

CITY OF PLYMOUTH

2006

IMPROVEMENT STANDARDS

Revised 5/25/16



Resolution 2006-10

TABLE OF CONTENTS

1.00 PURPOSE AND INTENT.....	5
2.00 GENERAL REQUIREMENTS.....	7
2.01 PLANS AND SPECIFICATIONS REQUIRED	7
2.02 STANDARD SPECIFICATIONS.....	7
2.03 PLAN SUBMITTAL.....	7
2.04 CHANGE IN PLANS DURING CONSTRUCTION	8
2.05 CONTRACTOR AND DEVELOPER RESPONSIBILITY.....	8
2.06 MAINTENANCE GUARANTEE	8
3.00 CONSTRUCTION STAKING	9
3.01 SCOPE.....	9
3.02 CONTROL STAKES	9
3.03 REQUIRED STAKING	9
3.04 CONSTRUCTION STAKE CHECKING.....	10
3.05 CONSTRUCTION STAKING.....	11
3.06 LINES AND GRADES.....	11
3.07 UTILITIES	11
4.00 BLANK.....	12
5.00 PLAN DETAILS.....	12
5.01 GENERAL	12
5.02 PLAN CONTENT REQUIREMENTS	12
5.03 PLAN FORMAT REQUIREMENTS.....	14
5.04 ADDITIONAL IMPROVEMENTS TO BE SHOWN	14
5.05 SIGN AND STRIPING PLAN	14
5.06 COMPLIANCE.....	14
6.01 GENERAL	15
6.02 NOTIFICATION.....	15
6.03 COMPLIANCE AND RESPONSIBILITY	15
6.04 INSPECTION FEES	15
6.05 INSPECTION DEPOSIT.....	15
7.00 FINAL INSPECTION	17
7.01 CLEAN UP	17
7.02 CITY ENGINEER INSPECTION	17
8.00 “AS-BUILT” PLAN.....	17
8.01 “AS-BUILT” PLAN REQUIREMENTS	17
9.00 IMPROVEMENT AGREEMENTS AND SECURITY.....	18
9.01 IMPROVEMENT AGREEMENT	18
9.02 IMPROVEMENT AGREEMENT SECURITY.....	18
9.03 TERMINATION	18
9.04 DEPOSITS AND CERTIFICATES	18
9.05 LETTER OF CREDIT.....	18
9.06 PERFORMANCE BOND.....	19
9.07 SECURITY RELEASE	19
9.08 TIME EXTENSION	19
10.00 DESIGN STANDARDS - STREETS	20
10.01 GENERAL	20

10.02	STREET CLASSIFICATIONS	20
10.03	GRADES, CROSS SLOPE, AND INTERSECTIONS	20
10.04	DESIGN SPEED.....	21
10.05	GEOMETRIC AND STRUCTURAL SECTIONS.....	21
10.06	TESTING OF MATERIALS.....	23
10.07	RIGHT OF WAY.....	24
10.08	SIGNING AND BARRICADES	24
11.00	DESIGN STANDARDS – STORM DRAINAGE	25
11.01	GENERAL	25
11.02	CLASSIFICATION OF STORM DRAINS	25
11.03	ALIGNMENT	26
11.04	LINES	26
11.05	EASEMENTS.....	26
11.06	NATURAL DRAINAGE COURSES.....	26
11.07	DRAINAGE STUDY.....	27
11.08	DRAINAGE MAP	27
11.09	CALCULATIONS	27
11.10	CLOSED STORM DRAIN SYSTEMS.....	28
11.11	OPEN CHANNELS.....	28
11.12	DRAINAGE STRUCTURES	29
12.00	DESIGN STANDARDS – SANITARY SEWER.....	31
12.01	DESIGN FLOW	31
12.02	GRADIENTS	31
12.03	PIPE SIZE	32
12.04	PIPE STRENGTH CLASS	32
12.05	LOCATION AND ALIGNMENT	32
12.06	MINIMUM DEPTH	32
12.07	MANHOLE LOCATIONS	32
12.08	CLEANOUTS OR FLUSHING HOLES.....	33
12.09	STUBS FOR FUTURE EXTENSION	33
12.10	SERVICE LINES	33
12.11	LIFT STATIONS	33
12.11.1	<i>General.....</i>	<i>33</i>
12.11.2	<i>Capacity.....</i>	<i>33</i>
12.11.3	<i>Station Configuration.....</i>	<i>33</i>
12.11.4	<i>Operation</i>	<i>34</i>
12.11.5	<i>Pumping Systems.....</i>	<i>34</i>
12.11.6	<i>Piping.....</i>	<i>35</i>
12.11.7	<i>Wet Well.....</i>	<i>35</i>
12.11.8	<i>Electrical and Communications.....</i>	<i>35</i>
12.11.9	<i>Water Service</i>	<i>36</i>
12.11.10	<i>Standby Systems</i>	<i>36</i>
12.11.11	<i>HVAC.....</i>	<i>37</i>
12.11.12	<i>Noise Control.....</i>	<i>37</i>
13.00	CONSTRUCTION STANDARDS - STREETS	38
13.01	LINES AND GRADES	38
13.02	ORDER OF WORK	38
13.03	MAINTAINING TRAFFIC	38
13.04	CONSTRUCTION AREA SIGNS	39
13.05	TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE.....	39
13.06	OBSTRUCTIONS.....	39
13.07	ADJUST UTILITIES TO GRADE.....	40
13.08	CLEARING AND GRUBBING.....	40

13.09	ASPHALT CONCRETE	40
13.10	PAVEMENT REINFORCING FABRIC	41
13.11	FOG SEAL COAT	41
13.12	STRIPING AND PAVEMENT MARKINGS.....	41
13.13	CITY SUPPLIED MATERIALS	41
13.14	SUBSURFACE DRAIN.....	41
13.15	LOCATE AND PROTECT EXISTING UTILITIES.....	42
14.00	CONSTRUCTION STANDARDS – STORM DRAIN AND SANITARY SEWER	43
14.01	SANITARY SEWER PIPE.....	43
14.02	STORM DRAIN PIPE	43
14.03	PRECAST CONCRETE BOX CULVERT	43
14.04	INSTALLATION.....	43
14.05	TRENCHES AND BACKFILL	44
14.06	PIPELINE TESTING	47
14.07	TESTS FOR OBSTRUCTIONS	47
14.08	SANITARY SEWER MANHOLES	48
14.09	CONNECTION TO EXISTING SEWER.....	48
14.10	SEWER LATERAL ADJUSTMENT TO GRADE AND SEWER LATERAL CONNECTION	48
14.11	CONCRETE STRUCTURES	49
14.12	MISCELLANEOUS IRON AND STEEL.....	49
14.13	ADJUSTING UTILITIES TO GRADE	50
15.00	DESIGN STANDARDS - WATER	51
15.01	GENERAL REQUIREMENTS.....	51
15.02	REGULATORY STANDARDS.....	51
15.03	DESIGN REQUIREMENTS.....	51
15.04	BENEFITTING AREAS NOT INCLUDED WITHIN PROJECT BOUNDARIES	52
15.05	CALCULATIONS	52
15.06	DESIGN FLOW	52
15.06.1	<i>Municipal Flow Requirements</i>	<i>53</i>
15.07	PIPE SIZE	54
15.08	PIPE STRENGTH CLASS	54
15.09	LOCATION AND ALIGNMENT	54
15.10	MINIMUM DEPTH	54
15.11	SERVICE LINES	54
15.12	TREATMENT PLANT MODIFICATION AND PUMP STATION IMPROVEMENTS	56
15.13	STORAGE FACILITIES.....	56
15.14	TRANSMISSION LINE	57
15.15	DISTRIBUTION LINES.....	57
15.16	CREEK CROSSINGS	58
16.00	FIRE HYDRANT REQUIREMENTS.....	60
16.01	GENERAL REQUIREMENTS.....	60
16.02	MAIN TEE, RUNNER, AND GATE VALVE REQUIREMENTS.....	60
16.03	SUBSTITUTION OF MATERIAL	60
17.00	CONSTRUCTION STANDARDS – WATER	61
17.01	GENERAL	61
17.02	DUCTILE IRON PIPE (DIP)	61
17.03	POLYVINYL CHLORIDE PIPE (PVC)	61
17.04	GATE VALVES	61
17.05	AIR RELEASE VALVES (ARV)	62
17.06	VALVE BOXES (VB).....	62
17.07	THRUST BLOCKS	62
17.08	TRENCHES AND BACKFILL	62

17.09	TRENCH SAFETY	64
17.10	PIPE LAYING	65
17.11	TRACER WIRE	65
17.12	FILLING, TESTING, AND CHLORINATION OF PIPELINES	65
17.13	SAFETY	67
17.14	CLEAN UP	67
17.15	CONNECTION TO EXISTING LINES.....	67
17.16	COMPACTION TESTING.....	67
17.17	ASPHALT CONCRETE (SHOULDER RESTORATION)	67
17.18	SERVICE CONNECTIONS.....	67
17.19	PIPE MATERIALS AND STORAGE.....	68
18.00	STANDARD DETAILS.....	69
	STORM DRAIN DETAILS:	69
	SANITARY SEWER DETAILS:	69
	WATER DETAILS.....	69
	STREET DETAILS:	69

1.00 PURPOSE AND INTENT

It is the purpose of these Improvement Standards to provide minimum standards to be applied to improvements and private development projects to be dedicated to the public and accepted by the City for maintenance or operation, as well as improvements to be installed within existing rights of way and easements. These standards provide for coordinated development of required facilities to be used by and for the protection of the public. These standards shall apply to and regulate the design and preparation of plans for construction of streets, highways, drainage, sewerage, street lighting, water system facilities and related public improvements.

Water lines shall be sized to meet the fire flow requirements of the Plymouth Fire Department. Minimum line size shall be 6" diameter and fire hydrants shall be spaced no more than 300 feet apart and located such that all lots shall be within 150' of a hydrant. Fire hydrant location shall be approved by City Fire Chief. For specific fire requirements or specifications contact:

Fire Chief
City of Plymouth Volunteer Fire Department
P.O. Box 429
Plymouth, CA 95669
(209) 245-6941

It is not possible to anticipate all situations that arise or to prescribe standards applicable to every development. The intent of these Standards is to assist developers, engineers, and contractors toward completion of improvements that will comply with City requirements and be accepted by City for maintenance and operation. The Planning Commission or City Council may impose project specific requirements which may supersede the requirements and standards set forth herein. Any items or situation not included in these Improvement Standards shall be designed in accordance with accepted engineering practice, the applicable Standard Plans and Standard Specifications of the State of California Department of Transportation, and shall be subject to the approval of the City Engineer.

In these Improvement Standards, the intent and meaning of the terms that are used shall be as defined in State Standard Specifications, and as herein specifically noted.

CONTRACTOR - Shall mean any person or persons, firm, partnership, corporation, or combination thereof, licensed to perform the type of work involved, who has entered into a contract with any person, corporation, company, special district of the City of Plymouth, or his or their legal representative, for the construction of any improvement or portions of any improvement within the City.

CITY - Shall mean City of Plymouth including any special districts administered by the City Council.

DETENTION BASIN - A facility which stores storm water for a relatively short time designed with type of metered outlet.

DEVELOPER - Shall mean any person or persons, firm, partnership, corporation, or combination thereof, financially responsible for the work involved.

DEVELOPMENT - Shall mean single properties as well as subdivision improvement.

CITY ENGINEER - Shall mean the Engineer authorized by the City Council to represent City or their authorized representatives including City Planner, City Building Official, and inspectors under direction of the City Engineer.

LABORATORY - Shall mean any testing agency or testing firm which has been approved by the City Engineer.

SITE IMPROVEMENTS - Shall mean required improvements for projects other than subdivisions.

STANDARD SPECIFICATIONS - Shall mean the July 1992 volume of the State of California Standard Specifications as issued by the Business and Transportation Agency, Department of Transportation, State of California.

STANDARD PLANS - Shall mean the July 1992 volume of the State of California Standard Plans as issued by the Business and Transportation Agency, Department of Transportation, State of California.

STATE - As used in the State Specifications, or Standard Drawings, shall mean City of Plymouth.

STATE STANDARD DRAWINGS - Shall mean the July 1992 Standard Drawings and Plans of the State of California, Business and Transportation Agency, Department of Transportation.

ZONING CLASSIFICATIONS - Shall mean those zones established by and as listed in the Plymouth Zoning Ordinance.

2.00 GENERAL REQUIREMENTS

2.01 Plans and Specifications Required - Complete plans and specifications shall be prepared by an engineer for all proposed streets, drainage facilities, sewerage, street lighting, and water distribution system improvements. All plans and specifications for improvements to be accepted for maintenance by the City shall be prepared by an Engineer of the appropriate branch of engineering covering the work submitted. All dedications and easements necessary to accommodate all improvements shall be submitted to the City Engineer for approval and offered for dedication to the City. Possession of a complete set of City approved plans and a valid encroachment permit shall constitute the necessary permits for a Contractor to perform work in the City right of ways or easements. Engineer or his representative shall order the Contractor to cease work on any project when the Contractor does not have properly approved plans in his possession. Contractor shall be duly licensed by the State of California and shall be bonded as required to meet the requirements of the City.

2.02 Standard Specifications - The Standard Specifications shall be made a part of contract documents by note or reference which shall appear in the Special Provisions and in the General Notes on the plans. The note or reference shall be as follows:

"The Standard Specifications are part of the contract documents of this project and all materials and construction shall be in strict conformance with said Standard Specifications or as authorized by these plans."

2.03 Plan Submittal - Two sets of plans for subdivisions and two sets of plans for site improvements, complete and in accordance with these Improvement Standards and the Standard Specifications, shall be submitted along with any required specifications, computations, test data, and other material required by the City for approval. When the plans are initially submitted to the City, a plan check fee will be required as a deposit to initiate checking of the plans by the City.

Any portion of the required deposit over and above the accumulated costs expended by the City on the development will be refunded to the Developer. Should there be required alterations or revisions to the plans as submitted, one copy will be returned with the required corrections marked or indicated thereon. Plans not prepared in accordance with these Improvement Standards and the Standard Specifications or plans not prepared consistent with the standards of the profession, may be returned unmarked and unapproved.

No plans will be approved nor construction authorized until such times as all appropriate City Official(s) signifies approval on the plans. All changes, corrections, or additions required shall be resubmitted to the City for approval as prescribed. At such times when the plans meet the requirements of the City and the plan check and inspection fees have been paid, the plans will be signed and stamped "Approved for Construction. The Engineer shall deliver not less than three complete sets of plans to the City Engineer. Two sets will be retained by the City.

Excepted from approval are any features of the plans that are contrary to or in conflict with any California State Law, City ordinance, or resolution or generally accepted sound engineering practice, or not in keeping with the standards of the profession; even though such errors, omissions or conflict may have been overlooked in review of the plans.

2.04 Change in Plans During Construction - Should changes become necessary during construction, the Engineer shall resubmit "red lined" plan sheet prints for approval by the City. Necessary changes shall be clearly shown and dated on the plans. Minor changes, which do not affect the basic design or contract, may be made upon the authorization of the City Engineer. All changes shall be shown on "as-built" plans when the work is completed.

2.05 Contractor and Developer Responsibility - Contractor and Developer are directed to the Construction Safety Orders of the Division of Industrial Safety. Contractor and Developer shall conduct all work in accordance with these standards. Contractor and Developer shall be responsible for all damage arising from any failure to comply with such orders regardless of any action taken by the City or its authorized agents.

Contractor and Developer are directed to the regulatory provisions of the State Standard Specifications. City will assume no costs or liability for complying with these provisions.

2.06 Maintenance Guarantee - Developer or Contractor shall guarantee the entire work required by City to be free of defects in materials and workmanship for a period of one (1) year following the date of acceptance of work by the Owner. Developer or Contractor shall make, at their expense, any repairs or replacements made necessary by defects in materials and workmanship which become evident within guarantee period. The Contractor shall indemnify and save harmless the City and officers, agents, and employees of the City and against and from all claims and liability arising from damage and injury due to said defects. The Developer shall cause all repairs and replacements to be made promptly upon receipt of written order from the City. Should Developer fail to have repairs and replacements made promptly, City shall cause the work to be done, and the surety provided therefore shall be claimed for the cost of all such work.

Maintenance guarantee shall be a surety bond or other approved security which shall be delivered to City prior to recording of a final map or other approval requested of City. Said security shall be in an approved form and executed by a surety company or companies satisfactory to City in the amount of ten percent (10%) of approved engineer's estimate of construction costs. Security shall remain in force for the duration of the guarantee period specified. In lieu of providing security as prescribed above, the Developer may provide for the Faithful Performance Bond under agreement to remain in force until the expiration of guarantee periods.

Specific guarantees for periods longer than one (1) year may be specified due to special conditions of materials or workmanship.

3.00 CONSTRUCTION STAKING

3.01 Scope - It is the intent of this section to define the responsibilities of the Contractor regarding the use, maintenance, and replacement of construction stakes. The Developer's Engineer or Contractor shall furnish the stakes and reference points for the improvements relative to the work and shall provide restaking as required by the City as set forth in Section 3.03.

3.02 Control Stakes - Control and reference stakes for all construction work shall be conspicuously flagged. Contractor shall be responsible for the preservation and perpetuation of these points, marks, and stakes. When removal of a control point, mark, or stake is required by construction operations, Contractor shall notify the Developer's Engineer at least two (2) working days in advance of such operations. Developer's Engineer shall perpetuate such control points subject to approval of City Engineer.

3.03 Required Staking - The Developer's Engineer shall provide the stakes and reference marks sufficient to control the work. Staking requirements shall be not less than:

A. Street Grading

One set of slope stakes will be set at fifty (50) foot intervals. Reference stakes will be set at an appropriate offset from the top of cut or toe of fill. The top of cut or toe of fill need not be staked. The reference stake will indicate the offset to the top of cut or toe of fill and indicate the cut or fill from the reference point to the top of cut or toe of fill. The reference stakes will indicate the cuts or fills and distances from the top of cut or toe of fill to the subgrade hinge point and centerline subgrade elevation.

