01 will be kept separate from other cement in order to prevent any but the specified cement from entering the work. Safe and suitable facilities for sampling cement shall be provided at the weigh hopper, or in the feed line immediately in advance of the hopper.

If cement is used prior to sampling and testing as provided in Caltrans Section 6-1.07, "Certificates of Compliance," and the cement is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the cement manufacturer or supplier of the cement. If the cement is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of such concrete or product.

Cement furnished without a Certificate of Compliance shall not be used in the work until the Engineer has had sufficient time to make appropriate tests and has approved the cement for use.

**90-2.02 Aggregates.** Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags and other extraneous material.

All natural aggregates shall be thoroughly and uniformly washed before use.

The Contractor, at his expense, shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates.

Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."

Aggregates shall have not more than 10 percent loss when tested for soundness in accordance with California Test 214.

The soundness requirement for fine aggregate will be waived, provided that the durability index,  $D_r$ , of the fine aggregate is 60, or greater.

The results of Cleanness Value, Sand Equivalent and aggregate grading tests shall conform to the requirements in Section 90-2.02A, "Coarse Aggregate," 90-2.02B, "Fine Aggregate," and 90-3, "Aggregate Gradings," respectively. If the results of any one or more of the said tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range.":

If the results of either or both the Cleanness Value and coarse aggregate grading tests do

not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that said concrete is structurally adequate, the concrete may remain in place.

**90-2.02A Coarse Aggregate.** Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, crushed air-cooled iron blast furnace slag, or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in any reinforced or prestressed concrete.

Coarse aggregate shall conform to the following quality requirements:

<i>Test</i>	<i>California Test</i>	<i>Requirements</i>
Loss in Los Angeles Rattler (after 500 revolutions) . . . . .	211	45% max.
Cleanness Value . . . . .	227	
Operating Range . . . . .		75 min.
Contract Compliance . . . . .		71 min.

In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71 min. and a Cleanness Value "Contract Compliance" limit of 68 min will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Caltrans Section 6-1.07, "Certificates of Compliance," certifying that:

1. coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested by California Test 227, and
2. prequalification tests performed in accordance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

**90-2.02B Fine Aggregate.** Fine aggregate shall consist of natural sand, manufactured sand produced from arger aggregate, or a combination thereof. Manufactured sand shall be well graded.

Fine aggregate shall conform to the following quality requirements:

<i>Test</i>	<i>California Test</i>	<i>Requirements</i>
Organic Impurities . . . . .	213	Satisfactory <sup>1</sup>
Mortar Strengths Relative to Ottawa Sand . . . . .	515	95% min.
Sand Equivalent . . . . .	217	75 min.
Operating Range . . . . .		75 min.
Contract Compliance . . . . .		71 min.

<sup>1</sup> Fine aggregate developing a color darker than the reference standard color solution may be accepted if it is determined by the Engineer, from mortar strength tests, that a darker color is acceptable.

In lieu of the above Sand Equivalent requirements, a Sand Equivalent "Operating Range" limit of 71 min. and a Sand Equivalent "Contract Compliance" limit of 68 min. will be used to determine the acceptability of the fine aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Caltrans Section 6-1.07, "Certificates of Compliance," certifying that:

1. fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217, and;
2. prequalification tests performed in accordance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

**90-2.03 Water.** In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO<sub>4</sub>. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO<sub>4</sub>. In no case shall the water contain an amount of impurities that will cause a change in the setting time of portland cement or more than 25 percent nor a reduction in the compressive strength of mortar at 14 days of more than 5 percent when compared to the results obtained with distilled water.

In non-reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 2,000 parts per million of chlorides as Cl, nor more than 1,500 parts per million of sulfates as SO<sub>4</sub>.

In addition to the above requirements, water for curing concrete shall not contain any impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water reclaimed from mixer wash-out operations may be used in mixing concrete. Such water shall not contain coloring agents or more than 300 parts per million of alkalies (Na<sub>2</sub>O + 0.658 K<sub>2</sub>O) as determined on the filtrate. The specific gravity of such water shall not exceed 1.03 and shall not vary more than ±0.010 during any day's operations.

**90-3.01 General.** Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes which he proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. Such gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in his opinion, the furnishing of said gradation is not necessary for the type or amount of concrete work to be constructed.

Gradations proposed by the Contractor shall be within the following percentage passing limits:

<i>Primary Aggregate Nominal Size</i>	<i>Sieve Sizes</i>	<i>Limits of Proposed Gradation</i>
1½" x ¾" .....	1"	19 - 41
1" x No. 4 .....	¾"	52 - 85
1" x No. 4 .....	½"	15 - 38
Fine Aggregate .....	No. 16	55 - 75
Fine Aggregate .....	No. 30	34 - 46
Fine Aggregate .....	No. 50	16 - 29

Should the Contractor change his source of supply, he shall submit in writing to the Engineer the new gradations before their intended use.

**90-3.02 Coarse Aggregate Grading.** The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

<i>Sieve Sizes</i>	<i>Percentage Passing</i>			
	<i>1 1/2" x 3/4"</i>		<i>1" x No. 4</i>	
	<i>Operating Range</i>	<i>Contract Compliance</i>	<i>Operating Range</i>	<i>Contract Compliance</i>
1".....	100	100	-----	-----
1 1/2".....	88-100	85-100	100	100
1".....	X±18	X±25	88-100	86-100
3/4".....	0 - 17	0 - 20	X±15	X±22
3/8".....	0 - 7	0 - 9	X±15	X±22
No. 4.....	-----	-----	0 - 16	0 - 18
No. 8.....	-----	-----	0 - 6	0 - 7

In the above table, the symbol X is the gradation which the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

Coarse aggregate for the 1 1/2" Max. combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately provided that if the materials were combined they would conform to the grading requirements for that particular primary aggregate nominal size being separated.

When the 1" Max. combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately provided that when combined the material shall conform to the grading requirements for the 1" x No. 4 primary aggregate nominal size.

**90-3.03 Fine Aggregate Grading.** Fine aggregate shall be graded within the following limits:

<i>Sieve Sizes</i>	<i>Percentage Passing</i>	
	<i>Operating Range</i>	<i>Contract Compliance</i>
3/8".....	100	100
No. 4.....	95-100	93-100
No. 8.....	65-95	61-99
No. 16.....	X±10	X±13
No. 30.....	X±9	X±12
No. 50.....	X±6	X±9
No. 100.....	2 - 12	1 - 15
No. 200.....	0 - 8	0 - 10

In the above table, the symbol X is the gradation which the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the No. 16 sieve and the total percentage passing the No. 30 sieve shall be between 10 and 40 and the difference between the percentage passing the No. 30 and No. 50 sieves shall be between 10 and 40.

Fine aggregate may be separated into 2 or more sizes and stored separately, provided that when the materials are combined they will conform to the grading requirements specified in this Section 90-3.03.

**90-3.04 Combined Aggregate Gradings.** Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that will produce a mixture within the grading limits for combined aggregates as specified in the Section 90-3.04. Within these limitations, the relative proportions shall be as ordered by the Engineer, except as otherwise provided in Section 90-1.01, "Description."

The combined aggregate grading used in portland cement concrete pavement shall be the 1 1/2" Max. grading.

The combined aggregate grading used in concrete for structures and other concrete items, except when specified otherwise in these specifications or the special provisions, shall be either the 1 1/2" Max. grading or the 1" Max. grading at the option of the Contractor.

**Grading Limits of Combined Aggregates**

*Percentage Passing*

Sieve Sizes	Percentage Passing	
	1 1/2" Max.	1" Max.
2" .....	100	—
1 1/2" .....	90 - 100	100
1" .....	50 - 86	90 - 100
3/4" .....	45 - 75	55 - 100
5/8" .....	38 - 55	45 - 75
No. 4 .....	30 - 45	35 - 60
No. 8 .....	23 - 38	27 - 45
No. 16 .....	17 - 33	20 - 35
No. 30 .....	10 - 22	12 - 25
No. 50 .....	4 - 10	5 - 15
No. 100 .....	1 - 6	1 - 8
No. 200 .....	0 - 3	0 - 4

Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

**90-4.01 General.** Admixtures used in portland cement concrete shall conform to and be used in accordance with the requirements in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.

Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by weight of admixture, as determined by California Test 415, shall not be used in prestressed or reinforced concrete.

Calcium chloride shall not be used in any concrete containing steel reinforcement or other embedded metals unless otherwise specified.

Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.

If more than one admixture is used, said admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

**90-4.02 Materials.** Admixtures shall conform to the requirements of the ASTM Designations shown below:

Chemical Admixtures - ASTM Designation: C 494.

Air-entraining Admixtures - ASTM Designation: C 260.

Calcium Chloride - ASTM Designation: D 98.

Mineral Admixtures - ASTM Designation: C 618, except that the loss on ignition shall not exceed 4 percent.

**90-4.04 Required Use of Chemical Admixtures and Calcium Chloride.** When the use of a chemical admixture or calcium chloride is specified or ordered by the Engineer, the admixture shall be used at the dosage specified or ordered, except that if no dosage is specified or ordered, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.

**90-4.05 Optional Use of Chemical Admixtures.** The Contractor will be permitted to use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cement or to facilitate any concrete construction application subject to the following conditions.

When concrete is designated by compressive strength, no reduction in minimum cement content will be allowed.

When concrete is not designated by compressive strength and a water-reducing admixture or a water-reducing and retarding admixture is used, the cement content specified or ordered may be reduced by a maximum of 5 percent by weight except that the resultant cement content shall be not less than 470 pounds per cubic yard.

When a reduction in cement content is made, the dosage of admixture used shall be the dosage used in determining approval of the admixture.

If the specified or ordered cement content is reduced as permitted by this Section 90-4.05, the resultant cement content shall be considered as the amount of portland cement required to satisfy the requirements of Section 90-1.01, "Description," before applying the provisions of Section 90-4.08, "Required Use of Mineral Admixtures," or Section 90-4.09, "Optional Use of Mineral Admixtures."

**90-4.06 Required Use of Air-entraining Admixtures.** When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

**90-4.07 Optional Use of Air-entraining Admixtures.** When air entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content of 3 successive tests shall not exceed 4 percent and no single test value shall exceed 5 1/2 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, he shall so indicate at the time he designates his source of aggregate as provided in Caltrans Section 40-1.015, "Cement Content."

**90-4.08 Required Use of Mineral Admixtures.** When the use of mineral admixtures in concrete is specified or is ordered by the Engineer, the minimum amounts of mineral admixture and portland cement and the type of cement shall be as specified or ordered. If the use of mineral admixture in concrete is specified or ordered but the minimum amounts of admixture and cement and the cement type have not been specified or ordered, the concrete shall conform to one of the following:

A. The concrete shall contain "Type IP (MS) Modified" cement conforming to the provisions in Section 90-2.01, "Portland Cement," in an amount sufficient to satisfy the specified minimum cement content.

B. The concrete shall contain "Type II Modified" cement conforming to the provisions in Section 90-2.01, "Portland Cement," in an amount not less than 85 percent of the amount required to satisfy the specified minimum cement content. The concrete shall also contain a mineral admixture in an amount not less than 15 percent, by weight, of the amount of cement required to satisfy the specified minimum cement content. Where Section 90-1.01, "Description," specifies a maximum cement content in pounds per cubic yard, the total weight of portland cement and mineral admixture per cubic yard shall not exceed the specified maximum cement content.

**90-4.09 Optional Use of Mineral Admixtures.** The Contractor will be permitted to replace up to 15 percent of the required portland cement, other than Type IP (MS) Modified or Type III cements, with a mineral admixture in all concrete except where high early strength has been specified or where the use of mineral admixtures is otherwise specified or prohibited. The weight of mineral admixture used shall be equal to or greater than the weight of portland cement replaced.

**90-4.10 Proportioning and Dispensing Liquid Admixtures.** Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers for liquid admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within  $\pm 5$  percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.

Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.

If more than one liquid admixture is used in the concrete mix, a separate measuring unit shall be provided for each liquid admixture, and dispensing shall be accomplished by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix.

When automatic proportioning devices are required for concrete pavement, dispensers for liquid admixtures shall operate automatically with the batching control equipment. Such dispensers shall be equipped with an automatic warning system in good operating condition which will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of concrete.

Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

Liquid admixtures requiring dosages greater than one-half gallon per cubic yard shall be considered to be water when determining the total amount of free water per cubic yard as specified in Section 90-6.06, "Amount of Water and Penetration."

Special admixtures, such as "high range" water reducers which may contribute to a high rate of slump loss, shall be measured and dispensed as recommended by the admixture manufacturer and as approved by the Engineer.

Mineral admixture used in concrete for exposed surfaces of like elements of a structure shall be of the same brand and of the same percentage.

**90-6.01 General.** All concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in accordance with the provisions in Section 90-6.05, "Hand Mixing."

Equipment having components made of aluminum or magnesium alloys, which would have contact with plastic concrete during mixing, transporting or pumping of portland cement concrete, shall not be used.

All concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cements.

Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533 and by variations in the proportion of coarse aggregate as determined by California Test 529.

The difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 1/2 inch. Variation in the proportion of coarse aggregate will be determined from the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 6 pounds per cubic foot.

The Contractor, at his expense, shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

**90-6.02 Machine Mixing.** Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators which have an accumulation of hard concrete or mortar shall not be used:

The temperature of mixed concrete, immediately before placing, shall be not less than 50°F. nor more than 90°F. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 150° F. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

The batch shall be so charged into the mixer that some water will enter in advance of cement and aggregates. All water shall be in the drum by the end of the first 1/4 of the specified mixing time.

Cement shall be batched and charged into the mixer by means that will not result in loss of cement due to the effect of wind, or in accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which reduce or vary the required quantity of cement in the concrete mixture.

Paving and stationary mixers shall be operated with an automatic timing device that can be locked by the Engineer. The timing device and discharge mechanism shall be so interlocked that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

The total elapsed time between the intermingling of damp aggregates and cement and the start of mixing shall not exceed 30 minutes.

The size of batch shall not exceed the manufacturer's guaranteed capacity.

When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at jobsite batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

Concrete shall be mixed and delivered to the site of the work by means of one of the following combinations of operations:

- A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in non-agitating hauling equipment. (Known as central-mixed concrete.)
- B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer. (Known as shrink-mixed concrete.)
- C. Mixed completely in a truck mixer. (Known as transit-mixed concrete.)
- D. Mixed completely in a paving mixer.

Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.



When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

**90-6.03 Transporting Mixed Concrete.** Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the requirements in Section 90-6.01, "General."

Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity. They shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

Bodies of non-agitating hauling equipment shall be so constructed that leakage of the concrete mix or any part thereof, will not occur at any time, and they shall be self-cleaning during discharge.

Concrete hauled in open-top vehicles shall be protected during hauling against access of rain or exposure to the sun for more than 20 minutes when the ambient temperature exceeds 75° F.

No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1½ hours, or before 250 revolutions of the drum or blades, whichever comes first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85° F., or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

Each load of ready-mixed concrete delivered at the jobsite, except loads to be used for pavement, shall be accompanied by a ticket showing volume of concrete, the concrete mix identification number, and the total amount of water added to the load. The ticket shall also show the time of day at which the materials were batched and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged.

Each load of ready-mixed concrete used for paving shall be accompanied by a ticket which shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The ticket shall be stamped with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.

**90-6.04 Time or Amount of Mixing.** Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture if added with water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall be counted as part of the required mixing time.

The required mixing time, in paving or stationary mixers, or concrete used for concrete structures, except minor structures, shall be not less than 90 seconds nor more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.

The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds nor more than 5 minutes.

The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete which conforms to the uniformity requirements in Section 90-6.01, "General."

**90-6.05 Hand-Mixing.** Hand-mixed concrete shall be made in batches not more than 1/3 cubic yard and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than one foot in total depth. On this mixture shall be spread the dry cement and the whole mass turned not less than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned not less than 3 times, not including placing in the carriers or forms.

**90-6.06 Amount of Water and Penetration.** The amount of water used in concrete mixes shall be regulated so that the consistency of the concrete as determined by California Test 533 is within the nominal penetration range shown in the following table. When the penetration, the mixture of subsequent batches shall be adjusted to reduce the penetration to a value within the nominal range shown. Batches of concrete with a penetration exceeding the maximum penetration shall not be used in the work. When Type F or Type G chemical admixtures are added to the mix, penetration measurements will be taken prior to the addition of such chemical admixtures.

<i>Type of Work</i>	<i>Nominal Penetration (Inches)</i>	<i>Maximum Penetration (Inches)</i>
Concrete pavement .....	0 - 1	1 ½
Non-reinforced concrete facilities .....	0 - 1 ½	2
Reinforced concrete structures		
Sections over 12 inches thick .....	0 - 1 ½	2 ½
Sections 12 inches thick or less .....	0 - 2	3
Concrete placed under water .....	3 - 4	4 ½
Cast-in place concrete piles:		
16" diameter or less .....	1 ½ - 3	3 ½
17" to 24" diameter .....	1 - 2 ½	3
Over 24" diameter .....	½ - 2	2 ½

The amount of free water used in concrete shall not exceed 312 pounds per cubic yard, plus 20 pounds for each required 100 pounds of cement in excess of 564 pounds per cubic yard.

The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

Where there are adverse or difficult conditions which affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cement content per cubic yard of concrete. The increase in water and cement shall be at a ratio not to exceed 30 pounds of water per added 100 pounds of cement per cubic yard. The cost of additional cement and water added under these conditions shall be at the Contractor's expense and no additional compensation will be allowed therefor.

The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for any batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

**90-7.01 Methods of Curing.** All newly placed concrete shall be cured in accordance with the provision in Section 90-7, "Curing Concrete."

The method or methods of curing to be used shall be as specified in these specifications and the special provisions.

**90-7.01A Water Method.** The concrete shall be kept continuously wet by the application of water for a minimum period of 7 days after the concrete has been placed.

Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period.

When cotton mats, rugs, carpets, or earth or sand blankets are to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

When concrete bridge decks and flat slabs are to be cured without the use of a moisture retaining medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified in the preceding paragraph, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

**90-7.01B Curing Compound Method.** Surfaces of the concrete which are exposed to the air shall be sprayed uniformly with a curing compound.

Curing compounds to be used shall be as follows:

- (1) Pigmented curing compound conforming to the requirements of ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.
- (2) Pigmented curing compound conforming to the requirements of ASTM Designation: C 309, Type 2, Class B.
- (3) Pigmented curing compound conforming to the requirements of ASTM Designation: C 309, Type 2, Class A.
- (4) Non-pigmented curing compound conforming to the requirements of ASTM Designation: C 309, Type 1, Class B.
- (5) Non-pigmented curing compound conforming to the requirements of ASTM Designation: C 309, Type 1, Class A.
- (6) Non-pigmented curing compound with fugitive dye conforming to the requirements of ASTM Designation: C 309, Type 1-D, Class A.

The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.

The loss of water for each type of curing compound, when tested in accordance with California Test 534, shall not be more than 0.15 kilogram per square meter in 24 hours nor more than 0.45 kilogram per square meter in 72 hours.

The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.

When the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.

Curing compound shall be applied at a nominal rate of one gallon per 150 square feet, unless otherwise specified.

At any point, the application rate shall be within  $\pm 50$  square feet per gallon of the nominal rate specified and the average application rate shall be within  $\pm 25$  square feet per gallon of the nominal rate specified when tested in accordance with California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.

Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas which are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.

The curing compound shall be applied to the concrete following the surface finishing operation immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.

At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.

Agitation shall not introduce air nor any other foreign substance into the curing compound.

The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, deemulsification or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Any settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sidewise manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.

All curing compounds shall remain sprayable at temperatures above 40° F. They shall not be diluted or altered in any manner after manufacture.

The curing compound shall be packaged in clean 55-gallon barrels or round 5-gallon containers or shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with Department of Transportation Code of Federal Regulations, Hazardous Materials Regulations Board, Reference 49CFR. The 55-gallon barrels shall have removable lids and airtight fasteners. Five-gallon containers shall be round and have standard full open head and bail. Lids with bungholes will not be permitted. On-site storage tanks shall be kept clean and free of all contaminants. Each tank shall have a permanent system designed to completely redisperse any settled material without introducing air or any other foreign substance.

Steel containers and lids shall be lined with a coating which will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.

Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, number of gallons, date of manufacture and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in accordance with the Construction Safety Orders and General Industry Safety Orders of the State of California.

All containers of curing compound shall be labeled to indicate that the contents fully comply with all rules and regulations concerning air pollution control in the State of California.

When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.

Curing compound will be sampled by the Engineer at the source of supply or at the jobsite, or at both locations.

Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.

All tests will be conducted in accordance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

**90-7.01C Waterproof Membrane Method.** The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.

Sheeting material for curing concrete shall conform to the specifications of AASHTO Designation: M 171 for white reflective materials.

The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. All joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 0.33-foot.

The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer,

Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.

Sections of membrane which have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

**90-7.01D Forms-In-Place Method.** Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 20 inches in least dimension the forms shall remain in place for a minimum period of 5 days.

All joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

**90-7.02 Curing Pavement.** The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using a pigmented curing compound as the contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound which have been disturbed by sawing operations shall be restored by spraying with additional curing compound.

Curing shall commence as soon as the finishing process provided in Caltrans Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the requirements specified in Section 90-7.01, "Methods of Curing."

When curing compound method is used, the compound shall be applied to the entire pavement surfaced by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator which provides for continual agitation of the curing compound during the time of application. The spray shall be adequately protected against wind and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage uniformly on all exposed faces. Hand spraying of small and irregular areas and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient temperature is above 60° F., the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of 10:00 a.m. and 4:30 p.m. on the day the concrete is placed, however the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

**90-7.03 Curing Structures.** All newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, all in accordance with the requirements in Section 90-7.01, "Methods of Curing."

The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces which are to be buried underground, and surfaces where only Ordinary Surface Finish is to be applied and on which a uniform color is not required and which will not be visible from any public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

The top surface of highway bridge decks shall be cured by both the curing compound method, and by the water method. The curing compound shall be curing compound (1). The curing compound shall be applied progressively during the deck finishing operations immediately after finishing operations are completed on each individual portion of the deck. The water cure shall be applied not later than 4 hours after completion of deck finishing or, for portions of the decks on which finishing is completed after normal working hours, the water cure shall be applied not later than the following morning.

Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method, or by the curing compound method.

When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Such application of water will be paid for as extra work as provided in Caltrans Section 4-1.03D.

**90-7.04 Curing Precast Concrete Members.** Precast concrete members shall be cured for not less than 7 days by the water method in conformance with Section 90-7.01A, "Water Method," or by steam curing, at the option of the Contractor. Steam curing for precast members shall conform to the following provisions.

A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 50° F., steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 50° and 90° F.

B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.

C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner to prevent the loss of steam and moisture.

D. Steam at the jets shall be low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam the temperature rise within the enclosure shall not exceed 40° F. per hour. The curing temperature throughout the enclosure shall not exceed 150° F. and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.

E. Temperature recording devices that will provide an accurate continuous permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 200 feet of continuous bed length will be required for checking temperature.

F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm or the temperature under the enclosure shall be maintained above 60° F. until the stress is transferred to the concrete.

G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

**90-7.05 Curing Precast Prestressed Concrete Piles.** All newly placed concrete for precast prestressed concrete piles shall be cured in accordance with Section 90-7.04, "Curing Precast Concrete Members," except that piles with a class designation ending in C (corrosion resistant) shall be cured as follows:

Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in accordance with the provisions in Section 90-7.01A, "Water Method," except that the minimum curing period shall be 14 days.

If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 7 days including the holding and steam curing periods.

**90-7.06 Curing Slope Protection.** Concrete slope protection shall be cured in accordance with any of the methods specified in Section 90-7.01, "Methods of Curing."

Concreted-rock slope protection shall be cured in accordance with any of the methods specified in Section 90-7.01, "Methods of Curing," or with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

**90-7.07 Curing Miscellaneous Concrete Work.** Exposed surfaces of curbs shall be cured by pigmented curing compounds as provided in Section 90-7.01B, "Curing Compound Method,"

Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in accordance with any of the methods specified in Section 90-7.01, "Methods of Curing."

Shotcrete shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

Mortar and grout shall be cured by keeping the surface damp for 3 days.

After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

**90-8.01 General.** In addition to the requirements of Caltrans Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8.

Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.

All concrete that has been frozen, or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at his expense.

**90-8.02 Protecting Concrete Structures.** All structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 45° F. for 72 hours after placing and at not less than 40° F. for an additional 4 days. When required by the Engineer, the Contractor shall submit a written outline of his proposed methods for protecting the concrete.

**90-8.03 Protecting Concrete Paving.** Pavement concrete shall be maintained at a temperature of not less than 40° F. for 72 hours. When required by the Engineer, the Contractor shall submit a written outline of his proposed methods for protecting the concrete.

Except as provided in Caltrans Section 7-1.08, "Public Convenience," the Contractor shall protect concrete pavement against all construction and other activities which abrade, scar, discolor, reduce texture depth, lower coefficient of friction or otherwise damage the surface. Stockpiling, drifting or excessive spillage of soil, gravel, petroleum products, and concrete or asphalt mixes on the surface of concrete pavement is prohibited unless otherwise specified in these specifications, the special provisions or permitted by the Engineer.

When ordered by the Engineer or shown on the plans or specified in the special provisions, pavement crossings shall be constructed for the convenience of public traffic. The material and work necessary for the construction of such ramps, and their subsequent removal and disposal, will be paid for at the contract unit prices for the items of work involved and if there are no contract items for the work involved, payment for pavement crossings will be made by extra work as provided in Caltrans Section 4-1.03D. Where public traffic will be required to cross over the new pavement, and if directed by the Engineer, Type III portland cement shall be used in concrete. When Type III portland cement is used in concrete, and if permitted in writing by the Engineer, the pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 550 pounds per square inch.

The modulus of rupture will be determined by California Test 523.

No traffic or Contractor's equipment, except as hereinafter provided, will be permitted on the pavement before a period of 10 calendar days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 550 pounds per square inch. Concrete that fails to attain a modulus of rupture of 550 pounds per square inch within 10 days shall not be opened to traffic until directed by the Engineer.

Equipment for sawing weakened plane joints will be permitted on the pavement as specified in Section 40-1.08B, "Weakened Plane Joints."

When requested in writing by the Contractor, the tracks on one side of paving equipment will be permitted on the pavement after a modulus of rupture of 350 pounds per square inch has been attained, provided that:

- A. Unit pressure exerted on the pavement by the paver shall not exceed 20 pounds per square inch.
- B. Tracks with cleats, grousers, or similar protuberances shall be modified or shall travel on planks or equivalent protective material, so that the pavement is not damaged.
- C. No part of the track shall be closer than one foot from the edge of pavement.

In the case of visible cracking of, or other damage to the pavement, operation of the paving equipment on the pavement shall be immediately discontinued.

Any damage to the pavement resulting from early use of pavement by the Contractor's equipment as provided above shall be repaired by the Contractor at his expense.

**90-9.01 General.** Concrete compressive strength requirements consist of a minimum strength which must be attained before various loads or stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of 28 days. The various strengths required are specified elsewhere or are shown on the plans.

The compressive strength of concrete will be determined from test cylinders which have been fabricated from concrete sampled in accordance with California Test 539. Test cylinders will be molded and initial field cured in accordance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in accordance with California Test 521. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, said cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in accordance with Method 1 of California Test 540. The compressive strength of concrete determined for such purposes will be evaluated on the basis of individual tests.

When concrete is designated by 28-day compressive strength rather than by cement content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540.

No single 28-day strength test shall represent more than 300 cubic yards.



When a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders which have been handled and stored in accordance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. When such concrete is designated by 28-day compressive strength rather than by cement content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided such strength is reached not more than 28 days after the member is cast.

When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use, will be required prior to placement of such concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.

Certified test data, in order to be acceptable, must indicate that not less than 90 percent of at least 20 consecutive 28-day tests exceed the specified strength, and non of said tests are less than 95 percent of specified strength. Strength tests included in such data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete. Trial batch test reports, in order to be acceptable, must indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days after molding shall be at least 600 pounds per square inch greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength. Data contained in the report shall be from trial batches which were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.

All tests shall be performed in accordance with either the appropriate California Test methods or the comparable ASTM test methods. All equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

The certified test data and trial batch test reports shall include the following information:

- A. Date of mixing.
- B. Mixing equipment and procedures used.
- C. The size of batch in cubic yards and the weight, type and source of all ingredients used.
- D. Penetration of the concrete.
- E. The air content of the concrete if an air-entraining admixture is used.
- F. The age at time of testing and strength of all concrete cylinders tested.

All certified test data and trial batch test reports shall be signed by an official of the firm which performed the tests.

When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and such concrete will be paid for as the type or class of concrete required at that location.

After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making any changes which, in the judgement of the Engineer, could result in a lowering of the strength of the concrete below that specified.

The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.

When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

**90-10.01 General.** Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.

The Engineer, at this discretion, will inspect and test the facilities, materials and methods for producing the concrete to insure that a minor concrete of the quality suitable for use in the work is obtained.

**90-10.02 Materials.** Minor concrete shall conform to the following requirements:

**90-10.02A Portland Cement.** Portland cement shall conform to the provisions in Section 90-2.01, "Portland Cement."

**90-10.02B Aggregate.** Aggregate shall be clean and free from deleterious coatings, clay balls, roots and other extraneous materials. The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, all aggregate furnished for minor concrete shall conform to said grading, unless a change is authorized in writing by the Engineer.

The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 1½ inches nor smaller than ¾ inch.

The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in his opinion, the furnishing of said gradation is not necessary for the type or amount of concrete work to be constructed.

Mineral admixture will be required in the manufacture of concrete containing aggregate that is determined to be "deleterious" or "potentially deleterious" when tested in accordance with ASTM Designation: C 289. The use of mineral admixture in such concrete shall conform to the requirements in Section 90-4.08, "Required Use of Mineral Admixtures," except the use of Class C mineral admixture will not be permitted.

**90-10.02C Water.** Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities which would discolor or etch the surface or have an adverse effect on the quality of the concrete.

**90-10.02D Admixtures.** The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

**90-10.03 Production.** Cement, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice, which will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and which conforms to requirements specified herein. "Recognized standards of good practice" are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or California Department of Transportation.

The cement content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."

The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.

Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before any stiffening occurs. An elapsed time of 1½ hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cement to the aggregates, or a temperature of concrete of more than 90° F. will be considered as conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.

The required mixing time in stationary mixers shall be not less than 50 seconds nor more than 5 minutes.

The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.

Each load of ready-mixed concrete shall be accompanied by a ticket which shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The ticket shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.

A Certificate of Compliance in accordance with the provisions in Caltrans Section 6-1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets all contract requirements, including minimum cement content specified.

**90-10.04 Curing Concrete.** Curing minor concrete shall conform to the requirements in Section 90-7, "Curing Concrete."

**90-10.05 Protecting Concrete.** Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 40° F. for 72 hours after placing.

## SECTION 100

### STREET OPENING AND PAVEMENT RESTORATION REGULATIONS

**100-1 Moratorium.** Permission to excavate in newly resurfaced streets will not be granted for three years after completion of street resurfacing. For those streets with chip seal or slurry seal coatings, the moratorium shall be for 18 months. Utilities shall determine alternative methods of making necessary repairs to avoid excavating in newly resurfaced streets. Exceptions to the above are as follows:

1. Emergency which endangers life or property.
2. Interruption of essential utility service.
3. Work that is mandated by City, State or Federal legislation.
4. Service for buildings where no other reasonable means of providing service exists.
5. Other situations deemed by the Western Hills Water District to be in the best interest of the general public.

**100-2 General.** The following regulations pertain to street excavations:

#### **100-3 Permits.**

1. Except in extreme emergency, street opening permits must be taken out in advance of excavation work. An extreme emergency is considered to exist only when life or property is endangered or when an essential utility service is interrupted during weekends, holidays, or between 5 p.m. and 8 a.m. of normal working days.
2. A plan showing approximate location of excavation will be acceptable provided that an "as-built" plan shall be submitted when the location of excavation changes substantially from the original plan.
3. Permits for street opening shall be valid for six (6) months. The estimated date of commencement and completion of work shall be indicated in all permits. Conflicts in the schedules of work under two or more permits shall be resolved by the permittees involved.
4. As a condition of the permit to excavate, the applicant must have been provided an inquiry identification number by a regional notification center (USA) pursuant to Section 4216, Chapter 1153, Assembly Bill #1606 of the California State Law.

#### **100-4 Excavation.**

1. All excavated material not suitable for backfilling shall be removed from the job site within twenty four (24) hours. Excavated material suitable for backfilling may be stored on the job site for a maximum of five (5) working days, provided it does not occupy any more street space than the permit allows and provided this material is completely prevented from blowing, washing, or being thrown about at all times.
2. No trench shall be opened on any street which is not backfilled at the end of the day. With prior approval of the permit inspector, the trench may be left open at the end of the day with adequate safety precautions for vehicular and pedestrian traffic.

#### **100-5 Backfill.**

1. Trenches shall be backfilled with sand or suitable site excavated material. Compaction of backfill shall be in accordance with Drawing U-5 or U-6.
2. Unless otherwise specified, initial backfill shall be sand, gravel, crushed aggregate or native free-draining granular material. If, in the opinion of the Engineer, the native material is unsuitable for initial backfill, the Engineer may require the Developer to test the native material, at the Developer's expense. For native material to be considered suitable it shall have a sand equivalent of not less than 30 or a coefficient of permeability greater than 1.4 inches per hour. The initial backfill shall be free of rocks or clods greater than 3 inches in diameter and shall be free of organic or other unsuitable material.
3. All native backfill material shall be free of rocks and clods greater than 3 inches in diameter and free of organic or other unsuitable material.
4. In the event that native backfill materials as described in the above paragraph are not available in the trench spoils, material shall be imported to satisfy the requirements of this section.
5. When undermining has occurred, remove existing pavement as required to compact backfill.
6. Certificates shall be obtained from an independent testing laboratory verifying that compaction meets or exceeds the requirements of this section. The number of tests will be specified on the permit. The intent of these tests is to assure that pavement is properly restored. Tests will generally be required on all major excavations (excavations lasting longer than five (5) working days). The number of tests required will increase if results are poor and decrease if good compaction is consistently obtained.
7. The Western Hills Water District Engineer shall be notified one (1) day in advance of any backfilling and paving work.

#### **100-6 Paving.**

1. Trenches shall be paved as shown on Drawing U-5. Sawcutting of the existing pavement shall be in neat straight lines. To allow for proper placement of the new pavement section, damaged pavement outside of the original trench cut lines shall be removed by cutting in lines perpendicular to or parallel to the original trench lines. No diagonal cuts are to be made. Undamaged pavement of three (3) feet or less between two damaged areas shall also be removed.
2. Pavement will be restored using the "T Section" shown on Drawing U-5. For trenches in moratorium streets parallel to the center line of the street, the entire lane shall be key-cut one and one-half inches (1-1/2") deep and repaved with asphalt concrete. For trenches in moratorium streets with chip seal or slurry seal coatings, the entire lane shall be resurfaced with these coatings, the entire lane shall be resurfaced with these coatings.
3. Trenches in concrete streets shall be paved with concrete pavement. The thickness of the new pavement shall be equal to the thickness of the existing pavement with the minimum thickness to be six (6) inches in the roadway.
4. Trenches in all streets with asphalt wearing surfaces shall be paved to meet the greater of the following:
  - a. Engineer's calculations based on soil conditions and traffic index.
  - b. Nine inches (9") class 2 aggregate base topped with three inches (3") of asphalt concrete wearing surface.
  - c. Match the existing pavement section.
5. Pavement shall be restored within fourteen (14) working days from the time

the trench is backfilled. For minor excavations such as service installations, the pavement shall be restored within thirty (30) working days from the time the trench is backfilled. The asphalt concrete wearing surface shall be placed within two (2) working days after placement of asphalt concrete base, weather permitting.

6. Prior to placing asphalt concrete, the existing asphalt concrete shall have a vertical face so that new AC paving can be butt joined. No feathering of new paving to existing paving is allowed. The vertical faces shall be tack coated. In moratorium streets, placement of the final one and one-half inches of AC wearing surface shall be done by a paving machine or spreader box in order to eliminate the uneven, wash-board effect that results from hand spreading. Asphalt concrete shall be delivered and compacted in accordance with the Standard Specifications.
7. Asphalt pavement shall be compacted to obtain a minimum relative compaction of ninety-five percent (95%). The asphalt concrete wearing surface will be smooth enough so that there is no irregularity greater than five-sixteenths of an inch (5/16") in ten feet (10') in any direction.
8. On major streets steel plates shall be used when ordered by the permit inspector to facilitate traffic flow and to protect the excavation until finished pavement is restored. Steel plates used to bridge a street opening shall be ramped to the elevation of the adjacent pavement and secured against movement in any direction. Temporary ramps shall be constructed of asphalt and shall have a gradual slope. On all other streets, temporary asphalt cutback is permitted.
9. Utility trenches shall be color coded with a four (4) inch painted mark at the beginning and end of each trench at each intersection when paving is completed. The color assigned to each franchised utility is as follows:

PG&E Electric (red)	Street Repair (Dark green)
Evans Telephone (orange)	Propane (yellow)
Western Hills Water & Sewer (white)	T.C.I./Cable
10. Wheelchair ramps shown on Drawing No. C-7 or C-8 shall be constructed where any portion of the curb at a legal pedestrian crosswalk or any portion of the sidewalk in immediate contact with such curb is removed, except where there is an existing wheelchair ramp in the crosswalk or where there is a subsidewalk basement behind the crosswalk.

#### **100-7 Defects.**

1. Depressed trench pavement shall be repaired as follows:
  - a. Wearing surface defects - remove and restore wearing surface.
  - b. Major defects - excavate, remove and restore surface and base.
  - c. The severity of the defect will be determined by the Permit Inspector.
2. Work not complying with the above requirements will be rejected, removed and redone to the satisfaction of the District Engineer.
3. Utilities shall be responsible to correct trench defects until such time as the street is resurfaced.

#### **100-8 Miscellaneous:**

1. Street excavation signs shall be installed at the project site at least two (2) days in advance of any construction work lasting five (5) days or more.

Signs must state name of utility company and contractor, twenty four (24) hour telephone number, and type of construction.

2. Standard Specifications and Plans will apply for any regulations not covered in this section.
3. Any violation of the above regulations may result in the revocation of the street opening permit and/or be subject to a police citation or fine.

SECTION 101

STATE OF CALIFORNIA DEPARTMENT OF HEALTH CRITERIA

101-1.01 Separation of Water Mains with Sanitary Sewers and Storm Sewers.

101-1.02 Basic Standards. The "California Waterworks Standards" sets forth the minimum separation requirements for water mains with sanitary and storm sewer lines. These standards, contained in section 64630, title 22, California Administrative Code, specify:

1. Parallel construction: The horizontal distance between pressure water mains and sewer lines shall be at least 10 feet.
2. Perpendicular construction (crossing): Pressure water mains shall be at least one foot above sanitary sewer lines where these lines must cross.
3. Separation distances specified above shall be measured from the nearest edges of the facilities.
4. Water mains and sewer lines must not be installed in the same trench.
5. Water mains and sewers of 24 inches diameter or greater may create special hazards because of the large volumes of flow. Installations of water mains and sewer lines 24 inches diameter or larger must be reviewed and approved by the health agency and city engineer prior to construction.
6. Wherever the word "sewer" is used in connection with any requirements as shown on drawings U-3 & U-4 the word shall apply equally to sanitary or storm sewer installations.

101-1.03 Exceptions to Basic Separation Standards. Local conditions, such as available space, limited slope, existing structures, etc., may create a situation where there is no alternative but to install water mains or sewer lines at a distance less than that required by the basic separation standards. In such cases, alternative construction criteria as specified in section 101-1.04 shall be followed, subject to the special provisions in section 101-1.05.

101-1.04 Alternate Criteria for Construction. The construction criteria for sewer lines or water mains where the basic separation standards cannot be attained are shown on drawings U-3 and U-4. There are two situations encountered:

- Case 1 -- new sewer line -- new or existing water main.
- Case 2 -- new water main -- existing sewer line.

For case 1, the alternate construction criteria apply to the sewer line.

For case 2, the alternate construction criteria may apply to either or both the water main and sewer line.

The construction criteria apply to the house laterals that cross above a pressure water main but not to those house laterals that cross below a pressure water main.

Case 1: New Sewer Being Installed (Drawing U-3).

<u>ZONE</u>	<u>SPECIAL CONSTRUCTION REQUIRED FOR SEWER</u>
A	Sewer lines parallel to water mains shall not be permitted in this zone without approval from the responsible health agency and water supplier.
B	A sewer line placed parallel to a water line shall be constructed of: <ol style="list-style-type: none"> <li>1. Extra strength vitrified clay pipe with compression joints.</li> <li>2. Plastic sewer pipe with rubber ring joints (per ASTM D 3034) or equivalent.</li> <li>3. Cast or ductile iron pipe with compression joints.</li> </ol>



- C A sewer line crossing a water main shall be constructed of:
1. Ductile iron pipe with hot dip bituminous coating and mechanical joints.
  2. A continuous section of class 200 (dr 14 per AWWA C 900) plastic pipe or equivalent, centered over the pipe being crossed.
  3. Any sewer pipe within a continuous sleeve.
- D A sewer line crossing a water main shall be constructed of:
1. A continuous section of ductile iron pipe with hot dip bituminous coating.
  2. A continuous section of class 200 (DR 14 per AWWA C900) plastic pipe or equivalent, centered on the pipe being crossed.
  3. Any sewer pipe within a continuous sleeve.

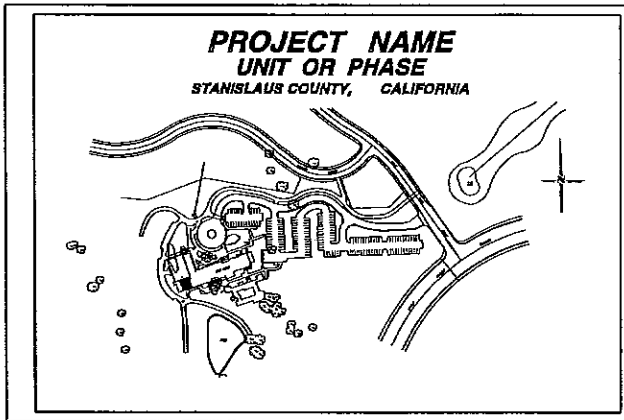
**Case 2: New Water Mains Being Installed (Drawing U-4).**

<u>ZONE</u>	<u>SPECIAL CONSTRUCTION REQUIRED FOR SEWER</u>
A	No water mains parallel to sewers shall be constructed without approval from the health agency.
B	If the sewer paralleling the water main does not meet the case 1, zone b, requirements, the water main shall be constructed of: <ol style="list-style-type: none"> <li>1. Cement lined ductile iron pipe with hot dip bituminous coating.</li> <li>2. Dipped and wrapped one-fourth-inch-thick welded steel pipe.</li> <li>3. Class 200, type II, asbestos-cement pressure pipe.</li> <li>4. Class 200 pressure rated plastic water pipe (dr 14 per AWWA C900) or equivalent.</li> <li>5. Reinforced concrete pressure pipe, steel cylinder type, per AWWA (C300-74 or C301-79 or C303-70).</li> </ol>
C	If the sewer crossing the water main does not meet the case 1, Zone C, requirements, the water main shall have no joints in Zone C and be constructed of: <ol style="list-style-type: none"> <li>1. Cement lined ductile iron pipe with hot dip bituminous coating.</li> <li>2. Class 200 pressure rated plastic water pipe (dr 14 per AWWA C900) or equivalent.</li> <li>3. Reinforced concrete pressure pipe, steel cylinder type, per AWWA (C300-74 or C301-79 or C303-70). Requires specific design approval of pipe and fitting prior to <u>possible</u> use.</li> </ol>
D	If the sewer crossing the water main does not meet the requirements for Zone D, case 1, the water main shall have no joints within four feet from either side of the sewer and shall be constructed of: <ol style="list-style-type: none"> <li>1. Cement lined ductile iron pipe with hot dip bituminous coating.</li> <li>2. Class 200 pressure rated plastic water pipe (dr 14 per AWWA C900) or equivalent.</li> <li>3. Reinforced concrete pressure pipe, steel cylinder type, per AWWA (C300-74 or C301-79 or C303-70). Requires specific design approval of pipe and fitting prior to <u>possible</u> use.</li> </ol>

**101-1.05 Special Provisions.**

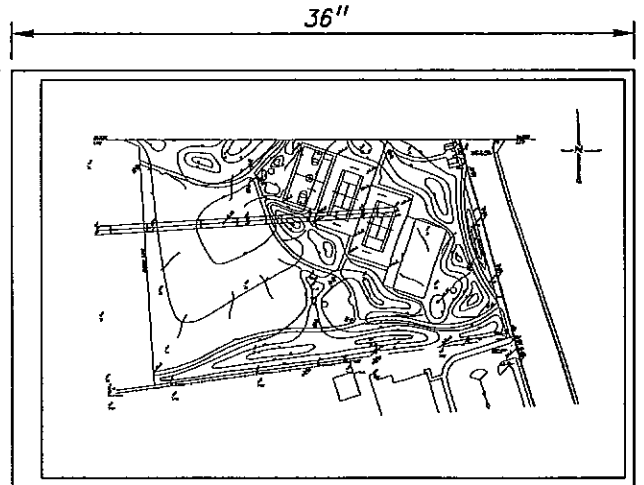
1. The basic separation standards are applicable under normal conditions for sewage collection lines and water distribution mains. More stringent requirements may be necessary if conditions, such as high ground water exist.

2. Sewer lines shall not be installed within 25 feet horizontally of a low head (5 psi or less pressure) water main.
3. New water mains and sewer shall be pressure tested where the conduits are located ten feet apart or less.
4. In the installation of water mains or sewer lines, measures should be taken to prevent or minimize disturbances of the existing line.
5. Special consideration shall be given to the selection of pipe materials if corrosive conditions are likely to exist.
6. Sewer force mains
  - a. Sewer force mains shall not be installed within ten feet (horizontally) of a water main.
  - b. When a sewer force main must cross a water line, the force main should be as close to perpendicular as practical. The sewer force main should be at least one foot below the water line.
  - c. When a new sewer force main crosses under an existing water main, all portions of the sewer force main within ten feet (horizontally) of the water main shall be enclosed in a continuous sleeve.
  - d. When a new water main crosses over an existing sewer force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating.



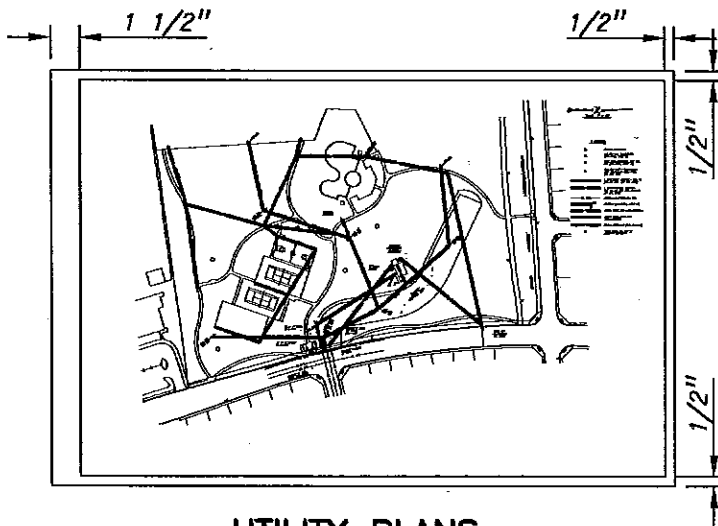
**COVER SHEET**

COVER SHEET SHALL INCLUDE THE PROJECT TITLE AN OVERALL VIEW OF THE PROJECT AND THE UNIT OR PHASE NUMBER, IF APPLICABLE.



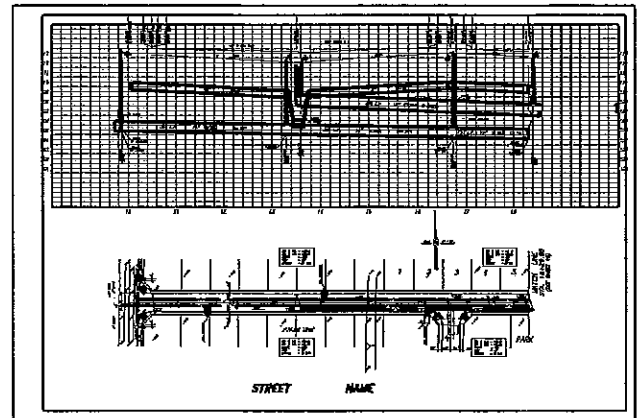
**GRADING PLAN**

GRADING PLAN SHALL INCLUDE STREET CROSS-SECTIONS, PAVEMENT THICKNESS TABLE FOR ALL PAVEMENT WITHIN PROJECT, AS WELL AS TOP OF CURB ELEVATIONS, PAD GRADES, STREET SLOPES AND, WHERE APPLICABLE, RETAINING WALL DETAILS.



**UTILITY PLANS**

UTILITY PLANS SHALL INCLUDE SEWER, WATER AND STORM DRAIN PIPE LENGTHS AND SIZES, RIM AND INVERT ELEVATIONS FOR ALL MANHOLES.



**PLAN AND PROFILES**

PLAN AND PROFILE SHEETS SHALL INCLUDE STATIONS FOR ALL MANHOLES, CATCHBASINS, GRADE BREAKS, CLEANOUTS, BLOW-OFFS, ETC. AND FOR ALL CURB RETURNS, BEGINNINGS AND ENDS OF CURVES, ENDS OF CUL-DE-SACS, MATCH LINES AND SUBDIVISION BOUNDARIES. HORIZONTAL SCALE SHALL BE 1"=20' TO 1"=60'.

THE PLAN SET SHALL INCLUDE A VICINITY MAP, A SHEET INDEX, LIST OF ABBREVIATIONS, LEGEND OF SYMBOLS, GENERAL NOTES, STANDARD DETAILS, TOPOGRAPHY PLAN AND TRAFFIC DRAWINGS (IF REQUIRED).

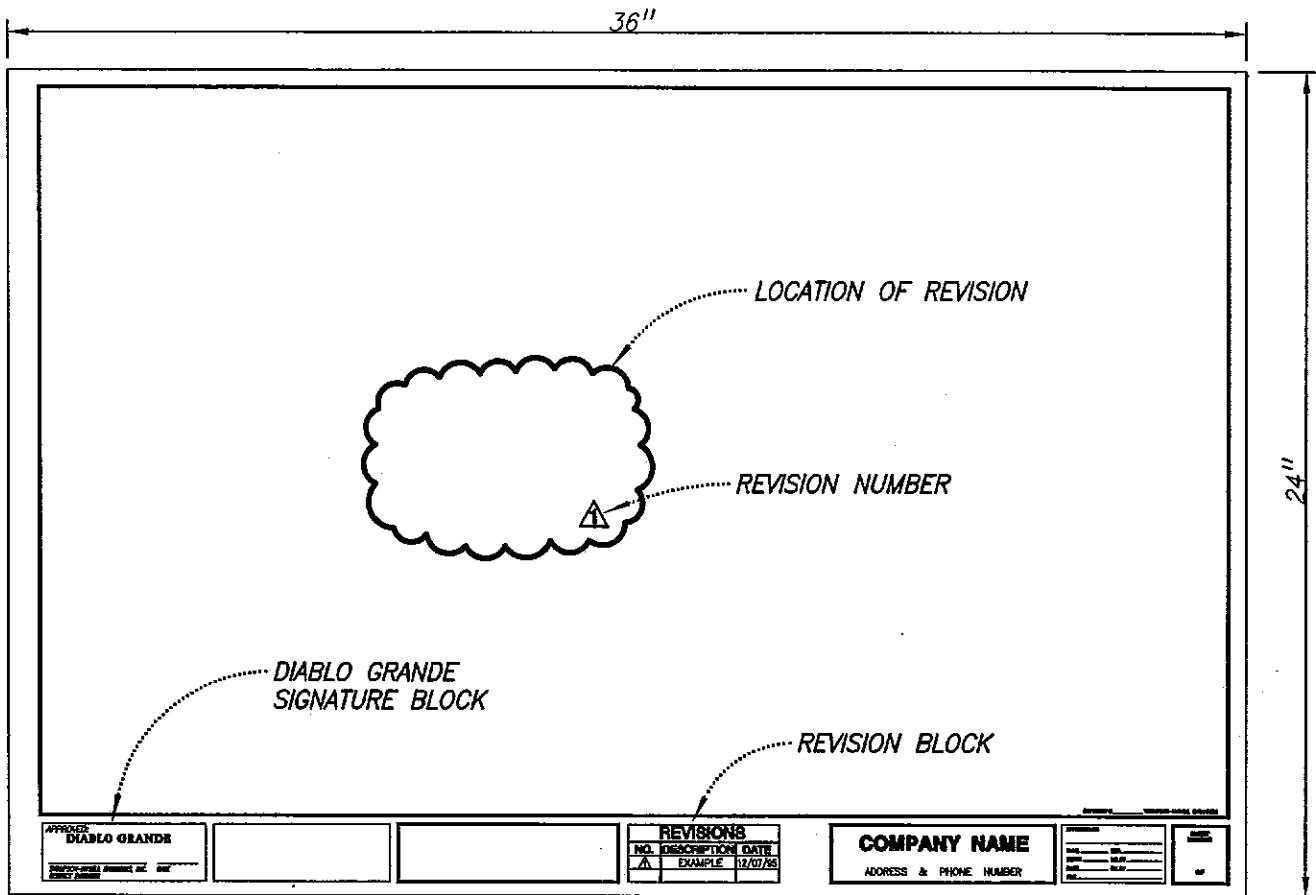
ALL DRAWINGS THAT REQUIRE APPROVAL BY THE WESTERN HILLS WATER DISTRICT SHALL HAVE THE WHWD SIGNATURE BLOCK, AS SHOWN ON STANDARD DRAWING NO. G-5.

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

**TYPICAL LAYOUT FOR IMPROVEMENT PLANS**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:	<i>A. Stanley Thompson</i>
DISTRICT ENGINEER	RCE 32260
THOMPSON-HYSELL ENGINEERS, INC.	
DATE: 01/01/96	<b>G - 1</b>
DRAWING NO.	



**NOTES:**

1. EACH DESIGN REVISION SHALL BE NUMBERED CONSECUTIVELY WITH THE REVISION NUMBER ENCLOSED WITHIN A TRIANGLE AND DESCRIBED IN THE REVISION BLOCK.
2. THE REVISION SHALL BE INDICATED BY A "CLOUD" AND A REVISION TRIANGLE (PER NOTE 1) SHALL BE PLACED WITHIN THE CLOUD TO IDENTIFY THE REVISION.
3. IF THE NUMBER OF REVISIONS IS SUCH THAT THE REVISED DRAWING WOULD BE MADE ILLEGIBLE, A SEPERATE SHEET MAY BE ADDED WITH PRIOR APPROVAL BY THE DISTRICT ENGINEER.

DRAWN BY: D.S.	<h2 style="margin: 0;">DESIGN REVISION FORMAT</h2>	APPROVED BY: <i>Stanley Thompson</i>
CHECKED BY: M.P.		DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
SCALE: NONE		DATE: 01/01/96
REVISED	BY	DRAWING NO. <b>G - 2</b>
<b>Diablo Grande</b> STANISLAUS COUNTY, CALIFORNIA		

⊙	AT	ECR	END OF CURB RETURN	NC	NORMALLY CLOSED
±	PLUS OR MINUS (NOT EXACT)	EFF	EFFLUENT	NO	NORMALLY OPEN; NUMBER
CL	CENTERLINE	EL OR ELEV	ELEVATION	NOM	NOMINAL
FL	FLOWLINE	ELECT	ELECTRICAL	NTS	NOT TO SCALE
PL	PROPERTY LINE	EOL	END OF LINE	OC	ON CENTER
Φ	DIAMETER	EP	EDGE OF PAVEMENT	OD	OUTSIDE DIAMETER
⊘	SQUARE FEET	EQ	EQUAL	OG	ORIGINAL GROUND / GRADE
#	POUND; NUMBER	ERV	EXPLOSION RELIEF VALVE	OH	OVERHEAD
AB	AGGREGATE BASE	ESMT	EASEMENT	OPP	OPPOSITE
AC	ASPHALT CONCRETE	EVC	END OF VERTICAL CURVE	PC	PORTLAND CEMENT
A/C	AIR CONDITIONING	EX OR EXIST	EXISTING	PCC	POINT OF COMPOUND CURVATURE
ACP	ASBESTOS CEMENT PIPE	EXP	EXPANSION	PI	POINT OF INTERSECTION
AD	ADDENDUM	EXP JT	EXPANSION JOINT	PL	PROPERTY LINE
ADH	ADHESIVE	EXT	EXTERIOR; EXTENSION	PP	POWER POLE
ADJ	ADJUSTABLE	FA	FLAME ARRESTOR	PRC	POINT OF REVERSE CURVATURE
ADPT	ADAPTER	FAB	FABRICATED	PRI	PRIMARY
AGG	AGGREGATE	FC	FLEXIBLE COUPLING	PRV	PRESSURE REDUCING VALVE
AH	AHEAD	FH	FIRE HYDRANT	PSI	POUNDS PER SQUARE INCH
ALT	ALTERNATE; ALTERNATIVE	FLEX	FLEXIBLE	PT	POINT
APPROX	APPROXIMATE	FLR	FLOOR	PUE	PUBLIC UTILITY EASEMENT
ARCH	ARCHITECTURAL	FM	FORCE MAIN	PVC	POLYVINYL CHLORIDE PIPE
ARV	AIR RELEASE VALVE	FPM	FEET PER MINUTE	PW	POTABLE WATER
ASB	AGGREGATE SUB-BASE	FPS	FEET PER SECOND	R	RADIUS
ASSY	ASSEMBLY	FT	FEET	RCP	REINFORCED CONCRETE PIPE
AUTO	AUTOMATIC	FTG	FOOTING	REF	REFERENCE
AUX	AUXILIARY	G	GAS	REQD	REQUIRED
BC	BEGINNING OF CURVE	GA	GAUGE OR GAGE	RET	RETURN
BCR	BEGIN CURB RETURN	GAL	GALLONS	RPM	REVOLUTIONS PER MINUTE
BD	BOARD	GALV	GALVANIZED	RR	RAILROAD
BDRY	BOUNDARY	GB	GRADE BREAK	RT	RIGHT
BK	BACK	GEN	GENERAL	RV	RESISTANCE VALUE
BKT	BRACKET	GI	GALVANIZED IRON	R/W	RIGHT-OF-WAY
BLDG	BUILDING	GND	GROUND	S OR SS	SANITARY SEWER
BLK	BLOCK	GPD	GALLONS PER DAY	SCH	SCHEDULE
BLV	BALL VALVE	GPM	GALLONS PER MINUTE	SCL	STEEL CEMENT LINED PIPE
BM	BENCHMARK	GR	GRADE	SCLC	STEEL CEMENT LINED & COATED PIPE
BO	BLOWOFF; BOTTOM OF	GSP	GALVANIZED STEEL PIPE	SD OR D	STORM DRAIN
BOT	BOTTOM	HDR	HEADER	SEC	SECONDARY
BPR	BACK PRESSURE REGULATOR	HORIZ	HORIZONTAL	SECT	SECTION
BRG	BEARING	HP	HIGH POINT	SED	SEDIMENTATION
BSL	BUILDING SETBACK LINE	HVAC	HEATING, VENTILATING AND	SHT	SHEET
BTU	BRITISH THERMAL UNIT	HW	HOT WATER	SNS	STREET NAME SIGN
BV	BUTTERFLY VALVE	HWL	HIGH WATER LEVEL	SPEC	SPECIFICATIONS
BVC	BEGINNING OF VERTICAL CURVE	ID	INSIDE DIAMETER	SQ	SQUARE
C & G	CURB AND GUTTER	IN	INCH	STA	STATION
CAP	CAPACITY	IND	INDUSTRIAL	STD	STANDARD
CB	CATCH BASIN	IND	INDUSTRIAL	STRUCT	STRUCTURAL
CF	CUBIC FEET	INSUL	INSULATED; INSULATION	SUPP	SUPPORT
CFM	CUBIC FEET PER MINUTE	INSTR	INSTRUMENTATION	SURF	SURFACE
CFS	CUBIC FEET PER SECOND	INT	INTERIOR, INTERNAL	SUSP	SUSPENDED
CIP	CAST IRON PIPE	INV	INVERT	SV	SHUTOFF VALVE
CIPC	CAST IN PLACE CONCRETE PIPE	IRR	IRRIGATION	S/W	SIDEWALK
CIR	CIRCLE	ISBM	IMPORTED SUB-BASE MATERIAL	SYM	SYMMETRICAL
CJ	CONSTRUCTION JOINT	JB	JUNCTION BOX	SYS	SYSTEM
CLR	CLEAR; CLEARANCE	JT	JOINT	T	TELEPHONE
CMP	CORRUGATED METAL PIPE	L	LENGTH	TAN	TANGENT
CMU	CONCRETE MASONRY UNIT	LB	POUND	TC	TOP OF CURB
CO	CLEAN OUT	L.F.	LINEAL FEET OR LINEAR FEET	TEMP	TEMPORARY
CONC	CONCRETE	LIN	LINEAR; LINEAL	THRU	THROUGH
COND	CONDUIT	LP	LOW POINT	TI	TRAFFIC INDEX
CONN	CONNECTION	MAN	MANUAL	TOW	TOP OF WALL
CONST	CONSTRUCTION	MAX	MAXIMUM	TPE	TREE PLANTING EASEMENT
CORR	CORRUGATED	MECH	MECHANICAL	TRANS	TRANSFORMER
CP	CONTROL PANEL	MEMB	MEMBRANE	TYP	TYPICAL
CRS	COURSE	MET	METAL	V	VENT
CTR	CENTER	MFR	MANUFACTURER	VAC	VACUUM
CV	CHECK VALVE	MG	MILLION GALLONS	VAR	VARIABLES
CW	COLD WATER	MGD	MILLION GALLONS PER DAY	VB	VALVE BOX
CY	CUBIC YARD	MH	MANHOLE	VC	VERTICAL CURVE
D OR SD	STORM DRAIN	MIN	MINIMUM	VCP	VITRIFIED CLAY PIPE
DET	DETAIL	MISC	MISCELLANEOUS	VERT	VERTICAL
DIA	DIAMETER	MJ	MECHANICAL JOINT	W	WATER
DIM	DIMENSION	ML	MATCH LINE	W/	WITH
DIP	DUCTILE IRON PIPE	MTR	MOTOR; MITER	W/O	WITHOUT
DN	DOWN	N	NORTH	WP	WATERPROOF; WATERPROOFING
DW	DRIVEWAY	NA	NOT APPLICABLE	WS	WATER SUPPLY; WATER SURFACE
DWG	DRAWING			WT	WEIGHT
EA	EACH				
EC	END OF CURVE				

DRAWN BY:	D.S.
CHECKED BY:	M.P.
SCALE:	NONE
REVISED	BY

## STANDARD ABBREVIATIONS

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:	<i>A. Stanley Thompson</i>
DISTRICT ENGINEER	RCE 31260
THOMPSON-HYSELL ENGINEERS, INC.	
DATE:	01/01/96
DRAWING NO.	<b>G - 3</b>

1. ALL IMPROVEMENT PLANS, CONSTRUCTION DRAWINGS AND ALL MAPS AND PLATS SUBMITTED TO THE WESTERN HILLS WATER DISTRICT ENGINEER FOR CONSIDERATION SHALL CONFORM TO AND BE PREPARED IN CONFORMANCE WITH THE ENCLOSED STANDARDS.
2. TITLE BLOCK AND OTHER RELATED LETTERING SHALL BE IN ACCORDANCE WITH STANDARD ACCEPTED ENGINEERING PRACTICE.

### TYPICAL IMPROVEMENT PLAN LEGEND

LEGEND		
EXISTING	PROPOSED	DESCRIPTION
		SUBDIVISION BOUNDARY
		LOT LINE
		CENTERLINE
		CURB, GUTTER AND SIDEWALK
		STORM DRAIN LINE
		SANITARY SEWER LINE
		WATER LINE
		IRRIGATION LINE
		CATCH BASIN
		MANHOLE
		CLEANOUT
		FIRE HYDRANT
		BLOW OFF
		WATER VALVE
		ELECTROLIER
		SURVEY MONUMENT
		MONUMENT IN MONUMENT WELL
		STOP SIGN WITH STREET NAMES
		SIGN
		SEWER LATERAL
		WATER LATERAL
		DRIVEWAY
		FENCE
		MASONRY WALL
		VALLEY GUTTER
		CURB RETURN W/ HANDICAP RAMP

DRAWN BY: D.S.	<b>DRAFTING STANDARDS</b>	APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
CHECKED BY: M.P.		DATE: 01/01/96
SCALE: NONE		DRAWING NO. <b>G - 4</b>
REVISED	BY	<b>Western Hills Water District</b> STANISLAUS COUNTY, CALIFORNIA

5"

**APPROVED:**  
**Western Hills Water District**

\_\_\_\_\_      \_\_\_\_\_  
 THOMPSON-HYSELL ENGINEERS, INC.      DATE  
 DISTRICT ENGINEER

1 5/8"

**NOTES:**

1. EACH SHEET SHALL BE SIGNED BY A REGISTERED CIVIL ENGINEER.
2. SIGNATURE BLOCK SHALL BE LOCATED ON ALL SHEETS THAT SHOW DESIGN FEATURES WHICH MUST BE APPROVED BY THE DISTRICT ENGINEER.

DRAWN BY: D.S.	<b>WESTERN HILLS WATER DISTRICT SIGNATURE BLOCK</b>	CHECKED BY: M.P.	APPROVED BY: <i>W. Stanley Thompson</i>	
SCALE: NONE		DISTRICT ENGINEER	RCE 32260	
		THOMPSON-HYSELL ENGINEERS, INC.		
REVISED	BY	<b>Western Hills Water District</b>	DATE: 01/01/96	<b>G - 5</b>
		STANISLAUS COUNTY, CALIFORNIA	DRAWING NO.	

**PEAK FACTOR:**

FOR AVG. FLOW < 0.5 MGD                      PF = 2.29 (AVG. FLOW) <sup>- 0.338</sup>  
 FOR 0.5 MGD < AVG. FLOW < 1.8 MGD      PF = 2.50 (AVG. FLOW) <sup>- 0.216</sup>  
 FOR AVG. FLOW > 1.8 MGD                    PF = 2.37 (AVG. FLOW) <sup>- 0.124</sup>

**NOTE:**

USE ABOVE VALUES OR REFER TO PEAKING FACTOR CHART ON STD. DWG. S-2.

**AVERAGE FLOW:**

**PLANNING VALUES**

**DESIGN VALUES**

	GAL/DAY/ACRE	GAL/DAY/UNIT	GAL/DAY/1000 S.F.
<b>RESIDENTIAL</b>			
SINGLE FAMILY	2100	300	---
MULTI FAMILY	6800	270	---
PURD	3700	270	---
<b>COMMERCIAL</b>			
OFFICE	2400	---	90
RETAIL	2000	---	80
EATING AND DRINKING	8600	---	500
WHOLESALE, STORAGE	800	---	40
<b>INDUSTRIAL</b>			
FOOD PROCESSING		SPECIAL CASE	
LIGHT	3000	---	150
HEAVY (LOW WASTEWATER)	3000	---	150
HEAVY (HIGH WASTEWATER)		SPECIAL CASE	
<b>SCHOOLS</b>			
PRIMARY	1800	---	340
SECONDARY	1400	---	310

**INFLOW/INFILTRATION(I/I):**

400 GALS/DAY/ACRE

**DESIGN FLOW:**

(AVERAGE FLOW + I/I ) PEAK FACTOR

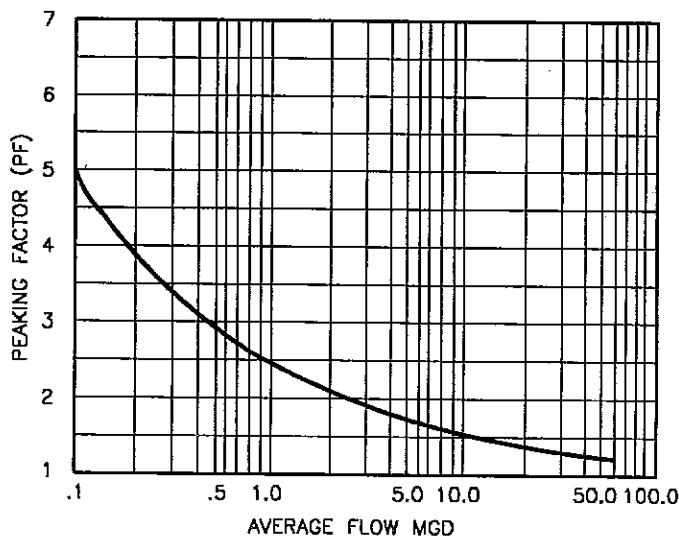
DRAWN BY: D.S.	<b>SANITARY SEWER DESIGN DATA</b>	APPROVED BY:
CHECKED BY: M.P.		<i>H. Stanley Thompson</i>
SCALE: NONE		DISTRICT ENGINEER RCE #2260 THOMPSON-HYSELL ENGINEERS, INC.
REVISED	BY	DATE: 01/01/96
	Western Hills Water District STANISLAUS COUNTY, CALIFORNIA	DRAWING NO. <b>S-1</b>



**NOTES:**

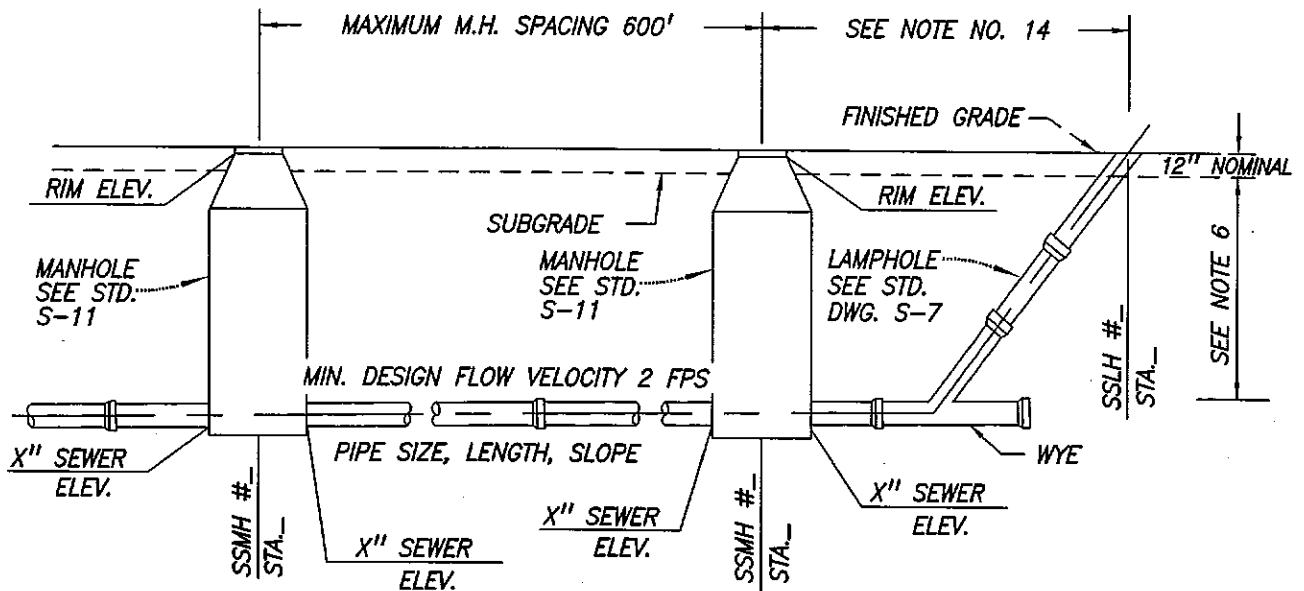
1. PIPE SHALL BE DESIGNED TO HAVE A MIN. VELOCITY OF 2 FPS AT DESIGN FLOW. ON END RUNS AND PIPE RUNS WITH LOW FLOWS SPECIAL ARRANGEMENTS SHALL BE MADE WITH THE DISTRICT ENGINEER TO ALLOW PIPE SIZES THAT FLOW LESS THAN 2 FPS.
2. PUMPING STATIONS SHALL CONFORM TO THE FOLLOWING:
  - A. PUMPING CAPACITY TO HANDLE DESIGN FLOW WITH THE LARGEST PUMP OUT OF SERVICE. THIS SHALL BE DONE BY PROVIDING A REDUNDANT PUMP.
  - B. MULTIPLE PUMPS OF EQUAL CAPACITY.
  - C. AT LEAST 3 PUMPS FOR FLOW GREATER THAN 0.5 MGD OR 2 PUMPS FOR FLOW LESS THAN 0.5 MGD.
  - D. PUMPING STATIONS SHALL BE EQUIPPED WITH:
    - 1) TELEMETRY EQUIPMENT CAPABLE OF TRANSMITTING VARIOUS ALARM CONDITIONS SUCH AS HIGH AND LOW SUMP, FLOODED DRY WELL, PUMP OR POWER FAILURE, TO A CENTRAL DISPATCH LOCATION.
    - 2) STANDBY POWER GENERATING EQUIPMENT SIZED TO OPERATE ALL PUMP STATION EQUIPMENT EXCEPT THE REDUNDANT PUMP, UNLESS IT CAN BE SHOWN THAT A SUSTAINED FAILURE WILL NOT CAUSE OVERFLOW OR FLOODING.
    - 3) FLOW MONITORING EQUIPMENT WITH A METER IN THE DISCHARGE LINE, PUMP RUNNING TIME RECORDERS WITH SUMP LEVEL RECORDERS, OR OTHER APPROVED METHODS. ALSO, PROVISION SHALL BE MADE FOR FACILITATING INSTALLATION OF PORTABLE GRAVITY FLOW METERS IN INFLOW METERS.
    - 4) EQUIPMENT AS NECESSARY (VENTILATION, FALL PROTECTION, ETC.) TO CONFORM TO OSHA AND OTHER PERTINENT REGULATORY AGENCY REGULATIONS.
  - E. NON-CLOG TYPE PUMPS DESIGNED FOR SANITARY SEWAGE PUMPING.
  - F. FORCE MAINS SIZED TO LIMIT VELOCITIES TO AROUND 7 FPS FOR UP TO 300 FT. IN LENGTH, TO AROUND 5 FPS FOR LENGTHS IN EXCESS OF 1000 FT. THESE VALUES ARE APPROXIMATE, AND FINAL DESIGN SHOULD BE BASED UPON ANALYSIS OF A SYSTEM HEAD CURVE BASED UPON COMMERCIALY AVAILABLE PUMPS AND PIPE DIAMETERS.

**PEAKING FACTOR CHART**



DRAWN BY: D.S.	<b>SANITARY SEWER DESIGN DATA</b>	APPROVED BY: <i>W. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	
CHECKED BY: M.P.		RCE 322.60	
SCALE: NONE		DATE: 01/01/96	
REVISED	BY	Western Hills Water District STANISLAUS COUNTY, CALIFORNIA	DRAWING NO. <b>S-2</b>





**NOTES:**

1. THE MINIMUM SIZE PIPE SHALL BE 6" DIAMETER.
2. A MANHOLE SHALL BE INSTALLED AT ALL INTERSECTING STREETS AND/OR LINES WITH INTERMEDIATE MANHOLES UNIFORMLY SPACED.
3. ALL CONNECTIONS TO SANITARY SEWERS SHALL BE MADE WITH 'Y' OR 'T'. THE DISTRICT SHALL INSTALL A 'T' SADDLE AT OWNER'S/DEVELOPER'S EXPENSE ON EXISTING LINES.
4. THE DISTRICT ENGINEER SHALL BE SUPPLIED WITH A RECORD DRAWING PLAN SHOWING LATERAL LOCATIONS BY THE ARCHITECT OR PROJECT ENGINEER.
5. 8" DIAMETER PIPE ON A SLOPE OF 0.006 FT/FT MINIMUM ON ENDS OF RUNS UP TO 15 CONNECTIONS.
6. SANITARY SEWERS AND SEWER LATERALS SHALL BE DESIGNED TO MINIMIZE THEIR DEPTH AT ALL LOCATIONS. MINIMUM COVER FOR SANITARY SEWERS SHALL BE 4'-6" FROM THE FINISHED GRADE TO THE TOP OF THE PIPE. MINIMUM COVER FOR SEWER LATERALS SHALL BE 4'-0" FROM THE FINISHED GRADE AT BACK OF WALK TO THE TOP OF THE LATERAL. IN RESIDENTIAL AREAS, THE DEPTH OF THE SEWER LATERAL, FROM THE FINISHED GRADE AT BACK OF WALK TO TOP OF LATERAL SHALL BE NO GREATER THAN 7' AT THE PROPERTY LINE. WHERE MINIMUM COVER CANNOT BE OBTAINED, DUCTILE IRON PIPE SHALL BE USED. CONCRETE ENCASEMENT MAY BE USED IN CERTAIN AREAS ONLY IF APPROVED BY THE DISTRICT ENGINEER. SEE STANDARD DRAWING S-13.
7. CUT SHEETS SHALL BE SUPPLIED TO THE DISTRICT ENGINEER PRIOR TO THE CONSTRUCTION OF SANITARY SEWER.
8. ALL SEWERS MUST BE DESIGNED FOR GRAVITY FLOW UNLESS OTHERWISE PERMITTED BY SPECIAL APPROVAL OF THE DISTRICT ENGINEER. THE DISTRICT REQUIRES MATCHING OF TOPS OF PIPES (CROWNS) RATHER THAN INVERTS UNLESS AN ALTERNATE DESIGN IS APPROVED BY THE DISTRICT ENGINEER AT THE TENTATIVE MAP OR MASTER PLAN STAGE.
9. PIPES SHALL BE DESIGNED FOR ACTUAL FLOWS WITH A MINIMUM 2 FPS FLOWRATE.
10. PIPES AND STRUCTURES SHALL BE LABELED WITH STATIONS AND ELEVATIONS AS SHOWN ABOVE.
11. A SEWER DESIGN SHEET (STD. DWG. S-3) SHALL BE SUBMITTED WITH ALL PROJECT DESIGNS.
12. MANNINGS "n" FACTOR SHALL NOT BE LESS THAN 0.011 FOR PVC AND HDPE PIPE, OR LESS THAN 0.013 FOR OTHER PIPE MATERIALS. THE FOLLOWING SLOPES SHALL BE USED AS MINIMUMS:

PIPE SIZE	MIN. SLOPE ( <i>n</i> = 0.013)	MIN. SLOPE ( <i>n</i> = 0.011)
6" DIA.	.0070 FT/FT	.0050 FT/FT
8" DIA.	.0045 FT/FT	.0032 FT/FT
10" DIA.	.0025 FT/FT	.0018 FT/FT
12" DIA.	.0020 FT/FT	.0014 FT/FT
15" DIA.	.0015 FT/FT	.0011 FT/FT
18" DIA.	.0012 FT/FT	.0009 FT/FT

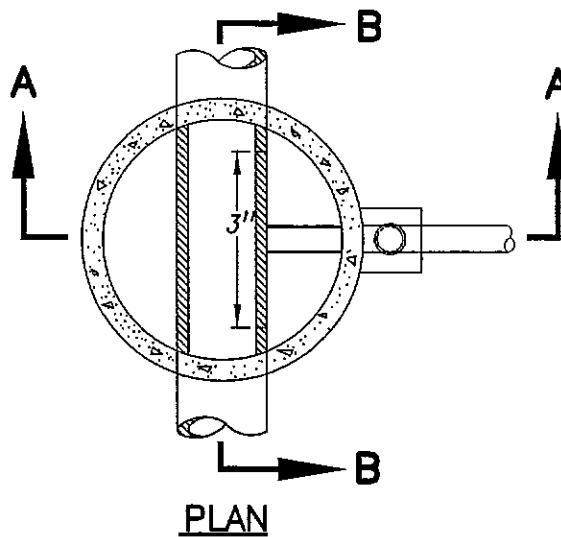
13. MAX. 150' LAMPHOLE SPACING. FOR USE ON SHORT RUNS OF PIPE THAT WILL BE EXTENDED AND A MANHOLE INSTALLED AT A LATER DATE.
14. SANITARY SEWER LATERAL DEPTH IN RESIDENTIAL AREAS SHALL NOT EXCEED 12' FROM THE FINISHED GRADE TO THE POINT OF CONNECTION AT THE SEWER LINE.
15. NO DIRECT SERVICE TAPS SHALL BE ALLOWED ON SEWER MAINS 15" AND LARGER.
16. FOR SANITARY SEWER SERVICE CONNECTIONS TO MANHOLES, NO MORE THAN 1 SHALL BE ALLOWED PER QUADRANT. (i.e IN ANY 1/4 OF THE PERIMETER).