At street intersections, the radius points for pavement rounding will be staked. The elevation of the top of the stake will be established and marked on witness lath.

B. Clearing

When slope stakes are not required, clearing stakes will be set on streets and roads. Lath marked "CLEAR" will be set at fifty (50) foot intervals at the clearing limits. Lath will be oriented so the marking faces the centerline of the street or the improvement.

C. Sewer

Sewer trunk lines will be staked on an appropriate offset from centerline at fifty (50) foot intervals on tangents and twenty-five (25) foot intervals on horizontal and vertical curves. All manholes and curve points will be staked on an appropriate offset from the sewer centerline. Stakes will indicate offset to pipe centerline and the cut to the flow line of the sewer pipe. When a flow-line grade

is indicated on the plans for a sewer service, a cut to the flow line at the end of the service will be marked on the offset stake or witness lath thereto.

D. Curb and Gutter

Stakes for curb and gutter will be set no more than five (5) feet from the proposed work and at twenty-five (25) foot intervals. Subgrade and **forms shall be checked and approved by the City prior to placing curb and gutter.**

E. Cross Culverts

The ends of all cross culverts will be staked by an offset stake set on the prolongation of the centerline of the culvert. Offset stakes will be marked with a cut or fill to the flow line at the ends of the culverts. The final length of cross culverts shall be determined in the field at the time of staking.

F. Underground Storm Drains

Underground storm drains will be staked in the same general manner as sewer trunk lines.

G. Drain Channels

The centerline of drainage channels will be marked with lath at fifty (50) foot intervals for horizontal alignment only. When vertical alignment is noted on the plans, offset grade stakes will be set at fifty (50) foot intervals.

H. Finish Subgrade

One set of finish subgrade stakes will be set on centerline at finished subgrade at fifty (50) foot intervals on tangent and twenty-five (25) foot intervals on vertical curve by the Developer's Engineer. An additional set of stakes will be set on hinge points at finished subgrade at fifty (50) foot intervals on tangents and twenty-five (25) feet on vertical curves by Contractor and checked by Developer's Engineer. Any realignment or adjustments of blue tops on hinge points will be reset and rechecked as necessary. Developer will be responsible for staking base rock grade from the finished subgrade once the subgrade has been accepted by the City Engineer. The method of staking shall be approved by the City Engineer.

I. Additional Stakes

Additional stakes required by the City will be set at the Developer's expense.

3.04 Construction Stake Checking - Should occasion arise where the validity of a stake is questionable, either as to its location, offset, cut or fill marked thereon, Contractor shall notify the City Engineer and Developer's Engineer, who will check the stake or stakes in question. It

shall be the Contractor's responsibility to examine the stakes before commencing operations. Any stakes found to be in error shall be reset. The Developer shall be responsible for any error in the finished work resulting from questionable or erroneous stakes.

3.05 Construction Staking - When the Developer has a registered civil engineer or licensed land surveyor, other than the engineer who prepared the plans, provide construction staking, he shall provide the City Engineer, in writing, with the name of the individual or firm one week prior to staking of the project for construction. Developer shall be responsible for providing professional engineering services for any plan change which may be required during the construction phase and for the preparation of revised plans, and upon completion of the improvements, preparation of "as-built" plans.

3.06 Lines and Grades - At all points along any grade line shown on the drawings, between the points along any grade line shown on the drawings, and between the points at which the grade elevations are given, the grades shall conform to a straight line except that grading through a vertical curve shall conform to a smooth curvilinear alignment. In any case where grade variation exists, it shall be reported to the Developer and City Engineer.

Contractor shall preserve all stakes and points set for lines, grades, or measurements of the work in their proper place until authorized to remove them by the Developer and City Engineer.

3.07 Utilities - All utilities shall be shown on the plans. The Engineer shall contact utilities early in the planning stage. Prints with the utilities approval shall be submitted to the City. All utilities must be contacted so they can properly plan their relocation work and construction of additional facilities. Engineer shall notify the City Engineer, by letter, when all utility companies have been so notified. Utility company approved plans for underground work in city streets shall be submitted to the City Engineer for review and approval prior to start of work.

4.00 BLANK

5.00 PLAN DETAILS

5.01 General - All plans submitted to the City shall be prepared in a manner that will produce legible prints. All line work must be clear, sharp and heavy. Letter and numerals shall be 1/8 inch minimum height, well formed, and sharp. Numerals showing profile elevations shall not be bisected by station grid lines. Computer drafting shall be by clear and legible lettering acceptable to City.

5.02 Plan Content Requirements - The following requirements shall apply to all plans submitted for approval. Engineer shall prepare plans neat, accurate, and comprehensive in keeping with the standards of the profession. Engineers are directed to Caltrans Standard Plans.

A. Title Sheet

On subdivision or improvement plans, exceeding three sheets in the set, a title sheet shall be prepared showing the entire subdivision or project complete with subdivision or assessment district limits, city limits, street names, section lines, corners, and the location within the City. (Minimum scale 1"=500'.) The title sheet shall also include an index of the sheets; Engineer's name, license number, and signature; the date and scale of the drawing; north arrow; and the block for the necessary approval of the City Engineer and other officials. A sample of the City approval block may be obtained from the City Engineer. All sheets shall be 24" x 36".

B. Layout Sheet

The layout sheet (Sheet 2) shall contain thereon the entire subdivision unit on one sheet in skeleton form shown drainage features and sewer and water lines. Drainage pipe, sewer pipe, water lines, and other underground utilities shall each be identifiable from other underground conduits. Appurtenances such as manholes, valves, and drop inlets shall be shown in their proper location. The scale of the project shall be 1" = 100' or 1" = 200'. An index of the plan and profiles sheets shall be shown on the layout sheet.

C. Title Blocks

Each sheet within the set of drawings shall show the sheet title, sheet number, date, scale, and the Engineer's name, signature, and license number.

D. Right of Way

Right-of-way lines, the boundaries of lots fronting on the street, drainage easements, utility easements, planting easements, section lines and corners, land

grant lines, and temporary construction easements both existing and proposed shall be shown on the plans. All right-of-way and easement lines shall be properly dimensioned.

E. Topography

All pertinent topographic features shall be shown such as street lines, curbs, sidewalks, shoulders, location and size of storm and sanitary sewer lines, high water and frequent inundation levels, water lines, gas lines, telephone conduits, other underground utilities, existing structures, houses, trees (6" and larger) and other foliage, traffic signals, street lights, pull boxes, underground electrical conduits, drainage ditches, utility poles, fire hydrants, retaining walls, masonry structures, and all other features in the area which may affect the design requirements for the area. Any tree (6" and larger) which falls within the existing or proposed right of way or easement shall be shown on the cross section when requested by the City Engineer. Permission to remove any tree (not required to be removed by construction) in the City rights of way or easements shall be obtained from the City Engineer prior to removal.

F. Contours, Elevations, and Drainage Plan

Existing contours or supporting elevation data shall be shown on all plans. The Drainage Study, if required, shall contain contours of the subdivision unit and the immediate vicinity sufficient to indicate the perimeter of areas to be drained by each structure. Calculations supporting the design of drainage studies shall be submitted with the drainage sheet. Scale of map shall be of sufficient size to clearly show the drainage features and the location of major structures. FEMA established 100 year floodplains shall be identified when applicable.

G. Profiles

Plans shall show the profile of all existing roadway centerlines, existing edges of pavement, existing curb and gutter flow lines, drainage ditches, storm and sanitary sewers. All profiles of proposed improvement shall state centerline elevations at fifty (50) foot intervals and rate of grades, vertical curves and other vertical alignment data. Elevations of any warped surfaces shall be set at twenty-five (25) foot intervals. When required by the City Engineer, the Engineer shall provide centerline profiles and cross section information beyond the limits of the proposed development to facilitate setting proper vertical alignment within the proposed improvement limits.

H. Stationing and Orientation

The stationing on plan and profiles sheets shall read from left to right. Plans shall be so arranged that the north arrow points toward the top or upper 180 degrees of the sheet, insofar as practical.

I. Bench Marks

The bench marks and datum shall be clearly noted on the plans both as to location, description, and elevations. The datum shall be U.S.G.S. or otherwise approved by the City Engineer.

J. Typical Sections

A typical section, setting out the structural features for each type of facility within the improvement, shall be set forth on the plans.

K. Cross Sections

Cross sections, when required, shall be included with the plans. When, in limited areas, unusual topographic features or special conditions occur that would affect the work, individual cross sections or typical sections may be shown on the pertinent plan sheet.

L. Special Notes

Special notes shall be clearly indicated and it shall be conspicuously noted on the plans that all construction work and installation shall conform to the State Standard Specifications, the City of Plymouth Improvement Standards, and that all work is subject to the approval of the City Engineer.

5.03 Plan Format Requirements - All improvement plans shall be prepared on plan and profile sheets, 24" x 36". Scales: Horizontal 1" = 20', 40', or 50'; Vertical 1" = 2', 5', or 10', but only the scale, horizontal or vertical for which the sheet was intended. Design cross sections plotted on 1" = 5' scale, taken on maximum 50' intervals shall be submitted with preliminary improvement plans or cut and fill slopes shall be shown on the plans. Cross sections shall be plotted with background grid with reference to identifiable base line or centerline.

5.04 Additional Improvements to Be Shown - Storm drainage improvements shall be shown on the street plans. Sanitary sewer and water improvements may be shown on the street plans or separately as indicated above. Street lighting shall be shown separately. Street lighting plans shall be drawn to a scale of 1" = 100' with individual lot dimensions and street dimensions shown. Location of all utilities shall be shown on the "as-built" plans.

5.05 Sign and Striping Plan - Sign and striping plan shall be set forth on a separate plan sheet or detail sheet in Caltrans format or with reference thereto.

5.06 Compliance - Plans shall be checked for compliance with these standards and all conditions of approval by City Engineer. Plan checking deposit shall be as set forth in Section 6.05 of these standards.

6.00 INSPECTION DURING CONSTRUCTION

6.01 General - Any improvement which is intended for future City maintenance responsibility or required by City as a condition of approval, shall be constructed to City requirements and inspected during construction by the City Engineer. Each phase of construction shall be inspected and approved prior to proceeding to subsequent phases.

Inspection includes field inspection during the course of construction and materials testing of those improvements over which no other public agency or utility exercises inspection responsibility.

6.02 Notification - The Engineer shall notify the City Engineer when the Contractor first calls for grades or staking. Any improvements constructed without inspection as provided above or any construction contrary to the orders or instructions of the City Engineer shall be deemed not in compliance with City requirements and will not be accepted by City.

6.03 Compliance and Responsibility - The City will inspect the work for ultimate compliance with the specifications but will not be responsible for the conduct of the work itself or the manner in which it is performed. Requirements of State or Federal agencies shall be verified by appropriate agency representatives.

6.04 Inspection Fees - The applicant shall deposit an estimated fee to cover the City's actual cost of inspection of the project. This fee may be deposited in two installments. The first installment shall be paid when plans are submitted for checking. The balance of the inspection fee shall be deposited prior to approval of the plans. All other public agency or utility fees shall be paid separately by the developer. The inspection fee deposit shall be determined in accordance with Table I.

6.05 Inspection Deposit - Inspection deposits shall be placed in a plan check fund and all charges for inspection, as deemed necessary by the City shall be charged against that fund. No inspection work or construction work shall be undertaken when the cost of such inspection or work exceeds the funds remaining in the account for the project.

Whenever the inspection fee deposit is exhausted, the developer shall deposit additional funds for further inspection work. When the total inspection charges are less than the deposit, the balance will be returned to the applicant after the improvements have been certified as complete by the City Engineer and all conditions of approval complied with.

CITY OF PLYMOUTH

TABLE I			
FEE DEPOSIT AMOUNTS			
Total Estimated Cost of Improvements	Plan Check	Inspection	Total
Less than \$10,000	\$ 300.00	\$ 600.00	\$ 900.00
\$10,000 to \$49,999	\$ 500.00	\$1,000.00	\$1,500.00
\$50,000 to \$99,999	\$1,000.00	\$5,000.00	\$6,000.00
\$100,000 to \$399,999	2% *	4% *	6% *
\$400,000 and over	1.75% *	3.75% *	5.5% *

*Percentage of Approved Engineer's Estimate of Improvement Costs.

7.00 FINAL INSPECTION

7.01 Clean Up - Upon completion of any improvements which are constructed under and in conformance with these Improvement Standards and prior to requesting a final inspection, the work area shall be thoroughly cleaned of all rubbish, excess material, and all portions of the work shall be left in a neat and orderly condition.

7.02 City Engineer Inspection - Within five (5) working days after receiving a request for final inspection, the City Engineer shall inspect the work. Contractor, Engineer, and Developer will be notified in writing as to any particular defects or deficiencies to be remedied. Contractor shall proceed to correct all defects or deficiencies at the earliest possible date. At such time as the work has been completed, an inspection shall be made by the City Engineer to determine if all defects have been repaired, altered, and completed in accordance with these Improvement Standards. At such time as the City Engineer finds the work acceptable, the City Clerk will be notified and the matter scheduled for City Council approval. The Contractor, Engineer, and Developer will be notified in writing as to the date of final approval and acceptance by the City Council.

8.00 “AS-BUILT” PLAN

8.01 “As-Built” Plan Requirements - One complete set of “as-built” reproducible mylar plans, as prescribed by the City Engineer, shall be submitted to the City Engineer prior to acceptance of the improvements.

Engineer shall keep an accurate record of all approved deviations from the plans. These are to be utilized with the Inspector's plans for preparing a complete and accurate set of “as-built” tracings for the permanent records of the City. “As-built” plans shall be prepared by the Engineer responsible for the work. Preparation of as-built plans, complete and in accordance with these standards, shall be the responsibility of the Developer.

9.00 IMPROVEMENT AGREEMENTS AND SECURITY

9.01 Improvement Agreement - When project improvements are not completed at the time the Final or Parcel Map is ready for approval by the City Council, the applicant shall enter into an Improvement Agreement with the City. The agreement shall require the applicant to complete all conditions of approval and improvements as shown on the approved improvement plans within the time frame set forth therein.

9.02 Improvement Agreement Security - Applicant's performance under any such agreement shall be secured by a good and sufficient instrument of surety in an amount fixed by the estimated costs of the improvement in accordance with Table II. The estimate of construction costs shall be submitted to the City Engineer for review and approval. Security for City maintained street improvements shall provide that ten percent of the secured amount be withheld by the City for a period of one year after the completion of improvements. The ten percent retention may be used by the City to correct any defects in material or workmanship which become evident in the one year period following completion.

TABLE II			
AMOUNT OF AGREEMENT SECURITY			
TYPE OF SECURITY	PERFORMANCE	LABOR/ MATERIALS	TOTAL
Bonds	100%	100%	200%
Letter of Credit	100%	50%	150%
Bank Deposit (1)	100%	50%	150%
Deposit with City (2)	100%	50%	150%
(1) Savings account assigned to City.			
(2) Deposit in a trust account or a negotiable certificate of deposit with principal payable to the City upon demand.			

9.03 Termination - Termination date of any security shall extend beyond the termination date of the agreement or any extension thereof. Termination date shall be subject to the requirements of the City Council.

9.04 Deposits and Certificates - Bank deposits and certificates of deposit shall be purchased or an account opened so that the principal and interest are payable to the City of Plymouth.

When the account or certificate is made jointly payable to the developer and the City, the developer shall submit a negotiable order of withdrawal with the bank book or an endorsed certificate.

9.05 Letter of Credit - The letter of credit shall be extended prior to its expiration date for any extension of time requested.

9.06 Performance Bond - Performance bonds shall be for the amount set forth in Table II. Performance bonds shall be provided by an "admitted California surety."

9.07 Security Release - Security will be released upon request of the project proponent in accordance with the terms of these standards, the Subdivision Ordinance, and the Improvement Agreement.

9.08 Time Extension - Upon written request by the developer, no less than thirty days prior to the expiration of the agreement, an extension of time may be requested from the City. The developer shall have made a good faith effort to complete improvement requirements, or weather conditions or litigation prevents completion of the improvements. An extension of time of up to one year may be approved, provided the improvement security is adjusted subject to approval of the City Engineer.

10.00 DESIGN STANDARDS - STREETS

10.01 General - The Design Standards provide the minimum standards for the design, construction and alterations for all streets, roadways, drainage, utility placement, and all appurtenances thereto. The Design Standards shall consist of the applicable provisions in the Highway Design Manual, the Standard Plans, and this Chapter.

The City Engineer, at his discretion, may approve or require modifications to the minimum standards for a particular development whenever it appears necessary, reasonable, and proper. Exceptions to these standards will not be allowed unless the request is accompanied by written justification and certification by a licensed engineer that traffic safety is not compromised.

The Planning Commission or the City Council may specify project specific road improvement requirements different from the standards set forth herein. In all such cases, the "project specific" requirements of the Planning Commission or City Council shall govern.

The City Engineer shall be the final authority on all questions which may arise as to the interpretation of the Design Standards. The City Engineer's decision shall be final and he shall have authority to enforce and make effective such decisions. Appeals of the City Engineer's decisions shall be in writing to the City Administrator.

10.02 Street Classifications - Streets shall be classified as arterial, collector, local streets, or private. Street classification shall be as follows:

- Arterial:** A through street collecting traffic from minor and collector streets and classified in the Circulation Element of the City as an "arterial" street.
- Collector:** A primary street that collects traffic from local streets and is classified in the Circulation Element of the City as a "collector" street.
- Local:** A local street that collects traffic along its frontage.
- Private:** A local street not accepted for maintenance by City.