DRAWN BY: D.S.  
 CHECKED BY: M.P.  
 SCALE: NONE  
 REVISED BY  
 03/08/02 rk

**SANITARY SEWER  
 DATA**

**Western Hills Water District**  
 STANISLAUS COUNTY, CALIFORNIA

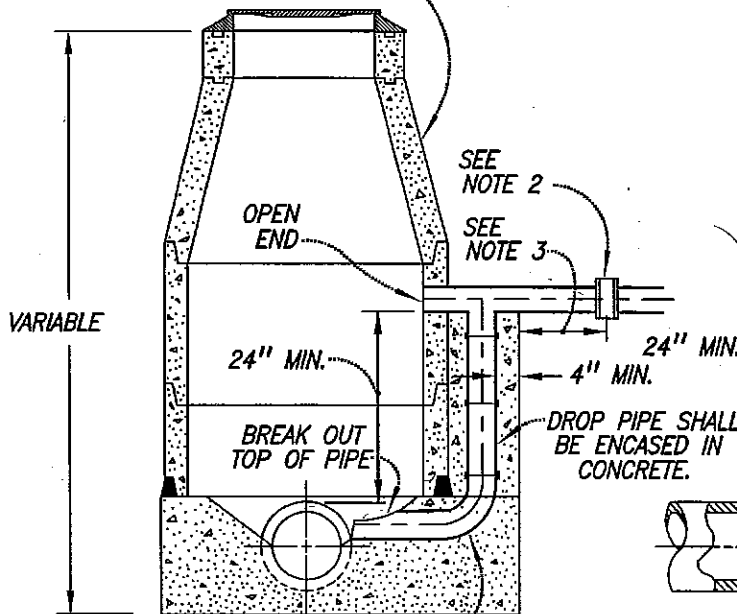
APPROVED BY: *Stanley Thompson*  
 DISTRICT ENGINEER  
 THOMPSON-HYSSELL ENGINEERS, INC.  
 DATE: 01/01/96  
 DRAWING NO. **S - 4**



PLAN

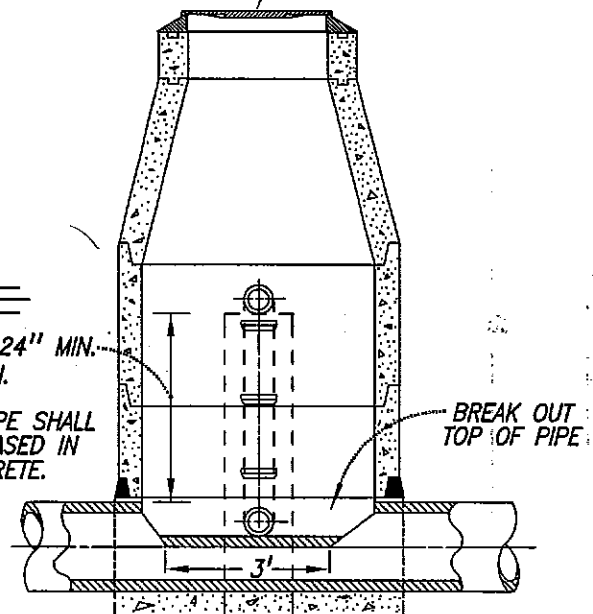
STANDARD CONCENTRIC CONE  
MANHOLE - PER STD DRAWING  
S-11

STANDARD FRAME AND COVER  
- PER STD DRAWING S-10



SMOOTH 1/4 RAD. BEND

SECTION A-A



SECTION B-B

**NOTES:**

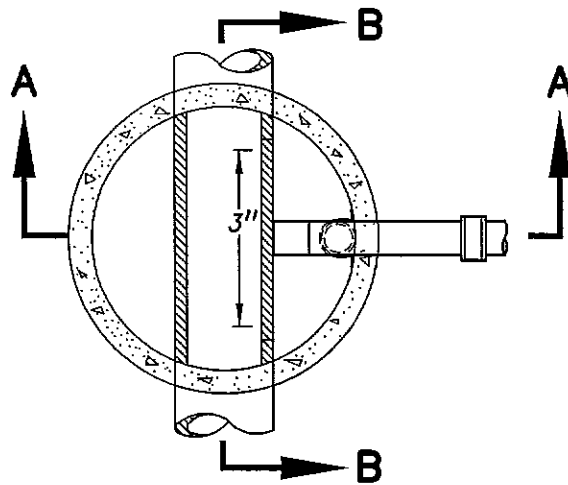
1. THIS INSTALLATION SHALL BE USED ON NEW MANHOLES ONLY WHERE THE DIFFERENCE IN ELEVATION BETWEEN THE TOP OF THE OUTLET PIPE AND THE INVERT OF THE FEEDER OR COLLECTOR SEWER EXCEEDS 24".
2. FLEXIBLE JOINT - BELL AND SPIGOT OR CAULDER COUPLING. SOLVENT WELDED JOINT NOT PERMITTED.
3. 12" MAX. FOR 8" TO 12" OR LARGER PIPE. 24" MAX. FOR PIPES LESS THAN 8".
4. THIS DETAIL SHALL ONLY BE USED FOR DROP PIPES 12" OR LESS. LARGER PIPES REQUIRE INDIVIDUAL DESIGN AND APPROVAL BY THE DISTRICT ENGINEER.
5. DROP MANHOLES FOR PIPES GREATER THAN 12" SHALL BE DESIGNED ON A CASE BY CASE BASIS.
6. INTERIOR OF MANHOLE TO BE COATED IN ACCORDANCE WITH SECTION 71-1.09 OF THE STANDARD SPECIFICATIONS.

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
03/08/02	rk

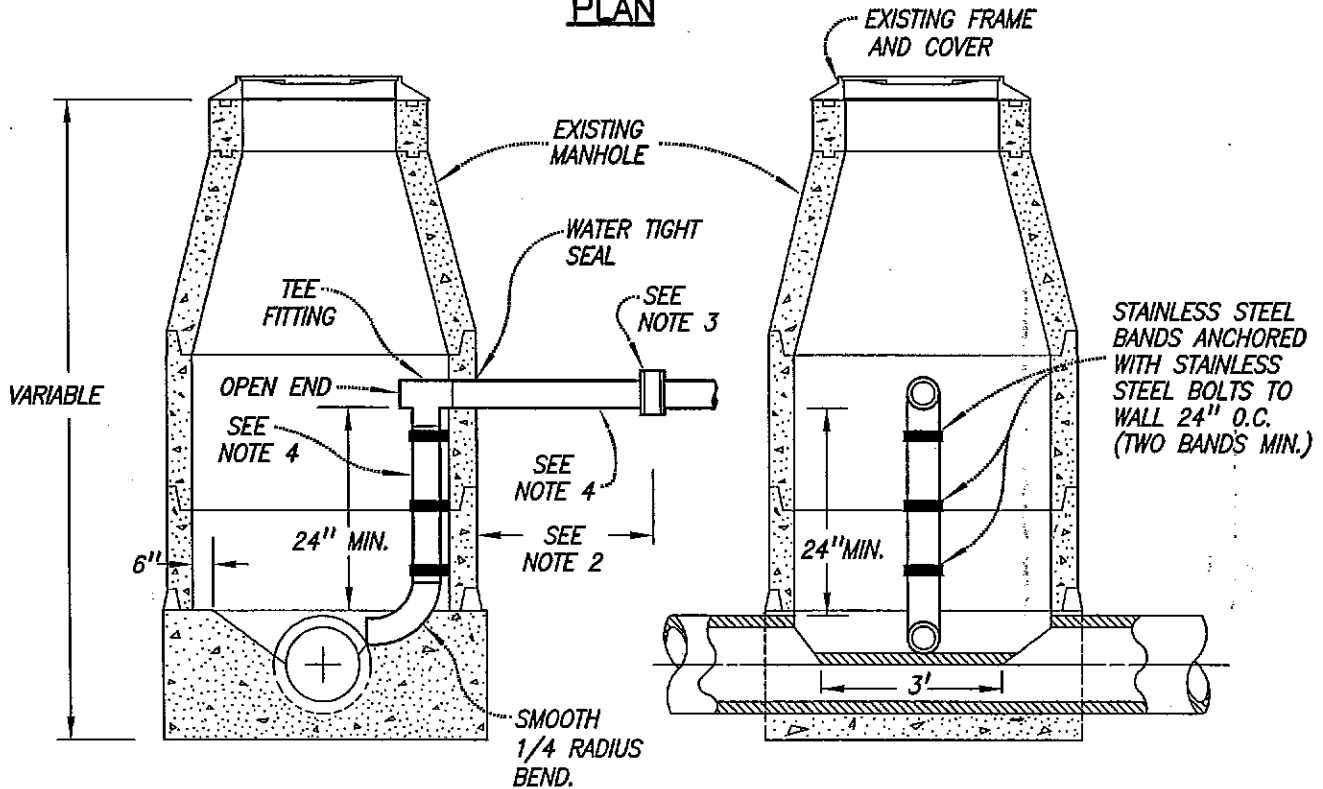
**SANITARY SEWER DROP  
IN NEW MANHOLE**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>S-5</b>



PLAN



SECTION A-A

SECTION B-B

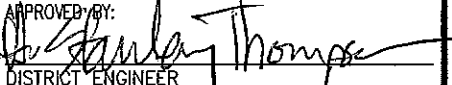
**NOTES:**

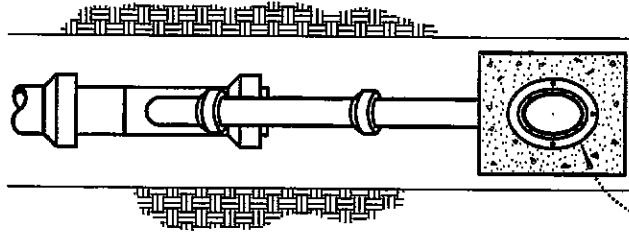
1. THIS INSTALLATION SHALL BE USED ON EXISTING MANHOLE ONLY WHERE THE DIFFERENCE IN ELEVATION BETWEEN THE TOP OF THE OUTLET PIPE AND THE INVERT OF THE FEEDER OR COLLECTOR SEWER EXCEEDS 24".
2. 12" MAX. FOR 8" OR LARGER PIPE. 24" MAX FOR PIPES LESS THAN 8".
3. FLEXIBLE JOINT - BELL & SPIGOT OR CAULDER COUPLING. SOLVENT WELDED JOINT NOT PERMITTED.
4. FOR USE WITH NEW SANITARY SEWER PIPE ONLY, 12" MAX. PIPES LARGER THAN 12" SHALL HAVE SEPARATE APPROVAL OF THE DISTRICT ENGINEER. P.V.C. OR A.B.S. PIPE MUST BE USED INSIDE MANHOLE.
5. INTERIOR OF MANHOLE TO BE COATED IN ACCORDANCE WITH SECTION 71-1.09 OF THE STANDARD SPECIFICATIONS.

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
03/08/02	rk

## SANITARY SEWER DROP IN EXISTING MANHOLE

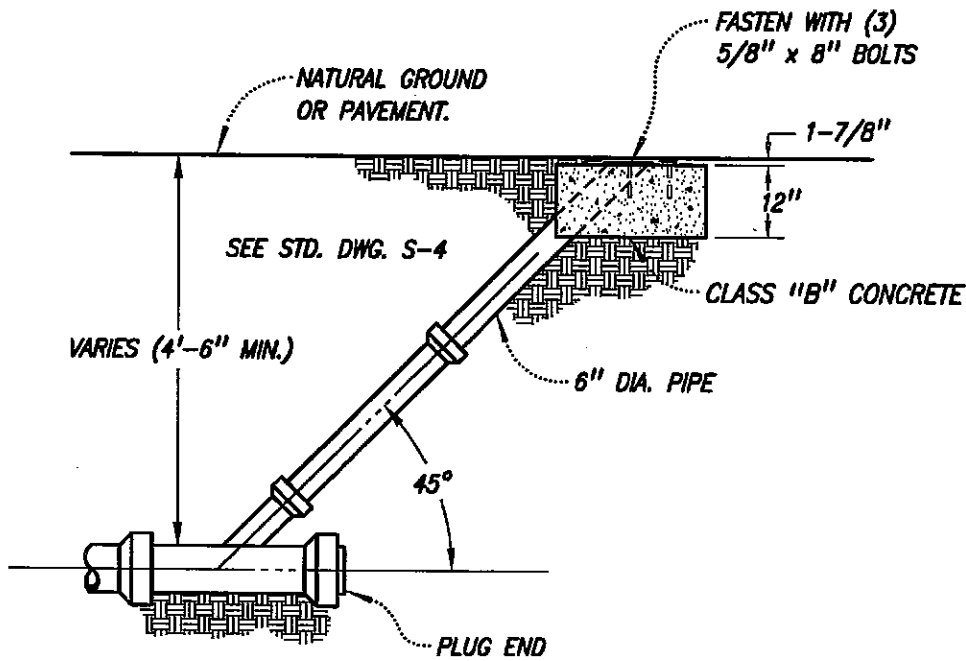
**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:	
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	
DATE: 01/01/96	<b>S - 6</b>
DRAWING NO.	

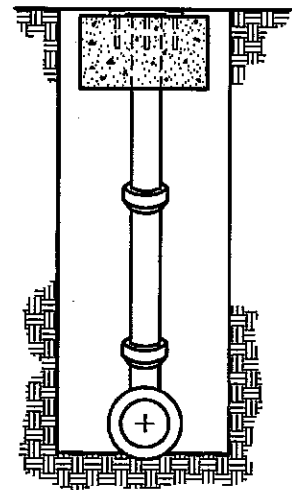


SEE STANDARD DRAWING S-8  
FOR RING AND COVER DETAIL.

**PLAN VIEW**



**ELEVATION**

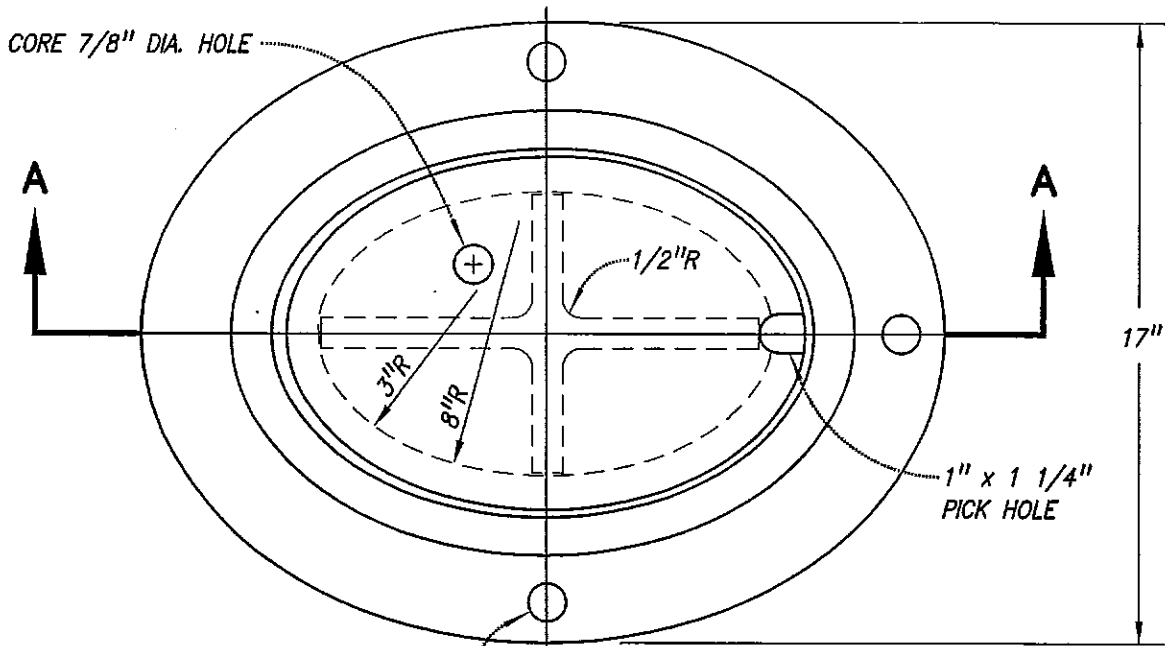


**END VIEW**

**NOTE:**

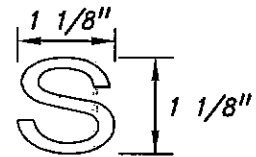
INSTALL LAMP HOLE AT END OF SANITARY TRUNK LINES BUT ONLY AFTER APPROVAL BY THE DISTRICT ENGINEER..

DRAWN BY: D.S.	<b>LAMP HOLE</b>	APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
CHECKED BY: M.P.		RCE 32260
SCALE: NONE		DATE: 01/01/96
REVISD	BY	DRAWING NO. <b>S-7</b>
Western Hills Water District STANISLAUS COUNTY, CALIFORNIA		

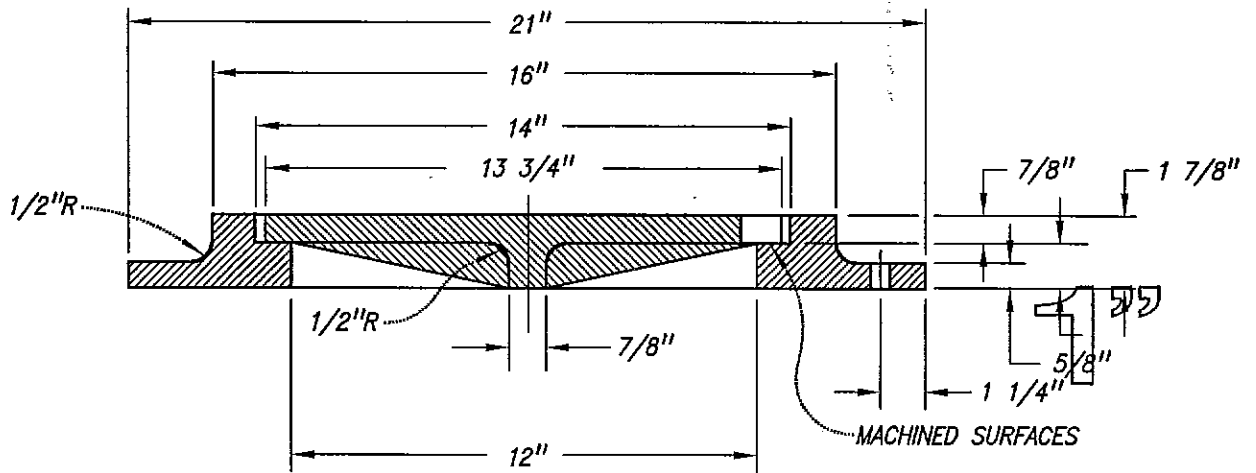


CORE (3) HOLES FOR 5/8" DIA. ANCHOR BOLTS

**PLAN**



LETTER "S" PLACED AT CENTER OF COVER

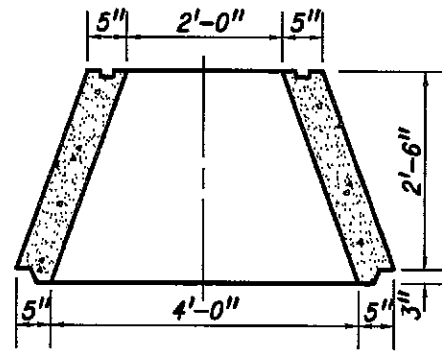
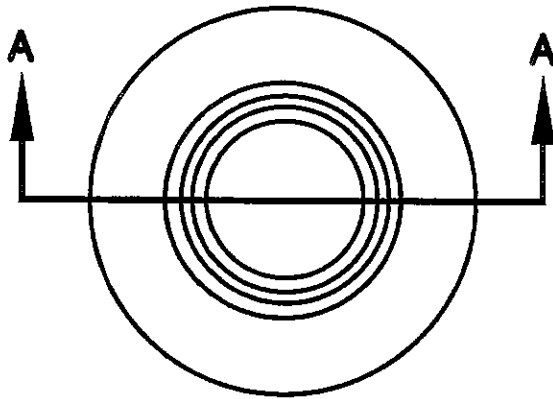


**SECTION A-A**

**NOTE:**

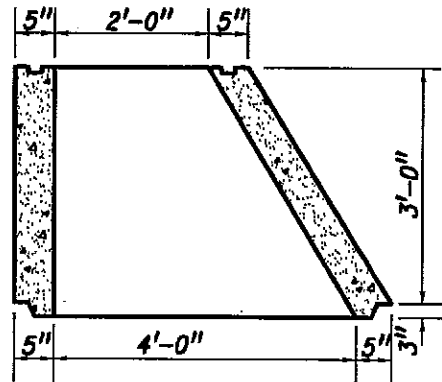
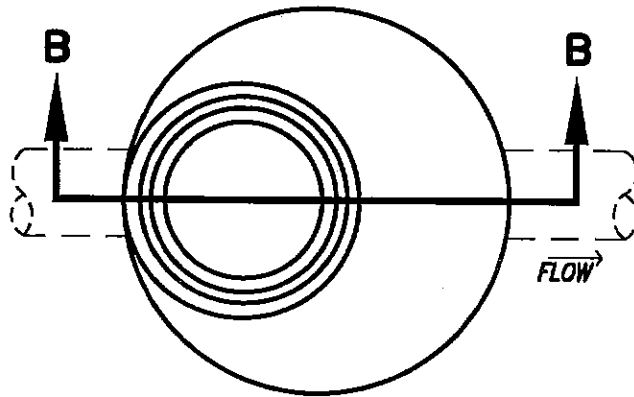
- LAMPHOLE RING AND COVER TO BE "CALIFORNIA CONCRETE PIPE" A-142 ASSEMBLY.

DRAWN BY: D.S. CHECKED BY: M.P. SCALE: NONE	<h2>LAMPHOLE RING AND COVER</h2> <p>Western Hills Water District          STANISLAUS COUNTY, CALIFORNIA</p>	APPROVED BY: <i>Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
REVISED BY 03/08/02 rk		DATE: 01/01/96 DRAWING NO. <b>S-8</b>



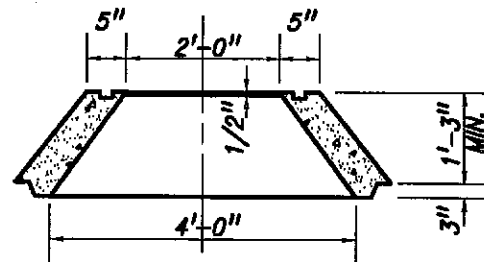
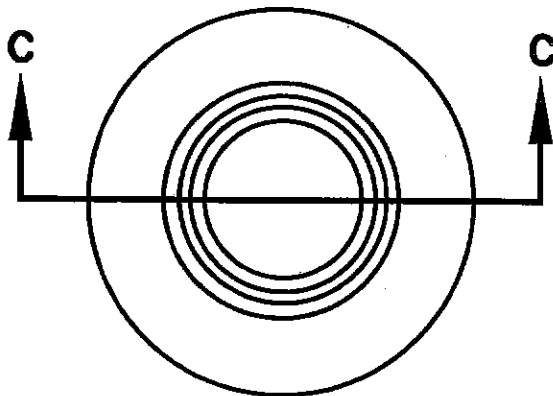
**SECTION A-A**

**CONCENTRIC CONE**  
(STANDARD INSTALLATION)



**SECTION B-B**

**ECCENTRIC CONE**  
(USE WITH PRIOR APPROVAL ONLY)



**SECTION C-C**

**CONCENTRIC SHORT CONE**  
(USE WITH PRIOR APPROVAL ONLY)

**NOTES:**

1. INTERIOR OF CONE TO BE COATED IN ACCORDANCE SECTION 71-1.09 OF THE STANDARD SPECIFICATIONS.
2. ALL HANDLING HOLES SHALL BE PLUGGED WITH CONCRETE MORTAR AFTER CONE INSTALLATION.

DRAWN BY: D.S. CHECKED BY: M.P. SCALE: NONE	<b>PRE - CAST CONCRETE MANHOLE CONES</b>	APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
REVISED BY:		DATE: 01/01/96 DRAWING NO.
<b>Western Hills Water District</b> STANISLAUS COUNTY, CALIFORNIA		<b>S - 9</b>



2" HIGH LETTERS AS SPECIFIED TO BE LOCATED IN THIS AREA. (SEE NOTE 5)

CAST IRON SKID RESISTANT COVER

CAST IRON FRAME

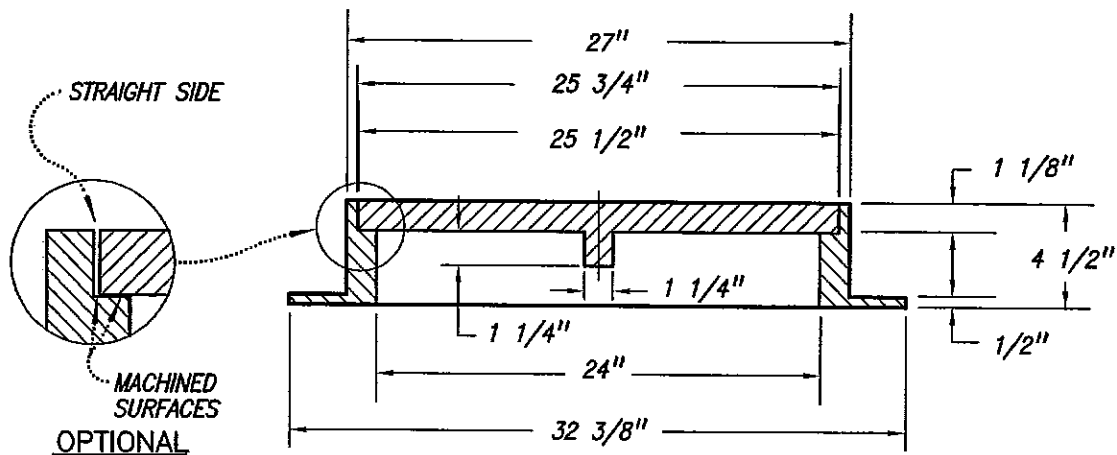
PRY HOLE

ADDITIONAL PICK HOLE 1" x 1/4"

1 1/2" DIA. GROUT HOLES. 3 HOLES EQUALLY SPACED.

FOUNDRY, COUNTRY OF ORIGIN AND DATE OF MANUFACTURE HERE.

**PLAN**



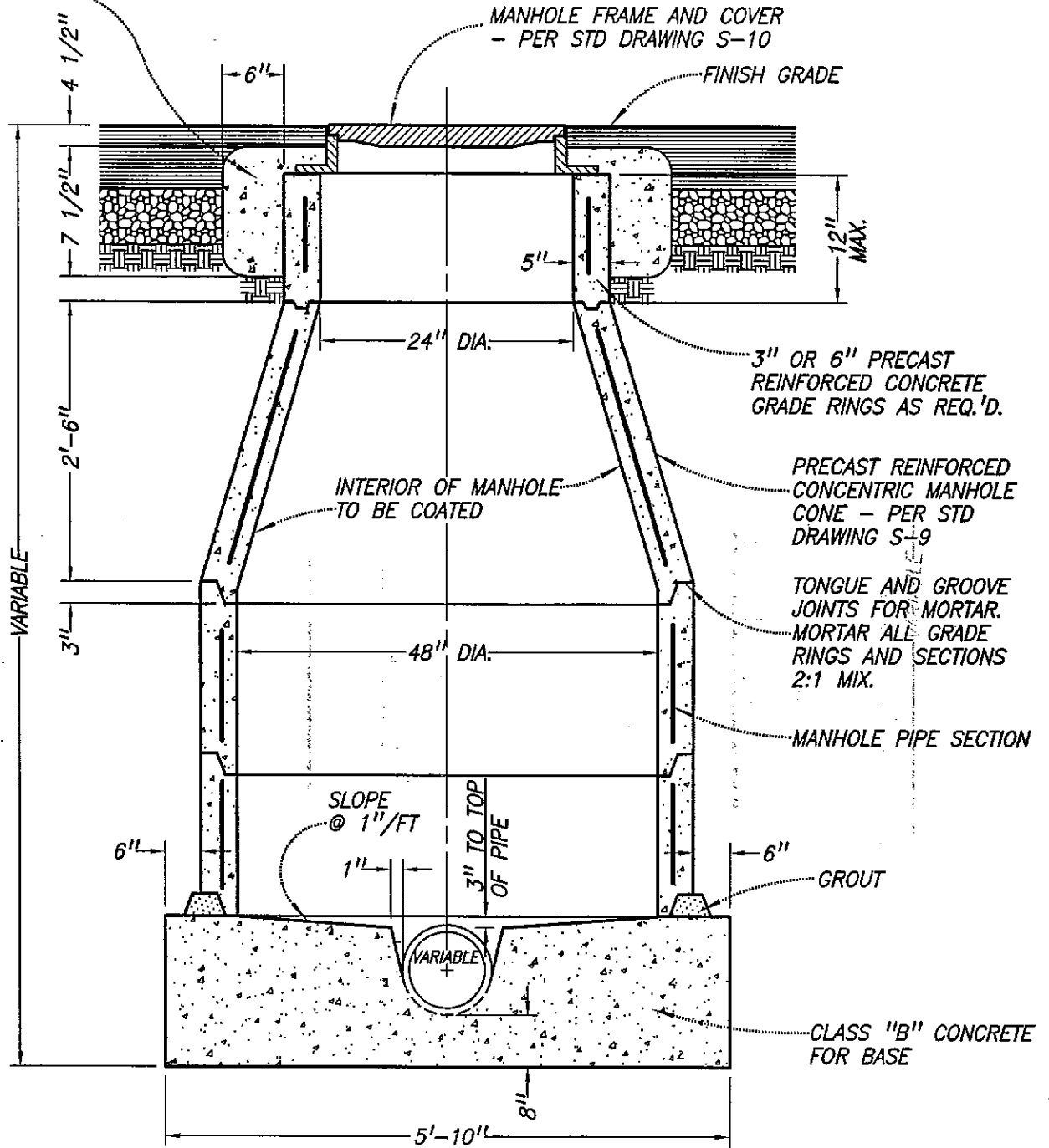
**SECTION**

**NOTES:**

1. MANHOLE FRAME AND COVER TO BE "CALIFORNIA CONCRETE PIPE" TYPE A-624 ASSEMBLY.
2. COVER SHALL BE DESIGNED TO WITHSTAND HS-20 HIGHWAY LOADING.
3. FRAME AND COVER SHALL BE FULLY MACHINED TO ASSURE INTERCHANGEABILITY AND A CLOSE, QUIET FIT.
4. SEE SECTION 75-1.02a OF THE STANDARD SPECIFICATIONS.
5. THE FOLLOWING LABELS MAY BE USED FOR SANITARY SEWER, USE "SANITARY SEWER" OR "SANITARY".

DRAWN BY: D.S. CHECKED BY: M.P. SCALE: NONE	<h2>SEWER MANHOLE FRAME AND COVER</h2>	APPROVED BY:  DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
REVISIONS: 03/08/02    BY: rk		DATE: 01/01/96 DRAWING NO.
<b>Western Hills Water District</b> STANISLAUS COUNTY, CALIFORNIA		<b>S - 10</b>

CONCRETE COLLAR CONSTRUCTION  
TYPICAL FOR ALL MANHOLES IN  
PAVEMENT AREAS



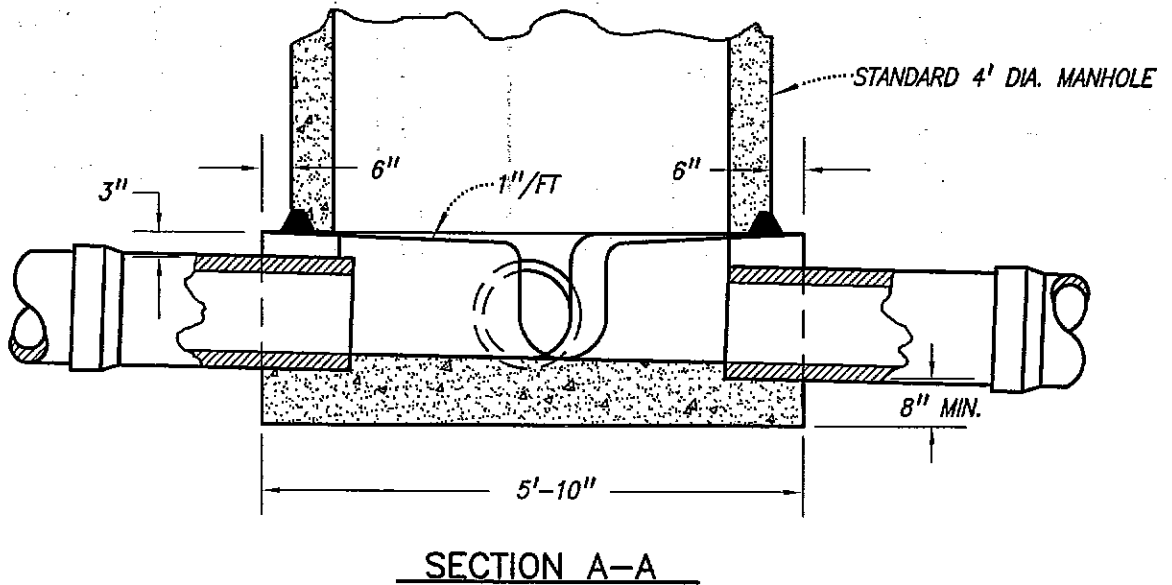
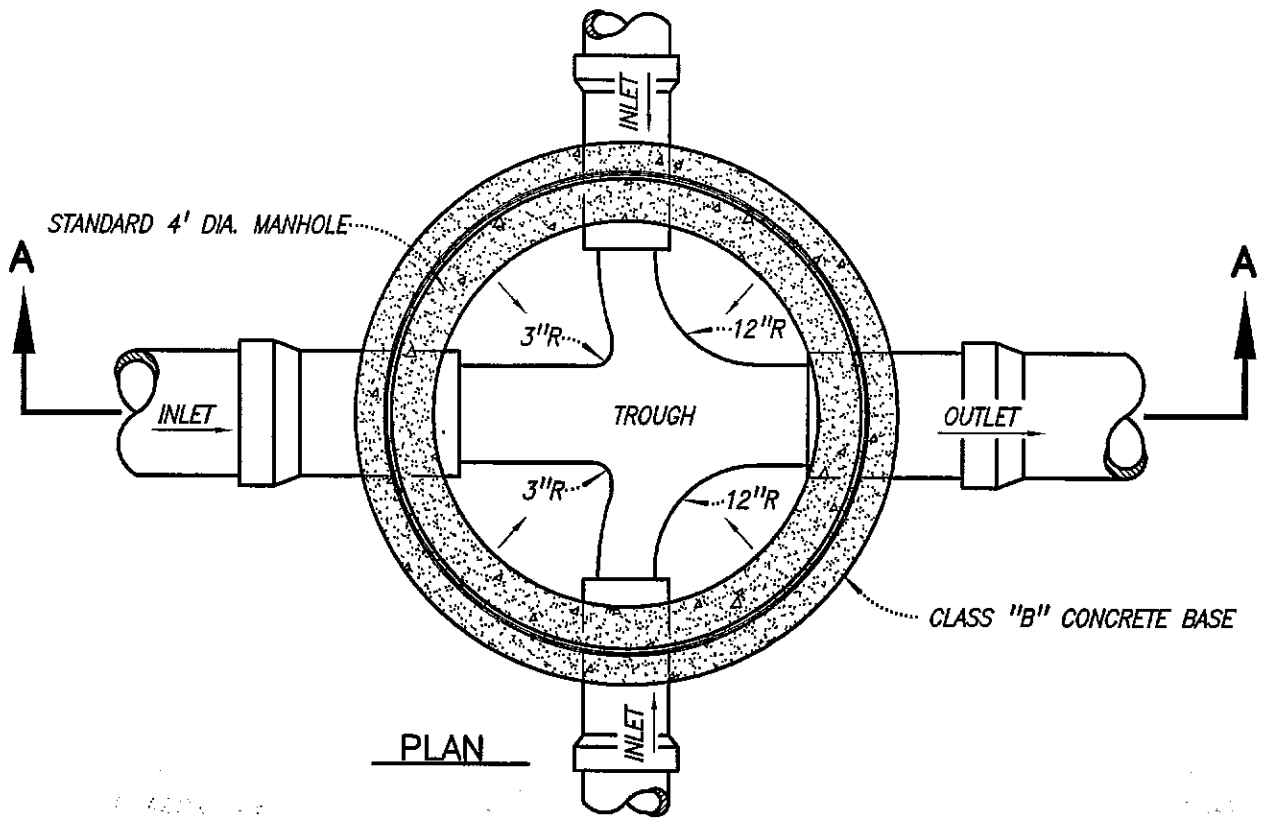
NOTE: PRECAST REINFORCED CONCRETE MANHOLE UNITS SHALL CONFORM TO A.S.T.M. C-478. CONSTRUCT PIPE JOINT AT 2 FEET MAXIMUM FROM BASE OF MANHOLE. FLEXIBLE JOINT.

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
03/08/02	rk

## SANITARY SEWER MANHOLE

Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>S-11</b>



**NOTES:**

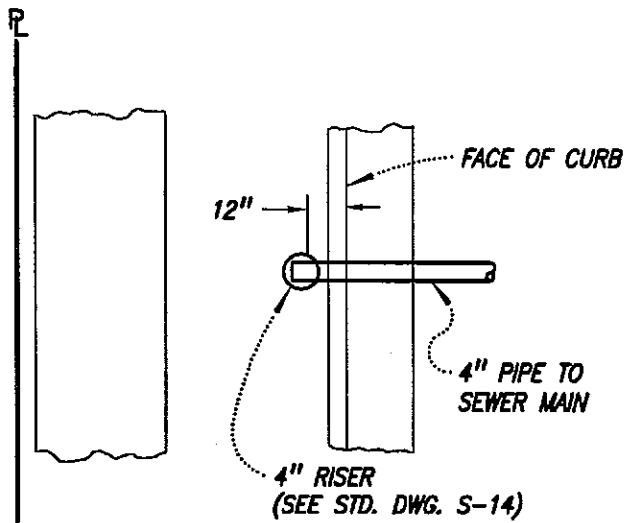
1. TROUGHS WITHIN MANHOLE TO BE FULLY ACCESSIBLE.
2. INLET PIPES NOT TO EXTEND MORE THAN 3" INTO MANHOLE.
3. OUTLET PIPE TO BE FLUSH AND ALL EDGES SMOOTH WITH M.H. WALL.
4. CONSTRUCT PIPE JOINTS AT 2' MAXIMUM FROM BASE OF MANHOLE (FLEXIBLE JOINTS).
5. MANHOLE BOTTOM SHALL BE HYDRAULICALLY SHAPED IN THE FIELD AS DIRECTED.