10.03 Grades, Cross Slope, and Intersections - The criteria for road grades and cross slopes shall be as follows:

- A. Minimum grade on new streets shall be 1.00 percent.
- B. Minimum grade of gutter section constructed on existing street shall be 0.50 percent with approval of City Engineer.
- C. Standard cross slope on new streets shall be 2.0 percent.
- D. Minimum cross slope on widening shall be 1.5 percent.

- E. Maximum cross slope of the traveled way shall be 3.0 percent.
- F. The roadway minimum vertical curve length allowable at the intersection of two grades shall be fifty (50) feet. Vertical curves may be omitted at intersections where the algebraic difference in grades does not exceed 2.0 percent.
- G. Streets shall have a desirable maximum grade of 15 percent. Steeper grades may be authorized where justified and approved by the City Engineer. Decision of the City Engineer concerning grades in excess of 15 percent shall be based upon local conditions.
- H. When two streets intersect, the minor street shall not have a grade greater than 7.0 percent for a minimum distance of forty (40) feet measured from the curb line of the intersecting street, except in unusually rough terrain, as determined by the City Engineer. The centerline of the lesser intersecting street shall meet the crown slope at the projected lip of gutter. Crown slope of the major street may be reduced to 1.0 percent within the intersection when approved by the City Engineer.

10.04 Design Speed - Arterial streets shall be based upon design speeds as follows:

<u>Classification</u>	<u>Design Speed</u>
Arterial	45 MPH
Collector	35 MPH
Local and Private	25 MPH

Cul-de-sac streets, less than 300' in length, may be designed for 15 miles per hour.

Streets with grades in excess of 5 percent intersecting highways or arterial roads shall have a minimum of thirty (30) feet "storage" area from the edge of pavement of the primary road to the beginning of vertical curves (BVC).

10.05 Geometric and Structural Sections - Geometric and structural sections for proposed improvements shall comply with the following:

- A. Cross gutters will be allowed only with the specific approval of the City Engineer. Cross gutters shall be concrete.
- B. The curve data for all centerline curves shall be computed and shown on the plans. Where unusual alignment problems exist, less than minimum curve radii may be allowed when approved by the City Engineer. Property lines radius at curb returns for intersecting streets shall be not less than twenty (20) feet.

- C. The property line radius for cul-de-sacs shall be fifty (50) feet unless otherwise specified by the City Engineer. A curve of twenty (20) foot radius shall connect the tangent and the fifty (50) foot radius curve. (See Section 15.00, Standard Details.)
- D. Cut and fill slopes: Fill slopes shall be 2:1 or flatter and cut slopes shall be 2:1 or flatter depending upon the material encountered. Desired slopes are 3:1 where compatible with other project design criteria. This condition may be modified when engineering studies indicate the need for flatter slopes or when stable slopes can be maintained on steeper grades and are approved by the City Engineer. Slope rounding shall be provided where the height of cuts or fills exceeds six (6) feet.
- E. Clearing Right of Way: Designated trees and all brush shall be removed from the road right of way when within a distance of five (5) feet from the edge of the paved surface of the roadway regardless of the width of the paved section. The right of way shall be cleared to a minimum of three (3) feet beyond any cut or fill slope. At intersections, clearing may be required to the property line for a distance of 100 feet from the centerline of the intersection when deemed necessary to provide safe sight distance for approaching traffic.
- Tree removal may be restricted by project specific conditions. Trees 12" in diameter or larger shall be protected and preserved where possible. The clearing limits of this section may be modified to protect such trees.
- F. Driveways: In areas where sidehill cuts and fills exceed three (3) feet or where damage may occur to public right of way during future driveway construction, driveways shall be graded into each lot at the time of grading for the roadway. All material from driveway construction shall be disposed of consistent with the grading plan or Appendix 33 of the Uniform Building Code.
- G. Access Roads: All roads to be accepted for dedication and maintenance by the City shall be paved to the boundary of the subdivision. Private road approaches that encroach into a city street shall be constructed in accordance with these standards.
- H. Minimum allowable roadbed structural section shall be as follows:
- | | |
|------------------------------|--|
| 1. Collector & Local Streets | 0.20' asphalt concrete
0.75' aggregate base |
| 2. Arterial Streets | 0.30' asphalt concrete
0.83' aggregate base |

Pavement thickness and total structural section shall be designed on the basis of resistance factor "R" determined in accordance with Caltrans Highway Design Manual, Section 614.3, "California R-Value" or other approved method. The thickness of various structural components shall be determined by the tables, charts, formulas, and procedures contained in Section 600 of the State Design Manual and shall be approved by the City Engineer.

The minimum traffic index used for structural section design shall be as follows:

<u>Street Type</u>	<u>Traffic Index</u>	<u>Safety Factor</u>
Arterial	7	1.2
Collector	6	1.1
Local	5.5	1.0
Cul-De-Sac	5.5	1.0

For "R" value of 5, structural section requirements shall be:

Street Type	T.I.	S.F.	G.E.*	A.C.	A.B.*
Arterial	7	1.2	2.554	0.3'	1.74'
Collector	6	1.1	2.006	0.2'	1.41'
Local	5.5	1.0	1.672	0.2'	1.11'
Cul-de-Sac	5.5	1.0	1.672	0.2'	1.11'
*Based on minimum asphalt concrete (A.C.) thickness. All dimensions in feet.					
Gravel Equivalent (G.E.) Based on Caltrans Design Manual equation: $G.E. = 0.0032 (TI) (100-R) (SF)$ $= 0.0032 (TI) (95) (SF)$ $= 0.304 (TI) (SF)$					

- I. Where new paving meets existing paving, all low areas shall be paved as directed by City to maintain a uniform cross slope and provide required drainage.

10.06 Testing of Materials - Testing of materials for compliance with these Standards shall be performed in accordance with the methods set forth in the Standard Specifications. Signed copies of all test results required shall be submitted to the City Engineer. Test results shall show clearly the name of the individual and the firm performing the tests, as well as the name of the project, the date of sampling, and the date of testing.

The tests indicated in the Standard Specifications will be required at locations and frequencies determined by the City Engineer.

10.07 Right of Way - Minimum right-of-way widths shall be as set forth in these Standards for the type of street under consideration. (See Section 15.00, Standard Details.) In no instance, without specific approval of the City Council, shall a street have a right-of-way width which is less than fifty (50) feet. No street right of way shall be less than forty feet (40'). Right-of-way requirements for widening at intersections shall be as approved by the City Engineer.

10.08 Signing and Barricades - Street name signs shall be furnished and erected at all intersections. Street name signs shall conform to requirements of these Standards. Street names shall appear on plans submitted for approval.

Where phased improvement covers a portion of the ultimate improvement and where an improved street is proposed to be extended in the future, the improvements shall include a permanent-type barricade at the end of such a street to extend completely across the right of way to serve as a warning to the public. The barricade shall be constructed, painted, and signed in accordance with the Standard Specifications and Standard Plans. Gates may be required where streets stub into areas where ingress and egress is required.

11.00 DESIGN STANDARDS – STORM DRAINAGE

11.01 General - These standards shall serve as a guideline for drainage system design and indicate minimum design standards acceptable to the City.

Improvement projects shall be protected from inundation, flood hazard, sheet overflow, and ponding of storm water, springs, and other surface waters. The design of improvements shall be such that water accumulating within the project will be carried away from the project without injury to adjacent improvements, residential sites, or residences to be constructed on sites within the project, or to adjoining areas. Water accumulating within the project shall be carried to storm drainage facilities or to a natural water course by closed conduit or open channel, and shall meet the design standards herein set forth.

Drainage systems within the project shall accommodate anticipated future development (consistent with the General Plan) within the drainage basin. Off-site drainage facilities shall be adequate for ultimate development of the drainage basin. Diversion of natural drainage will be allowed only within the limits of the proposed improvement. All natural drainage must enter and leave the improvement area at its original horizontal and vertical alignment unless an agreement, approved by the City, has been executed with the adjoining property owners. All concentrated drainage leaving the boundaries of an improvement area shall be connected to existing drainage ways approved by the City Engineer.

Where a subdivision is subject to flood hazard, the developer shall provide flood control works, drainage facilities, or other improvements sufficient to provide all structures or building sites, both existing and proposed, with 100-year flood protection.

Street improvements shall include adequate provisions for storm drainage. Adequate storm drainage shall consist of a system of underground piping, generating self-scouring velocities and leading to a disposal point which is workable under conditions of heavy rainfall and runoff.

Special design problems involving pump stations, retention basins, or other unusual features not covered herein, will require individual study and approval. Pump stations will not be allowed except where special circumstances warrant consideration.

11.02 Classification of Storm Drains

Cross Culverts - Drainage culverts transporting runoff across roadways into open ditches or natural drainage courses.

Driveway Culverts - Drainage culverts transporting runoff across driveways.

Onsite Drainage Facilities - All surface drains and underground drainage pipe within the development.

Offsite Drainage Facilities - Facilities required to carry storm water from the proposed project to a natural drainage course or existing conduit.

Modification of storm drain classifications may be required by special conditions. Any modification of classifications will be resolved on an individual basis by the City Engineer.

11.03 Alignment - The location of storm drainage pipelines in new streets shall be under or adjacent to the curb and gutter parallel to roadway centerline. Pipes placed under curb and gutter shall have minimum clearance of 0.5 feet between the bottom of gutter section and top of pipe.

11.04 Lines - Lines shall be as near parallel with the centerline of streets as possible. Angular changes shall not exceed 90 degrees. Open ditches, lined channels, swales, and flood plain areas shall be maintained as nearly as possible in their existing alignment. When an open ditch, other than a roadside ditch, is to be constructed parallel to an existing roadway, the ditch shall be constructed outside the proposed right of way of the ultimate street development.

11.05 Easements - Drainage conduits and channels, when not located in a public street, road or alley, or within an existing public drainage easement, shall be located in a recorded or dedicated public facility easement.

Dedications necessary for construction on private property shall be completed prior to acceptance of improvements by the City. Where a minor improvement of a drainage channel falls on adjacent property, a right of entry shall be obtained from the property owners, and a copy of the right of entry shall be submitted to the City prior to approval of the improvement plans.

Easements for closed conduits shall have a minimum width of fifteen (15) feet. The centerline of the pipe shall be not less than five (5) feet from the easement limit. Pipe may reverse sides of the easement at angle points.

Easements shall provide sufficient widths for vehicle access and working space.

For pipes exceeding 24" in diameter or trenches exceeding five (5) feet in depth, the easement shall have additional width to provide working space as required by the City Engineer.

Easements shall be provided for all ditches, culverts, and conduit systems whether constructed as newly built improvements or as rebuilt improvements and shall adequately meet the minimum width specified herein.

11.06 Natural Drainage Courses - All natural drainage courses within the boundaries of an area to be improved shall be provided with drainage easements extending the full length of the drainage courses within the improved area. The width of such easement shall be determined from the limit of the 100-year flood plain. A natural drainage course is defined as an existing drainage way having specific sides and bottom, but may not have year-round flow.

11.07 Drainage Study - A drainage study consisting of calculations and a drainage map shall be submitted with all improvement plans requiring storm drain improvements. The following information shall be included in the drainage study:

- A. A drainage map that depicts onsite facilities, offsite drainage adjacent to the project, and all natural water courses within the project limits.
- B. All existing drainage structures shall be checked to see that sufficient capacity exists to safely pass the increased runoff.
- C. Calculations as set forth in Section 11.09.

11.08 Drainage Map - A drainage map shall be submitted with each set of improvement plans and shall reflect the following criteria:

- A. Must be of adequate scale and accurately and clearly show contour lines and reference to the datum.
- B. All individual watershed areas shall be clearly delineated on the map.
- C. Concentrated storm flow patterns shall be delineated on the map.
- D. The quantity of water arriving at each structure, pipe or ditch from a 10-year and a 100-year frequency storm shall be calculated and shown on the map.
- E. The size, type, and location of conduit proposed.
- F. Channel dimensions and water surface profile computations for 100-year storm when required.

11.09 Calculations - One set of drainage calculations shall be submitted with each set of improvement plans. The calculations shall be submitted by a California registered civil engineer and shall conform to standard engineering practice.

Drainage calculations shall be checked and approved by the City Engineer. Drainage calculations may be from any accepted engineering method. The City will check flow determinations by the rational method.

Storm drains shall be designed to pass a 10-year storm with no head. The 100-year storm must be carried within drainage facility or roadways with no potential for property damage. All major structures shall be designed to pass the 100-year storm.

Runoff factors for the rational method shall be not less than the following:

<u>Land Use</u>	<u>Runoff Factor "C"</u>
Rural Residential	0.35
Single Family Residential	0.45
Multi-Family Residential	0.60
Commercial and Industrial	0.75 - 0.95

Time of concentration (t_c) shall be determined by accepted methods. A 10 minute minimum may be used for unsurfaced basins.

Rainfall intensities shall be in accordance with the "Rainfall Intensity Chart," (See Section 15.00, Standard Details) and shall be not less than:

t_c	i_{10} (in/hr)	i_{100} (in/hr)
10 minutes	2.5	3.4
20 minutes	1.6	2.3

11.10 Closed Storm Drain Systems - Closed conduits shall be of either cast-in-place concrete pipe, precast reinforced concrete pipe, non-reinforced concrete pipe, or smooth wall PVC pipe as set forth in the Standard Specifications. The specific type of pipe or alternate pipes to be used in the development shall be shown on the plans and be subject to approval of the City Engineer.

The minimum pipe diameter allowable on any storm drain shall be 12 inches for onsite development.

The minimum velocity in closed conduits shall be 2 f.p.s. when flowing at a depth of 0.5 D, (D = pipe diameter).

Minimum cover requirements are shown on Standard Drawings. At locations where the minimum cover requirements cannot feasibly be obtained, conduit shall be backfilled with cement slurry backfill or other method of pipe protection approved by the City Engineer.

11.11 Open Channels - Open channels shall consist of concrete-lined channels, rock slope protection lined channels, or earth channels with approved fabric liners. Open channels shall be designed to the following criteria:

Minimum Velocity

1. Unlined channels - 2 f.p.s.
2. Lined channels - 2 f.p.s.

Maximum Velocity

1. Unlined channels - 6 f.p.s.
2. Lined channels - 10 f.p.s.

All channels with earth sides shall have freeboard of not less than 1.5 feet at design capacity for a 10-year storm. All lined channels shall have freeboard of not less than 0.5 feet at design capacity for a 100-year storm.

In existing channels, abrupt changes in alignment or profile and all underbrush and debris, which restricts flow, shall be removed, trimmed, or otherwise improved.

All open channels shall pass the 100-year storm without the potential for property damage.

11.12 Drainage Structures - Drainage structures shall comply with the following specifications:

Manholes - Manholes shall be standard precast concrete. Cast-in-place type manholes may be used where required. Where special manholes or junction boxes are required, the design shall be approved by the City Engineer. In no case will junction boxes be allowed which are less than twenty-four (24) inches (inside dimensions). Manholes shall have a forty-eight (48) inch inside diameter.

Manholes shall be located at junction points and changes in conduit size. Manholes shall be placed at the BC and EC of all curves and on 300-foot maximum intervals along the curve.

Manholes, junction boxes or inlets shall be placed at intervals not to exceed 400 feet. All manholes and junction boxes other than inlets shall have standard manhole covers, as shown in Standard Drawing SD-2. Manholes will not be allowed in gutter flow lines.

Drop Inlets (DI) - Drop inlets shall be open curb-face types as shown in the Standard Drawings or other approved inlets.

Drop inlets shall be spaced so that the length of flow in the gutter does not exceed 600 feet. The depth of the flow in the gutter shall not exceed 0.35 feet for a 10-year storm. Outfall pipes shall accommodate the design runoff taking into consideration bypass flow from upstream inlets.

Junction Boxes - Junction boxes shall be constructed of reinforced concrete or fabricated from reinforced pipe sections.

Minimum wall thickness for reinforced concrete junction boxes shall be 8 inches.

The inside dimension of junction boxes shall be sufficient to provide a minimum of three inches clearance on the outside diameter of the largest pipe in each face. Junction boxes deeper than four feet shall have a minimum inside dimension of 48 inches.

Headwalls, Wingwalls, Endwalls, Trash Racks, and Railings - All headwalls, wingwalls, and endwalls shall be considered individually and shall be, in general, designed in accordance with the Standards and Specifications of the California Department of Transportation and the requirements of the City.

Trash racks shall be provided where, in the opinion of the City Engineer, they are necessary to prevent clogging of culverts and storm drains or eliminate hazards. Trash racks shall conform to the requirements of the City Engineer. Temporary trash racks will be allowed where pipe will be extended in the near future.

On cross culvert drains, flared-end sections shall be used where required by the City Engineer.

Guardrails may be required by the City Engineer at culverts, headwalls, and box culverts and on steep side slopes. When so required, the railing shall be installed in accordance with the requirements of the Uniform Building Code or State of California, Department of Transportation.

Pipe used as cross culverts to open ditches may be corrugated steel.

Detention Basins - Storm water detention basins will only be allowed when downstream improvements are either not feasible or impractical at the time of development. Unless otherwise approved by the City Engineer, basins will not be considered a permanent means for handling peak storm runoff flows. A plan may be required outlining the proper abandonment of the basin in the future.

Basins shall be constructed such that the collection system drains into the basin by gravity.

Design criteria shall be as follows:

Design Storm: 100 year, 24 hour

Basin volume shall be calculated by $V = CAR/12$ where:

C = Runoff Coefficient (Section 11.09)

A = Contributing Area in Acres

R = Total Rainfall in Inches for the Design Storm (100 Yr, 24 hr event in inches)

The volume shall account for a constant outflow not to exceed the pre-development peak runoff rate.

Alternate methods for volume calculations are subject to approval of the City Engineer.

12.00 DESIGN STANDARDS – SANITARY SEWER

12.01 Design Flow - An average flow of 100 gallons per person per day or 350 gallons per dwelling unit per day shall be used for design of sewers with peak flows calculated using the factors from the peak flow factor chart (See Standard Details). All sewers shall be designed to carry peak flows without surcharging the manholes.

The estimated population used for design, including population equivalents for commercial, industrial, and institutional uses, shall be submitted prior to commencement of improvement design.

Sewer mains subject to extension in the future shall be sized to serve the entire area tributary to the proposed development. The design engineer shall submit a study substantiating the proposed size of sewer in such cases. Discussion of parameters with the City Engineer is advised prior to the study.

12.02 Gradients - Sanitary sewer gradients shall be designed to provide a minimum flow velocity of two feet per second with pipes flowing half full. The following table indicates slopes which will provide that velocity. These shall be the **minimum slopes** for design of sanitary sewers unless flatter slopes are specifically approved by the City Engineer.

MINIMUM SEWER GRADIENTS

<u>DIAMETER</u>	<u>SLOPE (ft/ft)</u>
6"	.0050
8"	.0035
10"	.0025
12"	.0020
15"	.0015
18"	.0012
Service Line (4")	1/4 inch per foot (.020)

At changes in pipe size, the invert of the pipe flowing from the manhole shall be sufficiently lower than the incoming pipe in order that the inside crown elevation of both pipes is the same.

At manhole locations where angles of deflection occur in the alignment of the sewer, the pipe invert shall have a minimum drop from inlet to outlet according to the following table:

MINIMUM FLOW LINE DROP THROUGH MANHOLE

<u>ANGLE OF DEFLECTION</u>	<u>INVERT DROP (INLET TO OUTLET)</u>
0 to 45 degrees	.05 feet
45 degrees to 90 degrees	.10 feet
90 degrees plus	.20 feet

A drop manhole shall be constructed at any location where there is a drop in the sewer invert of more than 1.5 feet. Manhole structures used shall be in accordance with the Standard Details.

12.03 Pipe Size - Sewer pipe sizes shall be adequate to carry the peak design flows at the design gradient with a minimum size of 6 inch diameter except for service lines. Minimum size for main line sewers downstream of the last manhole on any given collector line shall be 8 inches unless otherwise approved by the City Engineer. Service lines shall be 4 inch diameter minimum except where estimated flow requires a larger size.

12.04 Pipe Strength Class - Manufacturer's specifications shall apply as to the proper class of pipe required for installation in the work except where these Standards are more stringent. Engineer may be required to substantiate the proposed class of pipe as required by the City Engineer.

12.05 Location and Alignment - Sanitary sewers shall be installed within right-of-way dedicated for public streets where practicable. If not located in street rights of way, sewers shall be installed within the center 10 feet of a 20 foot wide permanent easement deeded to the City as a public utility easement. In case of hardship in providing a 20 foot width, lesser widths may be approved on an individual basis by the City Engineer.

Where a curved alignment is necessary, the minimum radius of curvature shall be 400 feet. In no case shall the maximum deflection of pipe joints exceed the recommendation of the pipe manufacturer. Location of sewer lines relative to domestic water facilities and improvements shall be in accordance with applicable public health standards.

13.06 Minimum Depth - The depth of any sanitary sewer shall be adequate to provide a minimum cover of 4 feet in any traveled way. All service lines will, wherever practicable, be maintained at 4 feet cover at the property line. Minimum cover on service lines shall be 3.0 feet throughout the length of the line within the public rights of way.

Maximum depth shall not exceed 8 feet without the written consent of the City Engineer.

12.07 Manhole Locations - Manholes shall be constructed at all pipe line intersections except service lines, at angle points, at changes in pipe size or gradient, at the terminus of lines and at maximum intervals of 350 feet on sewers not greater than 12 inches in diameter or at intervals of 500 feet on sewers greater than 12 inches in diameter. Where manhole locations are fixed by

intersections, the spacing of intervening manholes shall be approximately equal. All manholes shall have "all weather" vehicular access subject to the approval of the City Engineer.

12.08 Cleanouts or Flushing Holes - Cleanouts or flushing holes may be used in lieu of manholes at the terminus of any sewer where the distance from the terminus to the next manhole does not exceed 200 feet. Cleanouts on service lines shall be as shown on the Standard Details.

Temporary cleanouts may be installed at terminus of lines intended for future extension.

12.09 Stubs for Future Extension - Stub pipes shall be installed in manholes with appropriate plugs or caps, where shown on the drawings, for anticipated future extension and shall be extended to the project limits or across project frontage when required by the City Engineer. The location and size of stubs is subject to approval by the City Engineer.

12.10 Service Lines - Service lines shall be installed for each and every residence or structure. Private sewers installed within the property lines shall be in conformance with Uniform Plumbing Code and these Improvement Standards.

The exact location of service lines passing under curb, gutter, and sidewalk shall be indicated with the letter "S" cast in the curb directly above the underground service line.

12.11 Lift Stations

12.11.1 General – Lift stations shall be designed by the Developer's engineer and reviewed and approved by City Engineer. City staff should be consulted in the early planning stages to assess the need for such installations and to develop the site-specific design criteria.

12.11.2 Capacity – The station design capacity and pumps shall be in accordance with Section 12.01 Design Flows, and other pump flows that may enter the system.

12.11.3 Station Configuration – Lift stations shall typically be of the duplex wet well submersible type with equipment and instrumentation as specified by the City. Where a three-pump lift station is required, there shall be two (2) duty pumps and one (1) standby pump. The standby pump shall have the same capacity as one duty pump. In addition, the following criteria are to be considered in the general design of the site:

A. Site Selection – Site selection shall be reviewed with the City and include consideration for zoning and proximity to homes and businesses. The site shall be a separate lot deeded to the City. The site shall be sized to allow for adequate clearance on all sides from any equipment, fencing or piping.

B. Site Improvements – Wastewater lift stations shall include features to make the station aesthetically acceptable in the location planned. At a minimum all electronic equipment shall be housed in a masonry structure using exterior split-face block. The site shall have fencing along the property and be paved within the fencing limits.

C. Grading – Grading of the site shall provide drainage away from the proposed structures. The lift station structures and electrical and mechanical equipment shall be protected from physical damage by flooding.

D. Accessibility and Security –The entire site shall be paved with a) 2-inches of Asphalt Concrete over 5-inches of Class II Aggregate Base or b) 4-inches of Portland Cement Concrete. The lift station shall be readily accessible by maintenance vehicles during all weather conditions. The site shall be accessible either via a minimum 12-foot driveway with a hammerhead turnaround and constructed of a) 2-inches of Asphalt Concrete over 5-inches of Class II Aggregate Base or b) 4- inches of Portland Cement Concrete. The driveway shall be accessible from a PUE or access easement dedicated to the City. Adequate working area within the site for large equipment vehicles is to be provided. The entire site shall be enclosed with 6 foot chain link fence with colored slats and 3-strand barbed wire and a minimum 14-foot double gate. Sufficient lighting shall be provided for City crews to perform night work.

E. Operation and Maintenance Manual – Lift Stations and portable equipment shall be supplied with a complete set of operational instructions, including emergency procedures, maintenance schedules, tools, and such spare parts as may be necessary. All training necessary for maintenance and operation of facility shall be provided to the City.

12.11.4 Operation – Typically, the station shall be of the duplex type (2 pumps) and have duplex controls which will automatically alternate the pumps and can energize both pumps on an alarm for high water level. The number of on/off cycles per hour shall be as recommended by the pump manufacturer. All doors and lids shall require no more than 50 lb force to open, provide lift assistance as required. Fall protection shall also be provided.

The system shall operate in accordance with the following wet well level indicators and shall be shown on the plans:

<u>LEVEL</u>	<u>INDICATOR</u>
1	Redundant off and low-level alarm
2	Pumps off
3	Lead pump on
4	Lag pump on
5	High level alarm

12.11.5 Pumping Systems

A. Type of Pumps – Pumps shall be FE Myers 4” Non-Clog submersible wastewater type. Each pump shall have the capacity such that, with one pump out of service, the remaining pump will have capacity to handle the design peak wet weather flow.

B. Pump Selection – Pumps and motors shall be selected by considering initial, interim, and ultimate conditions. Insofar as is practicable, stations shall be designed to deliver as uniform a flow as practicable in order to minimize hydraulic surges and to maintain a minimum velocity of two (2) feet per second in the force main. The design flow shall be within 60% to 120% of the best efficiency point (BEP) of the pump.

12.11.6 Piping – Suction and discharge piping shall be Class 350 ductile iron. All exposed piping shall have adequately sized and located thrust rods. A check valve isolated by shut off valves is required on all outlet piping. The discharge piping for each pump shall be the same size as the pump outlet or be a minimum of four (4) inches. The discharge piping shall terminate in a common valve vault adjacent to the wet well.

12.11.7 Wet Well – Fiberglass tanks or vaults shall not be permitted. The maximum wet-well depth shall be 18 feet. All interior concrete surfaces of the wet well, emergency storage, etc. shall be coated with an approved epoxy coating. Approved coatings are Tnemec 434 @ 125 mils with Tnemec 435 @ 15 mils or Carbolite Plasite 4550S @ 100 mils. All exterior concrete surfaces of the wet well, emergency storage, etc. shall be coated with an approved epoxy coating. Approved coatings are Tremco Tremproof 250 GC, 100mils of Hydro-Pox 204 or Thoroseal.

A. Size – Design calculations are to be submitted for the wet well. The design fill time and minimum pump cycle time shall be considered in sizing the wet well. The operational volume of the wet well shall be based on design average dry weather flow and a filling time not to exceed thirty (30) minutes plus the cycle time. When the anticipated initial flow to the station is less than the design average dry weather flow, provisions shall be made so that the fill time indicated is not exceeded.

B. Buoyancy – Buoyancy of the wastewater pumping station structures shall be considered, and adequate provisions shall be made for protection. Buoyancy calculations shall provide for groundwater at grade and a minimum 1.5 factor of safety.

12.11.8 Electrical and Communications – Electrical systems and communications components shall conform to the City's specifications. Soft starts are required for motors 15 HP and over. A power disconnect shall be provided at the building when the wet well is within 25 feet, or at the wet well when greater than 25 feet from the building. All electrical equipment placed in minimum NEMA 4x rated enclosures. All above grade electrical conduit shall be PVC coated rigid conduit.

A. Level Measurement – A level transducer and a backup float system shall be provided. Measurement devices should be so located in the wet well as not to be damaged by routine maintenance activities. The float system consists of five (5) floats that are to be set at elevations as directed at the time of installation.

B. Equipment Removal – The lift station shall be designed to facilitate removing pumps, motors, and other mechanical and electrical equipment. Submersible pumps shall be readily removable and replaceable on guide rails without dewatering the wet well or disconnecting any piping in the wet well. Provide appropriate hoists with stainless steel lifting changes and stainless steel guide rails for pump removal.

C. Communications – Lift Station shall be connected to a permanent phone line, and an autodialer shall be installed for alarm notification.

12.11.9 Water Service – A water service with a meter and backflow valve shall be provided at all installations. A 2-inch water meter shall be provided as well as a 2-inch freeze-proof service connection and 5/8-inch freeze-proof hose bib. There shall be no physical connection between potable water supplies and the lift station wastewater piping.

12.11.10 Standby Systems – A permanent, emergency generator is to be provided to prevent the discharge of raw or partially treated wastewater to any waters and to protect public health by preventing back-up of wastewater and subsequent discharge to homes, streets, and other public and private property. Generator shall be capable of running all required pumping equipment simultaneously. Automatic start and auto-transfer switches are required. The Developer shall be responsible for permitting all generators within the local Air District.

A. Storage – Emergency storage may be utilized, provided the average dry weather design flow to the station does not exceed 20,000 gallons per day. Such storage will provide a minimum of four (4) hours of peak wet weather flow. Emergency storage does not include upstream manholes, pipelines, or wet well operating storage volume. The storage shall have a common inlet/outlet pipe to the wet well with the invert set at the high water level of the wet well.

B. Standby Power – Standby power shall generally consist of one (1) engine-drive electric generator, fuel storage, and enclosure. Generating unit size shall provide power for sequential pump motor starting current and for lighting, ventilation, and other auxiliary equipment necessary for safety and proper operation of the lift station.

1. Fuel Type – diesel, propane, or natural gas fuel shall be used to drive generators.

2. Fuel Storage – Day storage or belly tanks are not allowed. Fuel storage shall be above ground and shall be sized to provide a minimum of 36 hours of generator run time under full load.

12.11.11 HVAC – Heating, ventilating, and cooling of the motor control and generator building is required. Design of the system is to be in accordance with the applicable state and local codes. Mechanical ventilation must be provided if routine maintenance will require personnel to enter the station. Thirty (30) air changes per hour are required for intermittent operation.

12.11.12 Noise Control – Noise from the generator building shall not exceed 55 decibels at 50 feet from the building perimeter.

13.00 CONSTRUCTION STANDARDS - STREETS

13.01 Lines and Grades - Attention is directed to Section 3.00, "Construction Staking," of these Improvement Standards. Construction staking to be supplied by the Engineer shall consist of horizontal and vertical location of curb, gutters, valley gutters, and storm drains as determined by the Engineer. Flow line, and grate and rim elevations of drop inlets and junction boxes shall be staked with offsets. All supplemental construction staking required by the Contractor shall be supplied by the Contractor. Engineer may revise curb and gutter alignment in the field to avoid tree root structure or conform to existing improvements.

13.02 Order of Work - Attention is directed to Section 5-1.05, "Order of Work," and Section 4-1.04 "Detours," of the State Standard Specifications where they apply.

Contractor shall provide City with a schedule of work, and Contractor shall perform all work in accordance therewith. Should circumstances cause Contractor to anticipate falling out of compliance with said schedule, Contractor shall notify City in advance and provide revised schedule for review and approval by the engineer.

13.03 Maintaining Traffic - Attention is directed to Sections 7-1.08, "Public Convenience," 7-1.09, "Public Safety," and 12, "Construction Area Traffic Control Devices," of the State Standard Specifications and these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from his responsibility as provided in said Section 7-1.09.

Lane closures shall conform to the provisions of Section 14.05, "Traffic Control System for Lane Closure" of these special provisions.

The Contractor shall notify local authorities of his intent to begin work at least 5 days before work is begun. The Contractor shall cooperate with local authorities relative to handling traffic through the work area and shall make his own arrangements to keep the working area clear of parked vehicles.

Whenever construction vehicles or equipment are parked on the shoulder within 6 feet of a traffic lane, the shoulder area shall be closed with fluorescent traffic cones or portable delineators placed on a taper in advance of the parked vehicles or equipment and along the edge of the pavement at 25-foot intervals to a point not less than 25 feet past the last vehicle or piece of equipment. A minimum of 9 cones or portable delineators shall be used for the taper. A C23 (Road Work Ahead) or C24 (Shoulder Work Ahead) sign shall be mounted on a telescoping flag tree with flags. The flag tree shall be placed where directed by the Engineer.

Minor deviations from the requirements of this section concerning hours of work which do not significantly change the scope of the work may be permitted upon the written request of the Contractor if in the opinion of the Engineer public traffic will be better served and the work expedited. Such deviations shall not be adopted until the Engineer has indicated his written approval.

13.04 Construction Area Signs - Construction area signs shall be furnished, installed, maintained, and removed when no longer required in accordance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications.

Type IV reflective sheeting for sign panels for portable construction area signs shall conform to the requirements specified as "Pre-qualified and Tested Signing and Delineation Materials" by Caltrans.

13.05 Traffic Control System for Lane Closure - A traffic control system shall consist of closing traffic lanes in accordance with the provisions of Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications and the provisions under "Maintaining Traffic" elsewhere in these Improvement Standards.

The provisions in this section will not relieve the Contractor from his responsibility to provide such additional devices or take such measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the State Standard Specifications.

If any component in the traffic control system is displaced, or ceases to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair said component to its original condition or replace said component and shall restore the component to its original location.

When lane closures are made for work periods only, at the end of each work period, all components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. When the Contractor so elects, said components may be stored at selected central locations approved by the Engineer, within the limits of the highway right of way.

Work areas adjacent to city streets shall be open to two-way traffic by 4:00 p.m. each work day. One lane shall remain open to traffic during construction unless otherwise approved by the City.

Contractor shall submit a Traffic Control Plan for review and approval by the City Engineer and Police Chief prior to commencing work affecting city streets.

13.06 Obstructions

Attention is directed to Sections 8-1.10, "Utility and Non-Highway Facilities," and Section 15, "Existing Highway Facilities," of the State Standard Specifications.

The Contractor shall notify the City and the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Regional notification centers include but are not limited to the following:

<u>NOTIFICATION CENTER</u>	<u>TELEPHONE</u>
City of Plymouth	1(209)245-6941
Underground Service Alert-Northern California (USA)	1(800)227-2600

13.07 Adjust Utilities to Grade - Contractor shall adjust all valve boxes, manhole frames, and meter boxes to grade in accordance with the plans and these Improvement Standards. (See Section 15.00, Standard Details and Section 14.14 of these Improvement Standards.)

13.08 Clearing and Grubbing - Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the State Standard Specifications.

Contractor shall protect existing trees from damage caused by his operations. All work in drip line of trees shall be as directed by Engineer. Pervious backfill shall be placed around all root structures exposed by Contractor's operations.

13.09 Asphalt Concrete - Asphalt concrete and pavement reinforcing fabric shall conform to the provisions in Section 39, "Asphalt Concrete," of the State Standard Specifications and shall be 1/2" maximum, medium grade, Type B aggregate. Asphalt binder shall be AR 4000 or AR 8000, as directed by the City Engineer.