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
03/08/01	rk

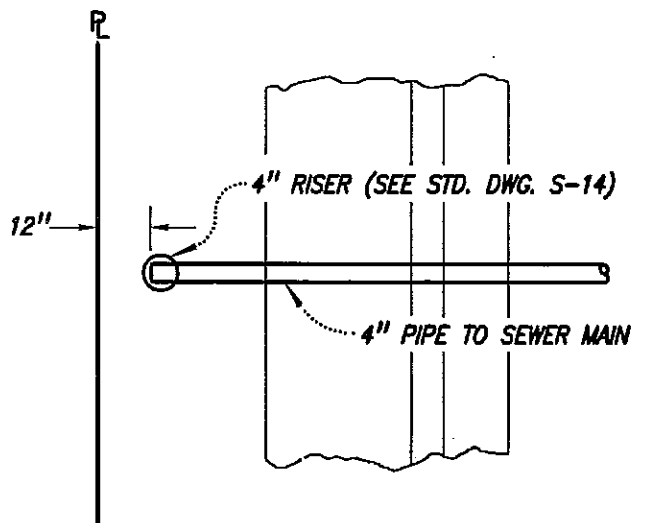
**TYPICAL INTERSECTION  
AT MANHOLE**

Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA

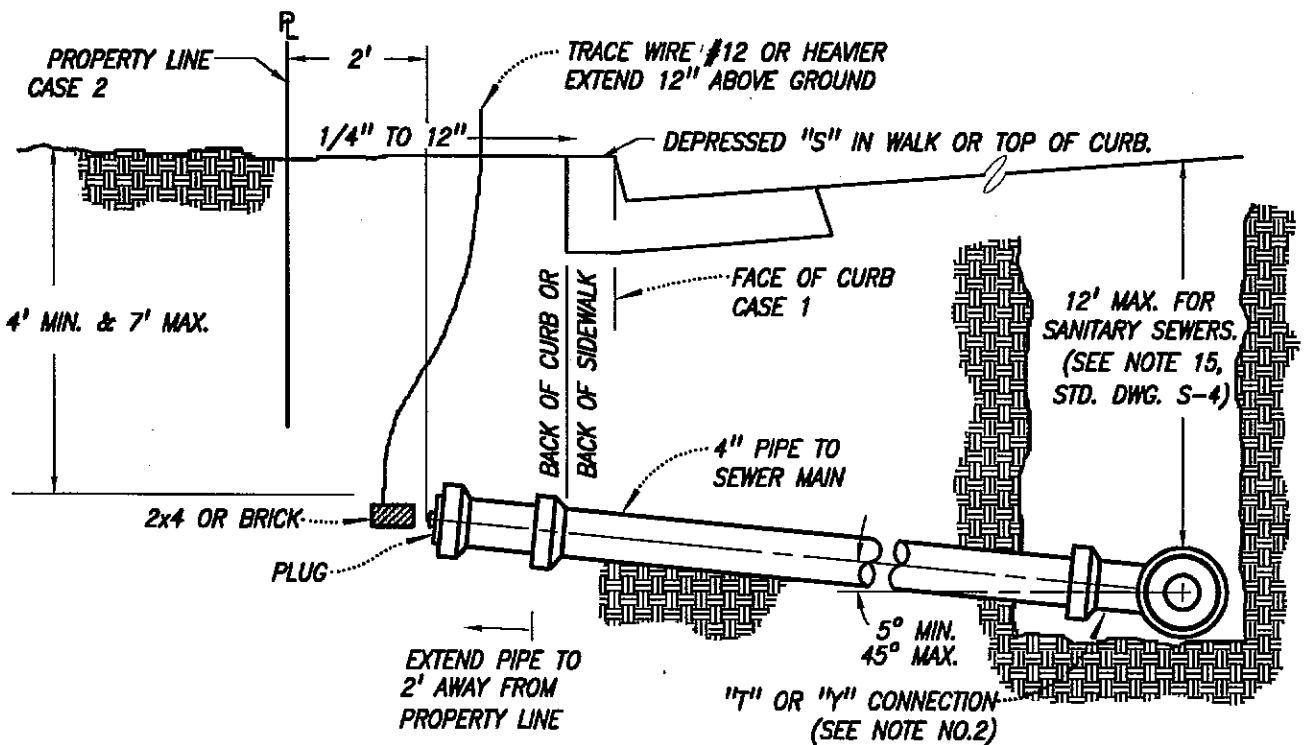
APPROVED BY: <i>Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>S - 12</b>



**CASE 1**  
(SEE STD. DWG. S-14)  
**VERTICAL TYPE**  
**CURB AND GUTTER WITH SIDEWALK**



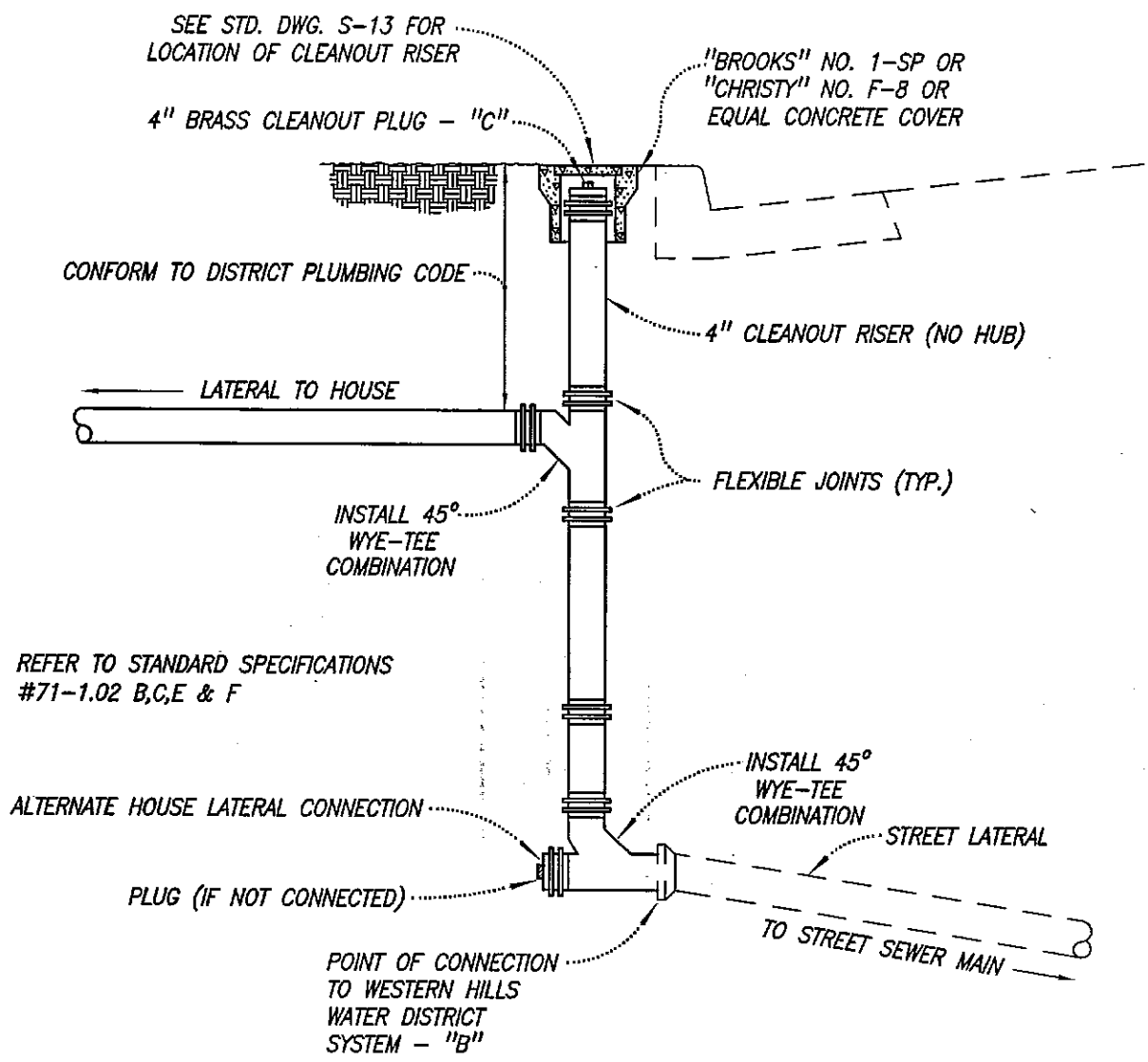
**CASE 2**  
(SEE STD. DWG. S-14)  
**ROLL TYPE**  
**CURB, GUTTER AND SIDEWALK**



**NOTES:**

1. WHEN MODIFIED CURB, GUTTER AND SIDEWALK, MEANDERING SIDEWALKS, OR ANY OTHER SPECIAL CASES ARE ENCOUNTERED, CLEANOUTS AND OTHER UTILITY LOCATIONS SHALL BE DETERMINED BY THE ENGINEER AT TIME SUBDIVISION PLANS ARE SUBMITTED FOR APPROVAL AND FINAL APPROVAL SHALL BE BY THE DISTRICT ENGINEER.
2. "T" CONNECTIONS TO BE USED ON V.C.P. MAIN LINE PIPE. "T" OR "Y" CONNECTION SHALL BE USED ON ALL OTHER MAIN LINE PIPES.

DRAWN BY: D.S.	<b>SERVICE LATERAL</b>	APPROVED BY: <i>D. Stanley Thompson</i> DISTRICT ENGINEER RCE 32260 THOMPSON-HYSELL ENGINEERS, INC.
CHECKED BY: M.P.		
SCALE: NONE		
REVISED	BY	DATE: 01/01/96
Western Hills Water District STANISLAUS COUNTY, CALIFORNIA		DRAWING NO. <b>S-13</b>



**NOTES:**

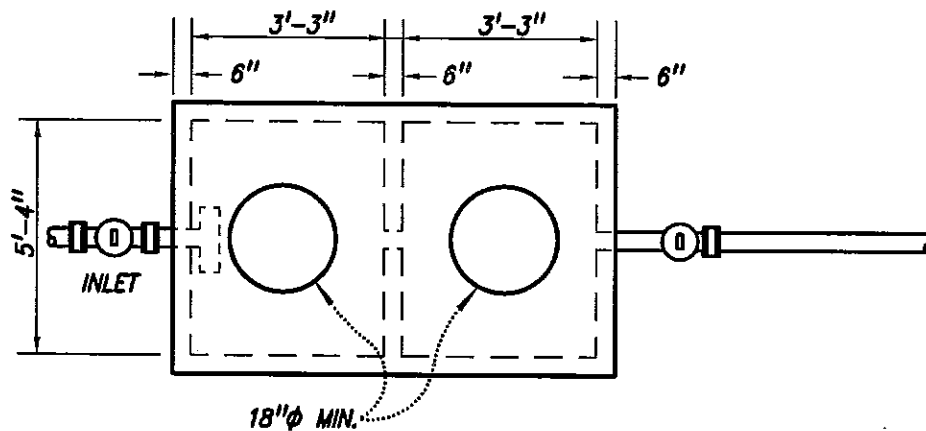
1. ALL FACILITIES ABOVE POINT "B" TO BE INSTALLED AND MAINTAINED BY PROPERTY OWNER IN ACCORDANCE WITH THE DISTRICT PLUMBING CODE.
2. ALL FACILITIES BELOW POINT "B" TO BE MAINTAINED BY THE WESTERN HILLS WATER DISTRICT THROUGH THE PROPERTY OWNERS CLEANOUT "C".
3. WHEN CLEANOUT FALLS IN DRIVEWAY, INSTALL "CHRISTY" NO. F-8C OR "BROOKS" NO. 1-SP (OR EQUAL) CAST IRON TRAFFIC COVER. "BROOKS" NO. 3-RT MAY ALSO BE USED.

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
03/08/02	rk

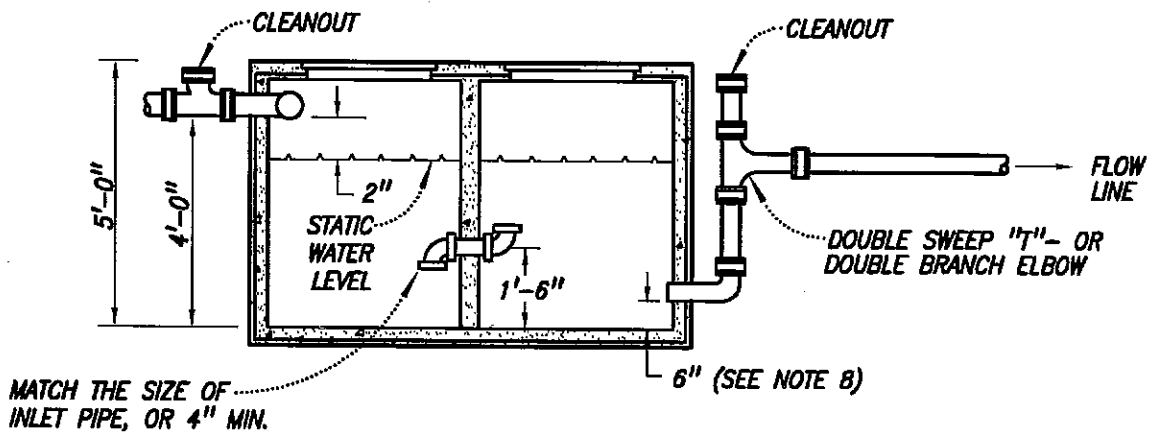
**CLEANOUT**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>D. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	DATE: 01/01/96	<b>S - 14</b>
DRAWING NO.		



PLAN VIEW



SECTION

**NOTES: OUTSIDE INSTALLATION**

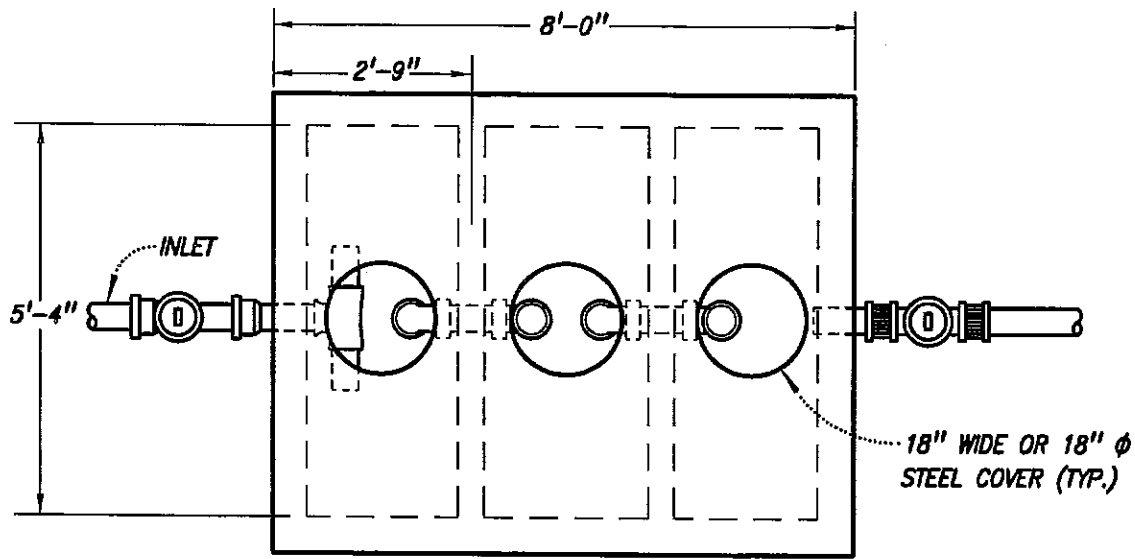
1. DIMENSIONS SHOWN ARE FOR MINIMUM SIZE (750 GALLON) TRAP.
2. EACH UNIT SHALL BE DESIGNED BY A REGISTERED CIVIL ENGINEER AND APPROVED BY THE DISTRICT ENGINEER. STREET INSTALLATIONS SHALL BE DESIGNED FOR HS20 44 LOADING.
3. ALL KITCHEN FIXTURES SHALL BE PLUMBED TO FLOW THRU TRAP.
4. CONCRETE SHALL BE A MINIMUM OF 3000 PSI AT 28 DAYS.
5. COVERS SHALL BE STEEL AND SHALL BE GAS TIGHT.
6. ALL WASTE SHALL ENTER TRAP THROUGH THE INLET PIPE ONLY.
7. NO WASTE FROM RESTROOMS SHALL FLOW THROUGH TRAP.
8. EFFLUENT PIPE SHALL EXIT TANK 6" FROM BOTTOM.

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

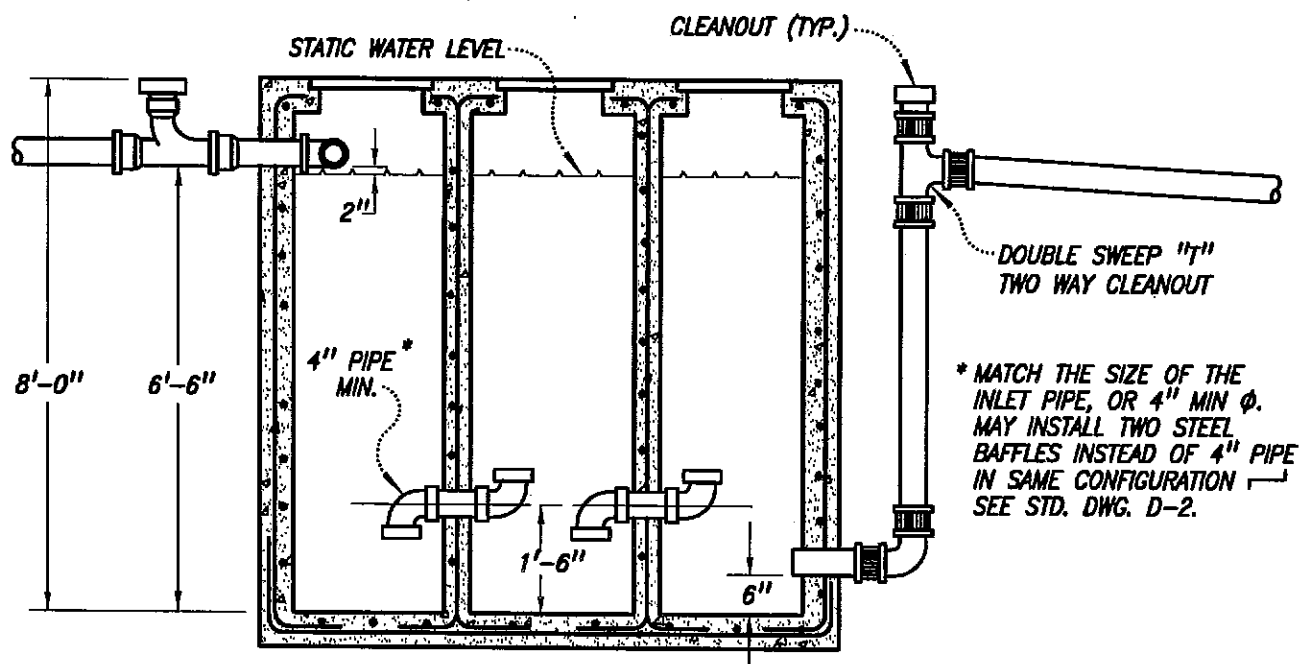
**TYPICAL GREASE TRAP**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:	<i>H. Stanley Thompson</i>
DISTRICT ENGINEER	RCE 82260
THOMPSON-HYSELL ENGINEERS, INC.	
DATE: 01/01/98	<b>S - 15</b>
DRAWING NO.	



**PLAN VIEW**



**SECTION**

\* MATCH THE SIZE OF THE INLET PIPE, OR 4" MIN  $\phi$ . MAY INSTALL TWO STEEL BAFFLES INSTEAD OF 4" PIPE IN SAME CONFIGURATION SEE STD. DWG. D-2.

**NOTES:**

1. EACH UNIT SHALL BE DESIGNED BY A REGISTERED CIVIL ENGINEER & APPROVED BY THE DISTRICT ENGINEER.
2. COVERS SHALL BE STEEL & GAS TIGHT. PROVIDE AMPLE ACCESS FOR MAINTENANCE.
3. REINFORCEMENT SHALL BE ADEQUATE FOR TRAFFIC CONDITIONS IN AREA WHERE TRAP IS LOCATED.
4. ALL KITCHEN FIXTURES TO BE PLUMBED TO FLOW THROUGH TRAP.
5. CONCRETE SHALL BE 3,000 P.S.I. MINIMUM AT 28 DAYS.
6. ALL WASTE SHALL ENTER TRAP THROUGH INLET PIPE ONLY.
7. RESTROOM WASTE SHALL NOT FLOW THROUGH TRAP.
8. EFFLUENT PIPE SHALL EXIT TANK 6" FROM BOTTOM.

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

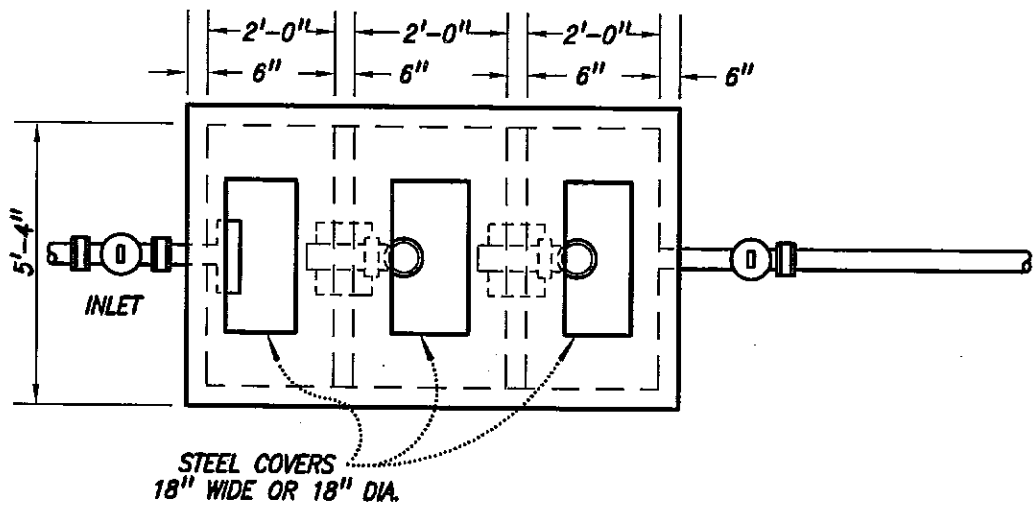
**TYPICAL GREASE TRAP  
(1200 GALLON OR LARGER)**

**Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA**

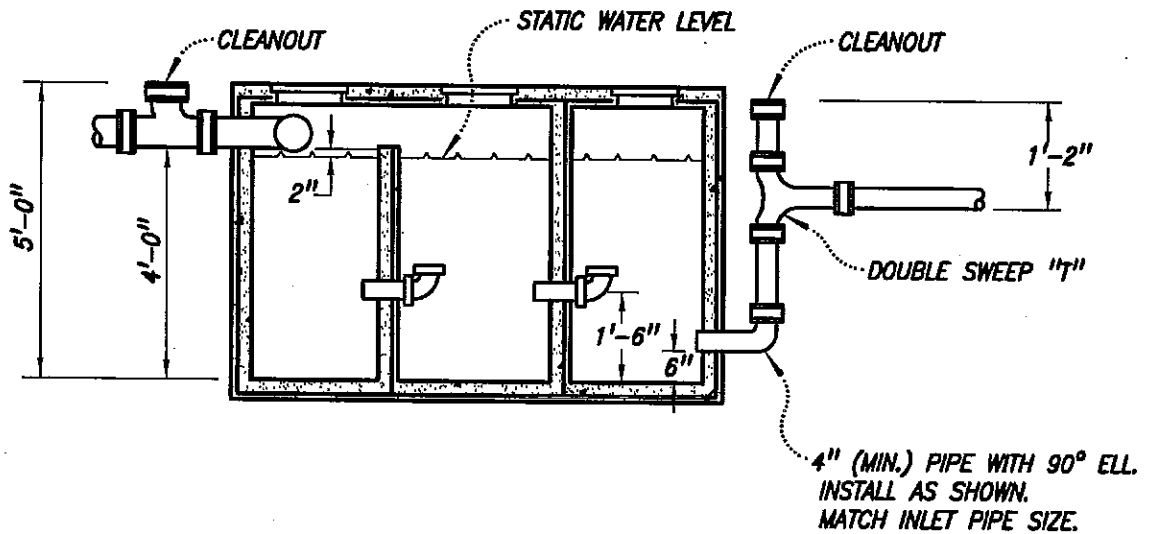
APPROVED BY:  
*D. Stanley Thompson*  
DISTRICT ENGINEER  
THOMPSON-HYSELL ENGINEERS, INC. RCE 32260

DATE: 01/01/96  
DRAWING NO.

**S - 16**



**PLAN VIEW**



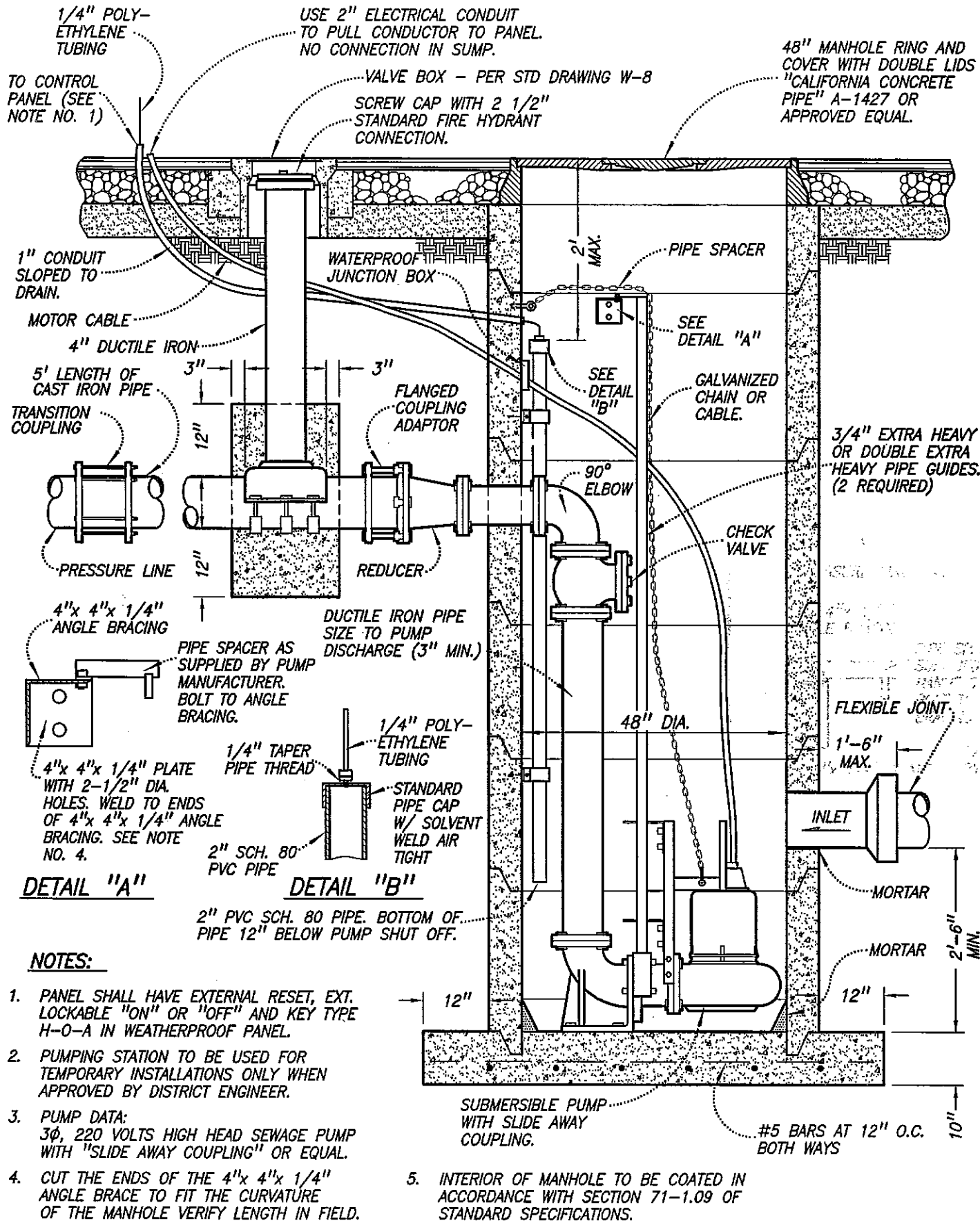
**SECTION**

**NOTES: OUTSIDE INSTALLATION**

1. DIMENSIONS SHOWN ARE FOR MINIMUM SIZE (750 GALLON) TRAP.
2. EACH UNIT SHALL BE DESIGNED BY A REGISTERED CIVIL ENGINEER AND APPROVED BY THE DISTRICT ENGINEER. STREET INSTALLATIONS SHALL BE DESIGNED FOR HS20 44 LOADING.
3. CONCRETE SHALL BE A MINIMUM OF 3,000 PSI AT 28 DAYS.
4. ALL WASTE SHALL ENTER TRAP THROUGH INLET PIPE ONLY.
5. COVERS SHALL BE STEEL AND SHALL BE GAS TIGHT.
6. EFFLUENT PIPE SHALL EXIT TANK 6" FROM BOTTOM.

DRAWN BY: D.S. CHECKED BY: M.P. SCALE: NONE REVISED BY	<b>TYPICAL SAND AND OIL TRAP</b> <b>Western Hills Water District</b> STANISLAUS COUNTY, CALIFORNIA	APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC. DATE: 01/01/98 DRAWING NO.
		<b>S - 17</b>





**DETAIL "A"**

**DETAIL "B"**

**NOTES:**

1. PANEL SHALL HAVE EXTERNAL RESET, EXT. LOCKABLE "ON" OR "OFF" AND KEY TYPE H-O-A IN WEATHERPROOF PANEL.
2. PUMPING STATION TO BE USED FOR TEMPORARY INSTALLATIONS ONLY WHEN APPROVED BY DISTRICT ENGINEER.
3. PUMP DATA:  
3φ, 220 VOLTS HIGH HEAD SEWAGE PUMP WITH "SLIDE AWAY COUPLING" OR EQUAL.
4. CUT THE ENDS OF THE 4" x 4" x 1/4" ANGLE BRACE TO FIT THE CURVATURE OF THE MANHOLE VERIFY LENGTH IN FIELD.

5. INTERIOR OF MANHOLE TO BE COATED IN ACCORDANCE WITH SECTION 71-1.09 OF STANDARD SPECIFICATIONS.

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
03/08/02	rk

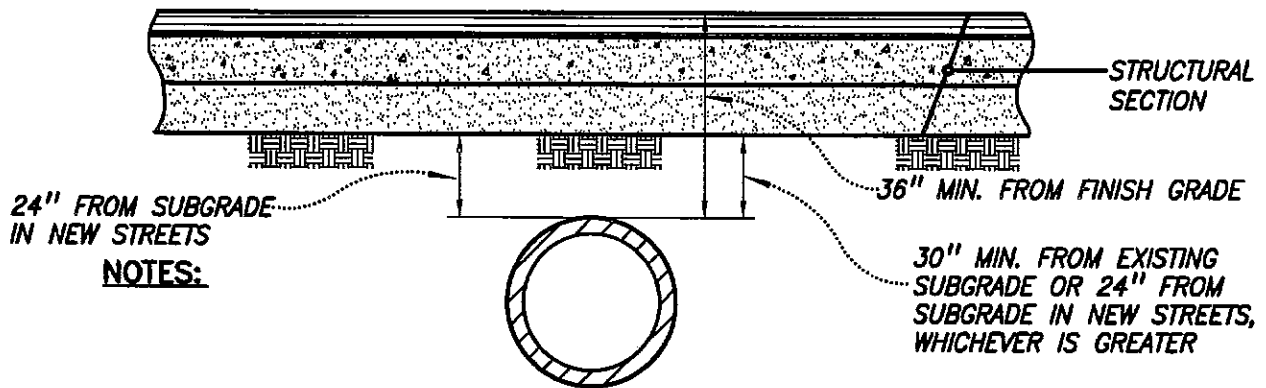
## TEMPORARY MANHOLE SEWER PUMPING STATION

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:  
*D. Stanley Thompson*  
DISTRICT ENGINEER  
THOMPSON-HYSELL ENGINEERS, INC.

DATE: 01/01/96

DRAWING NO. **S - 18**



24" FROM SUBGRADE  
IN NEW STREETS

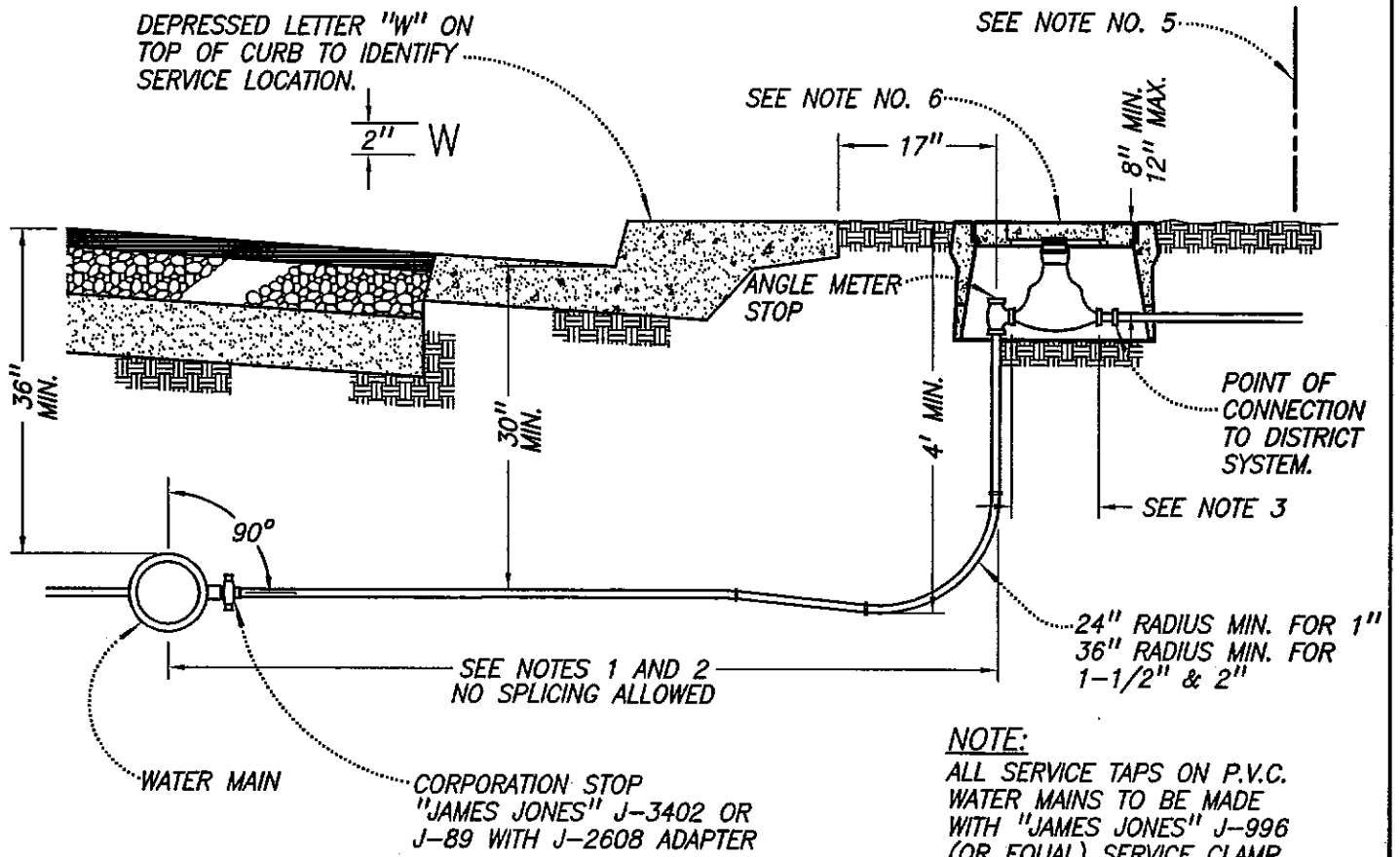
**NOTES:**

36" MIN. FROM FINISH GRADE

30" MIN. FROM EXISTING  
SUBGRADE OR 24" FROM  
SUBGRADE IN NEW STREETS,  
WHICHEVER IS GREATER

1. ALL WATER SYSTEM DESIGN SHOULD FOLLOW THE APPROVED DIABLO GRANDE MASTER WATER PLAN WHERE APPLICABLE. ANY DEVIATION FROM THE APPROVED WATER PLAN MUST BE APPROVED BY THE DISTRICT ENGINEER.
2. 6" MIN. PIPE SIZE IS ACCEPTABLE ONLY IN CUL-DE-SACS WHERE THERE IS NO FIRE HYDRANT CONNECTION. 8" MINIMUM PIPE SIZE IS REQUIRED IN ALL OTHER AREAS.
3. ALL WATER DISTRIBUTION SYSTEMS SHALL BE LOOPED IN ALL AREAS EXCEPT CUL-DE-SACS UNLESS OTHERWISE APPROVED BY THE DISTRICT ENGINEER. A NON-LOOPED WATER DISTRIBUTION SYSTEM MAY SERVE A MAXIMUM OF 25 RESIDENTIAL LOTS.
4. 14" PIPES SHALL NOT BE ALLOWED. 16" PIPES SHALL BE USED WHEREVER DESIGN CALCULATIONS CALL FOR THE USE OF 14" PIPES.
5. FIRE HYDRANT LOCATION AND PLACEMENT SHALL BE AT THE DIRECTION OF THE STANISLAUS COUNTY FIRE DEPARTMENT.
6. AT ANY INTERCONNECTION OF THREE OR MORE PIPES, THE NUMBER OF VALVES REQUIRED SHALL EQUAL THE TOTAL NUMBER OF PIPES MINUS ONE.
7. VALVE SPACING ON TRANSMISSION LINES SHALL BE DETERMINED BY THE DISTRICT ENGINEER. VALVES ON ALL OTHER LINES SHALL BE LOCATED SUCH THAT NOT MORE THAN 800' OF WATER LINE WILL BE SHUT DOWN AT ANY ONE TIME AND WILL NOT REQUIRE THE SHUT DOWN OF ANY PIPE SIZE 16" OR GREATER.
8. ALL WATER LINES, VALVES AND OTHER APPURTENANCES SHALL CONFORM TO A.W.W.A. AND WESTERN HILLS WATER DISTRICT STANDARD SPECIFICATIONS AND DRAWINGS.
9. CONTRACTOR SHALL CALL WESTERN HILLS WATER DISTRICT IF ANY LINES ARE BROKEN. NO WATER VALVES SHALL BE SHUT OFF BY ANYONE UNLESS SO DIRECTED BY THE WESTERN HILLS WATER DISTRICT.
10. REFER TO THE RULES AND POLICIES OF THE WESTERN HILLS WATER DISTRICT FOR METER CONNECTION.
11. MINIMUM CLEARANCE OF 4' FROM FINISHED GRADE AT BACK OF SIDEWALK TO WATER SERVICE. SEE DRAWING NO. W-2.
12. WATER LINE ELEVATIONS TO BE SHOWN ON ALL PLAN AND PROFILE SHEETS.
13. WATER SYSTEM DESIGN SHALL CONFORM TO STATE HEALTH CODES. SEE STANDARD SPECIFICATIONS AND STD. DWGS. U-3 & U-4.
14. SERVICE TAPS SHALL NOT BE PERMITTED ON PIPE SIZES 16" AND GREATER.
15. PIPE SYSTEM SHALL BE DESIGNED TO PROVIDE A FIRE FLOW OF 200 GPM AT A MINIMUM PRESSURE OF 25 PSI TO THE PROPOSED FIRE HYDRANTS WHILE ALSO SUPPLYING MAXIMUM DAILY DEMAND FOR THE SYSTEM.

DRAWN BY: D.S.	<b>WATER DESIGN DATA</b>	APPROVED BY: <i>A. Stanley Thompson</i>
CHECKED BY: M.P.		DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC. P.C.E. 32260
SCALE: NONE		DATE: 01/01/96
REVISED	BY	DRAWING NO. <b>W-1</b>
Western Hills Water District STANISLAUS COUNTY, CALIFORNIA		



## TYPICAL WATER SERVICE INSTALLATION FOR DISTRICT WATER SERVICE AREAS ONLY

### NOTES:

1. 1" DIA. MIN. LINE TO EACH LOT.
2. SEE SHEET NO. W-6 FOR FITTINGS.
3. ALLOW 8" MIN. CLEARANCE AND MAX. OF 12" BURY FOR 1" METER
4. THE LOCATION OF THE TAP SHALL BE A MIN. OF 24" FROM ANOTHER TAP, BELL, SPIGOT, OR OTHER FITTING.
5. METER BOX MAY BE PLACED ADJACENT TO PROPERTY OR EASEMENT LINE WITH PRIOR APPROVAL OF THE DISTRICT ENGINEER.
6. USE BROOKS NO. 37 METER BOX WITH NO. 37 TR/PL (TOUCH READ/PIT PROBE) COVER OR CHRISTY B-12 METER BOX WITH B12 TR/PL COVER. ALL BOXES LOCATED IN DRIVEWAY AREAS TO HAVE TRAFFIC COVERS WITH TOUCH READ HOLE 1 3/4" DIA. HOLE FOR T/R METER IN UPPER RIGHT OR LOWER LEFT CORNER OF LID.
7. PLASTIC SERVICE PIPE TO BE CONTINUOUS (NO JOINTS) BETWEEN MAIN AND 90° ELL.

DRAWN BY: K.L.

CHECKED BY: M.P.