Asphalt concrete shall be produced from commercial quality asphalt and aggregates. The spreading and compacting requirements in Sections 39-6.02, "Spreading," and 39-6.03, "Compacting," of the State Standard Specifications will apply to areas requiring asphalt concrete surfacing except as authorized by City Engineer.

Spreading and compacting shall be performed by methods that will produce an asphalt concrete surfacing of uniform smoothness, texture, and density.

The amount of asphalt binder to be mixed with the aggregate shall be between 4 percent and 7 percent by weight of the dry aggregate as determined by the Engineer. The fourth through seventh paragraphs in Section 39-3.03, "Proportioning," of the State Standard Specifications shall not apply.

Spreading of asphalt concrete shall be in accordance with Section 39-6.02 of the State Standard Specifications. All irregularities in existing pavement surface shall be prepared with an application of asphalt concrete as set forth below.

When improvement to existing asphalt concrete surfaces is required, contractor shall clean all open longitudinal joints and other cracks in existing surface with air or broom sufficient to provide a clean, dry surface. Contractor shall apply tack, place 3/8" asphalt leveling course, and compact all irregularities in asphalt concrete surface to accomplish relatively smooth surface suitable for placing asphalt concrete overlay.

Contractor shall remove all organic debris from areas to receive asphalt and shall sweep and apply paint binder over the entire project limits prior to placing asphalt concrete overlay. Paint binder shall be applied at a rate of 0.1 to 0.2 gallons per square yard as directed by the Engineer.

Contractor shall place asphalt concrete with a self-propelled paving machine in accordance with Section 39-5.01 of the State Standard Specifications.

13.10 Pavement Reinforcing Fabric - Pavement reinforcing fabric shall conform to the provisions of Section 88-1.02, "Pavement Reinforcing Fabric" of the State Standard Specifications. Reinforcing fabric shall be placed at location specified on the plans or in accordance with limits marked in the field.

13.11 Fog Seal Coat - Fog seal coat shall conform to the provisions in Section 37-1, "Seal Coats," of the State Standard Specifications and these special provisions. Fog seal shall be 60 percent asphaltic emulsion and 40 percent water and shall be applied at the rate of 0.10 to 0.12 gallons per square yard. Contractor shall provide Engineer verification of asphalt emulsion used.

Contractor shall comply with the notification requirements set forth in Section 6.02 of these special provisions prior to placing fog seal coat. Fog seal shall not be applied to thermoplastic surfaces.

13.12 Striping and Pavement Markings - Roadway striping shall conform to Section 84, "Traffic Stripes and Pavement Markings," of the State Standard Specifications, the plans and these Improvement Standards. Paint shall be in accordance with Section 84-3, "Painted Traffic Stripes and Pavement Markings," of the State Standard Specifications.

13.13 City Supplied Materials

City may supply sanitary sewer manhole risers subject to prior approval or conditions.

13.14 Subsurface Drain - Contractor shall construct subsurface drain where required in accordance with the plans and these Improvement Standards.

Storm drain and perforated plastic pipe shall conform to the provisions in Section 64, "Plastic Pipe," of the State Standard Specifications. Plastic pipe 15" in diameter and smaller shall be SDR-24 pipe with locked in O-ring. Subsurface drain trench width shall be not more than 12" wide and 30" deep with 4" and 6" diameter perforated plastic pipe and shall be in accordance with Section 68, Subsurface Drains, of the State Standard Specifications. Contractor shall make water tight connection to existing storm drain with concrete grout with smooth trowel finish on all concrete work.

Asphalt concrete road surfaces affected by subsurface drain work shall be saw cut prior to excavation of asphalt concrete. Subsurface drain filter fabric shall be in accordance with Section 88-1.03, Filter Fabric, of the State Standard Specifications.

Concrete affected by work shall be saw cut, removed, and replaced. Concrete shall be Class B concrete in accordance with Section 90 of the State Standard Specifications.

13.15 Locate and Protect Existing Utilities - This item of work shall cover the location and protection of ALL existing underground utilities as required under Section 4215 of the Government Code as amended and Section 13.06, "Obstructions," of these Improvement Standards.

Water service lines and meter boxes affected by the work will be adjusted to grade by the contractor. Should any service line require interruption of service, it will be adjusted to grade by Amador Water Agency. Gas and electrical service lines will be adjusted to grade by Pacific Gas & Electric (PG&E). Contractor shall coordinate with AWA and PG&E and establish a construction schedule that will allow compliance with this section and orderly prosecution of the work.

Contractor shall locate existing utilities and pothole designated areas for location and protection of existing underground facilities within the project as necessary to coordinate and schedule his work.

14.00 CONSTRUCTION STANDARDS – STORM DRAIN AND SANITARY SEWER

14.01 Sanitary Sewer Pipe - "Sewer Pipe" shall be PVC or ductile iron pipe in accordance with the plans and specifications. Sewer pipe shall be PVC pipe with maximum SDR of 35 in compliance with ASTM D3034 and shall be installed in conformance with ASTM D2321 or as modified herein. Damaged pipe shall be removed and replaced. Field repairs to PVC pipe will not be allowed.

Ductile iron pipe shall be cement lined, and shall conform to AWWA Specification C151 and shall be thickness of Class 51 or approved equal.

14.02 Storm Drain Pipe - Storm drain pipe shall conform to the provisions in Section 64, "Plastic Pipe" of the State Standard Specifications. Plastic pipe 18" diameter and larger shall be smooth wall, ribbed plastic Perma-Loc large diameter storm drain, PS46 (ASTM F-794), as manufactured by J-M Pipe, High Density Polyethylene Pipe (HDPE) per Section 64 of the State Standard Specifications, Reinforced Concrete Pipe (RCP) per Section 65 of the State Standard Specifications, or approved equal.

Storm drain pipe 15" diameter and smaller shall be SDR 35 pipe, with locked-in O-ring, as manufactured by J-M Pipe or approved equal.

Backfill material shall conform to the provisions in Section 19, "Earthwork," of the State Standard Specifications. Clean material excavated from storm drain trenches may be used for backfill subject to approval of the Engineer. Pervious backfill material required by the plans and these Improvement Standards shall be Class 1 backfill in accordance with Section 14.05 of these Special Provisions.

All piping shall be backfilled as designated on the plans and as set forth herein.

14.03 Precast Concrete Box Culvert - Precast concrete box culverts shall comply with ASTM Standard C850-95a and shall have interior dimensions as set forth on the plans. Wall, slab, and bottom thickness and reinforcement shall comply with Table 2 of said standard, or as otherwise approved by City. Backfill in roadways shall be Class 2 backfill and backfill off road shall be Class 3 backfill in accordance with Section 14.05, "Trenches and Backfill," of these Improvement Standards.

End sections to be placed adjacent to cast in place concrete shall have longitudinal steel protruding not less than 30 diameters for connection to cast in place inlet and outlet structures.

Joints for cast in place concrete box culvert shall be in accordance with Section 65-1.06, "Joints," of the State Standard Specifications.

14.04 Installation - Pipe shall be laid in strict conformity with the prescribed alignment and grade specified in the plans and these specifications, or as directed by the Engineer. Before any length of pipe is laid, it shall be carefully inspected for defects. No pipe or other material that shows defect shall be placed. Pipe laying shall proceed upgrade with the bell ends of the pipe placed upstream. Each section of pipe shall be laid in such a manner as to form a water tight concentric joint with the adjoining pipe. The interior of the pipe shall be kept clear of all dirt and debris during construction.

All pipe laying and joining, including the maximum deflection of joints in curved alignment shall be in accordance with the pipe manufacturer's specifications and as directed by the Engineer.

Small diameter storm drain connections to 36" diameter storm drain shall be in accordance with 36" diameter pipe manufacturer's recommendations and shall be water tight. No protrusion into large diameter pipe will be allowed.

Deflection for PVC pipe after installation shall not exceed manufacturer's recommended maximum deflection at any location. Should the installed pipe exceed manufacturer's recommended maximum deflection, each and every length of pipe so affected shall be removed and replaced at no cost to the Owner.

Sewer service connections shall be connected to the new pipe with PVC wye compatible with the new sewer pipe. Mechanical saddles shall not be used. Contractor's attention is directed to Section 14.10, "Sewer Lateral Adjustment to Grade and Sewer Lateral Connection," of these Improvement Standards.

14.05 Trenches and Backfill - This work shall consist of performing all operations necessary to excavate earth and rock or other material, of whatever nature, including water, regardless of character and subsurface conditions, necessary to excavate trenches for pipes and appurtenances; to place backfill for structure, pipes and appurtenances and other facilities; to backfill trenches and depressions resulting from the removal of obstructions; to remove and replace unsuitable material; to construct protection dikes; and to remove unstable material and slide material which may enter trenches. All such work shall be in conformance with the plans and these Improvement Standards or as directed by the Engineer. Typical trench details shall be shown on the plans.

Where pipes are to be installed above original ground or in new embankment fills, embankment shall first be constructed to the required height for a distance on each side of the pipeline of not less than five feet (5'). Embankment shall have relative compaction of not less than ninety-five percent (95%). Upon completion and approval of the embankment the trench shall be excavated with the sides nearly vertical and the pipelines installed in accordance with these Improvement Standards.

When a firm foundation is not encountered due to soft, spongy, or other unsuitable material, such material shall be removed to the limits directed by the Engineer, and the resulting excavation shall be backfilled with approved washed drain rock compacted to ninety-five percent (95%).

Materials excavated from trenches shall be placed and maintained so as to offer minimum obstruction to traffic.

Ditches shall be kept clear for the purpose of handling road drainage. Drainage ways, walkways, and driveways shall be kept clear at all times.

At the end of each working day, there shall be no open trench for any excavation operation, unless otherwise permitted by the Engineer.

In connection with earthwork, all tests shall be made in conformance with the following requirements set forth in the State Standard Specifications:

<u>Tests</u>	<u>Test Method No</u>
Relative Compaction	Cal 216 & 231
Sand Equivalent	217
Resistance (R-value)	301
Sieve Analysis	202

Foreign material which falls into the trench prior to or during placement of the backfill shall be removed.

The trench widths set forth on the plans are minimum widths. No caving within the roadway will be permitted. Where excavation greater than the specified widths is necessary for execution of the work, machine or hand excavation to a stabilized slope will be permitted provided one-way traffic can be maintained. Minimum trench widths is the distance face-to-face of trench walls or inside face to inside face of sheeting should solid sheeting be used. Maximum trench widths from the bottom of the trench to the top of the pipe shall be limited to six inches (6") outside the specified minimum trench width, except with specific approval by the Engineer.

The Contractor shall furnish all materials and facilities required for trench excavation and shall make trenches and excavation dry throughout all pipe laying operations.

The location of underground utilities or other obstructions shall be determined by the Contractor sufficiently in advance of excavation so that pipe alignment can be confirmed or re-routed without delay. Contractor's attention is directed to Section 13.15, "Locate and Protect Existing Utilities," of these Improvement Standards.

Material for backfill shall be placed in uniform horizontal layers not exceeding one foot (1') in thickness before compaction, and shall be brought up uniformly on all sides of the trench, structure or facility. When the Contractor can satisfactorily demonstrate to the Engineer an alternative method of placing the backfill so that all requirements, other than the layer thickness, are met, the Engineer may permit the Contractor to use the alternative method. Under no circumstance will the Contractor use the alternative method unless the Engineer's approval is obtained in writing.

Each layer of backfill shall be compacted to a relative compaction indicated for the backfill involved. Compaction of Class 3 Backfill by ponding and jetting outside City or State rights-of-way will be permitted when the backfill material, as determined by the Engineer, 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. When ponding and jetting is permitted, material for use as Class 3 Backfill shall be placed and compacted in layers not exceeding three feet (3') in thickness. The work shall be performed in such a manner that water will not be impounded. Ponding and jetting methods, if allowed, shall be supplemented by the use of vibratory or other compaction equipment when necessary to obtain required compaction.

Backfill shall not be placed until the pipe or other facility has been inspected by the Engineer and approved for backfilling. The percentage composition by weight as determined by laboratory sieves shall conform to the following requirements:

Class 1 Backfill

<u>Sieve Sizes</u>	<u>% Passing Sieves*</u>
3/4"	100
2"	30-50
No. 4	0-15
No. 6	0

Sand equivalent not less than 20

*Gradations requirements may be waived with written approval from the Engineer.

"Pervious backfill" shall be coarse or medium screenings in accordance with Section 37, "Bituminous Seals," of the State Standard Specifications or as otherwise approved by Engineer.

Class 2 Backfill

Class 2 Aggregate Base, 1-1/2" maximum, in accordance with Sections 26-1.02, 26-1.02B, 26-1.035 of the State Standard Specifications except that percentage of No. 200 material shall be 15-30% unless otherwise approved by the Engineer.

Class 3 Backfill

Material for Class 3 Backfill may consist of material from excavation free from rocks or lumps exceeding three inches (3") in greatest dimension, vegetable matter, and other unsatisfactory material. Backfill shall be compacted to the relative compaction shown on the plans or as set forth in these specifications.

Class 4 Backfill

Class 4 Backfill shall be a cement-sand slurry comprised of aggregate, cement and water. The aggregate, cement and water shall be proportioned either by weight or volume. Cement used shall be 190 to 210 pounds 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 shall be thoroughly machine mixed in a rotary drum mix truck and placed in the trench from a direct truck discharge unless otherwise approved.

Mixing shall continue until cement and water are thoroughly dispersed throughout the material. All mixed slurry shall be placed within one hour of the introduction of water and cement to the material.

Aggregate shall be free of organic materials and other deleterious substances and have a minimum sand equivalent of 20. Aggregate shall conform to the following grading:

<u>Percent Passing</u>	
2"	95-100%
3/8"	80-100%
#4	75-100%
#100	10-24%

Class 1 or Class 2 Backfill may be used as Class 4 Aggregate subject to the approval of the Engineer.

The Contractor may use Class 4 backfill, slurry cement backfill, at locations approved by the Engineer as an alternative to Class 1 backfill. Slurry backfill shall be placed to neat- line trench walls using care to completely envelope the pipe in the backfill. Road surfacing will not be permitted until the Engineer is satisfied that the set is sufficient to support traffic but in no case prior to setting four (4) hours.

The Contractor may use sufficient amounts of additives for speeding the set of slurry cement backfill in accordance with manufacturer's recommendations. No additive shall be used without prior approval of the Engineer as to type and amount.

Slurry cement backfill shall be placed in a uniform manner that prevents voids in, or segregation of the backfill and will not float the pipe.

14.06 Pipeline Testing - Testing of pipe lines for leakage shall be done prior to acceptance of the completed facility. All pipe lines shall be air tested under the terms of the Ramseier Method as interpreted and reduced below.

The pipe line to be tested shall be plugged and pumped full of air to a pressure of not to exceed 4.0 psi above the average back pressure created by any ground water that may submerge the pipe. A stabilization period of not less than 5 minutes shall follow filling prior to beginning the test unless waived by the Engineer. The pressure at the beginning of the test shall not be less than 3.0 psi. The allowable time for the pressure to drop a maximum of 0.5 psi is set forth below.

<u>Pipe Size</u>	<u>Allowable Time For 0.5 psi Drop</u>
4"	125 seconds
6"	185 seconds
8"	245 seconds
10"	306 seconds
12"	370 seconds
14"	460 seconds

If the pressure drop exceeds 0.5 psi over the time allowed, that section of pipe shall have failed the test and the Contractor shall locate and repair the faulty portion or portions and successfully retest.

Prior to air testing the Contractor shall satisfy the Engineer that the lines are free of obstructions to the point that the air test is deemed valid by the Engineer. Balling and flushing may be done at this time; however, balling and flushing is required after completion of all surface work.

Hydrostatic testing of lines may be substituted for air testing when approved by the Engineer.

14.07 Tests For Obstructions - All sewer pipe lines shall be tested for obstructions and cleaned by balling and flushing. The ball shall be controlled by a tag line or rope or sewer rods and shall be permitted to move slowly through the sewer pipe. The ball shall be followed by a 5% point mandrel.

The ball shall be passed freely through the test section and all debris flushed ahead of it shall be caught and removed at the first downstream manhole. If the mandrel is stopped or prevented from moving freely by debris, damaged pipe, alignment, irregularity or any other cause, the Contractor shall locate and remedy or repair the obstruction and shall retest the conduit to the satisfaction of the Engineer.

14.08 Sanitary Sewer Manholes - All manholes shall be of concrete construction and shall be placed in accordance with the plans, and these specifications. Control of water in excavations shall be to the satisfaction of the Engineer. Precautions shall be taken to assure that sewer pipe entering and leaving manholes does not deviate from the installed alignment and grade during and after construction. Flex connectors at the inlet and outlet of sewer manholes shall comply with ASTM C-923. Sufficient material shall be placed on sewer lines to prevent movement. Ground beneath the manhole shall be compacted to 95% relative compaction prior to placing the base.

All manholes shall be precast concrete bases with precast reinforced concrete pipe sections, tapered sections, and adjustment rings. Reinforced concrete parts shall conform to ASTM designation C-478, and pipe sections shall be not less than 4 feet inside diameter.

Manhole joints shall be sealed against infiltration and exfiltration by means of sand-cement mortar between each joint, or by means of joint sealing compound as manufactured by the K.T. Schneider Co., Houston, Texas under the brand name "Ram-Nek," or "Quick-Seal," as manufactured by Associated Concrete Products, Inc., or approved equal. Appropriate primers and preparation as specified by manufacturer shall be used.

Manholes shall be finished inside and out with sand-cement mortar to produce a water tight, smooth finish. Flow line channel through manhole shall have smooth trowel finish.

Sewer lift station manholes shall be 6' or 8' diameter with flat precast manhole cover. Cover shall have 6' x 3' aluminum access hatch cover cast into flat manhole cover. Covers shall be as manufactured by California Concrete Pipe, or Teichert Pre-Cast, or approved equal. Flat manhole cover shall be placed but not sealed.