SCALE: NONE

REVISED

BY

## 1" WATER SERVICE

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

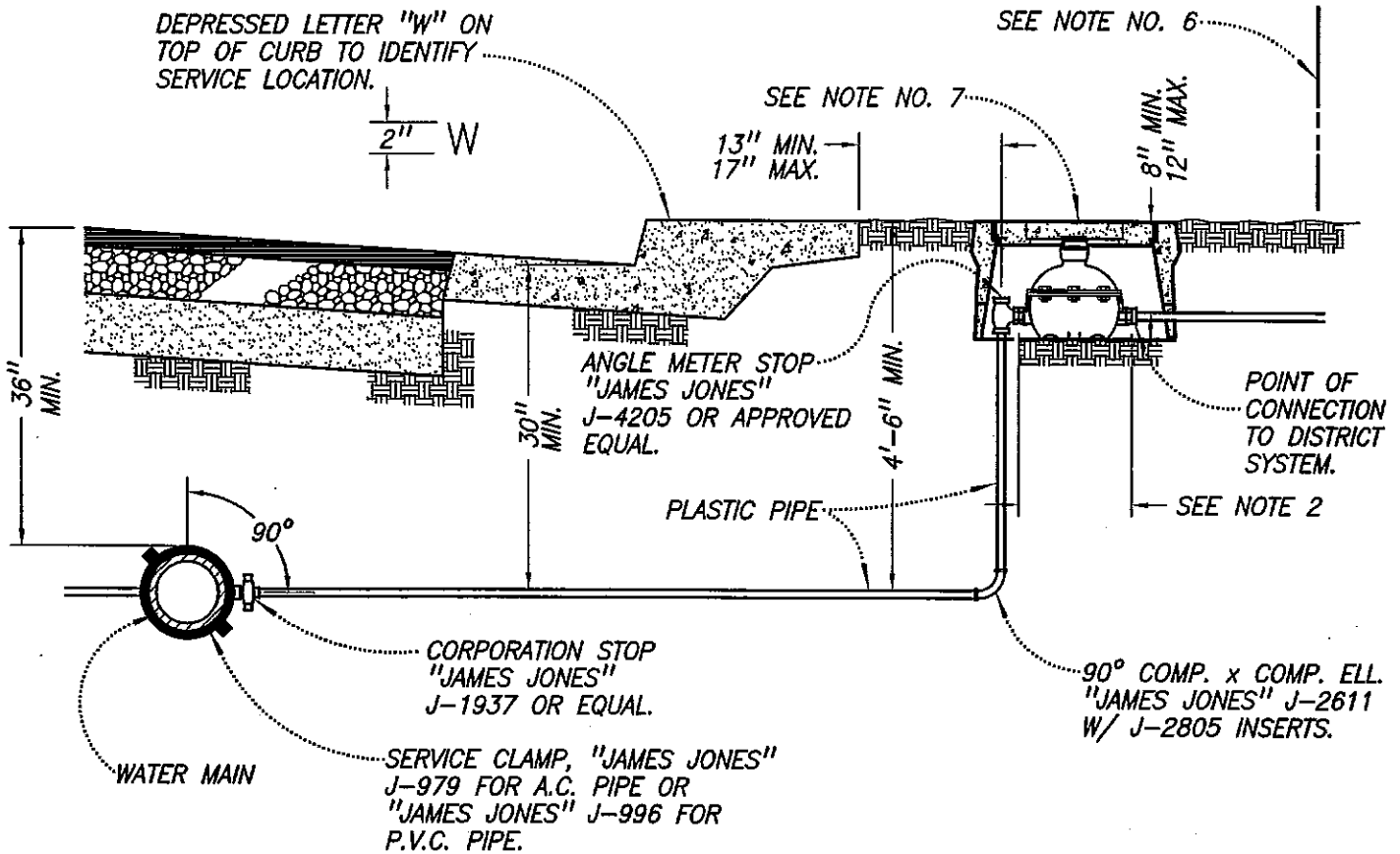
APPROVED BY:

DISTRICT ENGINEER  
THOMPSON-HYSELL ENGINEERS, INC.

DATE: 01/01/96

DRAWING NO.

# W - 2



THIS STANDARD FOR DISTRICT WATER SERVICE AREAS ONLY

NOTES:

1. PLASTIC SERVICE PIPE TO BE CONTINUOUS (NO JOINTS) BETWEEN MAIN AND 90° ELL.
2. ALLOW 8" MIN. CLEARANCE AND 12" MAX. BURY FOR 1 1/2" AND 2" METERS.
3. SERVICE CLAMPS SHALL BE "JAMES JONES" J-979 WITH DOUBLE FLAT SILICON BRONZE STRAP AND BRONZE NUTS FOR A.C. PIPE.
4. FITTINGS SHALL BE AS SHOWN.
5. SERVICE LINES FROM ALL METERS TO PROPERTY LINES SHALL HAVE A MIN. OF 8" OF COVER FROM TOP OF SIDEWALK OR GROUND LINE.
6. METER BOX MAY BE PLACED ADJACENT TO PROPERTY OR EASEMENT LINE WITH PRIOR APPROVAL OF THE DISTRICT ENGINEER.
7. USE BROOKS NO. 66 METER BOX WITH NO. 66 TR/PL (TOUCH READ/PIT PROBE) OR CHRISTY B-36 METER BOX WITH B36 TR/PL COVER. ALL BOXES LOCATED IN DRIVEWAY AREAS TO HAVE TRAFFIC COVERS WITH TOUCH READ HOLE 1 3/4" DIA.

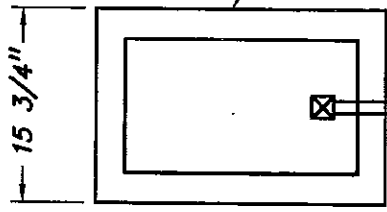
DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

**1 1/2" AND 2" WATER SERVICE**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>D. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>W - 3</b>

WATER METER BOX AND COVER AS PER NOTES 4 & 5 ON STD. DWG. W-6. ONE PER METER LOCATION.



6" VALVE BOX. COVER TO GROUND LEVEL AND SET TO GRADE WITH "JAMES JONES" J-4205 ANGLE STOP OR APPROVED EQUAL.

2"φ P3 2110 POLYBUTYLENE PIPE

4" NIPPLE & METAL PIPE THREAD x SLIP CONNECTOR, P.V.C. SCH. 80

2"x2"x2" TEE-SLIP

2"x2" SLIP x 3/4" I.P.T. TEE

90° ELBOW

"JAMES JONES" 3/4" CURB STOP J-182

4"x3/4"φ BRASS NIPPLE

ANGLE METER STOP

2"φ P3 2110 POLYBUTYLENE PIPE

8" - 12" OF COVER

90° COMP. x COMP. ELBOW "JAMES JONES" J-2611 W/ J-2805 INSERTS.

**NOTES:**

ALL PIPE AND FITTINGS ON MANIFOLD TO BE P.V.C. SCHEDULE 80 (EXCEPT AS NOTED)

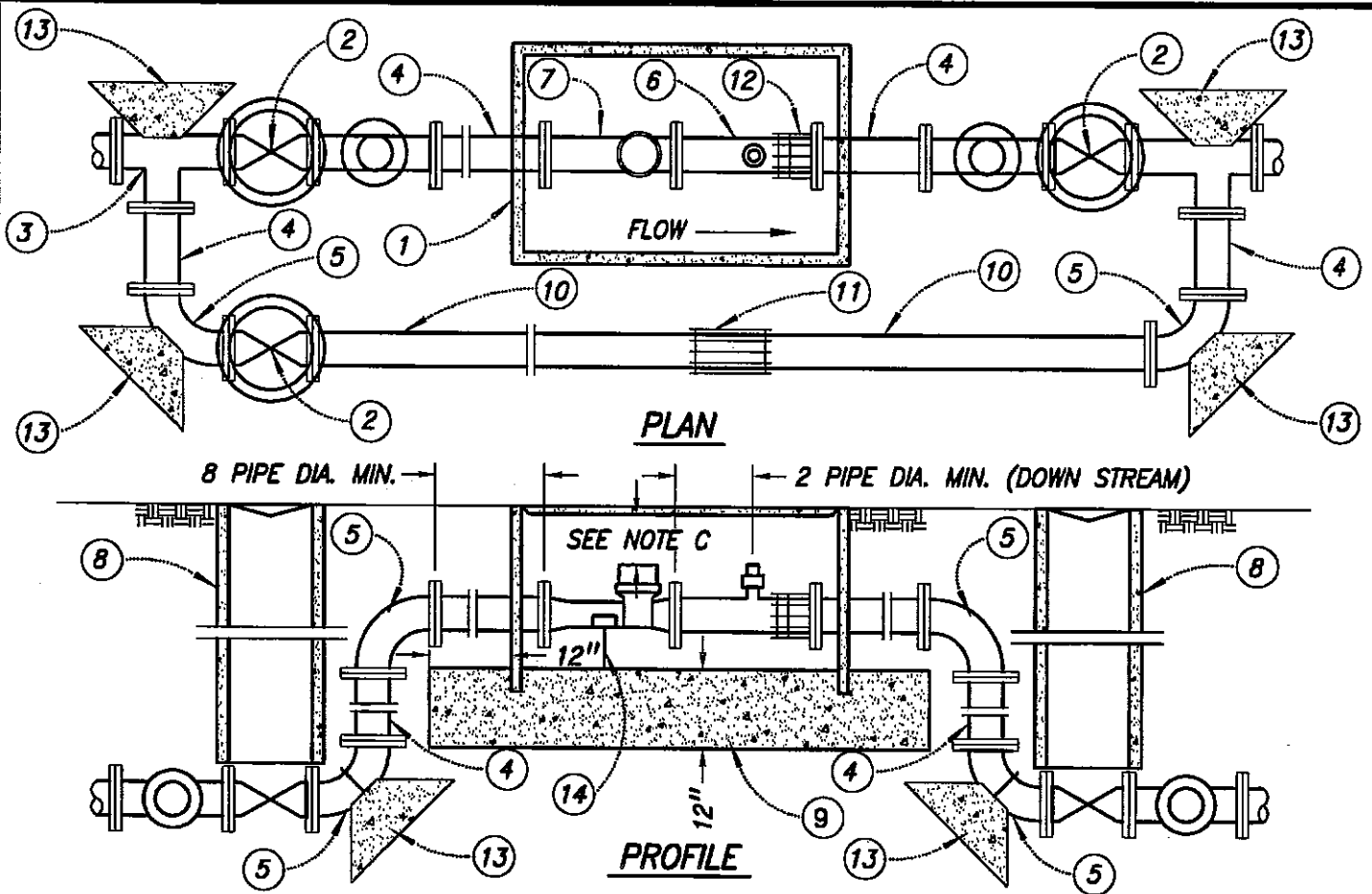
THERE SHALL BE NO RIGID PIPE BETWEEN VALVE AND MAIN.

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

**MULTIPLE UNIT METER SERVICE**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	DATE: 01/01/98	<b>W - 4</b>
DRAWING NO.		



### COMPONENTS FOR 3" OR LARGER METER INSTALLATIONS

1. SIZE OF METER VAULT SHALL BE DETERMINED BY METER SIZE. VAULT COVERS SHALL BE 2 OR 3 PIECE METAL WITH READING LID CUT-IN POSITIONED OVER REGISTER.
2. VALVE - SEE STANDARD SPECIFICATION 76-1.02D
3. CLASS 125 DUCTILE IRON PIPE TEE.
4. CLASS 125 DUCTILE IRON PIPE SPOOL.
5. CLASS 125 DUCTILE IRON PIPE 90° LONG RADIUS ELBOW.
6. CAST IRON TAPPED SPOOL OR TEE, FLANGE BY PLAIN END, WITH 2" BLIND FLANGED ACCESS.
7. METER AS SPECIFIED BY WESTERN HILLS WATER DISTRICT.
8. CHRISTY G-8 VALVE BOX OR BROOKS NO. 1-RT VALVE BOX. BOTH WITH DUCTILE IRON PIPE COVERS. SEE STD. DWG. W-8.
9. GRAVEL BASE. 12" MINIMUM DEPTH.
10. FLANGED BY PLAIN END CAST IRON PIPE. SEE STANDARD SPECIFICATION NO. 76-1.02B.
11. FLEX COUPLING - ROCKWELL 411 STEEL COUPLING OR EQUAL.
12. FLANGED COUPLING ADAPTER - ROCKWELL 912 OR EQUAL.
13. THRUST BLOCKS - SEE STANDARD SPECIFICATION 76-1.02H AND STD. DWG. W-9.
14. METER AND PIPE SUPPORTS AS REQUIRED.

### NOTES:

- A. DETAILED DESIGN WILL BE REQUIRED AND SHALL BE APPROVED BY THE DISTRICT ENGINEER PRIOR TO INSTALLATION.
- B. BY-PASS REQUIREMENTS WILL BE DETERMINED BY THE DISTRICT ENGINEER
- C. DIMENSION SHALL VARY FROM 12" TO 24" DEPENDING ON METER AND SERVICE SIZE.

DRAWN BY: K.L.  
 CHECKED BY: M.P.  
 SCALE: NONE

## 3" OR LARGER METER BY-PASS

Western Hills Water District  
 STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:  
*H. Stanley Thompson*  
 DISTRICT ENGINEER RCE 32260  
 THOMPSON-HYSELL ENGINEERS, INC.

DATE: 01/01/96

DRAWING NO.

**W - 5**

NOTE: SEE DRAWING NOS. W-2 & W-3 FOR DETAILS.

PLASTIC PIPE (SEE SECTION OF SPECIFICATIONS REGARDING PLASTIC PIPE)

PLASTIC SERVICE PIPE SHALL BE ULTRA HIGH MOLECULAR WEIGHT (UHMW) P.E. 3406, CS 255-63, POLYETHYLENE (SEE STD. SPEC. 76-1.02J) AS MANUFACTURED BY WESTFLEX, OR APPROVED EQUAL WITH MINIMUM PRESSURE RATING OF 160 P.S.I.. CONNECTION SHALL BE AS FOLLOWS:

1. CORPORATION STOPS

A. 6 INCH DIAMETER LINES

3/4" X 1" CORPORATION STOPS AS MANUFACTURED BY JAMES JONES (J-89 WITH J-2608 COMPRESSION ADAPTORS) COMPLETE WITH STAINLESS STEEL INSERTS FOR 1 INCH I.D. PLASTIC PIPE.

B. 8 AND 12 INCH DIAMETER AND LARGER LINES

1 INCH DIAMETER CORPORATION STOP AS MANUFACTURED BY JAMES JONES (J-3402) COMPLETE WITH STAINLESS STEEL INSERT FOR 1 INCH I.D. PLASTIC PIPE.

C. ALTERNATE PRODUCT SUPPLIER

CORPORATION STOPS

A. ONE (1) INCH CORPORATION STOP. FORD NO. 1001 WITH SS INSERTS.

B. THREE-QUARTER BY ONE INCH CORPORATION STOP (3/4" X 1") FORD NO. 800 PLUS A C-16-44 COMPRESSION ADAPTER WITH (SS) INSERTS.

C. ONE AND ONE-HALF (1 1/2") INCH AND TWO (2) INCH CORPORATION STOPS FORD NO. FB-1000.

2. ANGLE METER STOPS

A. ALL SIZES

1 INCH I.D. ANGLE METER STOP AS MANUFACTURED BY JAMES JONES (J-4202) COMPLETE WITH LOCK WING AND STAINLESS STEEL INSERT FOR 1 INCH I.D. PLASTIC PIPE.

B. 1 1/2" AND 2" ANGLE METER STOPS AS MANUFACTURED BY JAMES JONES (J-4205) SHALL BE USED WITH STAINLESS STEEL INSERTS.

C. ALTERNATE PRODUCT SUPPLIER

ANGLE METER STOP

A. ONE (1) INCH ANGLE METER STOP. FORD NO. KVP-3W WITH SS INSERT.

B. ONE AND ONE-HALF INCH (1 1/2") FORD FV 43-666 WITH SS INSERT.

C. TWO (2) INCH FORD FV 43-777 WITH STAINLESS STEEL INSERT.

3. SERVICE SADDLES

ALL SERVICE SADDLES SHALL BE MANUFACTURED BY JAMES JONES (J-979) WITH DOUBLE FLAT BRONZE STRAPS AND BRONZE NUTS. SERVICE SADDLE FOR ALL SIZE C-900 MAINS SHALL BE MANUFACTURED BY JAMES JONES (J-996).

4. WATER METER BOXES

1 INCH METER BOXES SHALL BE BROOKS NO. 37 OR CHRISTY B-12 BOX. FOR LIDS SEE NOTE #5.

1 1/2 INCH AND 2 INCH METER BOXES SHALL BE BROOKS NO. 66 OR CHRISTY B-36.

5. WATER METER BOX COVER

1 INCH METER BOX COVER SHALL BE BROOKS NO. 37 TR/PL OR CHRISTY B-12 TR/PL COVER. ALL BOXES LOCATED IN DRIVEWAY AREAS TO HAVE TRAFFIC COVERS WITH TOUCH READ HOLE 1 3/4" DIA.

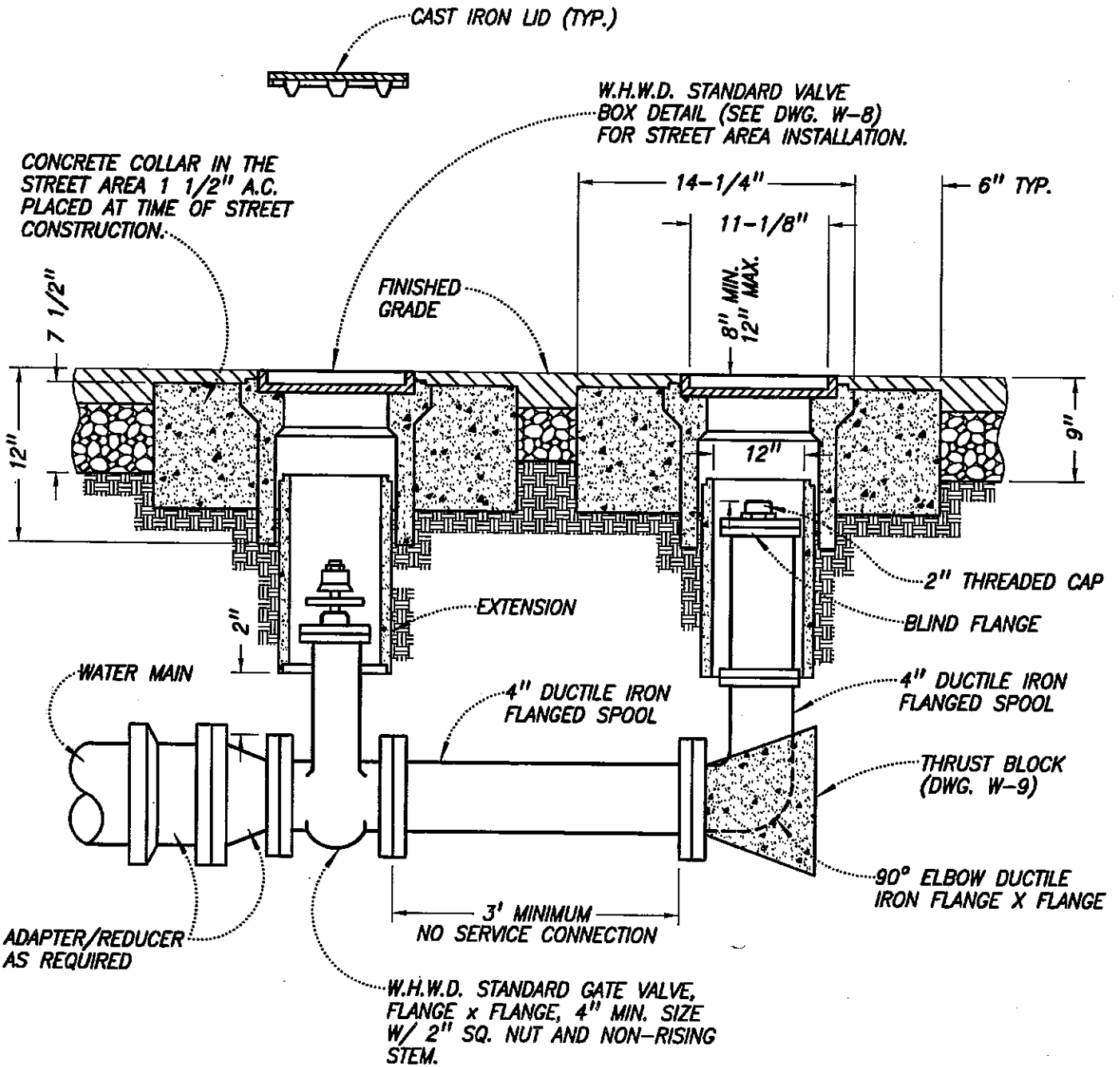
1 1/2" AND 2" METER BOXES SHALL HAVE BROOKS NO. 66 TR/PL OR CHRISTY B-36 TR/PL COVER. ALL BOXES LOCATED IN DRIVEWAY AREAS TO HAVE TRAFFIC COVERS WITH TOUCH TOUCH READ HOLE 1-3/4" DIA.

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

**FITTINGS FOR WATER SERVICE**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

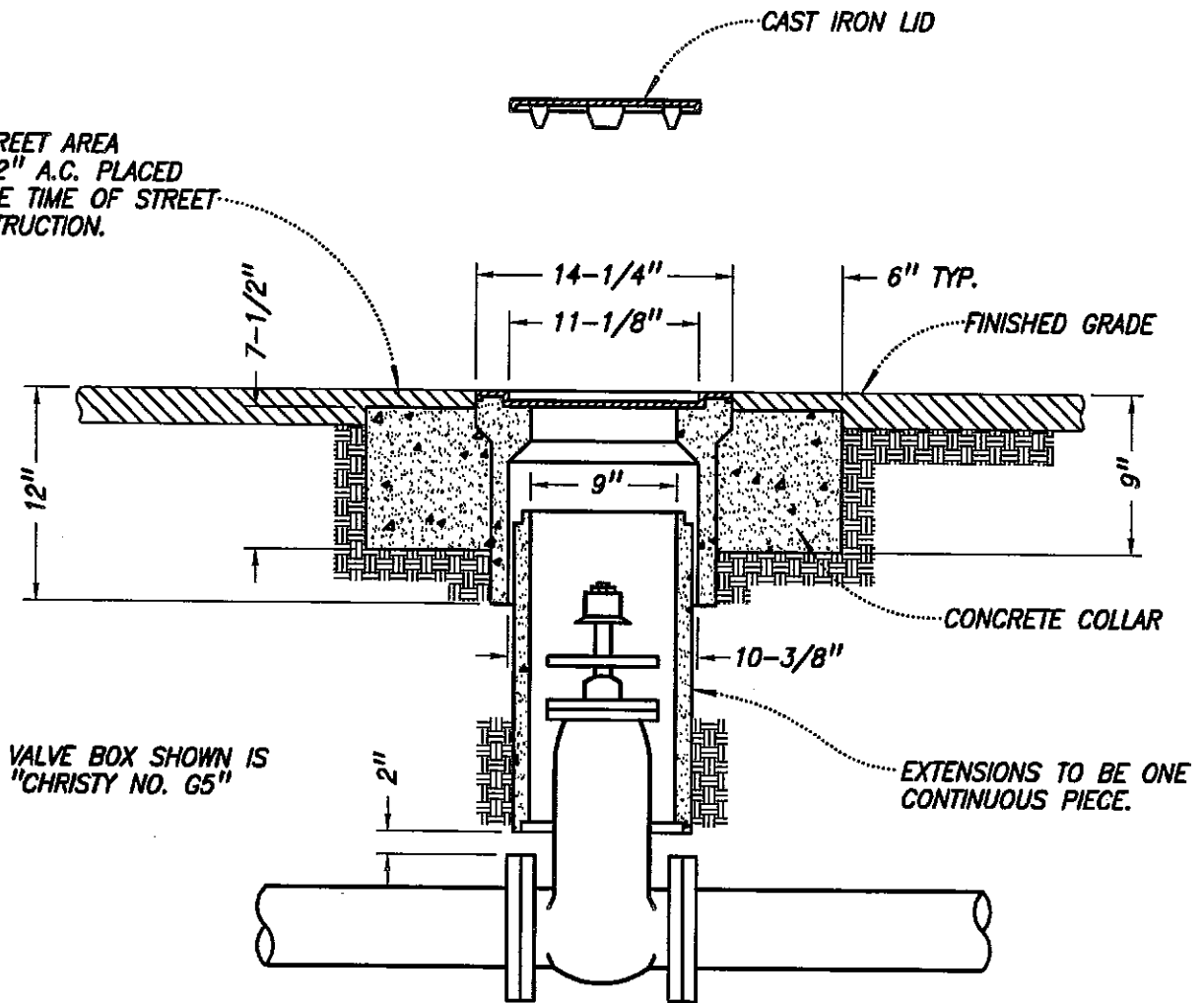
APPROVED BY: <i>A. Stanley Thompson</i>	
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	
DATE: 01/01/96	
DRAWING NO.	<b>W - 6</b>



DRAWN BY: K.L.	<b>BLOW-OFF</b>	APPROVED BY: <i>Stanley Thompson</i>
CHECKED BY: M.P.		DISTRICT ENGINEER RCE 32260
SCALE: NONE		THOMPSON-HYSELL ENGINEERS, INC.
REVISD	BY	DATE: 01/01/96
Western Hills Water District STANISLAUS COUNTY, CALIFORNIA		DRAWING NO. <b>W-7</b>



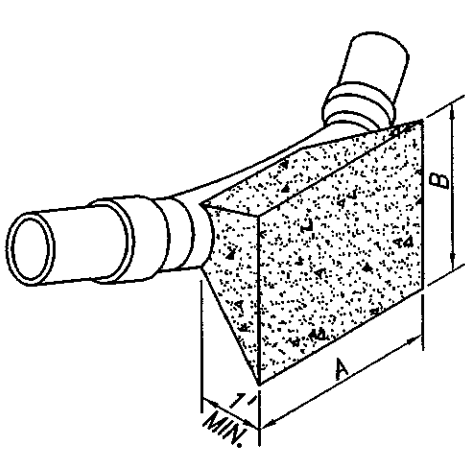
IN STREET AREA  
 1-1/2" A.C. PLACED  
 AT THE TIME OF STREET  
 CONSTRUCTION.



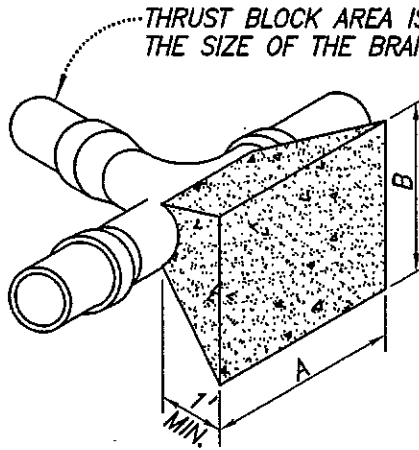
**NOTES**

1. VALVE BOX AND LID SHALL BE CHRISTY NO. G5 OR EQUAL.
2. ALL LIDS SHALL HAVE MACHINED SEATING SURFACES.
3. EXTENSIONS SHALL BE C900 PVC (WATER PIPE) OR SDR 35 PVC (SEWER PIPE).
4. FOR BLOWOFF INSTALLATION, REFER TO STD. DWG. W-7.
5. CONCRETE COLLAR NOT REQUIRED WHEN VALVE BOX IS LOCATED IN CONCRETE SIDEWALK AREA.

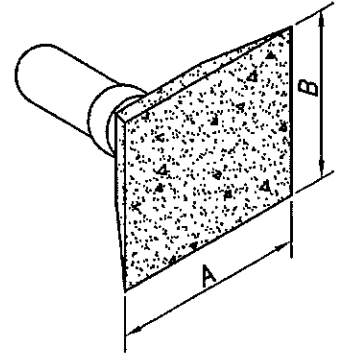
DRAWN BY: K.L.		<b>VALVE BOX DETAILS</b>	APPROVED BY:
CHECKED BY: M.P.			<i>A. Stanley Thompson</i>
SCALE: NONE			DISTRICT ENGINEER RCE 32260
REVIS	BY	Western Hills Water District	DATE: 01/01/96
		STANISLAUS COUNTY, CALIFORNIA	DRAWING NO. <b>W-8</b>



TYPICAL THRUST BLOCK BEND



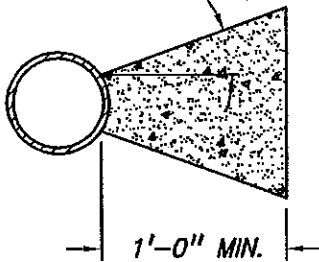
TYPICAL THRUST BLOCK TEE OUTLET



TYPICAL THRUST BLOCK DEAD END

THRUST BLOCK AREA IS BASED ON THE SIZE OF THE BRANCH LINE.

45° MAX.  
(TYP. FOR ALL ANGLES)



TYPICAL SECTION THRU THRUST BLOCK

**NOTES:**

1. ALL THRUST BLOCKS SHALL BE POURED AGAINST UNDISTURBED SOIL.
2. RESTRAINT SYSTEM FOR VERTICAL PIPE BENTS SHALL BE APPROVED BY THE DISTRICT ENGINEER.
3. THRUST RESTRAINT SYSTEMS FOR PIPES LARGER THAN 12" SHALL BE DESIGNED ON A CASE BY CASE BASIS AND SHALL BE APPROVED BY THE DISTRICT ENGINEER.

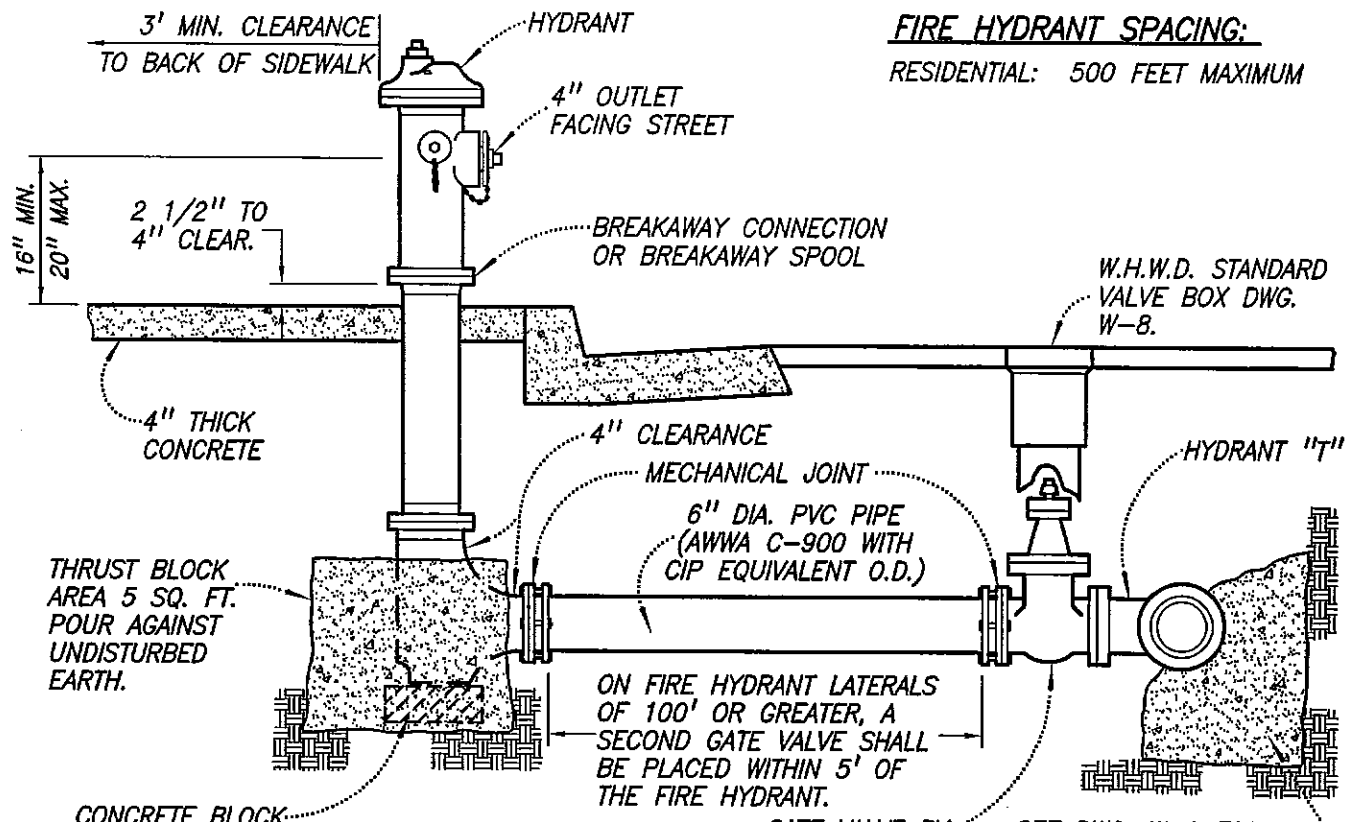
THRUST BLOCK AREA REQUIRED		
FITTINGS	ALLOWABLE SOIL BEARING VALUE	
	1000 LBS. PER SQ. FT.	
<b>6" LINE OR SMALLER</b>	~A"	~B"
22 1/2°	1'-6"	1'-6"
45°	2'-0"	2'-0"
90°	3'-0"	2'-6"
TEE OUTLET	2'-6"	2'-0"
DEAD END	2'-6"	2'-0"
<b>8" LINE</b>		
22 1/2°	2'-0"	2'-0"
45°	3'-0"	2'-6"
90°	4'-0"	3'-0"
TEE OUTLET	3'-0"	3'-0"
DEAD END	3'-0"	3'-0"
<b>10" LINE</b>		
22 1/2°	3'-0"	2'-0"
45°	3'-6"	3'-0"
90°	5'-0"	4'-0"
TEE OUTLET	4'-0"	3'-6"
DEAD END	4'-0"	3'-6"
<b>12" LINE</b>		
22 1/2°	3'-0"	3'-0"
45°	4'-0"	4'-0"
90°	7'-0"	4'-0"
TEE OUTLET	5'-0"	4'-0"
DEAD END	5'-0"	4'-0"

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

**THRUST BLOCK DETAILS**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

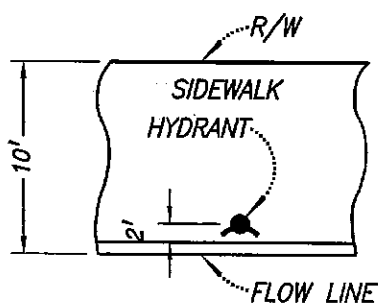
APPROVED BY: <i>A. Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>W - 9</b>



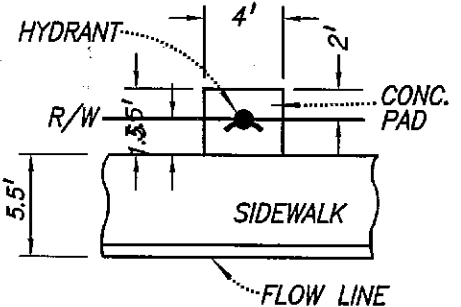
**FIRE HYDRANT SPACING:**  
RESIDENTIAL: 500 FEET MAXIMUM

**SECTION**

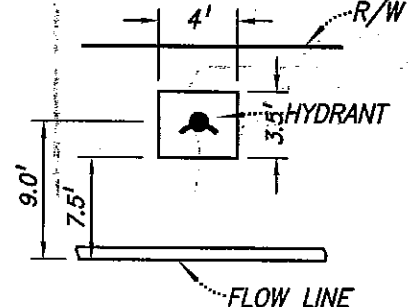
GATE VALVE BY MECHANICAL JOINT. SEE DWG. W-9 FOR SIZE OF THRUST BLOCK.



**COMMERCIAL**



**35' LANE / 50' VALLEY**



**50' HILL**

NOTE: AT ALL CURB RETURNS, FIRE HYDRANT SHOULD BE PLACED AT BACK OF SIDEWALK.

**HYDRANT LOCATION**

**HYDRANTS**

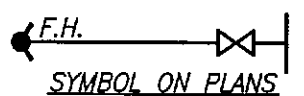
CLOW "MEDALLION" AMERICAN DARLING MODEL B-62B, KENNEDY GUARDIAN K81A MUELLER "CENTURION", "MODERN CENTURION", M & H VALVE CO. STYLE 129 OR WATEROUS PACER. 2-2 1/2" AND 1-4" NST OUTLETS; OPEN COUNTER-CLOCKWISE; 1 1/4" PENTAGON OPERATING AND CAP NUTS; DRIP PLUGS, IF ANY, SHALL BE PLUGGED. HYDRANTS SHALL BE LOCATED AT P/L EXTENSION, AT 2' MIN. FROM CURB RETURN, 3' MIN. FROM DRIVEWAYS, OR AS APPROVED BY DISTRICT ENGINEER.

**HYDRANT "T" TO A.C. PIPE FOR NEW DEVELOPMENT**

WESTERN HILLS WATER SYSTEM: RING TITE BY RING TITE BY FLANGE. CALIFORNIA WATER SERVICE CO.: RING TITE BY RING TITE BY FLANGE. CONTACT RESPECTIVE WATER SYSTEM REGARDING CONNECTION TO PIPE BY OTHER MATERIAL.

**GATE VALVES**

CLOW "RESILIENT WEDGE", MUELLER "RESILIENT SEAT", "AMERICAN DARLING", KENNEDY RESILIENT OR WATEROUS SERIES 500.



DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
03/08/02	rk

**FIRE HYDRANT**  
**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>W. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>W-10</b>

# STANDARDS FOR FIRE PROTECTION SYSTEMS

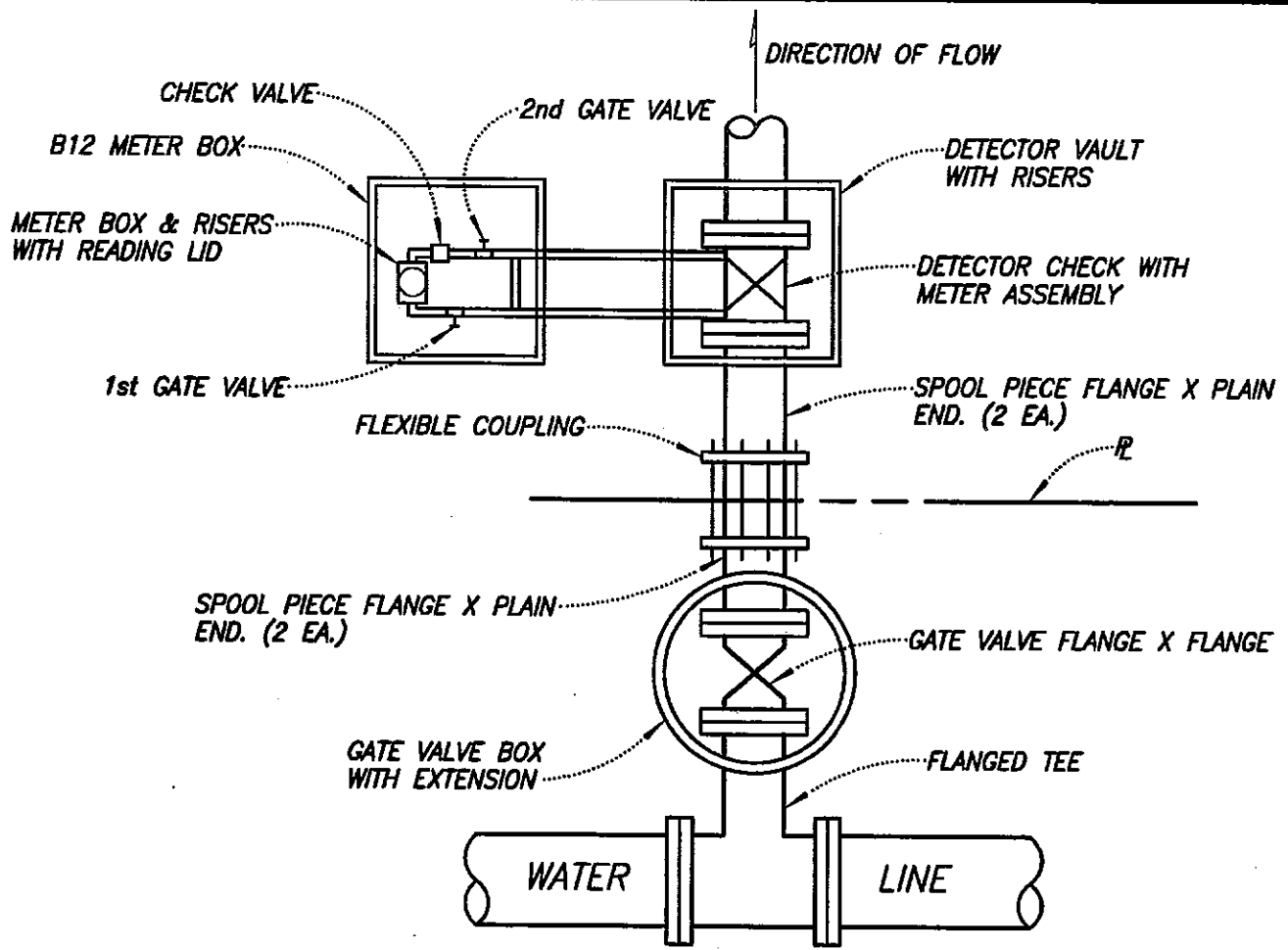
## GENERAL:

1. ALL PRIVATE FIRE SYSTEMS CROSS-CONNECTED TO UNAPPROVED WATER SOURCES AND CONNECTED TO DOMESTIC WATER MAINS SHALL HAVE BACKFLOW PREVENTION AS REQUIRED BY AWWA M-14 FOR CLASSES III, IV, V AND VI FIRE SYSTEMS. PLANS SHALL BE SUBMITTED TO AND APPROVED BY THE STANISLAUS COUNTY FIRE DEPARTMENTS AND WESTERN HILLS WATER DISTRICT PRIOR TO CONSTRUCTION. "AS-BUILT" DRAWINGS SHALL BE PROVIDED PRIOR TO CONNECTION TO THE PUBLIC WATER SYSTEM.
2. ALL FIRE PROTECTION SYSTEMS SHALL BE DISINFECTED PRIOR TO CONNECTION TO PUBLIC WATER SYSTEM IN ACCORDANCE WITH WESTERN HILLS WATER DISTRICT STANDARD SPECIFICATIONS SECTION 76.
3. WITHIN THE WESTERN HILLS WATER SERVICE AREA ALL ON-SITE FIRE HYDRANT SYSTEMS 300 FEET AND LONGER SHALL HAVE A DETECTOR CHECK LOCATED AT THE PROPERTY LINE IMMEDIATELY DOWN-STREAM OF THE MAIN SHUT OFF VALVE. PLANS AND SPECIFICATIONS SHALL BE SUBMITTED FOR APPROVAL BY THE WESTERN HILLS WATER DISTRICT.

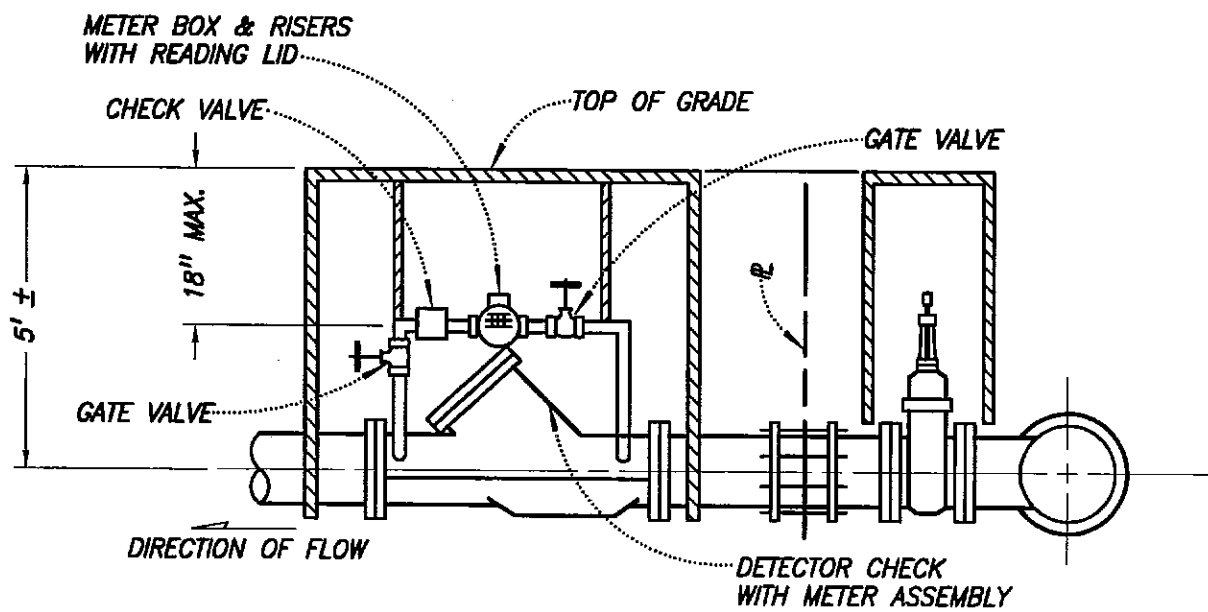
## INSTALLATION REQUIREMENTS:

1. FIRE HYDRANTS, ON-STREET AND/OR ON-SITE, SHALL BE INSTALLED IN ACCORDANCE WITH WESTERN HILLS WATER DISTRICT STANDARD SPECIFICATIONS. INSPECTION APPROVAL BY STANISLAUS COUNTY FIRE DEPARTMENT IS REQUIRED PRIOR TO ANY BACKFILL. WITNESSED PRESSURE TEST, 150 P.S.I. FOR 2 HOURS, IS REQUIRED FOR ALL ON-SITE SYSTEMS. STANISLAUS COUNTY FIRE DEPT. PLAN LOCATION APPROVAL REQUIRED PRIOR TO CONSTRUCTION. COMBINED SYSTEMS --SPRINKLER AND HYDRANT-- SHALL BE TESTED AT 200 POUNDS FOR TWO HOURS.
2. AUTOMATIC SPRINKLER SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH NFPA #13 STANDARD. PRIOR TO CONSTRUCTION, DETAILED PLANS SHALL BE SUBMITTED FOR STANISLAUS CO. FIRE DEPARTMENT APPROVAL. PRESSURE AND FLOW TESTING OF BOTH ABOVE GROUND AND UNDERGROUND SYSTEMS SHALL BE AT 200 POUNDS FOR TWO HOURS AND OBSERVED BY STANISLAUS CO. FIRE DEPARTMENT. A FINAL INSPECTION OF THE COMPLETED SYSTEM SHALL BE CONDUCTED BY THE STANISLAUS CO. FIRE DEPARTMENT TO INSURE THAT THE EQUIPMENT AND INSTALLATION CONFORMS TO THE APPROVED PLANS.
3. ALL STANDPIPE SYSTEMS (WET OR DRY) SHALL BE INSTALLED ACCORDING TO NFPA #14 STANDARDS. PRIOR TO CONSTRUCTION DETAILED PLANS SHALL BE SUBMITTED FOR STANISLAUS CO. FIRE DEPARTMENT APPROVAL. TESTING AND INSPECTION SHALL CONFORM TO SPRINKLER SYSTEM INSTALLATIONS.

DRAWN BY: K.L.	<b>FIRE PROTECTION SYSTEM STANDARDS</b>	APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	
CHECKED BY: M.P.		DATE: 01/01/96	<b>W - 11</b>
SCALE: NONE		DRAWING NO.	
REVISED	BY	<b>Western Hills Water District STANISLAUS COUNTY, CALIFORNIA</b>	

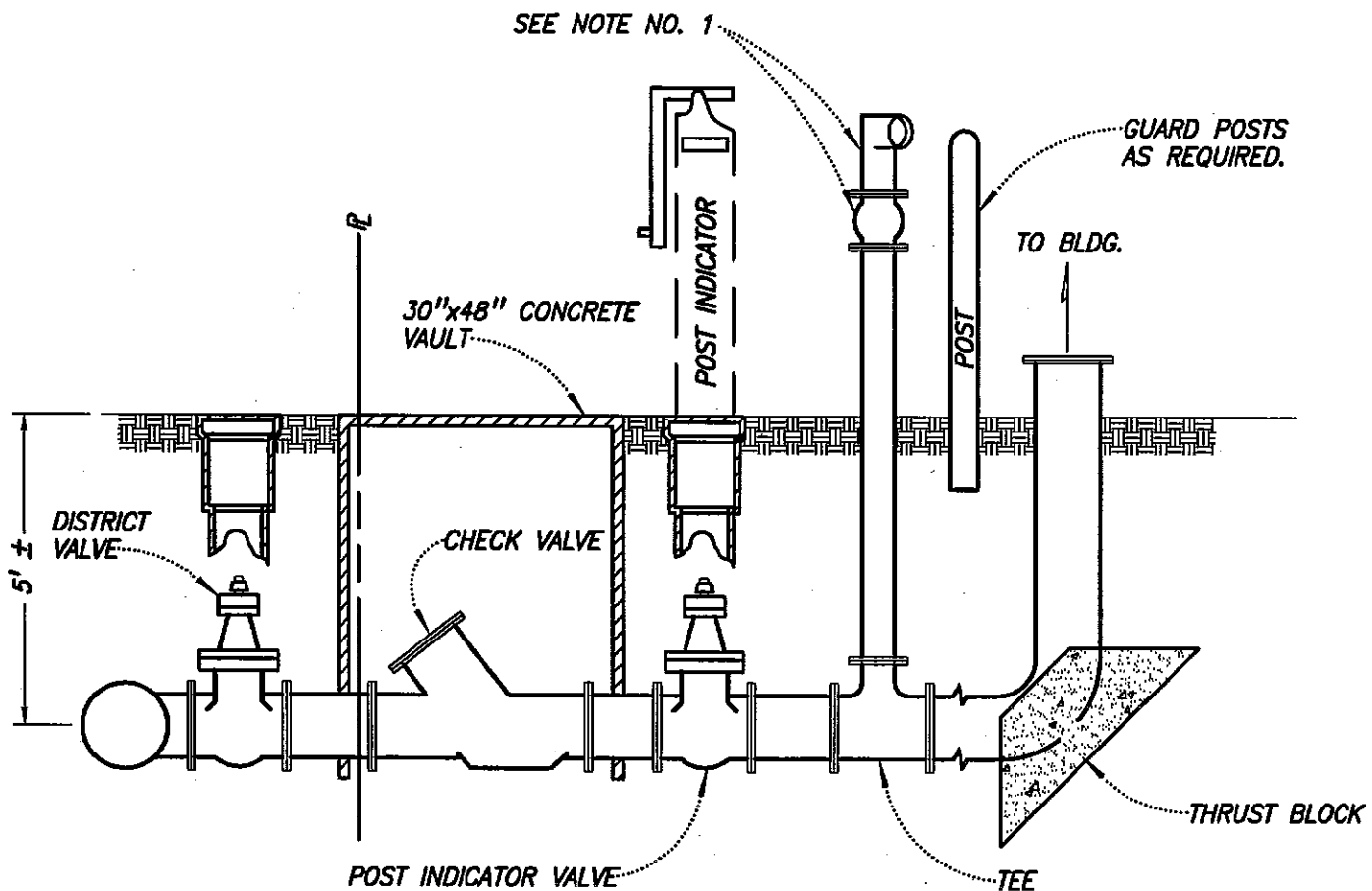


**PLAN VIEW**



**SECTION VIEW**

DRAWN BY: K.L. CHECKED BY: M.P. SCALE: NONE	<h2>DETECTOR CHECK METER ASSEMBLY</h2>	APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
REVISED BY		DATE: 01/01/98 DRAWING NO. <b>W - 12</b>
<b>Western Hills Water District</b> STANISLAUS COUNTY, CALIFORNIA		



**NOTE:**

1. FIRE DEPARTMENT CONNECTION WITH CHECK VALVE PER STANISLAUS COUNTY REQUIREMENTS.
2. DETECTOR CHECK ASSEMBLY MAY BE REQUIRED BY THE DISTRICT ENGINEER.

DRAWN BY: K.L.		<b>FIRE SPRINKLER LINE WITH POST INDICATOR VALVE</b>	APPROVED BY <i>A. Stanley Thompson</i>
CHECKED BY: M.P.			DISTRICT ENGINEER RCE 32260
SCALE: NONE			THOMPSON-HYSELL ENGINEERS, INC.
REVISED	BY	<b>Western Hills Water District</b> STANISLAUS COUNTY, CALIFORNIA	DATE: 01/01/96
			DRAWING NO. <b>W - 13</b>

ECLIPSE NO. 88 WC STATION  
 (1/2" BRASS DRAIN  
 PIPE NOT REQUIRED)

BACK OF SIDEWALK

18"x18"x4"  
 CONCRETE PAD—  
 CONCRETE PAD  
 SHALL NOT BE  
 PLACED BELOW  
 GRADE

PRECAST CONCRETE VALVE  
 BOX, CHRISTY #G5, OR  
 APPROVED EQUAL

2" RESILIENT  
 WEDGE GATE  
 VAVE W/A  
 2" OPERATING  
 NUT

30" MIN.

LOCATING WIRE  
 TAPED TO POLYETHYLENE  
 PIPE (NOT WRAPPED  
 AROUND)

3" PVC  
 SLEEVE  
 24" BURY

1" BRASS  
 PIPE

1" COUPLING

1" POLYETHYLENE PIPE

BRONZE REDUCING FITTING

2" SCH 80 PVC  
 INSULATING NIPPLE

2" ROMAC STAINLESS  
 STEEL WIDE STRAP,  
 MUELLER BRONZE STRAP,  
 OR EQUAL

**NOTES:**

1. SAMPLING STATIONS SHALL BE 24" BURY W/A 1" MIP INLET, AND A 1" FIP DISCHARGE. A 1/4" BENT NOSE SAMPLING BIBB SHALL BE LOCATED BEFORE THE DISCHARGE.
2. ALL STATIONS SHALL BE ENCLOSED IN A LOCKABLE, NONREMOVABLE, ALUMINUM CAST HOUSING.
3. WHEN OPENED, THE STATION SHALL REQUIRE NO KEY FOR OPERATION, AND THE WATER WILL FLOW IN AN ALL BRASS WATERWAY.
4. ALL WORKING PARTS WILL BE OF BRASS AND SERVICABLE FROM ABOVE GROUND WITH NO DIGGING.
5. A 1" BALL VALVE WILL CONTROL WATER FLOW, AND BE LOCATED AFTER THE SAMPLING BIBB, AS MANUFACTURED BY KUPFERLE FOUNDRY, ST. LOUIS, MO 63102.

DRAWN BY: A.Y.

CHECKED BY: J.B.

SCALE: NONE

REVISED

BY

**WATER QUALITY  
 SAMPLING STATION**

**Western Hills Water District**  
 STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:

DISTRICT ENGINEER  
 THOMPSON-HYSELL ENGINEERS, INC.

DATE: 05/08/03

DRAWING NO.

**W - 14**

JOB \_\_\_\_\_ NO. \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_  
DESIGN. BY \_\_\_\_\_ DATE \_\_\_\_\_  
CHK'D BY \_\_\_\_\_ DATE \_\_\_\_\_  
**STORM DRAIN DESIGN SHEET**  
BEGINNING DESIGN DATA: ASSUMED TIME TO INLET = \_\_\_\_\_ MINUTES  
ELEVATION HGL AT BEGINNING OF SYSTEM = \_\_\_\_\_ Δ HGL ELEV.  
ELEVATION HGL AT END OF SYSTEM = \_\_\_\_\_ APPROX. SYSTEM LENGTH \_\_\_\_\_  
MANNINGS "N" VALUE USED = \_\_\_\_\_ APPROX. AVERAGE SLOPE \_\_\_\_\_

SUBJECT \_\_\_\_\_  
DESCRIPTION \_\_\_\_\_

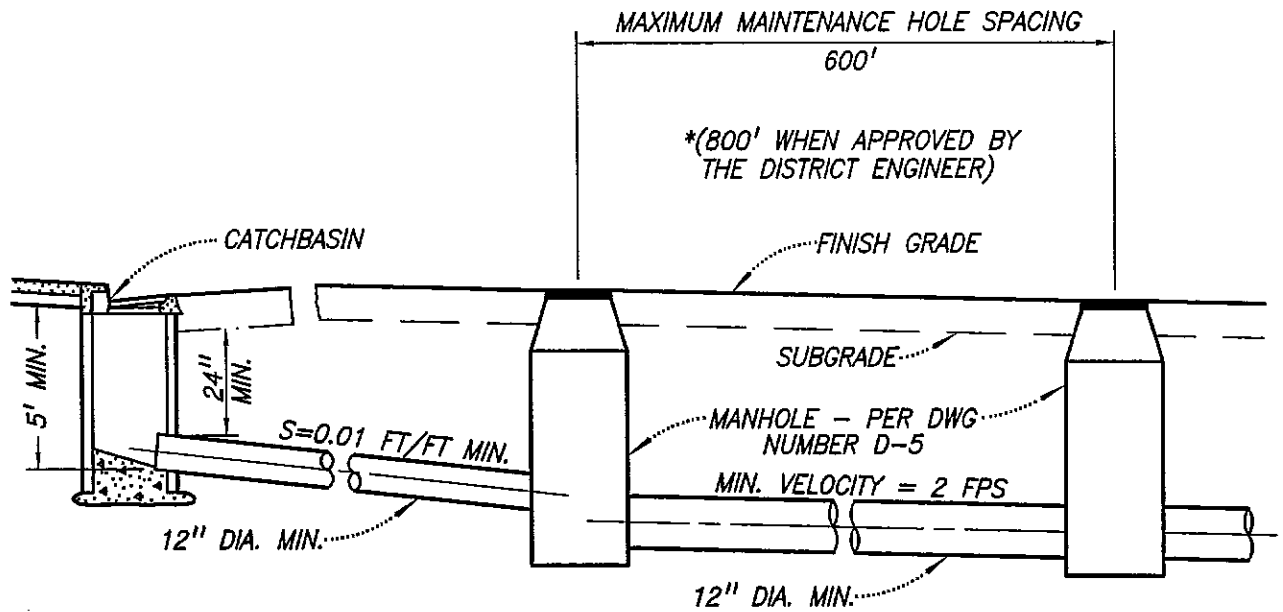
POINT OF CONCENTRATION	CONTRIB. A <sub>c</sub> (A)	RUN OFF COEF(C)	CA	n CA	INTENSITY (i)	n <sub>0</sub> cfs (CA x i)	PIPE DIA.	PIPE SLOPE FT/FT	HGL SLOPE FT/FT	LENGTH (FT)	Δ ELEV. (FT)	ELEV. HGL (FT)	ACTUAL VELOCITY (FT/S)	T, MIN. IN PIPE	T, MIN. TOTAL

DRAWN BY: D.S.  
CHECKED BY: M.P.  
SCALE: NONE  
REVISED \_\_\_\_\_ BY \_\_\_\_\_

**STORM DRAIN DESIGN SHEET**  
Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: *A. Stanley Thompson*  
DISTRICT ENGINEER *RCE 32260*  
THOMPSON-HYSELL ENGINEERS, INC.  
DATE: 01/01/96  
DRAWING NO. **D-1**





CAST IN PLACE (C.I.P.) CONCRETE PIPE SHALL MEET THE FOLLOWING MINIMUM STRENGTH REQUIREMENTS:

- 1400 P.S.I. .... 3 DAYS
- 2100 P.S.I. .... 7 DAYS
- 3500 P.S.I. .... 28 DAYS

CONCRETE SHALL BE CLASS A

PIPE SIZE	MIN. SLOPE ( $n=0.013$ )	MIN. SLOPE ( $n=0.011$ )
12" DIA.	.0020 FT/FT	.0014 FT/FT
15" DIA.	.0015 FT/FT	.0010 FT/FT
	.0012 FT/FT	.0009 FT/FT
	.0008 FT/FT	.0006 FT/FT
30" DIA.	.0006 FT/FT	.0011 FT/FT

**NOTES:**

1. CATCHBASINS SHALL BE INSTALLED AT ALL INTERSECTIONS AND AT ENDS OF ALL CUL-DE-SACS WHERE THE SLOPE AROUND THE CUL-DE-SAC IS LESS THAN .003 FT/FT. SLOPE SHALL BE A MINIMUM OF .01 FT/FT ON RADIUS OF CORNERS.
2. ALL CATCHBASINS LATERALS SHALL BE CONNECTED AT MANHOLES AND NOT DIRECTLY INTO TRUNK LINES.
3. MAXIMUM RUNS BETWEEN CATCHBASINS SHALL BE 600' UNLESS OTHERWISE APPROVED BY THE DISTRICT ENGINEER.
4. ALL STORM DRAINS TO BE DESIGNED FOR GRAVITY FLOW. (MATCHING OF PIPE CROWNS - NOT INVERT ELEVATIONS).
5. RUBBER GASKETED PIPE REQUIRED WHEN LINES ARE SURCHARGED.
6. 12" THRU 36" PIPE SHALL BE CLASS III MIN. R.C.P.; A.C.P.; OR NON-REINFORCED CONCRETE PIPE MEETING CAL-TRANS SPECIFICATIONS AND A "D" LOADING EQUIVALENT TO CLASS III R.C.P.; 34" AND LARGER PIPE SHALL BE CLASS III R.C.P. ONLY. FOR C.I.P. PIPE, SEE NOTE NO. 7 BELOW.
7. C.I.P. PIPE ALLOWED FOR 24" AND LARGER PIPES ONLY IN PROPOSED STREETS WITH PRIOR APPROVAL OF THE DISTRICT ENGINEER. NOT ALLOWED IN EXISTING STREETS.
8. FOR 12" THRU 15" PLASTIC PIPE, SDR 35 PVC, MEETING ASTM 3034 STANDARDS MAY BE USED.

NCIES

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
03/08/02	rk

**STORM DRAIN DATA**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: *[Signature]*  
DISTRICT ENGINEER  
THOMPSON-HYSELL ENGINEERS, INC.

DATE: 01/01/96

DRAWING NO. **D - 2**

2" HIGH LETTERS AS SPECIFIED  
TO BE LOCATED IN THIS AREA.  
(SEE NOTE 5)

CAST IRON SKID  
RESISTANT COVER

PRY HOLE

CAST IRON FRAME

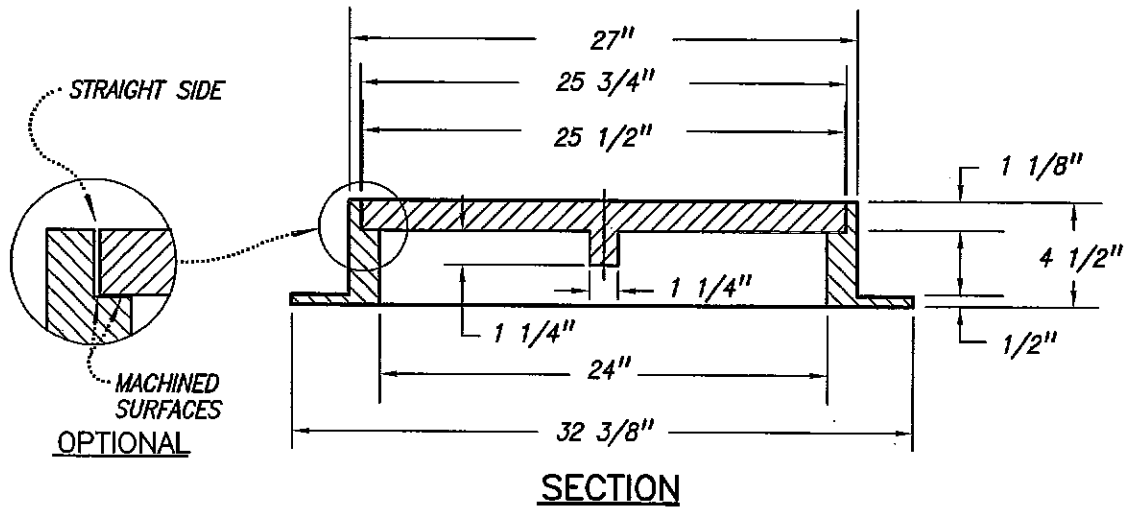
VENT HOLES

ADDITIONAL PICK  
HOLE 1" x 1/4"

1 1/2" DIA. GROUT HOLES.  
3 HOLES EQUALLY SPACED.

FOUNDRY, COUNTRY OF  
ORIGIN AND DATE OF  
MANUFACTURE HERE.

**PLAN**



**SECTION**

**NOTES**

1. MANHOLE FRAME AND COVER TO BE "CALIFORNIA CONCRETE PIPE" TYPE A-624. MANHOLE COVERS FOR STORM DRAIN MANHOLE SHALL BE "CALIFORNIA CONCRETE PIPE" TYPE A-624 WITH 4 HOLES CORED IN THE COVER.
2. COVER SHALL BE DESIGNED TO WITHSTAND HS-20 HIGHWAY LOADING.
3. FRAME AND COVER SHALL BE FULLY MACHINED TO ASSURE INTERCHANGEABILITY AND A CLOSE, QUIET FIT.
4. SEE SECTION 75-1.02a OF THE STANDARD SPECIFICATIONS.
5. THE FOLLOWING LABELS MAY BE USED: FOR STORM DRAINS, USE "STORM DRAIN" OR "STORM"

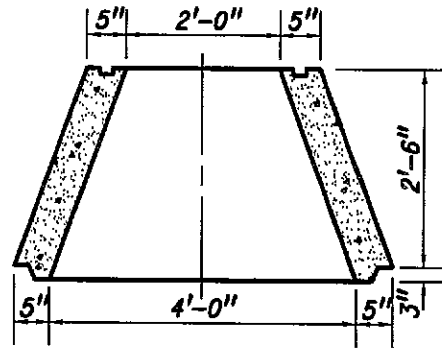
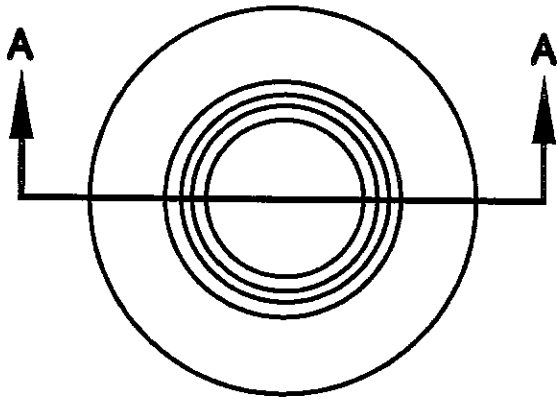
DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
02/08/02	rk

**STORM DRAIN MANHOLE  
FRAME AND COVER**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

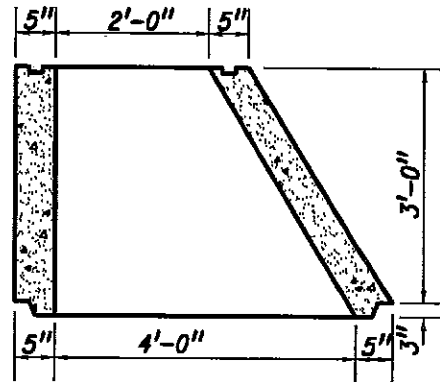
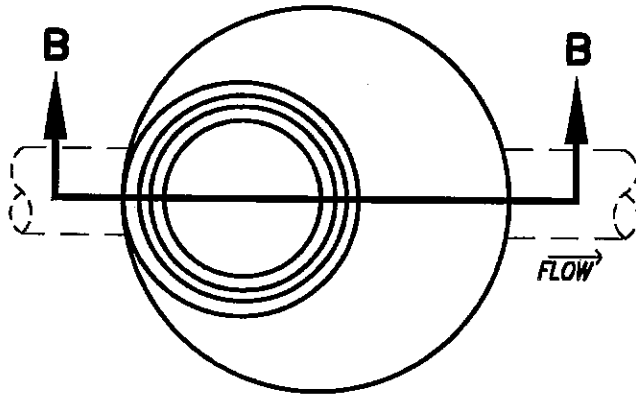
APPROVED BY: <i>M. Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO.

**D - 3**



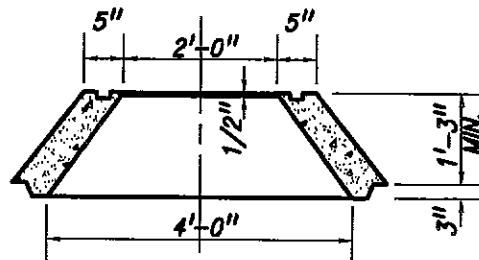
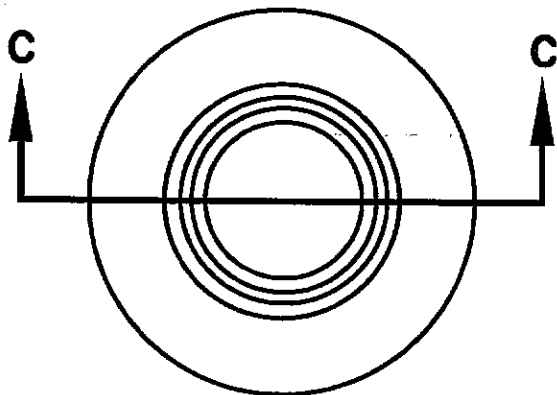
**SECTION A-A**

**CONCENTRIC CONE**  
(STANDARD INSTALLATION)



**SECTION B-B**

**ECCENTRIC CONE**  
(USE WITH PRIOR APPROVAL ONLY)



**SECTION C-C**

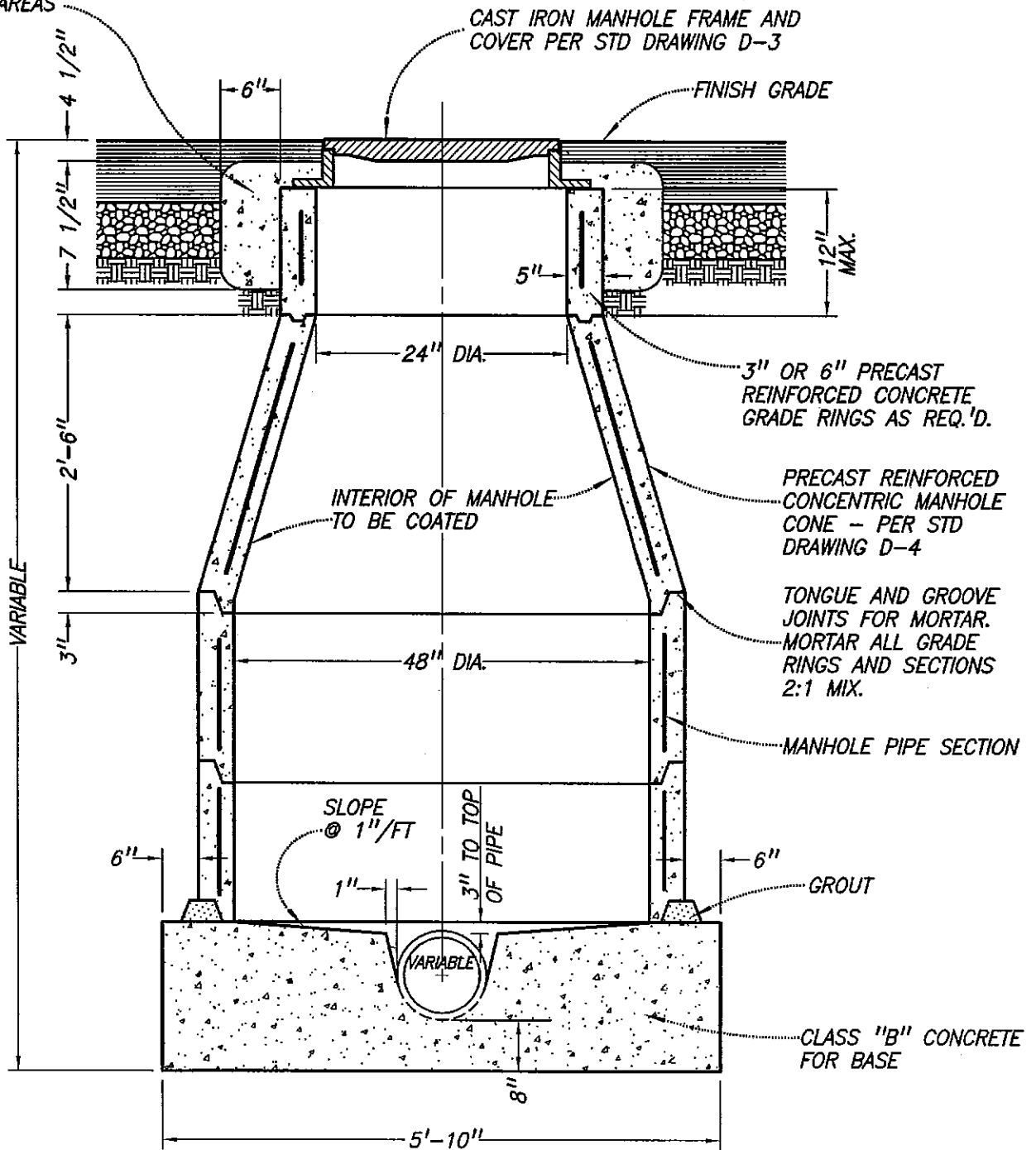
**CONCENTRIC SHORT CONE**  
(USE WITH PRIOR APPROVAL ONLY)

**NOTE:**

1. ALL HANDLING HOLES SHALL BE PLUGGED WITH CONCRETE MORTAR AFTER CONE INSTALLATION.

DRAWN BY: D.S.	<b>PRE - CAST CONCRETE MANHOLE CONES</b>	APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
CHECKED BY: M.P.		DATE: 01/01/96
SCALE: NONE	<b>Western Hills Water District</b> STANISLAUS COUNTY, CALIFORNIA	DRAWING NO. <b>D-4</b>
REVISED BY		

CONCRETE COLLAR CONSTRUCTION  
TYPICAL FOR ALL MANHOLES IN  
PAVEMENT AREAS



NOTE: PRECAST REINFORCED CONCRETE MANHOLE UNITS SHALL CONFORM TO A.S.T.M. C-478. CONSTRUCT PIPE JOINT AT 2 FEET MAXIMUM FROM BASE OF MANHOLE. FLEXIBLE JOINT.

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
02/08/02	rk

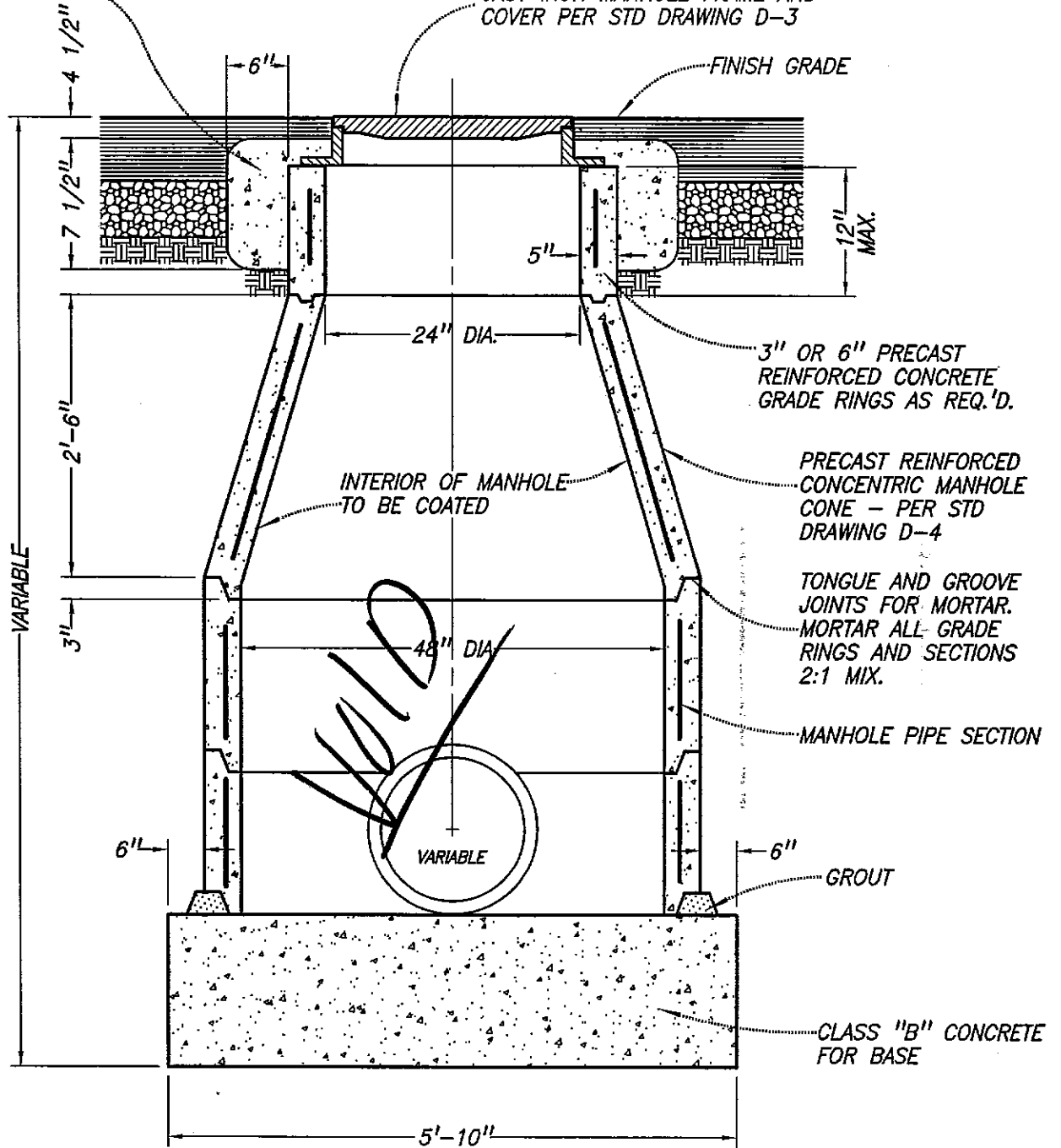
## STORM DRAIN MANHOLE

Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:	
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	
DATE: 01/01/96	<b>D - 5</b>
DRAWING NO.	

CONCRETE COLLAR CONSTRUCTION  
TYPICAL FOR ALL MANHOLES IN  
PAVEMENT AREAS

CAST IRON MANHOLE FRAME AND  
COVER PER STD DRAWING D-3



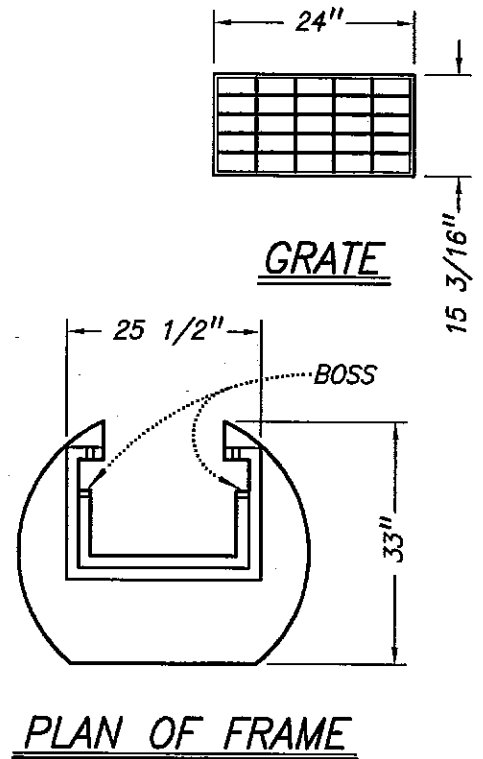
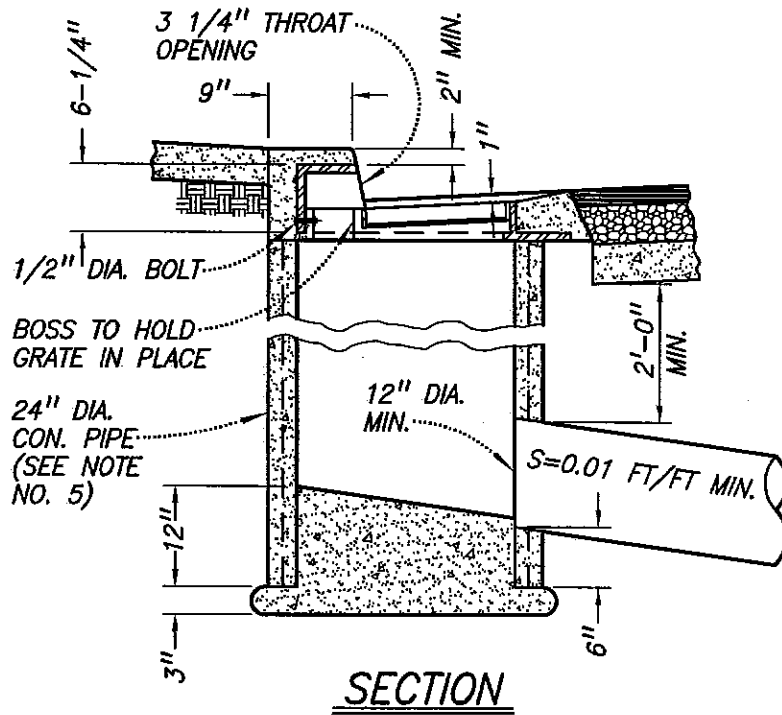
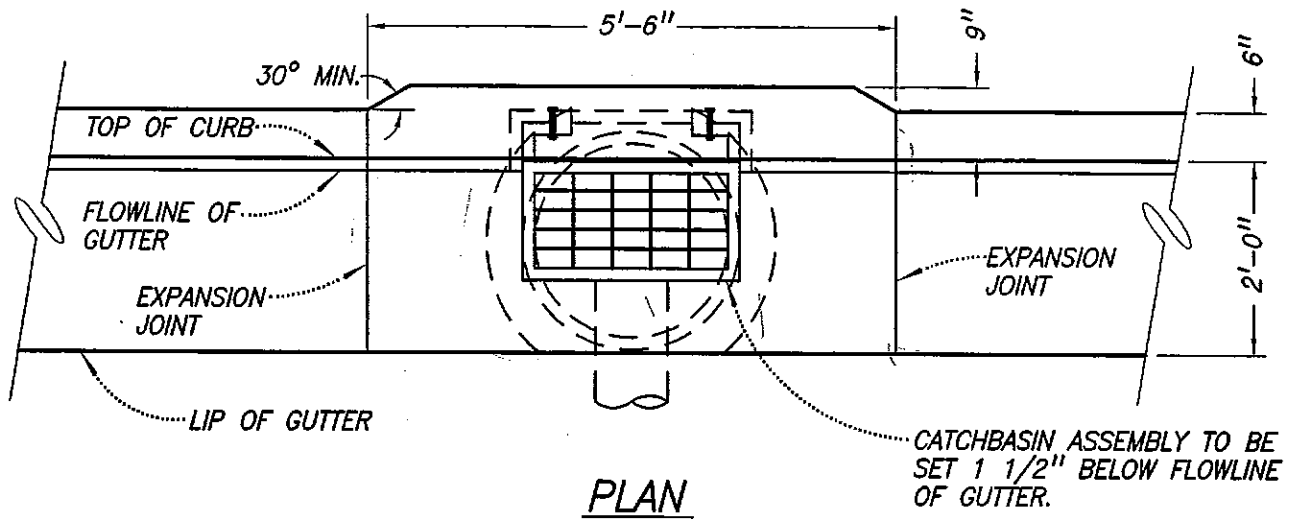
NOTE: PRECAST REINFORCED CONCRETE MANHOLE UNITS SHALL CONFORM TO A.S.T.M. C-478. CONSTRUCT PIPE JOINT AT 2 FEET MAXIMUM FROM BASE OF MANHOLE. FLEXIBLE JOINT.