Manhole cover shall have aluminum hatch, Series S3R, access door as manufactured by Halliday Products or approved equal. Hatch shall include locking bar, recessed lock box with spring assisted hinges. Clear opening shall be 36" x 72" except where a smaller size is allowed by City.

Backfill shall be placed uniformly around the outside of manholes so as to not create differential forces and the possibility of dislodging the manhole sections.

14.09 Connection to Existing Sewer - The Contractor shall connect to existing sewer at the locations shown on the plans in accordance with the plans and these specifications. The Contractor shall pothole existing sewers at the proposed points of connection prior to the commencement of construction to verify existing flow line elevations, pipe size, and type. The Contractor shall seal all connections into manhole barrel by use of an approved seal as directed by the Engineer.

14.10 Sewer Lateral Adjustment to Grade and Sewer Lateral Connection - Existing sewer laterals with a top of pipe elevation within 0.10 feet of any storm drain flow line, shall be adjusted to a lower grade as directed by the Engineer. Adjusting sewer laterals to grade shall include excavating existing laterals for a distance of not more than three feet on either side of the storm drain centerline, cutting and removing existing sewer lateral, placing new 4" diameter

sewer lateral on a grade sufficient to pass under the storm drain, and reconnecting lateral couplings sufficient to provide a water tight connection.

Contractor shall during the course of work maintain at all times, materials, equipment, and labor to adjust, connect, or repair sewer laterals which are encountered during the course of the work. All sewer laterals broken during the course of work shall be repaired within one hour of break or as directed by the Engineer. Contractor shall use all diligence necessary to remove foreign material from laterals and sewer line prior to repair or adjustment.

Contractor shall locate, expose, and plug existing sanitary sewer laterals to be abandoned with an approved water tight plug and shall encase plug end in not less than one (1) cubic foot of Class 4 backfill or Class B concrete. Water tight plug shall be inspected by City prior to placing encasement.

14.11 Concrete Structures - Concrete structures (drainage inlets and junction boxes, headwalls, inlet and outlet structures) shall be constructed of Class A concrete and shall conform to the plans, the provisions in Section 51, "Concrete Structures," of the State Standard Specifications, and these Improvement Standards. Concrete structure reinforcement, when not set forth on plans, shall conform to Caltrans Standard Plan D89 for headwalls and Standard Plan D80 for box culvert sections.

Box culvert invert elevations shall be as directed by the Engineer to match existing conditions.

Junction box covers on 36" diameter storm drains less than 4' deep shall be precast flat top manhole covers with cast in place manhole frames and shall be as manufactured by California Concrete Pipe or Teichert Pre-Cast. Flat top manhole covers shall be "park way" load rated and shall be of sufficient width to achieve not less than 6" of purchase on perimeter of junction box base.

All concrete structures shall have smooth trowel finish and rounded inlets at all openings. Drainage inlet, junction box combination structures shall pass full pipe flow in concrete channel.

Concrete structures in roadways shall be backfilled with Class 2 backfill compacted to not less than ninety-five percent (95%) relative compaction. Concrete structures off road or behind concrete curbs shall be backfilled with Class 3 backfill at not less than ninety percent (90%) relative compaction.

14.12 Miscellaneous Iron and Steel - Frames, grates, covers, and manhole riser rings shall conform to the provisions in Section 75, "Miscellaneous Metal," of the State Standard Specifications.

Drainage inlet shall be 18" x 24" or 24" x 36" frame and grates. Drainage inlets in concrete curb line shall have curb face openings and shall be California Concrete Pipe A509 or Type GO in accordance with Caltrans Standard Plan D74B or approved equal. Frames and covers not in curb line shall be 24" x 36" cast iron, cast steel, or welded steel in accordance with State Standard Plan D77A.

Manhole frames and covers shall be cast iron in accordance with ASTM A-48, Class 35B with H20 loading rating and shall be California Concrete Pipe Model A-640/A-1024 or approved equal.

Manhole covers shall have raised lettering not less than 1" spelling out "City of Plymouth, Calif.," cast into cover and center of each manhole shall spell out "Sewer" or "Storm Drain" with 2" lettering or as approved by Engineer.

Steel rails, where required, shall be in accordance with the approved plans and these specifications. Minimum height shall be 42" and maximum spacing shall be 6" and shall be in accordance with Vol. 1, Section 509, Guard Rail, of the 1997 Uniform Building Code.

Steel rail, steel plates, structural tubing, steel straps, rods, and angles shall conform to Section 55, "Steel Structures," of the State Standard Specifications. Final paint coat color shall be as directed by the Engineer.

14.13 Adjusting Utilities to Grade - Contractor shall adjust existing manhole frames, water valve boxes, and water meter boxes to grade in accordance with the plans and these Improvement Standards.

Manholes shall be adjusted to grade with cast iron riser rings and asphalt concrete backfill. Riser rings shall conform to Section 75-1.02 of the State Standard Specifications and these Improvement Standards. Asphalt concrete shall conform with Section 13.09 except it can be hand placed.

Contractor shall place Christy B16 meter box in accordance with Amador Water Agency Standard Drawing SW008. Service lines requiring an extension shall be extended on the customer side with PVC line size extension, line size ball valve, and connection to existing customer service pipe in accordance with Amador Water Agency Standards and Uniform Plumbing Code. Location of meter box shall be verified in the field with the AWA Engineer.

All fire hydrants impacted by the project shall be replaced in accordance with Amador Water Agency Standard Drawing SW006. Runner to new hydrant shall be connected to the existing fire hydrant guard valve with flanged or restrained joints. Existing hydrants, in compliance with SW006, may be reused subject to approval of Amador Water Agency and City Fire Chief.

Backfill of all water main adjustments in paved areas shall be Class 4 backfill.

Backfill of storm drain or sanitary sewer adjacent to power poles shall be with Class 4 backfill with the limits determined in the field by the Engineer.

15.00 DESIGN STANDARDS - WATER

15.01 General Requirements - These design criteria shall govern the engineering design of domestic water systems to be dedicated to the public and accepted by the City for maintenance and operation and for those systems designed for the City by its consultants.

It is the intent of these design standards to provide a water system that will dependably and safely convey the required amount of high quality water at adequate pressures and with minimum maintenance and operational costs.

Developers shall furnish, without cost to the City, all intrinsic and auxiliary water facility components necessary to provide a "complete and operational water system."

15.02 Regulatory Standards - Pertinent requirements of the following agency standards, including all changes thereto, shall be considered and complied with in the design and construction of water system improvements. In the event conflict in these standards is found, the stricter design criteria shall govern.

- A. American Water Works Association. (AWWA)
- B. Laws and Standards of the State of California, Department of Public Health.
- C. The Porter-Cologne Water Quality Control Act, and the Regional Valley Water Quality Control Board, Central Valley Region.
- D. Ordinances of the City.
- E. National Board of Fire Underwriters' "Standard Schedule for Grading Cities and Towns of the United States," as may be modified by the appropriate fire protection agency.
- F. Other standards as appropriate.

15.03 Design Requirements

A. General

The design for each water improvement project proposed to be dedicated to the City shall be submitted to, and approved by, the City Engineer in accordance with Section 3.00 of these City Standards. In addition to the general requirements of Section 3.00, the following specific requirements shall be complied with.

B. Preliminary Design

The preliminary design shall be submitted in the form of a map (and supporting calculations) to include the following:

- 1. Project area map that depicts project boundary and tributary areas between project and existing water facilities.
- 2. Contours over complete map and pressure zones. (5' contours minimum).
- 3. All main line locations and preliminary pipe sizes.

4. Residual pressures with design flows at major junctions, critical points, and different pressure zones.
5. Predicated design flows (peak and/or average as appropriate) at major junctions, including flows into and out of the project area.
6. Direction of flow under design conditions.
7. Land uses used to predict flows.
8. Special areas such as hospitals, schools, large office buildings, industrial, commercial areas, etc.
9. Boundaries of areas within the project which are tributary to points of major flow.
10. Location and sizing of major system components, including water treatment plant improvements, storage facilities, and pressure reducing valves if needed in the project.

C. Final Design

Final design shall be an expansion of the preliminary design in sufficient detail as to verify all preliminary sizing of facilities and to size those facilities not included in the preliminary design. All such final design calculations shall accompany the construction plans and specifications submitted for review leading to "Approval for Construction." Static pressure shall not exceed 150 psi or be less than 40 psi at any point in system.

15.04 Benefitting Areas Not Included Within Project Boundaries - A parcel or area which benefits and participates in a project, but is not included within the project boundaries shall have a note to this effect placed on the overall project map and on the plan and profile sheet if the parcel appears thereon. Parcels not so noted which make use of a project's facilities after the project's completion may be required to pay an "in-lieu or buy-in fee" prior to such use.

15.05 Calculations - The Hazen-Williams formula shall be used in the hydraulic study of the system, using a "c" value as recommended by the pipe manufacturer. A Hardy-Cross hydraulic analysis of any proposed distribution system shall be supplied to the City upon request.

15.06 Design Flow - Minimum design flows shall be determined by fire flow requirements. For single family one or two-story and small two family (duplex) one story dwellings, the minimum fire flows shall be 1000 GPM. For multi-family, commercial, and industrial zones, the minimum fire flow shall be 1500 GPM. These are minimum flow requirements. Additional considerations may be necessary, as set forth by the most current City resolution, the City Fire Chief, and the City Engineer.

Design flows, including fire flows, shall be met with line velocities not exceeding 10 ft/sec at any time. The estimated population for design including population equivalents for commercial, industrial, and institutional uses shall be submitted prior to commencement of improvements design.

Water mains subject to extension in the future shall be sized to serve the entire area adjacent to the proposed development. The design engineer shall submit a study substantiating the proposed size of water mains in such cases. Discussion of parameters with the City Engineer is advised prior to the study. Developer reimbursement for over sizing required shall be in accordance with the policies and regulations of the City of Plymouth.

15.06.1 Municipal Flow Requirements

A. Land Use

Flow determination shall be based upon the most recent or proposed land use. The minimum population density in areas of potential development shall be equivalent to that of single family residential use. All calculations shall assume full development, except where a staged concept has been specifically approved by the City.

B. Residential Living Units

Design population per living unit.

1. Developments of 100 living units and less. 3.5 persons per living unit.
2. Developments of greater than 100 living units. 3.0 persons per living unit.
3. Average daily flow for residential use shall be based on 150 gallons/day/person.

C. Commercial, Industrial Development

Flow requirements for commercial and industrial developments shall be based on specific development plans. In no case will water mains serving such areas be less than 8" in diameter.

D. Schools

School consumption shall be based on ultimate design, student population, plus administration, teaching, and operating personnel.

E. Average Daily Flow (ADF)

Average Daily Flow (ADF) shall be determined for service area(s) by multiplying the sum of the area(s) design population by the average per capita daily flow requirement, as designated above, plus any commercial, industrial, school, etc. contribution(s).

F. Maximum Daily Flow (MDF)

Maximum Daily Flow (MDF) shall be determined by multiplying the ADF by a factor of three (3). For projects of 50 dwelling units or more, multiply the ADF by a factor of two (2).

15.07 Pipe Size - Water pipe sizes shall be adequate to carry fire flow while not exceeding a velocity of 10 ft/sec. Minimum water main size shall be 6 inch diameter in any looped system. A 4" diameter main may be used on dead-end lines where no fire hydrant or future extension will be made subject to the approval of the City Engineer.

15.08 Pipe Strength Class - All pipe shall be not less than Class 150. When static working pressure exceeds 150 psi, Class 200 pipe shall be used.

15.09 Location and Alignment - Water mains shall be installed within right of way dedicated for public streets where practicable. When not located in street rights of way, water mains shall be installed within the center 10 feet of a 20 foot wide permanent easement deeded to the City as a public facility easement. In case of hardship in providing the 20 foot width, lesser widths may be approved on an individual basis by the City Engineer.

Water mains shall be designed to extend to the project limits or across project frontage when required by the City Engineer.

In no case shall maximum deflection of pipe joints exceed the recommendation of the pipe manufacturer.

Line Location

1. All water mains shall be designed to be within the paved portion of the roadway, normally twelve (12) feet from any line, or in a public utility or road easement. All locations within existing road rights of way shall be approved by City Engineer. If it is necessary to install a water main within a private road, the easement shall be the width of the paving plus one foot each side, or 20 feet, whichever is larger.
2. Crossings of any sanitary sewer line shall be in accordance with State of California Department of Health Services, "Criteria for the Separation of Water Mains and Sanitary Sewers."
3. Waterlines shall be placed parallel to and 6' either side of road centerline where pipe centerline radius complies with pipe deflection requirements. On short radius streets, alternate pipe locations will be allowed subject to approval of the City Engineer.

15.10 Minimum Depth - The depth of any water main shall be adequate to provide a minimum cover of 3.0 feet. All service lines shall be maintained at 2.0 feet of cover at the property line. Minimum cover on all service lines shall be 2.0 feet throughout the length of the line within public rights of ways or public utility easements.

15.11 Service Lines - Minimum service line size shall be 1-1/2" for single service and 2" for double service as shown in Standard Detail W-4. All service lines shall be sized in accordance with the City Code. Locator wire as shown in Standard Detail W-5 shall be installed with all service lines.

Requirements for services with residential fire sprinkler systems:

a. The system shall be connected downstream of the meter and shall be considered during the design of the water system for the project in order to size the water service and meter.

b. City standard $\frac{3}{4}$ " meters shall be used unless specific calculations for the dwelling and site indicate a larger meter is required. The calculations shall include the following alternative design measures before a larger meter is used:

- 1- $\frac{1}{2}$ " pipe from the meter to the dwelling;
- internal loops within the sprinkler system;
- domestic flow diverter valve

The system shall include use of a passive purge, such as connection to a toilet fill, and shall not include the use of antifreeze or other chemicals not permitted for potable water systems.

15.12 Treatment Plant Modification and Pump Station Improvements

- A. General - All phases of treatment plant modification and pumping station design shall be by the City. Such facilities shall include all necessary components and amenities as required by the City to insure a complete, automated, operating facility which will lend itself to minimum maintenance and operational costs.
- B. Pumping Units - No pumping unit shall be allowed.
- C. Access - All weather, paved access shall be provided to all major functional units of the water system.
- D. Structures - Structures shall provide protection against weather and vandalism, shall be designed to architecturally blend with the character of the development, and afford minimum City maintenance. Access to lower or upper structure levels shall be by inside stairways. Structures shall be multi-purpose whenever practicable.

Expansion of laboratory, storage and/or warehouse facilities may be required for new development.

15.13 Storage Facilities

- A. General - Storage capacity shall be equal to the sum of fire storage reservation, plus the allowance for system peaking, plus an allowance for emergency reserve. The minimum size storage tank shall be 250,000 gallons.
- B. Fire Storage Reservation (FSR) - FSR shall be the product of the appropriate fire flow and the design fire duration. The minimum design fire duration shall comply with the requirements of the City.
- C. System Peaking (Active) Storage (SPA) - SPA is a function of the system design and is twenty (20) percent of the total daily demand during the maximum day based on a 24 hour demand rate.
- D. Emergency Reserve (ER) - ER shall provide sufficient capacity, without encroaching into the fire storage reservation or the active storage, to carry the system through reasonable periods of system failure. An emergency reserve increment of four (4) hour duration, based on the Maximum Daily Flow (MDF) shall be required. Isolated developments may require a larger increment and must be discussed individually with the City.
- E. Overflow Pipes (OP) - OP must be sized to pass the maximum incoming flow rate with a design head of four (4) inches; head loss calculators must include both entrance and friction losses. Effluent must be directed to a natural water course in a manner that prevents scouring.

- F. In-Lieu Fees - Where it is impractical to construct required facilities at the required elevations, or where in the opinion of the City it is more practical to expand existing facilities, developer shall pay an “In-Lieu” fee based on required storage volume and current construction cost.

15.14 Transmission Line

- A. General - The following requirements are applicable from a source to a storage facility where there are no services off the transmission line. Beyond the point of storage, or if storage is not available, or where services are taken off, the requirements of distribution lines normally apply.
- B. Design Flow Rate - Size line to pass the Maximum Daily Flow, (MDF), plus fire flow.
- C. Design Pressure - The Design Flow Rate shall be maintained to supply water from the source to the storage facility.
- D. Valving, Blow-Offs, and Air Release Valves - Line valves shall be provided every 1800 lineal feet and any exceptions must be approved by City. Air release valves shall be installed at all summits and blow offs shall be installed at all low points subject to the approval of the City Engineer. Whenever possible, valves shall be shown at locations similar to those locations as designated under distribution lines (below).

15.15 Distribution Lines

- A. General - The following requirements shall apply to all water lines not classified as transmission lines.
- B. Design Flow Rate - Lines shall be sized for the more rigid of the following two conditions:

Design Pressure:

1. Minimum pressure 40 psi.
2. Maximum pressure 150 psi.

(The distribution system shall be zoned to provide the above pressure range.)

3. Fire Flow plus Maximum Daily Flow at 20 psi residual pressure.

- C. Valving, Blow-Offs, and Air Release Valves - Air release valves, blow-offs, combination air release and vacuum release valves and other valves shall be placed on the plans and be incorporated in the design of pipelines in accordance with good engineering practice. Valve location, type, and size shall be subject to approval by the City Engineer.

The distribution system shall be equipped with a sufficient number of valves so that no single shut down will necessitate the removal from service of a length of pipe greater than:

1. Five hundred (500) feet in a school, commercial, industrial, or multiple family dwelling areas.
2. Nine hundred (900) feet in other districts.
3. In no case shall more than two fire hydrants be removed from service.

The valves shall be so located that any section of main can be shut down without going to more than three locations to close valves. Valves shall preferably be located at street intersections. If it is necessary to install valves between street intersections, valve locations shall be established by the City Engineer.