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
02/08/02	rk

## STORM DRAIN MANHOLE

Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>A. Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>D-5</b>



**NOTES:**

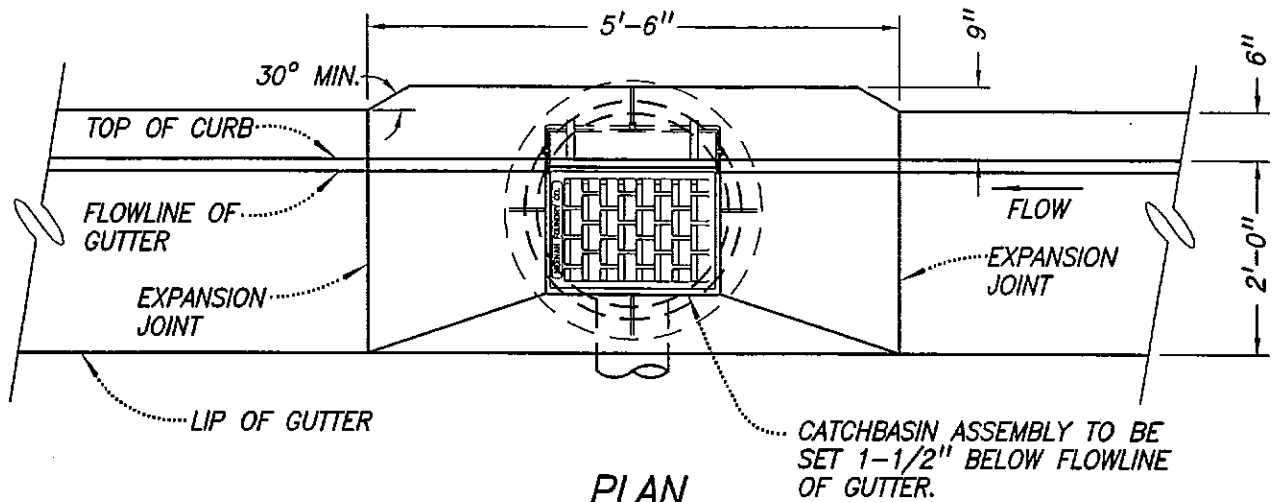
1. ALL EXPOSED STEEL SHALL BE GALVANIZED OR COATED WITH 2 COATS OF COAL TAR PITCH HEATED TO A MINIMUM OF 180° F.
2. GRATE, FRAME AND MODIFIED SIDE INLET SHALL CONFORM TO "CALIFORNIA CONCRETE PIPE" A-645 ASSEMBLY.
3. GRATE SHALL BE CHAINED TO FRAME.
4. GRATE SHALL BE DEPRESSED 1-1/2" BELOW GUTTER PROFILE GRADE.
5. 24" PIPE BARREL SHALL BE CLASS II R.C.P., OR CLASS 2 OR 3 NON-REINFORCED CONCRETE PIPE.

DRAWN BY: K.L.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY
02/08/02	rk

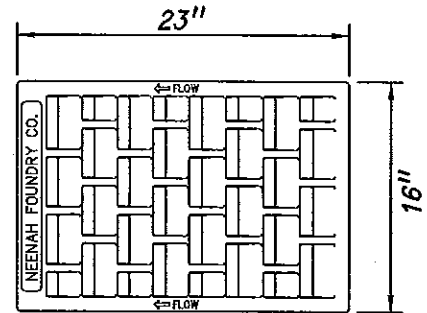
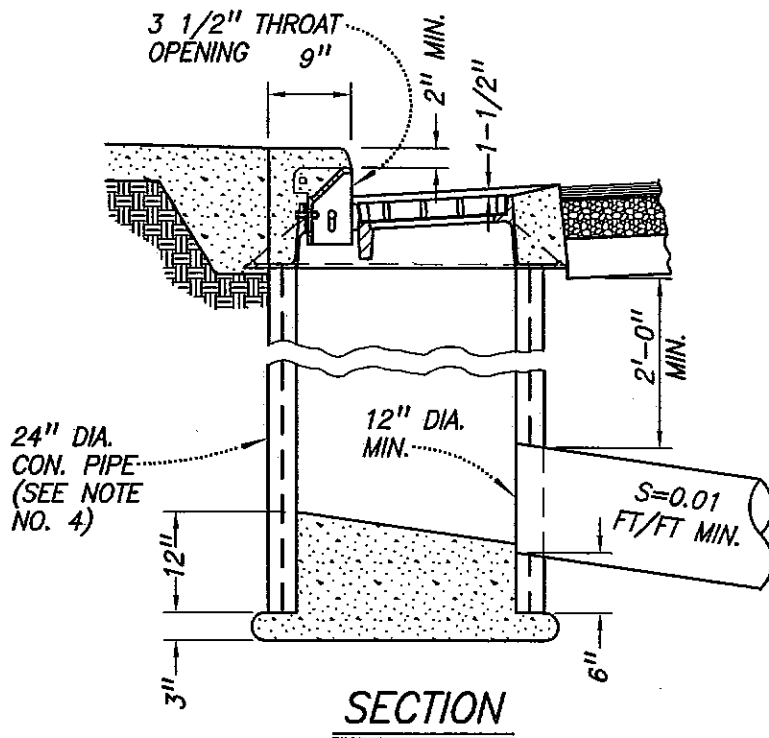
**TYPE 1  
CURB INLET CATCHBASIN**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>D-6A</b>



PLAN



"NEENAH" TYPE "L" VANE GRATE  
GRATE

NOTES:

1. FRAME AND SIDE INLET SHALL CONFORM TO "NEENAH" R-3030 CURB INLET AND CURB BOX. GRATE SHALL BE "NEENAH" TYPE "L" VANE GRATE. VANES SHALL BE ALIGNED WITH FLOW OF STORM DRAIN WATER.
2. GRATE SHALL BE CHAINED TO FRAME.
3. GRATE SHALL BE DEPRESSED 1-1/2" BELOW GUTTER PROFILE GRADE.
4. 24" PIPE BARREL SHALL BE CLASS II R.C.P., OR CLASS 2 OR 3 NON-REINFORCED CONCRETE PIPE.

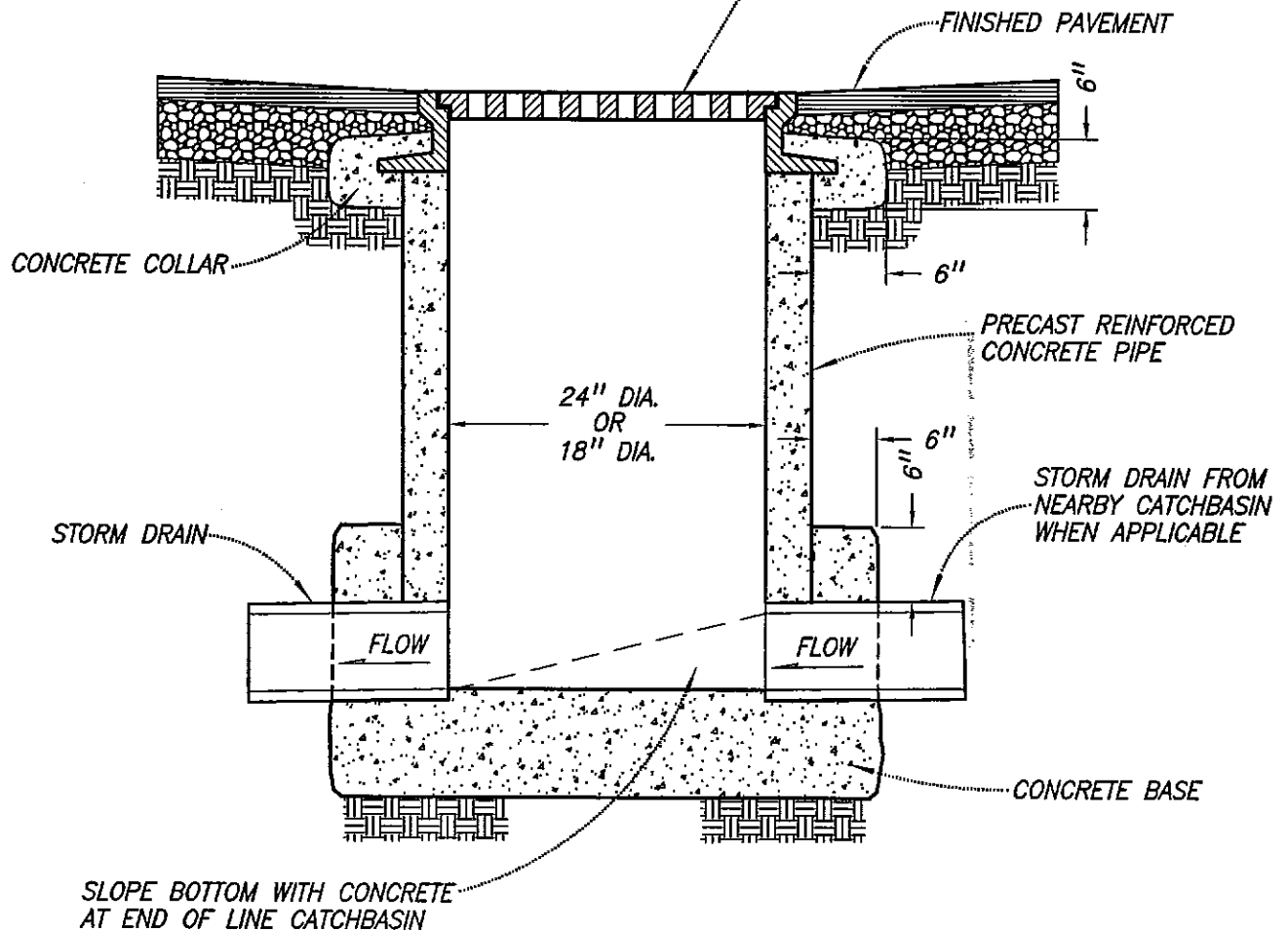
DRAWN BY: rk	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

**TYPE 2  
CURB INLET CATCHBASIN**

Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>H. Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 03/11/02
DRAWING NO. <b>D - 6B</b>

"CALIFORNIA CONCRETE PIPE" A-136 ASSEMBLY (18") OR A-1024/C2669 MANHOLE ASSEMBLY (24") OR APPROVED EQUAL



DRAWN BY: K.L.		<b>STANDARD CATCHBASIN</b>	APPROVED BY: <i>A. Stanley Thompson</i>	
CHECKED BY: M.P.			DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	
SCALE: NONE			DATE: 01/01/96	
REVIS	BY	Western Hills Water District		<b>D-7</b>
03/10/02	rk	STANISLAUS COUNTY, CALIFORNIA		
				DRAWING NO.



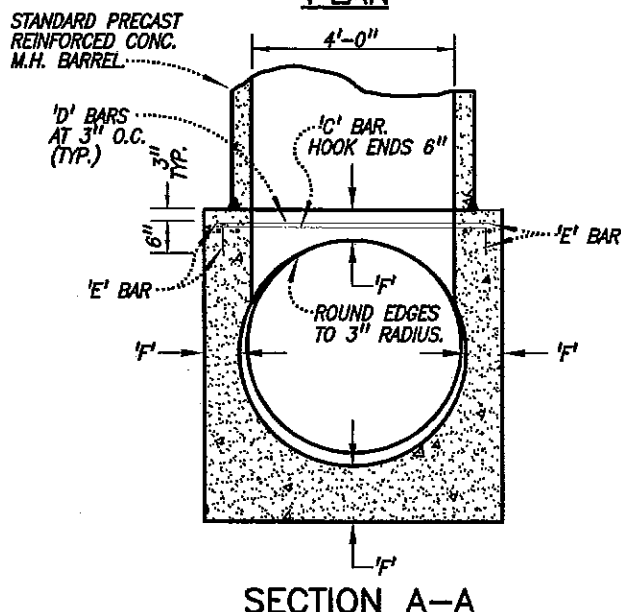
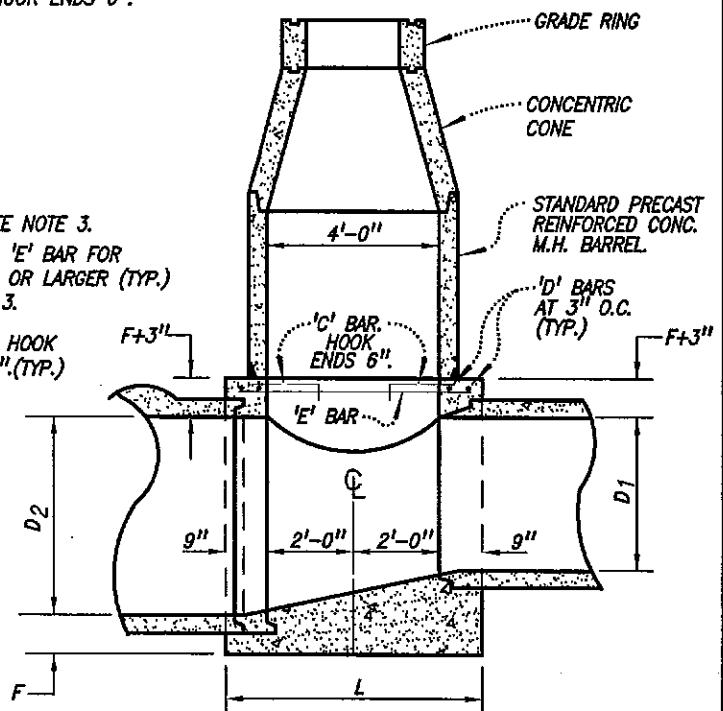
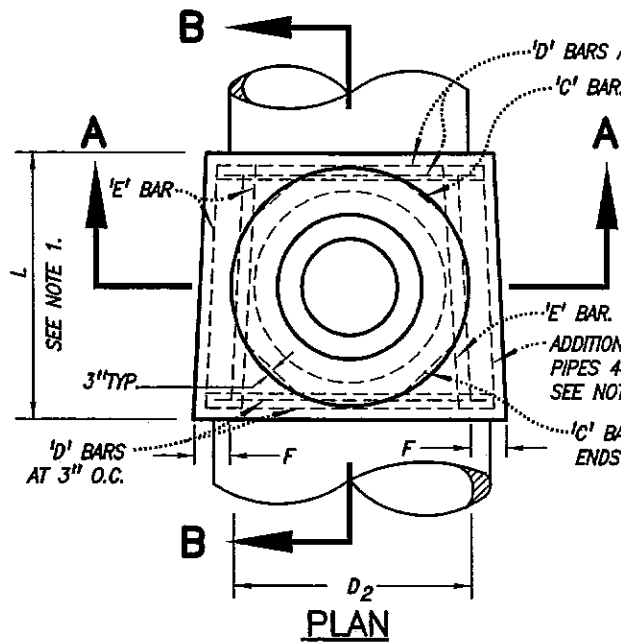


TABLE VALUES FOR 'F'

D <sub>2</sub>	'F'	D <sub>2</sub>	'F'
36"	11"	63"	10"
39"	10"	66"	10 1/4"
42"	8 3/4"	69"	10 3/4"
45"	7 3/4"	72"	11"
48"	8"	78"	11 3/4"
51"	8 1/2"	84"	12 1/2"
54"	9"	90"	13 1/4"
57"	9 1/4"	96"	14"
60"	9 1/2"		

**NOTES**

(SEE STD. DWG. U-9 FOR ADDITIONAL DETAILS)

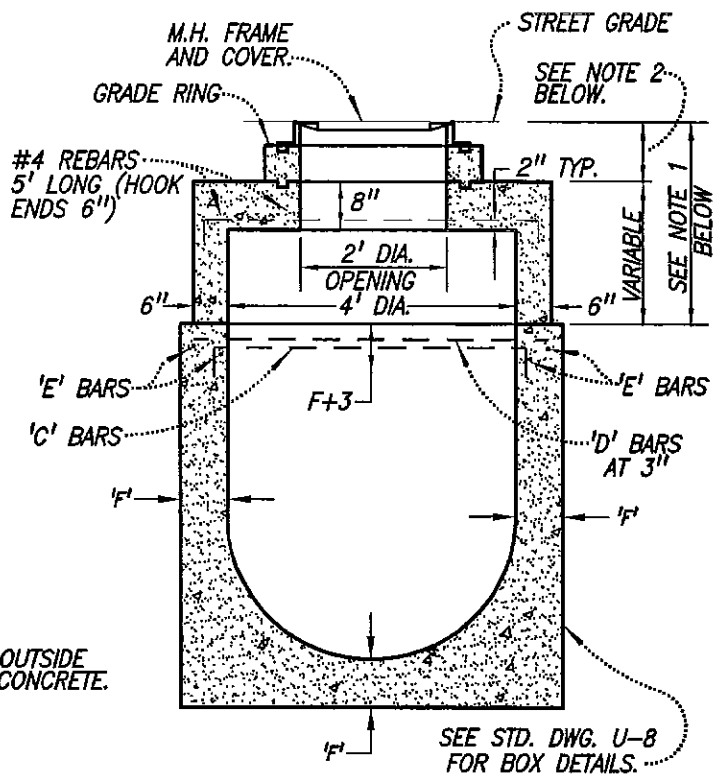
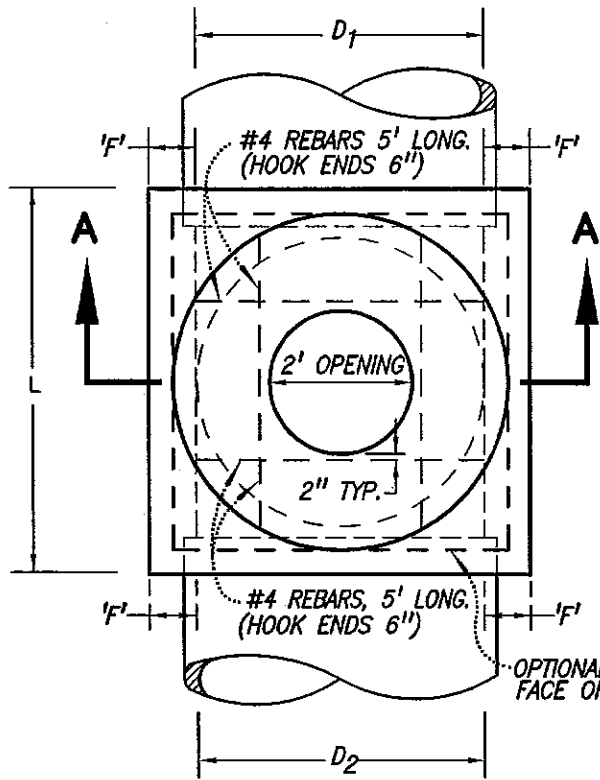
1. LENGTH SHALL BE 5'- 6" UNLESS OTHERWISE SHOWN ON THE IMPROVEMENT PLANS.
2. THICKNESS OF DECK SHALL VARY WHEN NECESSARY TO PROVIDE LEVEL SEAT FOR M.H. BARREL, BUT SHALL NOT BE LESS THAN TABULAR VALUES FOR 'F' SHOWN ON THIS SHEET.
3. REINFORCING STEEL SHALL BE ROUND, DEFORMED BARS, 2" CLEAR MINIMUM FROM FACE OF CONCRETE. SIZES AND LENGTH ARE SHOWN IN TABLE ON DRAWING NO. U-9.
4. CONCRETE SHALL BE 3000 LBS. PER SQ. INCH MINIMUM AT 28 DAYS.
5. M.H. STATIONING ON IMPROVEMENT PLAN SHALL BE TO THE CENTER OF M.H.
6. RINGS, REDUCERS, AND M.H. BARRELS FOR ACCESS SHAFT SHALL BE SEATED IN CONCRETE MORTAR COMPOSED OF ONE PART CEMENT TO 1 1/2 PARTS SAND BY VOLUME AND NEATLY PAINTED OR WIPED INSIDE THE SHAFT.
7. FLOOR OF M.H. SHALL BE STEEL TROWELED TO SPRING LINE.
8. BASE OF M.H. SHALL BE POURED IN ONE CONTINUOUS OPERATION, EXCEPT THAT THE CONTRACTOR SHALL HAVE THE OPTION OF PLACING A CONSTRUCTION JOINT AT THE SPRING LINE, WITH A LONGITUDINAL KEYWAY.
9. INTERIOR OF SANITARY SEWER M.H.'S SHALL BE COATED IN ACCORDANCE WITH SECTION 71-1.09 OF THE STANDARD SPECIFICATIONS.

DRAWN BY:	D.S.
CHECKED BY:	M.P.
SCALE:	NONE
REVISED	BY

**TYPE 2 MANHOLE  
FOR PIPES 36" AND LARGER**

**Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA**

APPROVED BY:	<i>A. Stanley Thompson</i>
DISTRICT ENGINEER	THOMPSON-HYSSELL ENGINEERS, INC.
DATE:	01/01/96
DRAWING NO.	<b>D - 8</b>



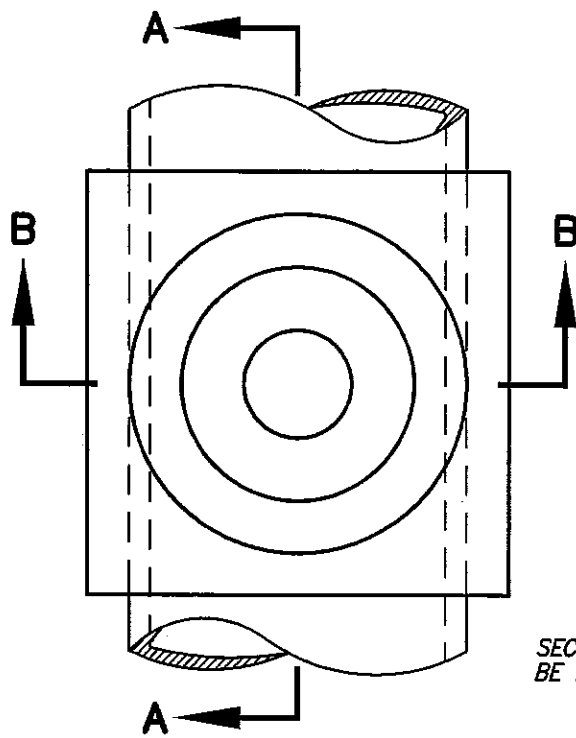
**NOTES:**

1. WHEN DEPTH OF M.H. FROM STREET GRADE TO TOP OF BOX IS LESS THAN 2'-10 1/2" FOR PAVED STREETS OR 3'-6" FOR UNPAVED STREETS, CONSTRUCT MONOLITHIC SHAFT AS SHOWN. THE CONTRACTOR SHALL HAVE THE OPTION OF CONSTRUCTING SHAFT AS SHOWN FOR ANY DEPTH OF M.H.
2. PER SECTION A-A ABOVE, IN PAVED STREETS THE MAXIMUM HEIGHT SHALL BE 10 1/2" AND THE MINIMUM HEIGHT 7 1/2"; IN UNPAVED STREETS THE MAXIMUM HEIGHT SHALL BE 16 1/2" AND THE MINIMUM HEIGHT 13 1/2".

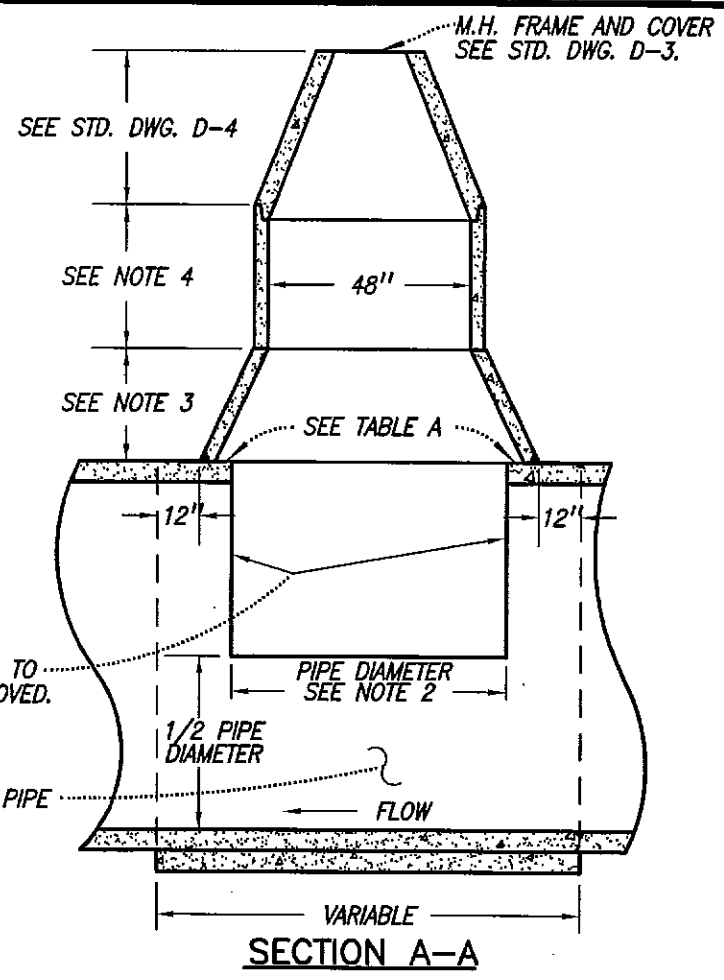
REINFORCING STEEL FOR M.H. BOX									
D <sub>2</sub>	'C' BAR 45°/45° HOOK ENDS 6"			'D' BAR			'E' BAR		
DIA.	NO. READ	SIZE	LENGTH	NO. READ	SIZE	LENGTH	NO. READ	SIZE	LENGTH
36"	2	#4	6'-4"	4	#4	4'-6"	2	#4	5'-2"
39"	2	#4	6'-4"	4	#4	4'-7"	2	#4	5'-2"
42"	2	#4	6'-4"	4	#5	4'-7 1/2"	2	#4	5'-2"
45"	2	#4	6'-4"	4	#5	4'-8 1/2"	2	#4	5'-2"
48"	2	#4	6'-4"	4	#5	5'-0"	4	#4	5'-2"
51"	2	#4	6'-4"	4	#5	5'-4"	4	#4	5'-2"
54"	2	#4	6'-4"	4	#5	5'-8"	4	#4	5'-2"
57"	2	#4	6'-4"	4	#5	5'-11 1/2"	4	#4	5'-2"
60"	2	#4	6'-4"	4	#5	6'-3"	4	#4	5'-2"
63"	2	#4	6'-4"	4	#5	6'-7"	4	#4	5'-2"
66"	2	#4	6'-4"	4	#5	6'-10 1/2"	4	#4	5'-2"
69"	2	#4	6'-4"	4	#5	7'-2 1/2"	4	#4	5'-2"
72"	2	#4	6'-4"	4	#5	7'-6"	4	#4	5'-2"
78"	2	#4	6'-4"	4	#5	8'-1 1/2"	4	#4	5'-2"
84"	2	#4	6'-4"	4	#5	8'-9"	4	#4	5'-2"
90"	2	#4	6'-4"	4	#6	9'-4 1/2"	4	#4	5'-2"
96"	2	#4	6'-4"	4	#6	10'-0"	4	#4	5'-2"

3. INTERIOR OF SANITARY SEWER M.H. SHALL BE COATED IN ACCORDANCE WITH SECTION 71-1.09 OF THE STANDARD SPECIFICATIONS.

DRAWN BY: D.S. CHECKED BY: M.P. SCALE: NONE REVISED BY:	<h2>TYPE 2 MANHOLE FOR PIPES 36" AND LARGER</h2> <p>Western Hills Water District STANISLAUS COUNTY, CALIFORNIA</p>	APPROVED BY:  DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC. DATE: 01/01/96 DRAWING NO.
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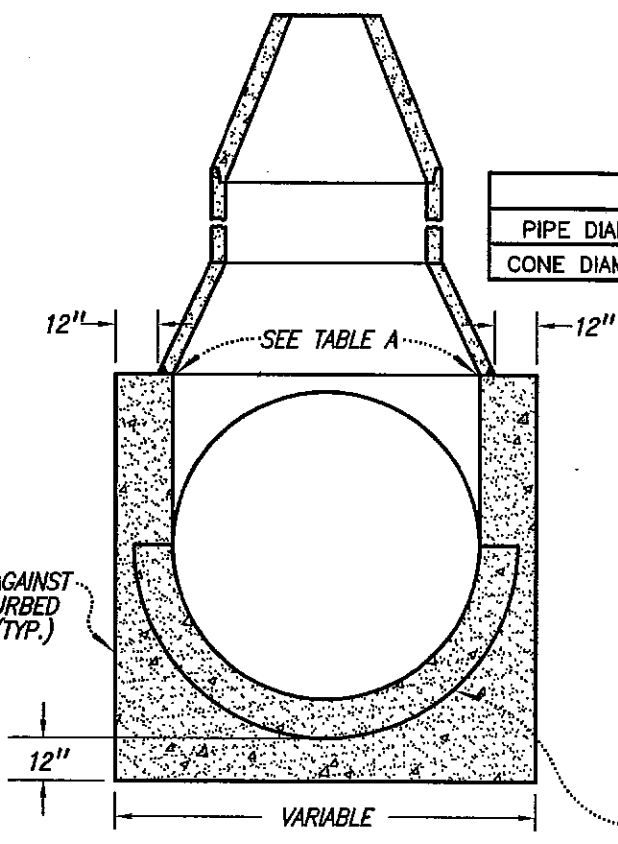


PLAN



SECTION A-A

TABLE A			
PIPE DIAMETER	36" THRU 39"	42" THRU 48"	54" THRU 72"
CONE DIAMETER	48"	60"	72"



POUR AGAINST UNDISTURBED EARTH (TYP.)

**NOTES:**

1. ALL CONE SECTIONS TO CONFORM TO A.S.T.M. C-478
2. MAINTENANCE HOLE TO BE PLACED SUCH THAT EXISTING OR CAST IN PLACE PIPE, RUNS STRAIGHT THROUGH. BREAK OUT TOP OF PIPE, TO A LENGTH EQUAL TO THE PIPE DIAMETER, TO PIPE SPRING LINE.
3. INSTALL CONCENTRIC PRECAST CONCRETE CONE.
4. IF REQUIRED, INSTALL STANDARD 48" PRECAST CONCRETE VERTICAL SECTIONS TO MEET GRADE.
5. CONSTRUCT FLEXIBLE PIPE JOINTS AT 2' MAXIMUM FROM BASE OF M.H.
6. GROUT ALL M.H. JOINTS WITH 1-1/2 : 1 MIX MORTAR.
7. INTERIOR OF SANITARY SEWER M.H. TO BE COATED IN ACCORDANCE WITH SECTION 71-1.09 OF THE STANDARD SPECIFICATIONS.

DRAWN BY:	D.S.
CHECKED BY:	M.P.
SCALE:	NONE
REVISED	BY

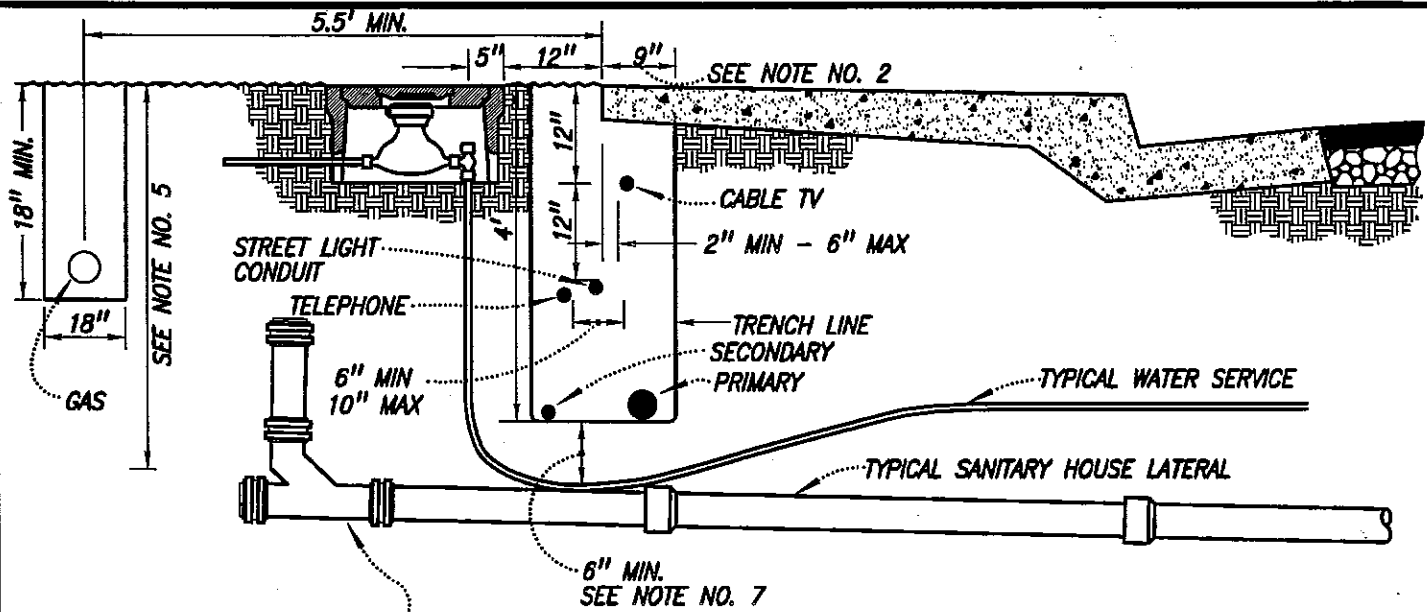
**TYPE 3 MANHOLE FOR PIPES 36" AND LARGER**

Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: *Stanley Thompson*  
DISTRICT ENGINEER  
THOMPSON-HYSELL ENGINEERS, INC.

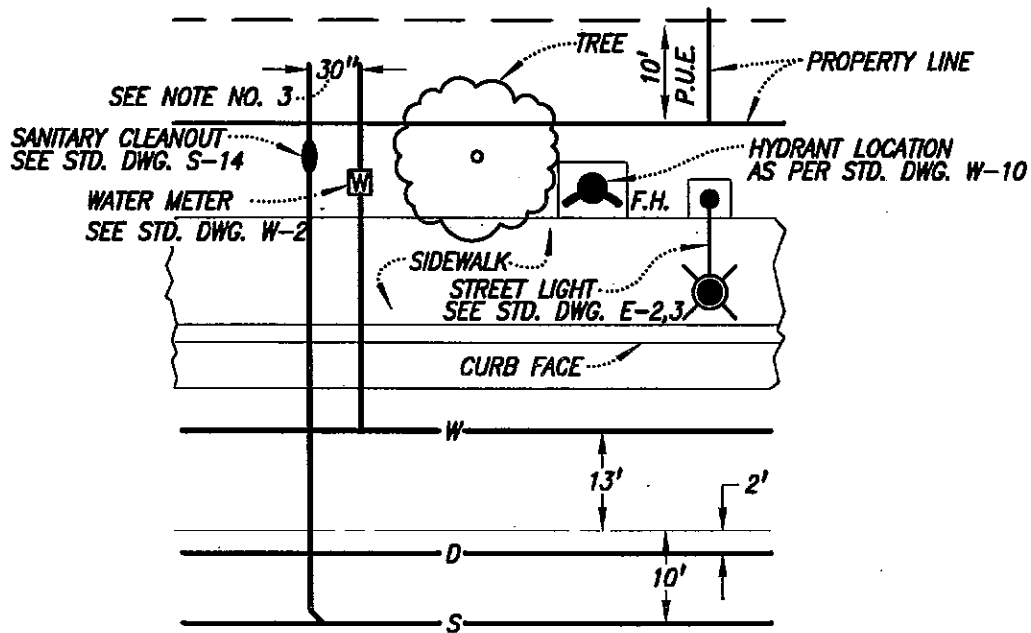
DATE: 01/01/96  
DRAWING NO.

**D - 10**



SEE STD. DWG. S-14 FOR CLEANOUT RISER.

**TYPICAL SECTION**

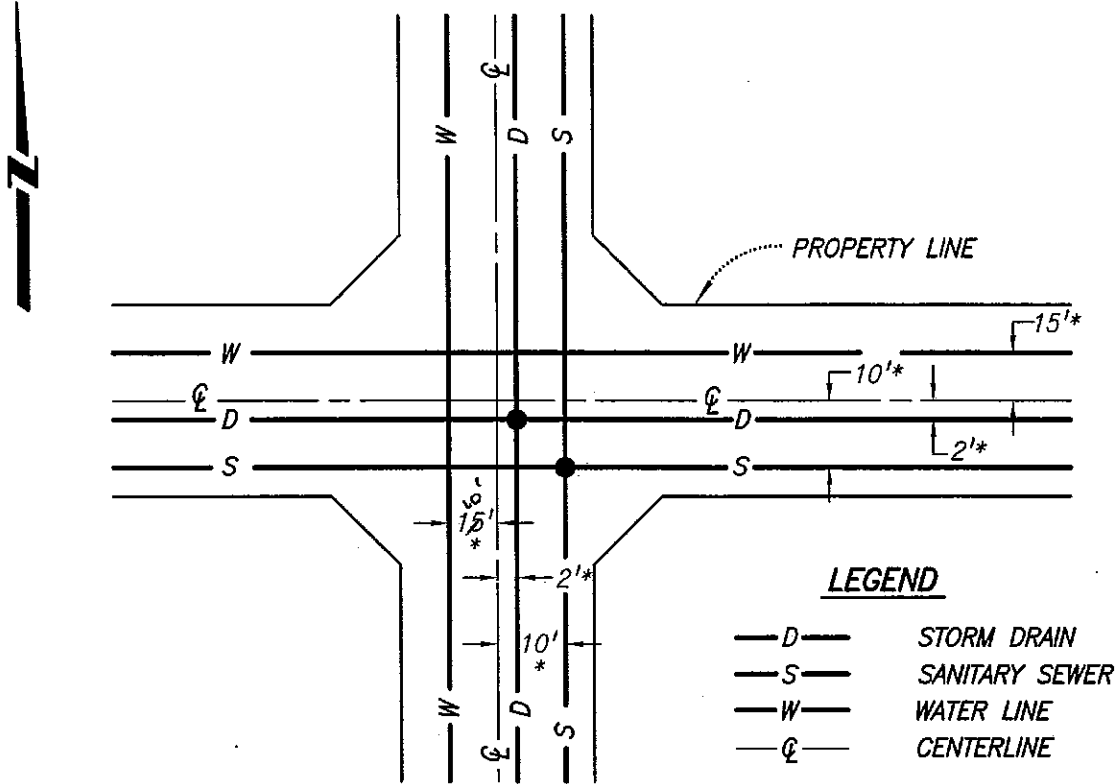


**PLAN**

**NOTES:**

1. ● DENOTES CABLE AND/OR CONDUIT.
2. IF THE TRENCH LIES MORE THAN 9" UNDER THE SIDEWALK IT SHALL BE BACKFILLED IN THE SAME MANNER AS THE TOP 3' OF A TRENCH SECTION IN EXISTING STREETS. SEE STD. DWG. U-5.
3. WATER SERVICE AND SANITARY SERVICE SHALL HAVE A MINIMUM LATERAL CLEARANCE OF 30".
4. UTILITIES TO BE PLACED AS PER PUBLIC UTILITY COMPANY REGULATIONS.
5. SANITARY HOUSE LATERAL SHALL HAVE 4'-0" MIN. AND 7' MAX. COVER AT PROPERTY LINE.
6. GAS LINE LOCATION TO BE DETERMINED BY DEVELOPER AND J.S. WEST PROPANE GAS COMPANY.
7. ALL SERVICES CROSSING UNDERNEATH PRIMARY AND SECONDARY ELECTRICAL LINES SHALL HAVE A MINIMUM CLEARANCE OF 6". ELECTRICAL LINES SHALL HAVE A CLEARANCE OF 12" IF PLACED BELOW SERVICE LATERALS.