A blow-off assembly shall be installed on all permanent dead-end runs and at all low points in the system subject to the approval of the City Engineer. Special attention shall be given to those of a temporary nature, taking into consideration the length of the dead-end run, the number of services on the line, and the estimated time before future extension.

Wherever possible, the blow off shall be installed in the street right of way. In no case shall the location be such that there is a possibility of back-siphonage into the distribution system. Wherever possible, fire hydrants shall be located to function as blow offs. Type of blow off installation shall be subject to the approval of the City Engineer.

Air release valves (ARV) shall be provided as follows:

1. At all high points in the system subject to the approval of the City Engineer.
2. At each end of long horizontal pipe runs.
3. At any point of significant pressure reduction.
4. At the low side of pressure reducing valves and every 2500-3000 feet of continuous pipeline.

D. Main Layout

The distribution system, whenever possible, shall be in a looped grid form so that pressures throughout the pressure zone(s) become equalized under varying rates and locations of maximum demand. The minimum pressures and flows as specified above shall govern design of the system.

15.16 Creek Crossings - Creek crossings shall be beneath the creek bed, concrete encased to the limits approved by the City Engineer, and constructed with Class 50 DIP. DIP shall be wrapped with PVC prior to placing concrete encasement. When, in the opinion of City Engineer, special circumstances warrant above ground creek crossings, the following requirements shall apply.

Crossing details of pipe, pier, anchorage, transition couplings, etc. shall be shown upon a detail sheet of the plans in sufficient scale for clear delineation of the work. Plans shall be submitted to the City Engineer for approval.

16.00 FIRE HYDRANT REQUIREMENTS

16.01 General Requirements

- A. Scope - These requirements shall apply to all fire hydrant installations in the City. Fire hydrants installed on the metered side of private systems or on private property and not subject to City maintenance are exempt from these requirements.
- B. Hydrant - The fire hydrant shall have 1 - 4 2" and 2 - 2 2" outlets with 5 1/4" inlet valve opening and shall be Clow Medallion or equal. The hydrant shall be yellow in color.
- C. Bury - The hydrant bury length shall be consistent with the depth of the water main. It shall be buried to the depth indicated. Hydrant shall set plumb with the 42" outlet facing the roadway. Runner to bury joint connections (AWWA C-900 PVC or AWWA C-151 Ductile Iron Pipe, identical in class to main) shall be a minimum of 6" in diameter. Contact shall be made with the Fire Department for specific requirements.
- D. Thrust Block - All fire hydrants require a thrust block consistent with Standard Detail WS-7.
- E. Location - The location of fire hydrants shall be as directed by the Fire Chief. Maximum spacing of fire hydrants in residential zones shall be 500 feet.

16.02 Main Tee, Runner, and Gate Valve Requirements

- A. General - All main tees, runners, and gate valves shall be a minimum of 6" diameter.
- B. Main Tees - Main tees shall be cast iron, flanged hub, and will be sized to match the pipe used. Fittings shall be a minimum of Class 125.
- C. Runners - All runners shall match class of distribution line and shall not be less than C-900, Class 150 PVC or ductile iron Class 50 minimum pressure pipe. Pipe shall be tested and certified in California in accordance with appropriate AWWA specifications. The pipe shall be marked with the manufacturer's name, nominal inside diameter, and class or pressure rating. The maximum length of runners shall be 20' without prior approval of the Fire Chief and the City Engineer.

No fire hydrant shall be installed without a closed coupled gate valve shut off at the main line.

16.03 Substitution of Material - Where the developer proposes to use different materials or fittings other than specified, such materials shall be AWWA approved, and be approved in writing by the Fire Chief and the City Engineer prior to installation.

17.00 CONSTRUCTION STANDARDS – WATER

17.01 General - All materials, workmanship and miscellaneous items pertaining to water pipelines shall be in accordance with applicable AWWA specifications, the plans, and these standards.

All pipe, couplings and fittings shall be marked with the manufacturer's name, nominal inside diameter, class or pressure rating. Piping material and class shall be as specified herein and as shown on the plans.

Prior to any construction, the developer and contractor shall meet with the City Engineer or his representative to discuss the proposed construction. Additionally, a minimum of 48 hours written notice shall be given to the City Engineer prior to the beginning of construction and prior to any construction on City distribution lines. Except under emergency conditions, the Contractor will contact the City Water Department to open or close any City valves.

17.02 Ductile Iron Pipe (DIP) - Ductile iron pipe shall be cement-mortar lined and shall conform to the requirements of AWWA Specification C151. Cast iron fittings shall conform to and meet the requirements of AWWA Specification C110. All cast iron pipe and fittings shall be wrapped in plastic and approved by City prior to backfilling.

Ductile iron pipe shall have a wall thickness of not less than Class 50 pipe.

Manufacturer's statement shall be provided to the City Engineer that the required inspection and tests have been made and found in compliance with AWWA Specification C151. Pipe shall be marked "DI" or Ductile Iron in accordance with Section 51-10 of AWWA Specification C151.

17.03 Polyvinyl Chloride Pipe (PVC) - Polyvinyl chloride pipe shall conform to the requirements of AWWA Specification C900-81.

Pipe shall be not less than Class 150 or Class 200 thick wall water pipe. All PVC pipe four inches in diameter or larger shall be elastomeric-gasket joints per Section 2.4 of AWWA Specification C900-81. Solvent-cement joints will not be allowed on pipe four inches in diameter or larger.

The class of pipe shall be not less than that shown on the plans.

PVC pipe less than four inches in diameter shall comply with ASTM D-2241 and shall have a wall thickness equal to or greater than Schedule 40 pipe. Solvent-cement jointed pipe shall have flexible joints at every 100 linear feet of pipe.

17.04 Gate Valves - Gate valves shall be Class 150 in accordance with AWWA C-509 and shall be iron body, gate type, resilient face, right hand, non-rising stem, flanged with 2" square operating nut. Valve boxes including extensions and traffic covers shall have cast iron ring and traffic lids marked "water" (Christy G-5 or approved equal). Unless otherwise shown on the plans, or required by the particular installation, valves shall be furnished with mechanical joint or flange ends. (See Standard Detail WS-1.)

All gate valves less than four inches (4") in diameter shall be IBDM resilient seat valves and equipped with hand wheel unless otherwise specified by the City Engineer.

17.05 Air Release Valves (ARV) - Air release valves shall be installed at the locations shown on the plans and as approved by the City Engineer.

Air release valves shall be combination air vacuum (VAC-ARV) and shall release air from the line under pressure and allow air to enter the line under vacuum conditions. VAC-ARV valves shall be Bermad Model 4415 or equal. Valves shall be sized and installed according to manufacturer's recommendations and these standards. (See Standard Detail WS-7.)

17.06 Valve Boxes (VB) - Valve boxes shall have a cast iron face and a cast iron traffic lid. Covers shall be marked "WATER" and shall have a loose fit in the box. Extensions shall be as furnished by the manufacturer. Valve boxes shall be installed in accordance with Standard Detail WS-1 and shall be Christy G-5.

17.07 Thrust Blocks - All valves, cast iron fittings and pipe directional changes shall be held in place by concrete thrust blocks. Thrust blocks shall consist of Class B concrete in accordance with Section 90 of the State Standard Specifications. The bearing areas shall be not less than the required area shown on the plans. (See Standard Detail WS-9.)

17.08 Trenches and Backfill - This work shall consist of performing all operations necessary to excavate earth and rock or other material, of whatever nature, including water, regardless of character and subsurface conditions, necessary to excavate trenches for pipes and appurtenances; to place backfill for structure, pipes and appurtenances and other facilities; to backfill trenches and depressions resulting from the removal of obstructions; to remove and replace unsuitable material; to construct protection dikes; and to remove unstable material and slide material which may enter trenches. All such work shall be in conformance with the plans and these standards or as directed by the City Engineer.

Where pipes are to be installed above original ground or in new embankment fills, the embankment shall first be constructed to the required height for a distance on each side of the pipeline location of not less than five feet (5'). Embankment shall have relative compaction of not less than ninety percent (90%). Upon completion and approval of the embankment the trench shall be excavated with the sides nearly vertical and the pipelines installed.

When a firm foundation is not encountered due to soft, spongy, or other unsuitable material, such material shall be removed to the limits directed by the City Engineer, and the resulting excavation shall be backfilled with Class 1 backfill material at the developer's expense. Class 1 backfill shall be compacted to 90 percent.

All crossings of state highways require boring and jacking. The developer shall contact Caltrans District 10 and the City Engineer regarding requirements and specifications.

In connection with earthwork, all tests shall be made in conformance with the following requirements set forth in the State Standard Specifications:

<u>Tests</u>	<u>Test Method No. Calif. or ASTM</u>
Relative Compaction	Cal 216 & 231 or ASTM D1557 & D1556
Sand Equivalent	217
Resistance (R-value)	301
Sieve Analysis	202

Backfill shall not be placed until the pipe or other facility has been inspected by the City Engineer and approved for backfilling. The percentage composition by weight as determined by laboratory sieves shall conform to the following requirements:

Class 1 Backfill

<u>Sieve Sizes</u>	<u>% Passing Sieves*</u>
3/4"	100
1/2"	30-50
No. 4	0-15

Sand equivalent not less than 20

*Gradations requirements may be waived with written approval from the City Engineer.

Class 2 Backfill - Class 2 Aggregate Base in accordance with Sections 26-1.02, 26-1.02B, 26-1.035 of the State Standard Specifications.

Class 3 Backfill - Material for Class 3 backfill may consist of material from excavation free from rocks or lumps exceeding two inches (2") in greatest dimension, vegetable matter, and other unsatisfactory material. Backfill shall be compacted to the relative compaction shown on the plans or in these specifications.

Class 4 Backfill - Class 4 Backfill shall be cement-sand slurry comprised of aggregate, cement and water. The aggregate, cement and water shall be proportioned either by weight or volume. Cement used shall be 190 to 210 pounds 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 shall be thoroughly machine mixed in a rotary drum mix truck and placed in the trench from a direct truck discharge unless otherwise approved.

Mixing shall continue until cement and water are thoroughly dispersed throughout the material. All mixed slurry shall be placed within one hour of the introduction of water and cement to the material.

Aggregate shall be free of organic materials and other deleterious substances and have a minimum sand equivalent of 20. Aggregate shall conform to the following grading:

Percent Passing	
1/2"	95-100%
3/8"	80-100%
#4	75-100%
#100	10-40%

Class 1 or Class 2 Backfill may be used as Class 4 aggregate subject to the approval of the City Engineer.

Class 4 backfill, slurry backfill, may be used at locations approved by the City Engineer as an alternative to Class 1 backfill. Slurry backfill shall be placed to neat-line trench walls using care to completely envelope the pipe in the backfill. Road surfacing will not be permitted until the

City Engineer is satisfied that the set is sufficient to support traffic but in no case prior to setting eight (8) hours. (Time may be adjusted if high, early strength concrete is used.)

Sufficient amounts of additives may be used for speeding the set of Class 4 backfill in accordance with manufacturer's recommendations. No additive shall be used without prior approval of the City Engineer as to type and amount.

Class 4 backfill shall be placed in a uniform manner that prevents voids in, or segregation of the backfill and will not float the pipe.

Foreign material which falls into the trench prior or during placing of the backfill shall be immediately removed.

Minimum trench width shall be 24" or the outside diameter of the pipe plus 12", whichever is greater. Water main trenches shall be constructed as noted in Detail WS-5.

The developer shall furnish materials and facilities required and shall make trenches and excavation dry throughout all construction operations.

At the end of each working day, there shall be no open trench except as approved by the City Engineer.

The location of underground utilities or other obstructions shall be determined by the developer sufficiently in advance of excavation so that pipe alignment can be confirmed or rerouted without delay.

Materials excavated from trenches shall be placed and maintained so as to offer minimum obstruction to traffic.

Gutter shall be kept clear for the purpose of handling road drainage. Drainage ways, walkways, and driveways shall be kept clear. The developer's operation shall at all times protect existing facilities and water from damage or pollution.

Material for Class 1 and Class 2 backfill shall be placed in uniform horizontal layers not exceeding one (1) foot in thickness before compaction, and shall be brought up uniformly on all sides of the trench, structure, or facility. If an alternative method of placing the backfill so that all requirements, other than the layer thickness, are met; the City Engineer may permit the developer to use an alternative method. Under no circumstance will an alternative method be used unless the City Engineer's approval is obtained in writing. Material for Class 3 backfill shall be placed in layers not to exceed one (1) foot in thickness before compaction.

Each layer of backfill shall be compacted to a relative compaction indicated for the backfill involved. Water jetting is not allowed.

17.09 Trench Safety - Attention is directed to the provisions of Sections 6705 and 6707 of the Labor Code of the State of California.

Excavation for any trench five feet or more in depth shall not begin until the Contractor has received approval from the City Engineer of the Contractor's detailed plan for worker protection from the hazards of caving ground during the excavation of such trench. Such plan shall be submitted at least five days before the Contractor intends to begin excavation for the trench and shall show the details of the design of shoring, bracing, sloping, or other provisions to be made

for worker protection during such excavation. No such plan shall allow the use of shoring, sloping, or a protective system less effective than that required by the Construction Safety Orders of the Division of Industrial Safety and if such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California.

In addition, the Contractor shall obtain, pay for, and comply with all provisions of the permit required by Section 6500 of the California Occupational Safety and Health Act of 1973.

In accordance with the provisions of Section 6707 of the State Labor Code, each bidder shall list, in the bid item indicated, the amount contained in his proposal for adequate trench excavation, sheeting, shoring, and bracing or equivalent method for the protection of life and limb which shall conform to applicable Safety Orders. By listing this sum in his proposal, the bidder warrants that his action does not convey tort liability to the Agency, the Agency's employees, or the City Engineer.

17.10 Pipe Laying - All pipe shall be laid true to line and grade as specified on the plans, or as directed by the City Engineer. Before any length of pipe is laid, it shall be carefully inspected for defects. No pipe or other material which shows defect, shall be placed. Pipes, valves and all fittings shall be new, clean and free of any foreign matter as they are laid. Pipes shall be plugged at the completion of each day's construction. The manner of plugging shall be approved by the City Engineer.

No deflection will be permitted at joints where water pipe is joined to cast iron fittings or valves. In areas where water pipe is not jointed to cast iron fittings or valves, deflection up to a maximum of four degrees after assembly will be permitted when "Ringtite" couplings are used for sizes up to twelve inches (12"). Rubber ring joints shall be field assembled in complete compliance with the manufacturer's recommendations. All pipe shall be inspected by the City Engineer prior to backfilling. The pipe in place shall permit thermal expansion of pipe ends through proper installation of pipe to pipe stop and not beyond pipe stop.

17.11 Tracer Wire - Where all non-ferrous pressure pipe is installed in the ground outside of buildings, a tracer wire shall be incorporated with the installation as specified herein.

Tracer wires shall be insulated No. 12 solid copper, National Electrical Code type UF and shall form a mechanically and electrically continuous line throughout the length of the pipe. Conductor's shall be spliced and insulated in accordance with Detail W-5. The wire shall be laid in accordance with Detail W-4 and shall be taped to top of pipe so as not to be broken or stressed by backfilling operations.

17.12 Filling, Testing, and Chlorination of Pipelines - All pressure piping shall be tested and chlorinated by the developer at his expense.

After the pipe has been installed and thirty-six (36) hours (for high early strength concrete; 7 days for Class B concrete) or more after placing all thrust blocks in the portion of the system to be pressure tested, the pipe shall be slowly filled with water as follows:

1. The line should be filled slowly, with flow velocity not to exceed 2 fps.
2. If possible, the line should be filled at its lowest point.

3. During filling, all air should be expelled through permanent air release valves at all high points.

After the pipe has been filled, it shall be allowed to set for a period of not less than twenty-four (24) hours. The pipe shall then be refilled to the original water level and subjected to a pressure of not less than 150 pounds per square inch or the service pressure plus 50 pounds, whichever is greater, measured at the lowest point in the line being tested. Such pressure shall be applied for a minimum period of two hours. Any part of the line which proves to be defective shall be replaced or repaired and retested. Pressure and leakage testing (combined) shall be as follows:

1. Purpose - a. Pressure test: to locate any defects in materials or workmanship so that repairs may be made; b. Leakage test: to establish that the section of the line tested will not leak, or that leakage is within acceptable limits.
2. Test Pressure and Duration - A test pressure of 150% of operating pressure is recommended. Test duration should be 2 hours for a combined pressure and leakage test.
3. Method - The system should be raised to specified pressure by means of a pump connected to the pipe. The test pressure is maintained by additional pumping (if necessary), and all fittings, valves, and hydrants, carefully examined for leakage.

The maximum allowable leakage shall not exceed the amount determined as set forth below:

Leakage is defined as the quantity of water that must be supplied to maintain pressure with 5 psi of the specified pressure after the pipe has been filled, vented, and raised to test pressures. Allowable leakage may be calculated from:

$$\text{Allowable Leakage} - L = \frac{ND/P}{7,400}$$

Where L = allowable leakage (gal./hr.)
N = number of joints in the tested line (pipe and fittings)
D = nominal diameter of pipe (in.)
P = average test pressure (psi)

Air pressure testing of PVC water pipe will not be allowed.

Following satisfactory pressure and leakage tests the system shall be chlorinated in accordance with the provisions of AWWA C601, "Disinfecting Water Mains," except there shall be duration of forty-eight (48) hours.

A negative coliform test meeting the requirements of the Health Department shall be made by a State approved bacteriological laboratory prior to acceptance of work. Water sample for coliform test shall be done by State approved laboratory.

Retesting costs including inspector time shall be borne by the developer.

17.13 Safety - All construction procedures necessary to provide a safe working condition through all phases of the work shall be followed. Said procedures shall conform to the Safety Orders, Division of Industrial Safety, Title 8, California Administrative Code.