DRAWN BY: D.S. CHECKED BY: M.P. SCALE: NONE REVISED BY:	<h2>UNDERGROUND UTILITY LOCATIONS</h2> <p>Western Hills Water District STANISLAUS COUNTY, CALIFORNIA</p>	APPROVED BY: <i>D. Stanley Thompson</i> DISTRICT ENGINEER RCE 32260 THOMPSON-HYSELL ENGINEERS, INC. DATE: 01/01/96 DRAWING NO.
		<h1>U-1</h1>



\* DISTANCES SHOWN APPLY TO ALL STREETS EXCEPT HILL AREA STREETS AND PRIVATE LANES. SEE CHART BELOW.

	DISTANCE FROM CENTERLINE		
	WATER	STORM	SEWER
HILL AREA STREETS	15'	3'	15'
<sup>35'</sup> PRIVATE LANES	12'	3'	12'

**NOTES:**

1. SEE STD. DWG. U-1 FOR LOCATION OF ELECTRIC, TELEPHONE, GAS, TV CONDUIT AND STREET LIGHT CONDUIT.
2. SANITARY SEWERS AND WATER MAINS SHOULD BE SEPARATED WITH SANITARY SEWERS ALWAYS LOWER THAN WATER MAINS.  
 PARALLEL CONSTRUCTION: THE HORIZONTAL DISTANCE BETWEEN SANITARY SEWERS OR STORM DRAINS AND WATER MAINS SHALL BE AT LEAST 10 FEET. SEE STD. DWGS. U-3 & U-4.  
 PERPENDICULAR CONSTRUCTION (CROSSING): SANITARY SEWERS SHALL BE AT LEAST 1 FOOT BELOW WATER MAINS WHERE THESE LINES MUST CROSS. SEE STD. DWGS. U-3 & U-4.
3. IN COMMERCIAL OR INDUSTRIAL SUBDIVISIONS WHERE WATER SERVICE SIZES AND LOCATIONS ARE UNKNOWN AT THE TIME THE WATER MAIN IS INSTALLED. THE WATER MAIN MAY BE LOCATED IN THE P.U.E. 2 FEET FROM THE PROPERTY LINE WITH THE APPROVAL OF THE DISTRICT ENGINEER. NO STREET CUTS SHALL BE PERMITTED FOR WATER SERVICES TO THE OPPOSITE SIDE OF THE STREET.
4. WHEN POSSIBLE WATER MAINS SHOULD BE LOCATED ON THE NORTH OR WEST SIDE OF THE STREET, EXCEPTIONS WOULD BE FOR CIRCLES OR CURVED STREETS THAT WOULD REQUIRE WATER TO DEVIATE FROM THE STANDARD ORIENTATION.

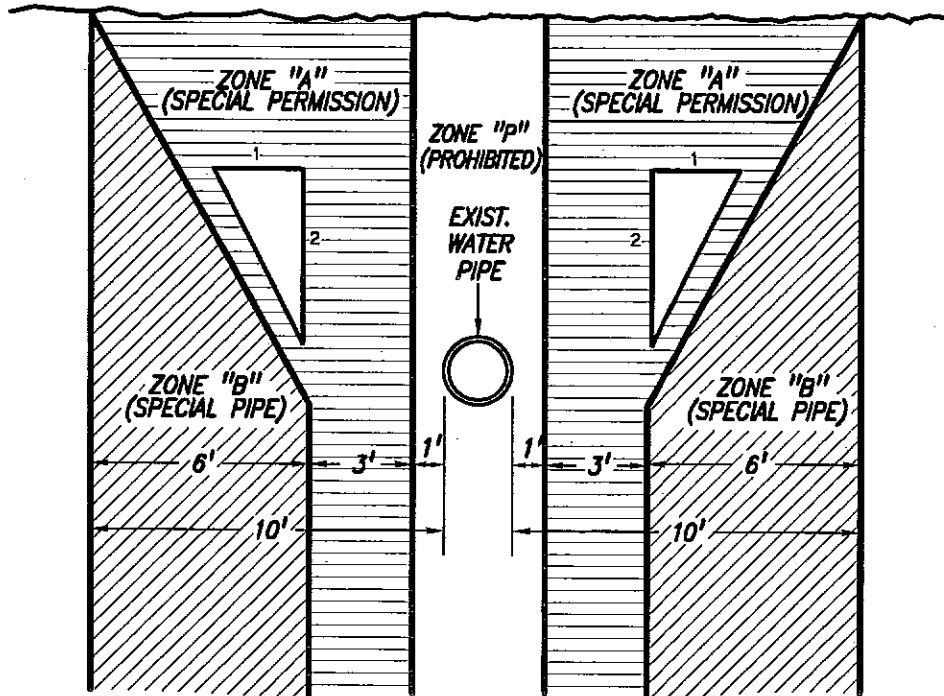
DRAWN BY: E.T.	<b>STREET LOCATION OF UNDERGROUND UTILITIES</b>	APPROVED BY: 	
CHECKED BY: M.P.		DISTRICT ENGINEER	THOMPSON-HYSELL ENGINEERS, INC.
SCALE: NONE			
REVISED	BY	DATE: 01/01/96	<b>U - 2</b>
Western Hills Water District STANISLAUS COUNTY, CALIFORNIA		DRAWING NO.	

# SPECIAL CONSTRUCTION REQUIREMENTS

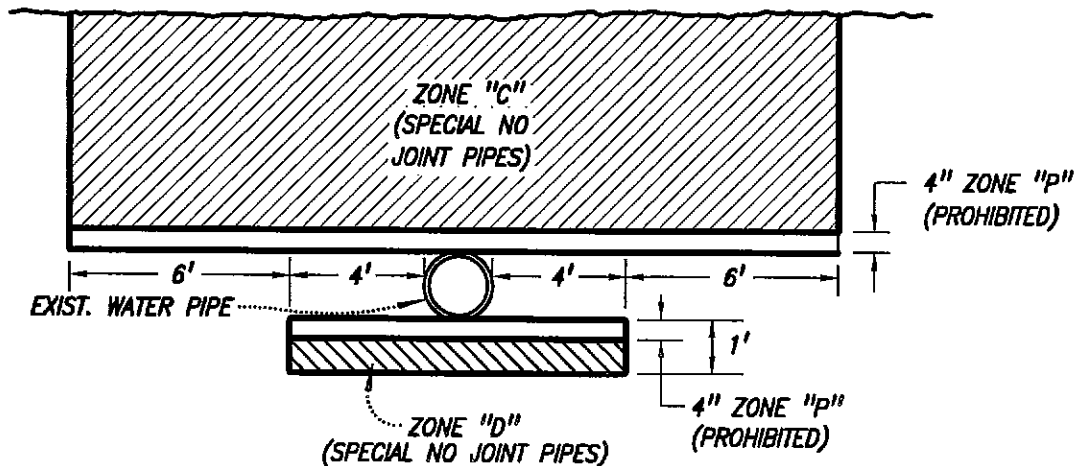
(TO BE USED ONLY WHERE REQUIRED SEPARATION CANNOT BE OBTAINED)

## CASE 1 - NEW SEWER BEING INSTALLED

ZONES "A","B","C", AND "D" INDICATE RESTRICTED USE AREAS.  
ZONES "P" INDICATE PROHIBITED USE AREAS.



PARALLEL CONSTRUCTION



PERPENDICULAR CONSTRUCTION

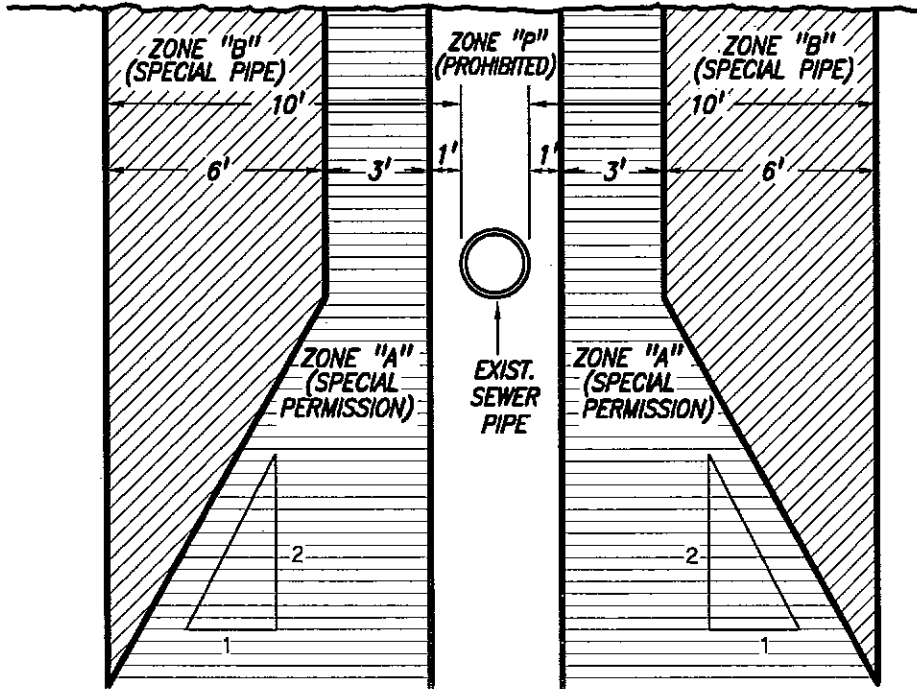
DRAWN BY: D.S.	<h2 style="margin: 0;">CALIFORNIA HEALTH DEPARTMENT REQUIREMENTS</h2> <p style="margin: 0;">Western Hills Water District STANISLAUS COUNTY, CALIFORNIA</p>	APPROVED BY: <i>Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.	
CHECKED BY: M.P.		DATE: 01/01/96	<p style="margin: 0;">RCE 32260</p> <h2 style="margin: 0;">U - 3</h2>
SCALE: NONE		DRAWING NO.	
REVISED	BY		

# SPECIAL CONSTRUCTION REQUIREMENTS

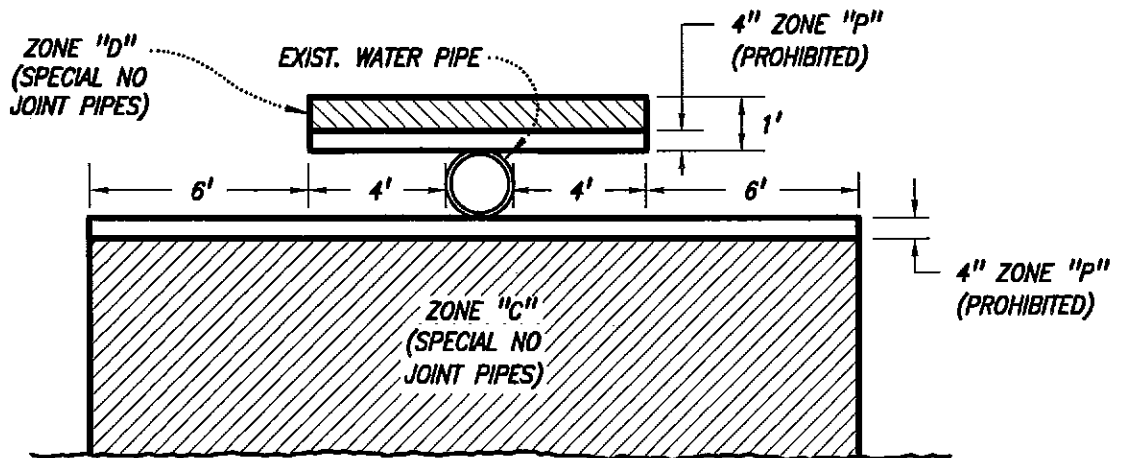
(TO BE USED ONLY WHERE REQUIRED SEPARATION CANNOT BE OBTAINED)

## CASE 2 - NEW WATER LINE BEING INSTALLED

ZONES "A", "B", "C", AND "D" INDICATE RESTRICTED USE AREAS  
ZONES P INDICATE PROHIBITED USE AREAS



PARALLEL CONSTRUCTION



PERPENDICULAR CONSTRUCTION

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

## CALIFORNIA HEALTH DEPARTMENT REQUIREMENTS

Western Hills Water District  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY:  
*Stanley Thompson*  
DISTRICT ENGINEER  
THOMPSON-HYSELL ENGINEERS, INC.  
RGE 32260

DATE: 01/01/96

DRAWING NO.

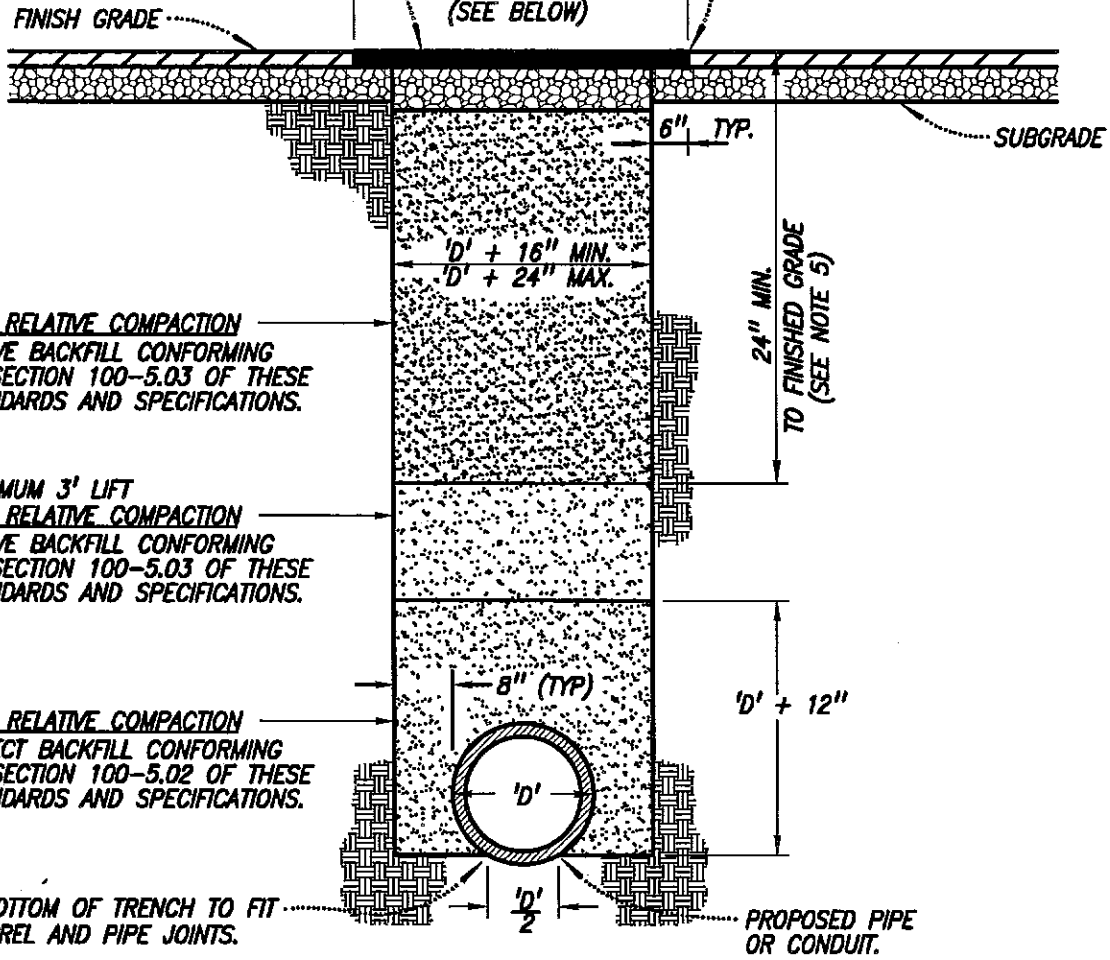
U - 4

PAVEMENT SECTION AS SPECIFIED IN AN "ENCROACHMENT PERMIT", OR APPROVED PLAN, SHALL TAKE PRECEDENCE OVER THE PAVEMENT SECTION AS DESCRIBED IN SECTION 100-6 OF THESE STANDARDS AND SPECIFICATIONS.

NEW PAVEMENT TO BE 1/8" HIGHER THAN ADJACENT PAVEMENT. APPLY FOG SEAL COAT OF CSS-1 OR SS-1 ASPHALT EMULSION.

REPLACE TRENCH SECTION (SEE BELOW)

DIAMOND SAW CUTTING MILLING OR OTHER APPROVED DEVICE SHALL BE USED. REPAVE TO A CLEAN STRAIGHT EDGE (TYP).



95% RELATIVE COMPACTION  
NATIVE BACKFILL CONFORMING TO SECTION 100-5.03 OF THESE STANDARDS AND SPECIFICATIONS.

MAXIMUM 3' LIFT  
85% RELATIVE COMPACTION  
NATIVE BACKFILL CONFORMING TO SECTION 100-5.03 OF THESE STANDARDS AND SPECIFICATIONS.

90% RELATIVE COMPACTION  
SELECT BACKFILL CONFORMING TO SECTION 100-5.02 OF THESE STANDARDS AND SPECIFICATIONS.

SHAPE BOTTOM OF TRENCH TO FIT PIPE BARREL AND PIPE JOINTS.

PROPOSED PIPE OR CONDUIT.

**TYPICAL TRENCH SECTION IN EXISTING IMPROVED STREETS**

**NOTES:**

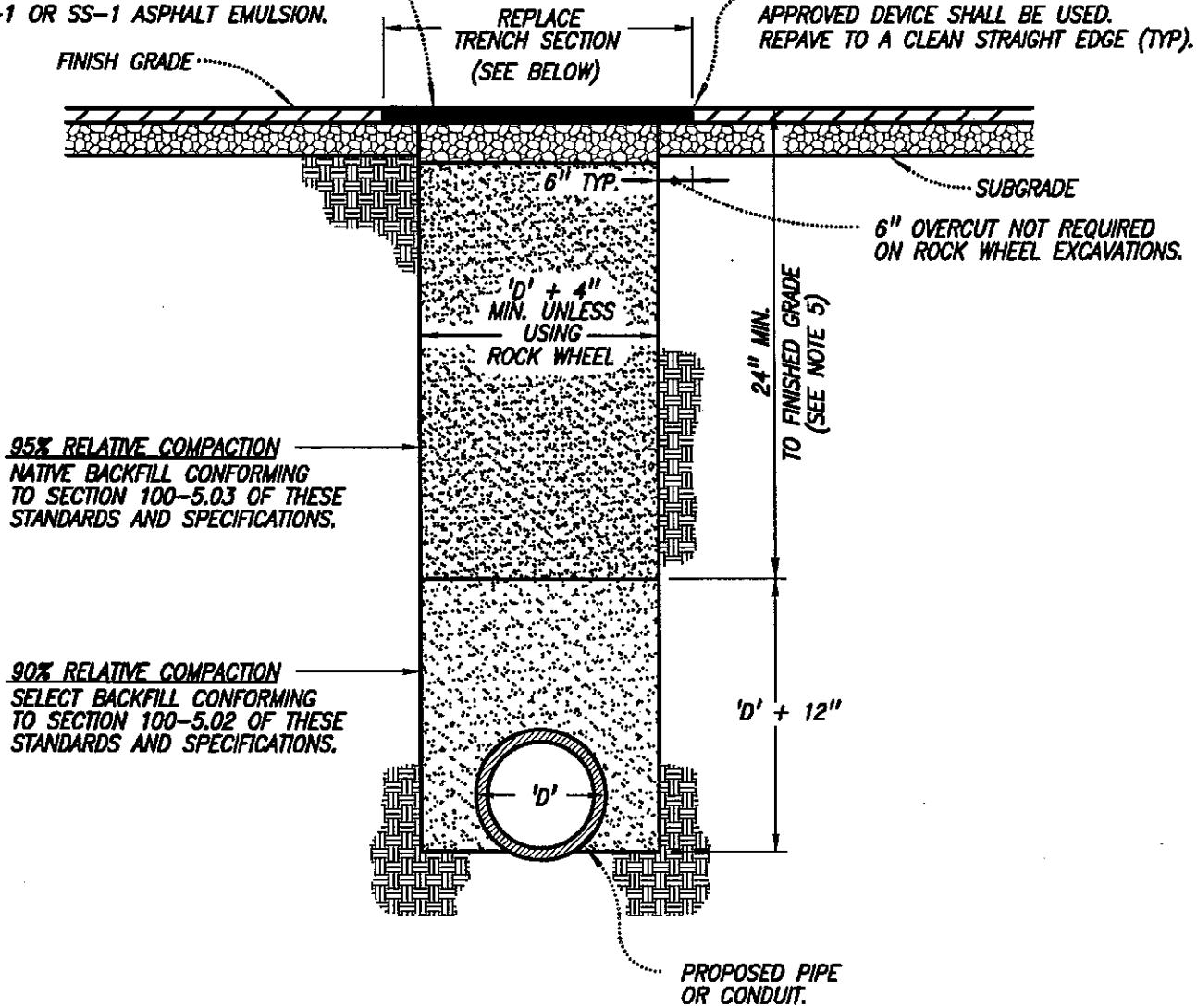
1. FOR RIGID PIPE CONTRACTOR MAY AT HIS EXPENSE EXCAVATE 6" BELOW THE BOTTOM OF THE PIPE AND REPLACE WITH SAND OR AGGREGATE SUBBASE IN LIEU OF SHAPING BOTTOM OF TRENCH TO FIT PIPE BARREL. JOINTS SHALL BE SHAPED IN EITHER CASE.
2. WHEN TRENCH AND EXCAVATION IS IN EXISTING PAVED STREETS, REPLACE PAVEMENT 6" ON EACH SIDE OF TRENCH.
3. DEVIATION FROM ABOVE MAY BE ALLOWED WHEN APPROVED BY THE DISTRICT ENGINEER.
4. TRENCH - WHERE THE TRENCH SECTION PARALLELS THE EXISTING CURB AND GUTTER, THE EDGE OF THE TRENCH SHALL BE A MIN OF 1' FROM THE LIP OF THE EXISTING GUTTER. THE PAVEMENT SHALL BE REMOVED AND REPLACED TO THE LIP OF THE GUTTER.
5. CONTROLLED DENSITY FILL (CDF) MAY BE USED IN LIEU OF SPECIFIED BACKFILL METHOD. MINIMUM TRENCH WIDTH MAY BE REDUCED TO 2 1/2" CLEAR OF EACH SIDE OF PIPE.
6. FLEXIBLE PIPE SHALL HAVE A 6" BEDDING OF GRANULAR MATERIAL AS DESCRIBED IN NOTE 1.
7. "D" INDICATES OUTSIDE DIAMETER.
8. ALL VERTICAL EDGES OF EXISTING ASPHALT CONCRETE SHALL BE TACK COATED.

DRAWN BY: D.S.	<b>TRENCH SECTION (EXISTING STREETS)</b>	APPROVED BY: <i>H. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
CHECKED BY: M.P.		DATE: 01/01/96
SCALE: NONE		DRAWING NO. <b>U-5</b>
REVISED	BY	Western Hills Water District STANISLAUS COUNTY, CALIFORNIA



NEW PAVEMENT TO BE 1/8" HIGHER THAN ADJACENT PAVEMENT. APPLY FOG SEAL COAT OF CSS-1 OR SS-1 ASPHALT EMULSION.

DIAMOND SAW CUTTING MILLING OR OTHER APPROVED DEVICE SHALL BE USED. REPAVE TO A CLEAN STRAIGHT EDGE (TYP).

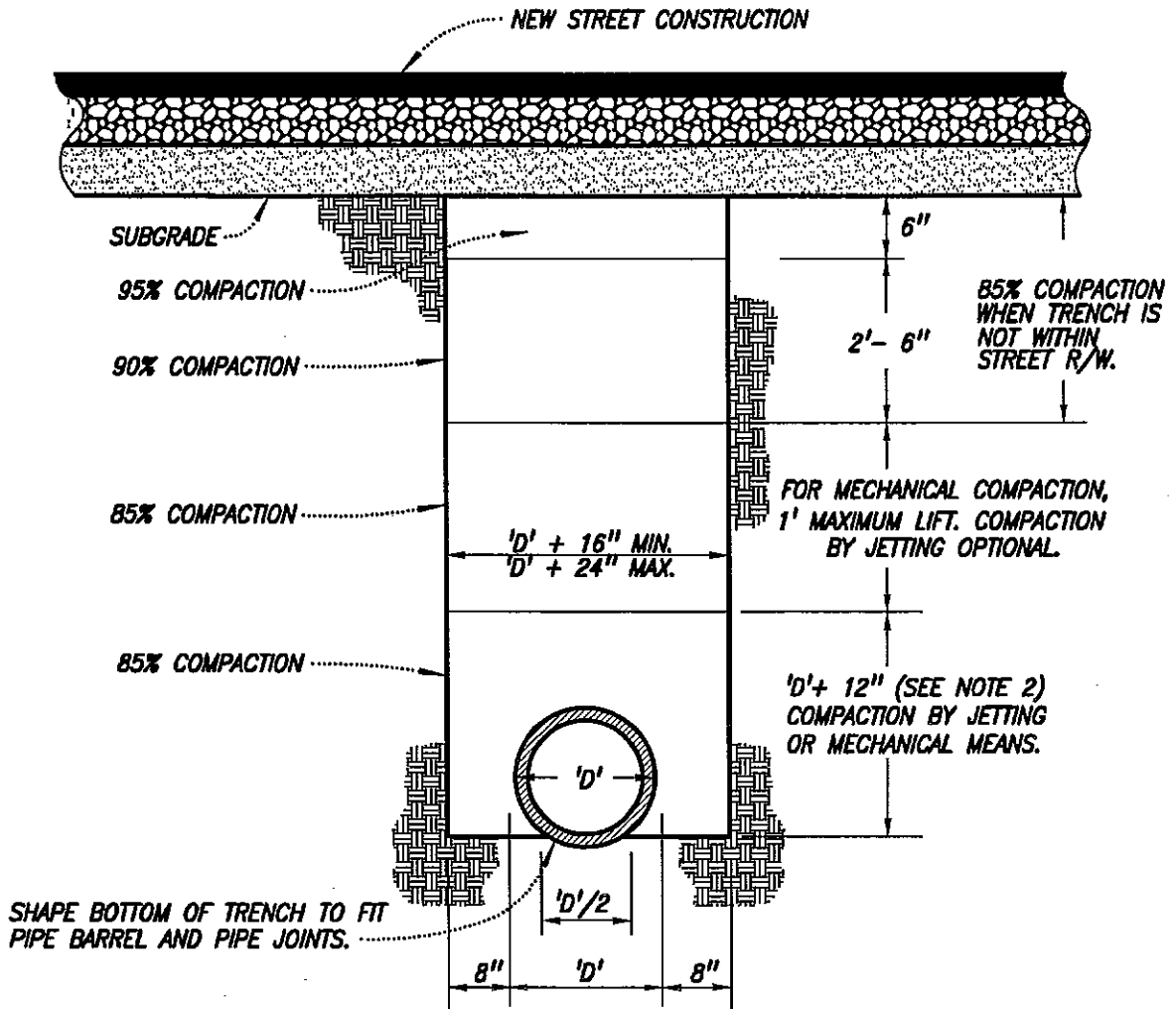


**TYPICAL TRENCH SECTION IN EXISTING IMPROVED STREETS**

**NOTES:**

- TRENCH** - WHERE THE TRENCH SECTION PARALLELS THE EXISTING CURB AND GUTTER, THE EDGE OF THE TRENCH SHALL BE A MIN. OF 1' FROM THE LIP OF THE EXISTING GUTTER AND THE PAVEMENT SHALL BE REMOVED AND REPLACED TO THE LIP OF THE GUTTER.
- PAVEMENT REPLACEMENT** - 1 1/2 INCHES OF A.C. SHALL BE PLACED WHEN TRENCHES ARE BACKFILLED WITH CDF. PAVEMENT SECTION AS SPECIFIED IN AN "ENCROACHMENT PERMIT" SHALL TAKE PRECEDENCE OVER THE PAVEMENT SECTION AS SHOWN.  
APPLY FOG SEAL COAT OF CSS-1 OR SS-1 ASPHALT EMULSION.
- PAVING SHALL CONFORM TO SECTION 100-6 OF THESE STANDARDS AND SPECIFICATIONS.
- ALL VERTICAL EDGES OF EXISTING ASPHALT CONCRETE SHALL BE TACK COATED.

DRAWN BY: D.S. CHECKED BY: M.P. SCALE: NONE REVISED BY	<b>EX. STREET TRENCH SECTION (4" AND SMALLER PIPES)</b>  <b>Western Hills Water District STANISLAUS COUNTY, CALIFORNIA</b>	APPROVED BY: <i>A. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC. DATE: 01/01/96 DRAWING NO.
		RCE 32260 <b>U - 6</b>



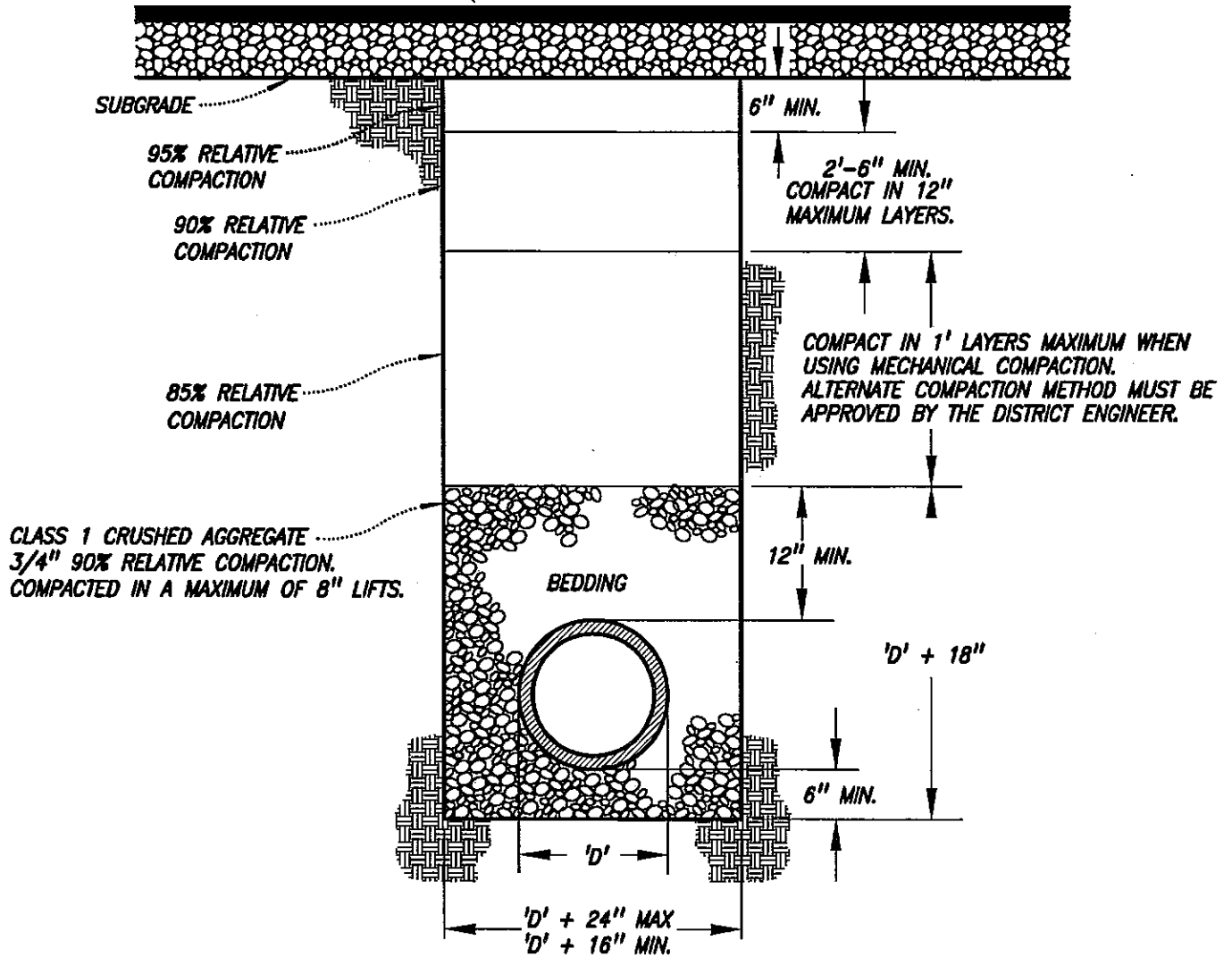
NEW STREETS  
TYPICAL TRENCH SECTION IN EXISTING IMPROVED STREETS

**NOTES:**

1. THIS PIPE BEDDING DETAIL IS APPLICABLE TO STABLE SOIL CONDITIONS ONLY.
2. BEDDING AROUND PIPE SHALL CONFORM TO STD. DWG. U-5.
3. THIS TRENCH SECTION MAY BE USED FOR UNIMPROVED STREET RIGHTS OF WAY OR EASEMENTS.

DRAWN BY: D.S.	<b>TRENCH SECTION (NEW CONSTRUCTION)</b>	APPROVED BY: <i>A. Stuley Thompson</i>	
CHECKED BY: M.P.		DISTRICT ENGINEER	PCE 32260
SCALE: NONE		THOMPSON-HYSELL ENGINEERS, INC.	
REVISED	BY	Western Hills Water District STANISLAUS COUNTY, CALIFORNIA	DATE: 01/01/96
			DRAWING NO. <b>U-7</b>

NEW OR EXISTING STREET  
SEE NOTE NO. 1



**TYPICAL TRENCH SECTION IN EXISTING IMPROVED STREETS**

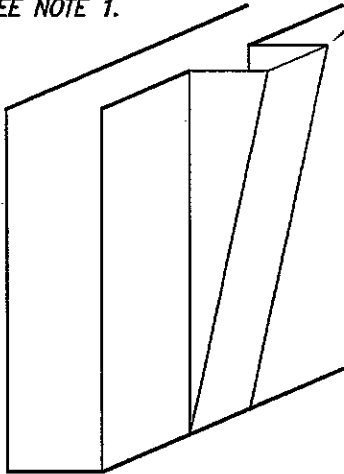
**NOTES:**

1. IF CONSTRUCTED IN AN EXISTING STREET, THE PAVEMENT AND SUBGRADE SHALL BE SUBJECT TO THE CONDITIONS SHOWN ON STD. DWG. U-5.
2. THIS PIPE BEDDING DETAIL SUITABLE TO STABLE SOIL CONDITIONS ONLY.
3. REFER TO SECTION 71 IN THE STANDARD SPECIFICATIONS.

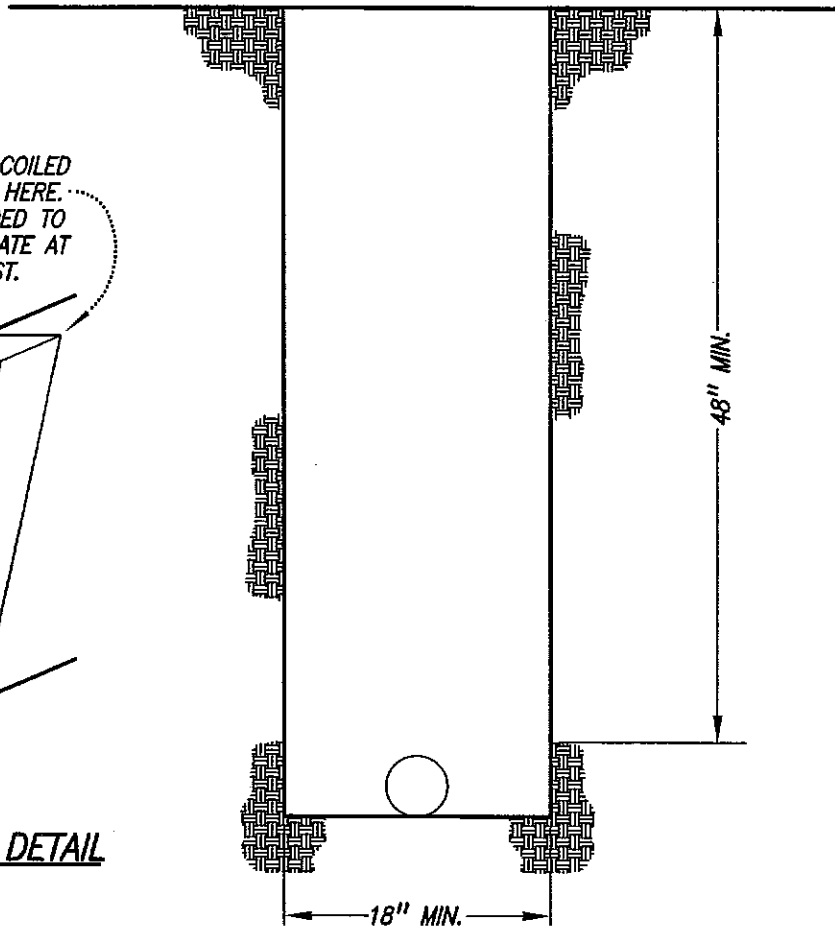
HDPE: HIGH DENSITY POLYETHYLENE PIPE

DRAWN BY: D.S. CHECKED BY: M.P. SCALE: NONE	<b>TRENCH SECTION (HDPE PIPE)</b>	APPROVED BY: <i>H. Stanley Thompson</i> DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
REVISED BY	<b>Western Hills Water District STANISLAUS COUNTY, CALIFORNIA</b>	DATE: 01/01/96 DRAWING NO.
		<b>U - 8</b>

LATERAL GAS LINE TO BE COILED AND BURIED AND MARKED HERE. TRENCH SHALL BE EXTENDED TO THE HOUSE AT A LATER DATE AT THE EXPENSE OF J.S. WEST. SEE NOTE 1.



LATERAL TRENCH DETAIL



TYPICAL TRENCH SECTION FOR J.S. WEST GAS LINE

NOTES:

1. THE TRENCH SHALL BE 48" DEEP AND 18" WIDE PER THE ENGINEERS LOCATION. A LATERAL TRENCH SHALL BE PROVIDED TO BRING THE P.E. PIPE UP TO THE 18" DEPTH REQUIRED BY NFPA58. THIS LATERAL WILL NOT EXTEND BEYOND THE MAIN TRENCH AND SHALL SERVE ONLY TO BRING THE P.E. PIPE FROM THE 48" DEPTH TO THE 18" DEPTH.
2. TRENCH BOTTOMS SHALL BE SMOOTH AND REGULAR OF EITHER UNDISTURBED SOIL OR A LAYER OF COMPACTED BACKFILL SO THAT MINIMAL SETTLEMENT SHALL OCCUR. VOIDS SHALL BE FILLED AND LEVELED TO THE BOTTOMS OF THE TRENCH. P.E. PIPE SHALL NOT BE WEDGED OR BLOCKED.
3. PRIOR TO BACKFILL THE P.E. PIPE SHALL BE EITHER 1) SHADE BACKFILLED - LEAVING ALL JOINTS EXPOSED SO THEY MAY BE EXAMINED DURING THE PRESSURE TEST AND 2) ALLOWED TO STAND UNCOVERED UNTIL TESTS ARE PERFORMED BY THE PROPER AGENCIES AND APPROVAL FROM J.S. WEST IS OBTAINED BEFORE BACKFILLING.
4. BACKFILL WILL BE DONE WITH MATERIAL THAT IS FREE OF LARGE OR SHARP ROCKS, BROKEN GLASS, OR ANY OBJECTS THAT MAY PUNCTURE OR CUT THE P.E. PIPE. WHERE SUCH CONDITIONS DO EXIST, SUITABLE BEDDING MATERIAL SUCH AS SAND MUST BE PROVIDED.

DRAWN BY: D.S.	
CHECKED BY: M.P.	
SCALE: NONE	
REVISED	BY

**J.S. WEST PROPANE  
GAS TRENCH**

**Western Hills Water District**  
STANISLAUS COUNTY, CALIFORNIA

APPROVED BY: <i>H. Stanley Thompson</i>
DISTRICT ENGINEER THOMPSON-HYSELL ENGINEERS, INC.
DATE: 01/01/96
DRAWING NO. <b>U-9</b>