The developer is solely responsible for outlining the safety procedures to be followed by his work force. The developer shall provide for the safety of the public both day and night where they are exposed to the construction operation.

Neither the City, the City Engineer, nor any representatives thereof shall be responsible for the procedures followed by the Developer.

The developer shall procure any and all permits in accordance with State and City laws and shall pay all fees required.

17.14 Clean Up - The developer shall at all times maintain an orderly and hazard free work area. The developer will remove all construction debris, excavated materials in excess of fill requirements, and surplus materials not incorporated into the facilities as required by the City Engineer.

17.15 Connection to Existing Lines - The City's emergency contractor or other contractor approved by the City Engineer shall make all connections into existing distribution or transmission lines at developer's expense. A note to this effect shall be placed on each plan sheet which requires such connection. Developer shall coordinate all work on the existing pipe with the City. Developer shall deposit not less than \$2,000 with the City prior to connection. City Engineer may require a greater deposit when estimated connection costs exceed \$2,000.

Existing water line shall be out of service for no more than four (4) hours unless otherwise approved by the City Engineer. The Developer shall provide not less than twelve (12) hour notification to the City Engineer in writing prior to making any connection to existing mains. All materials shall be at the site prior to interrupting water service. **Under no circumstances shall anyone other than a representative of the City open or close any valve in a City-operated water system.**

Connection to existing mains shall be with flanged and mechanical joint fittings only.

17.16 Compaction Testing - The developer will provide compaction tests at various locations during the work as directed by the City Engineer. In the event of a test failure the developer shall remove and recompact unacceptable backfill or fills in accordance with the plans, specifications, and these standards.

THE COST OF RE-TESTING SHALL BE BORNE BY THE DEVELOPER.

17.17 Asphalt Concrete (Shoulder Restoration) - Shoulder restoration shall be in accordance with the standard plans and these standards.

Asphalt concrete shall be placed in accordance with Section 39 of the State Standard Specifications.

17.18 Service Connections - Water service connections shall be placed in accordance with these standards and the standard plans.

Meter boxes located in areas in the traveled way shall be traffic rated.

All meter boxes shall be rodent proof subject to the approval of the City Engineer.

Connection of new services to existing service lines is not allowed without prior written approval of the City.

17.19 Pipe Materials and Storage - All PVC pipe and fittings shall be stored to prevent direct exposure to sunlight. PVC pipe may be covered with opaque material, providing for air circulation, or otherwise protected in a manner approved by the City Engineer.

18.00 STANDARD DETAILS

Index of Standard Detail Drawings

STORM DRAIN DETAILS:

Drain Inlet Box	SD-1A
Frame and Grate.....	SD-1B
Storm Drain Manhole	SD-2
Saddle Type Storm Drain Manhole	SD-3
Storm Drain Outfall	SD-4
Large Diameter Shallow Storm Drain Manhole	SD-5
Rainfall Intensity Chart	SD-6

SANITARY SEWER DETAILS:

Type "A" Manhole.....	SS-1
Type "B" Manhole.....	SS-2
Manhole Cover.....	SS-3
Sewer Service Laterals.....	SS-4
Property Line Cleanout.....	SS-5
Clean Out Branch	SS-6
Trench Details	SS-7
Peak Flow Factors	SS-8
Lift Station Plan & Profile	SS-9A
Lift Station Site Plan	SS-9B

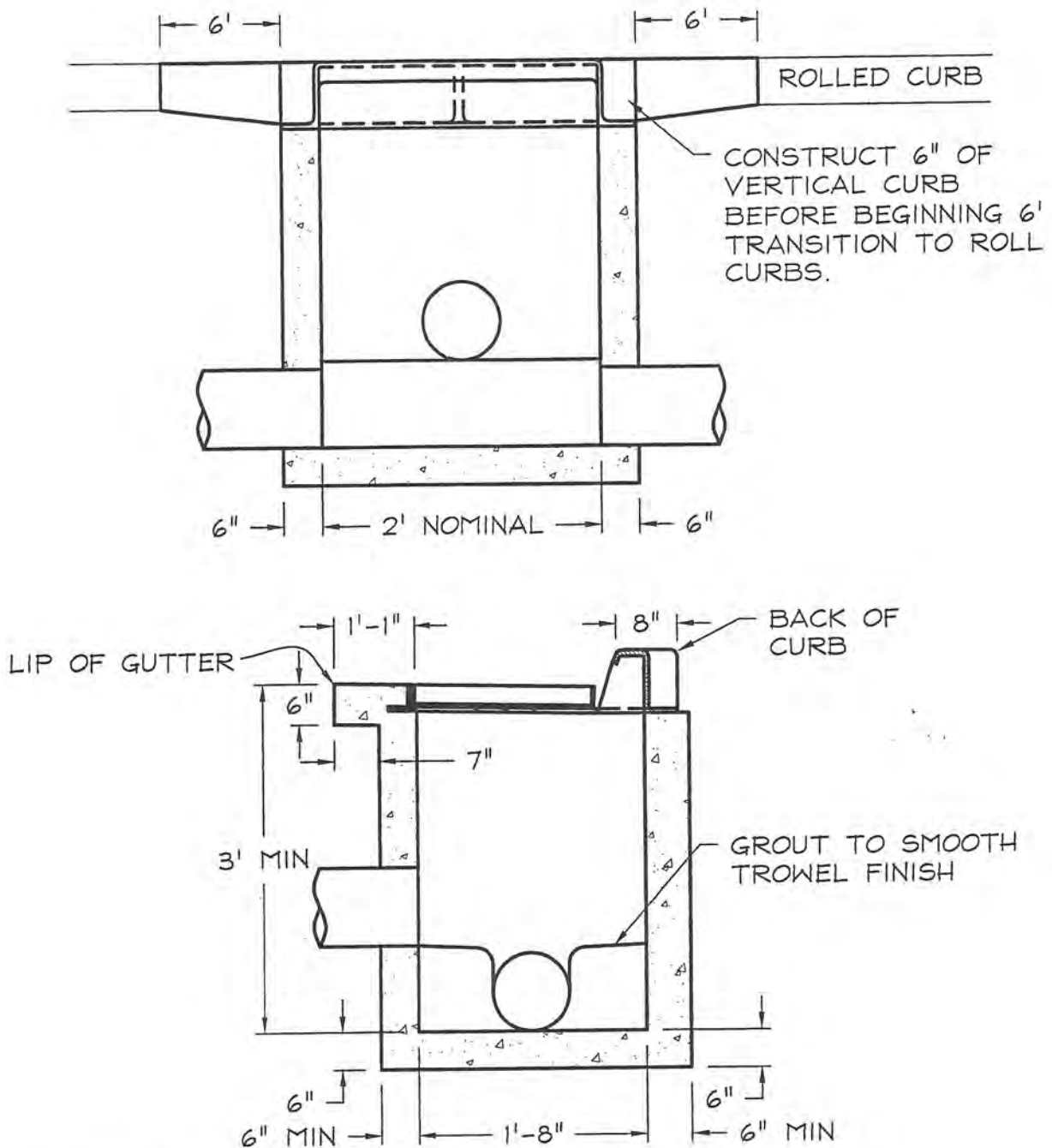
WATER DETAILS

Utility Locations	W-1
Trench Detail	W-2
Water Trench	W-3
1" Water Service	W-4
Locator Wire	W-5
Fire Hydrant	W-6
Thrust Block.....	W-7
Air & Vacuum Release Valve.....	W-8

STREET DETAILS:

Typical Road Section.....	ST-1
Wood Beam Barricade.....	ST-2

Street Name Sign and Stop Sign.....	ST-3
Curb, Gutter and Walkway	ST-4
Wheel Chair Ramp.....	ST-5
Residential Cul-De-Sac.....	ST-6
Intersection Bulb	ST-7
Up Slope Driveway.....	ST-8
Down Slope Driveway	ST-9
Residential Driveway.....	ST-10
Commercial Driveway	ST-11



NOTES:

1. CALIFORNIA CONCRETE PIPE TYPE A-509 FRAME AND GRATE. SEE DETAIL SD-1B.
2. BOTTOM OF INLET SHALL BE PLACED PRIOR TO OR AT THE SAME TIME AS SIDE WALLS.
3. INLET BOX SHALL BE COMPATIBLE WITH GRATE PER SD-1B.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

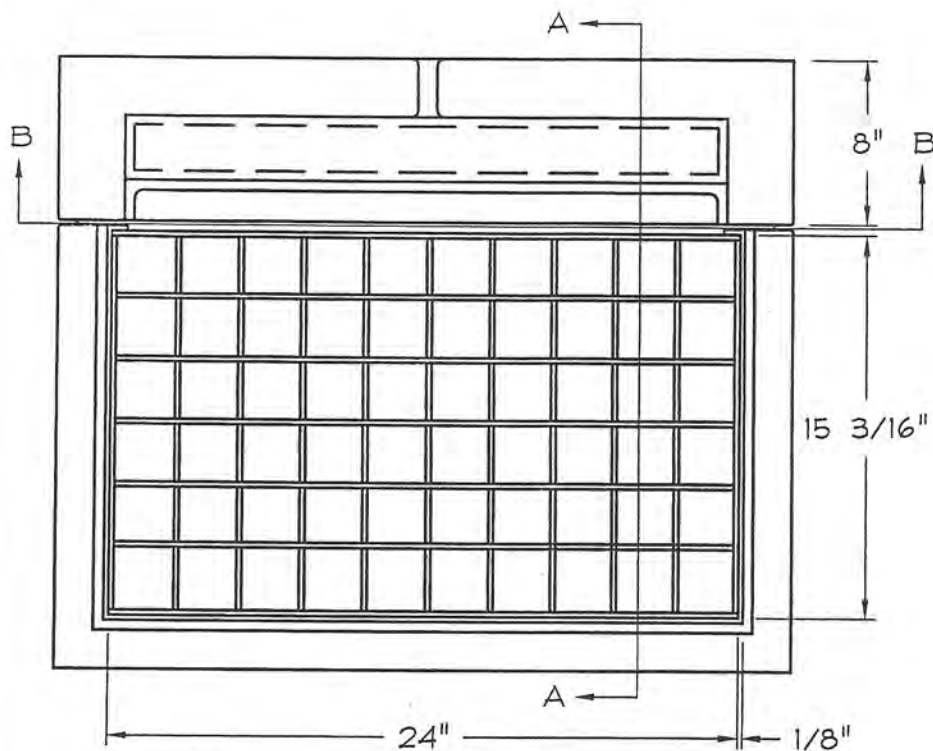
STANDARD DETAIL

DRAIN INLET BOX

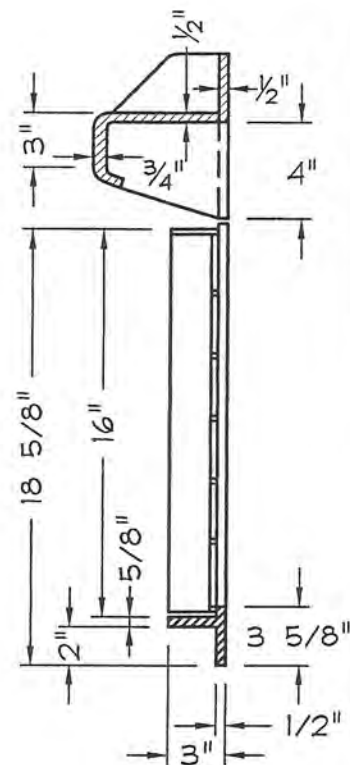
APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

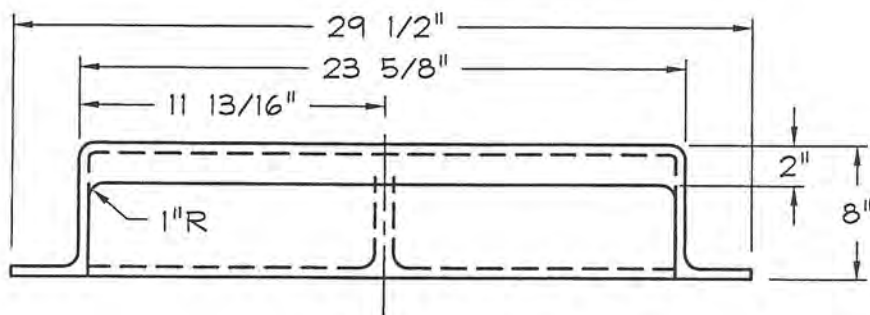
SD-1A



BEARING BARS $\frac{1}{4}'' \times 2\frac{1}{2}'' @ 1\frac{7}{8}''$ O.C.
CROSS BARS $\frac{3}{8}''$ ROD @ 4'' O.C.



SECTION A-A



SECTION B-B

NOTES:

1. CALIFORNIA CONCRETE PIPE TYPE A-509 FRAME AND GRATE.
2. GRATE SHALL BE BLACK WELDED STEEL OR CAST IRON.
3. DRAIN INLET BOX SHALL BE COMPATIBLE WITH FRAME AND GRATE.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL

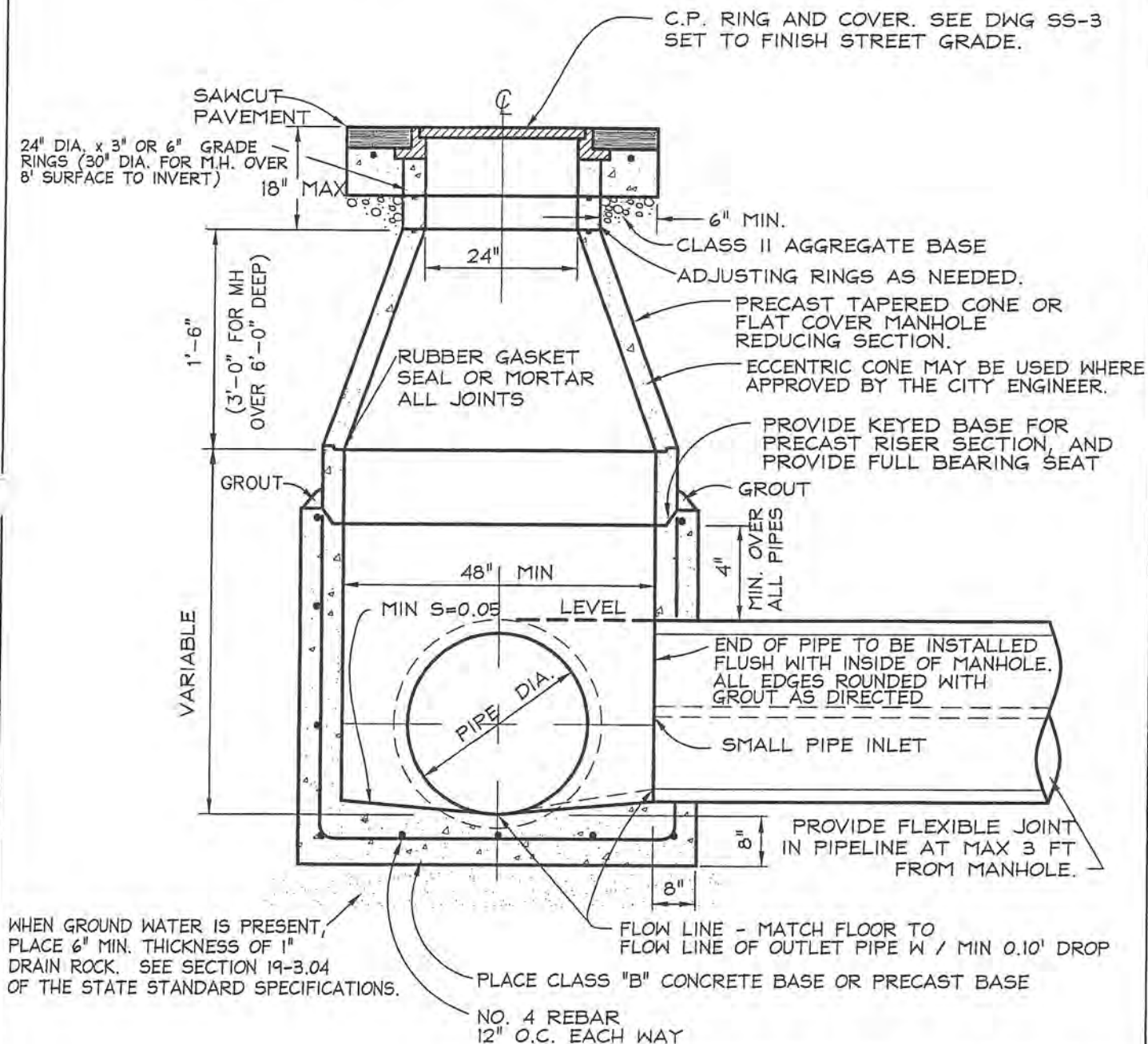
FRAME AND GRATE

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

SD-1B

- NOTE: 1. ALL JOINTS BETWEEN PRECAST SECTIONS SHALL BE MORTARED, INSIDE AND OUTSIDE.
 2. INTERIOR OF THE MANHOLE SHALL HAVE A SMOOTH TROWELED SURFACE.
 3. MANHOLE COVER SHALL HAVE THE WORDS "STORM DRAIN" MOLDED INTO THE COVER, WITH PICK HOLE AND EDGE HOLE.
 4. PIPES LARGER THAN 24" REQUIRE A SPECIAL DESIGN.
 5. CONSTRUCT STORM DRAIN BOX WITH DECK AND KEY FOR PRECAST TAPERED CONE, FOR A FULL DECK BEARING. ALL CONSTRUCTION JOINTS TO BE APPROVED BY CITY ENGINEER.
 6. REINFORCED CONCRETE GRADE RINGS, CONES, PIPE RISERS OR APPROVED PRECAST MANHOLE SECTIONS SHALL CONFORM TO CURRENT A.S.T.M. SPEC. No. C-478.



CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL

STORM DRAIN MANHOLE

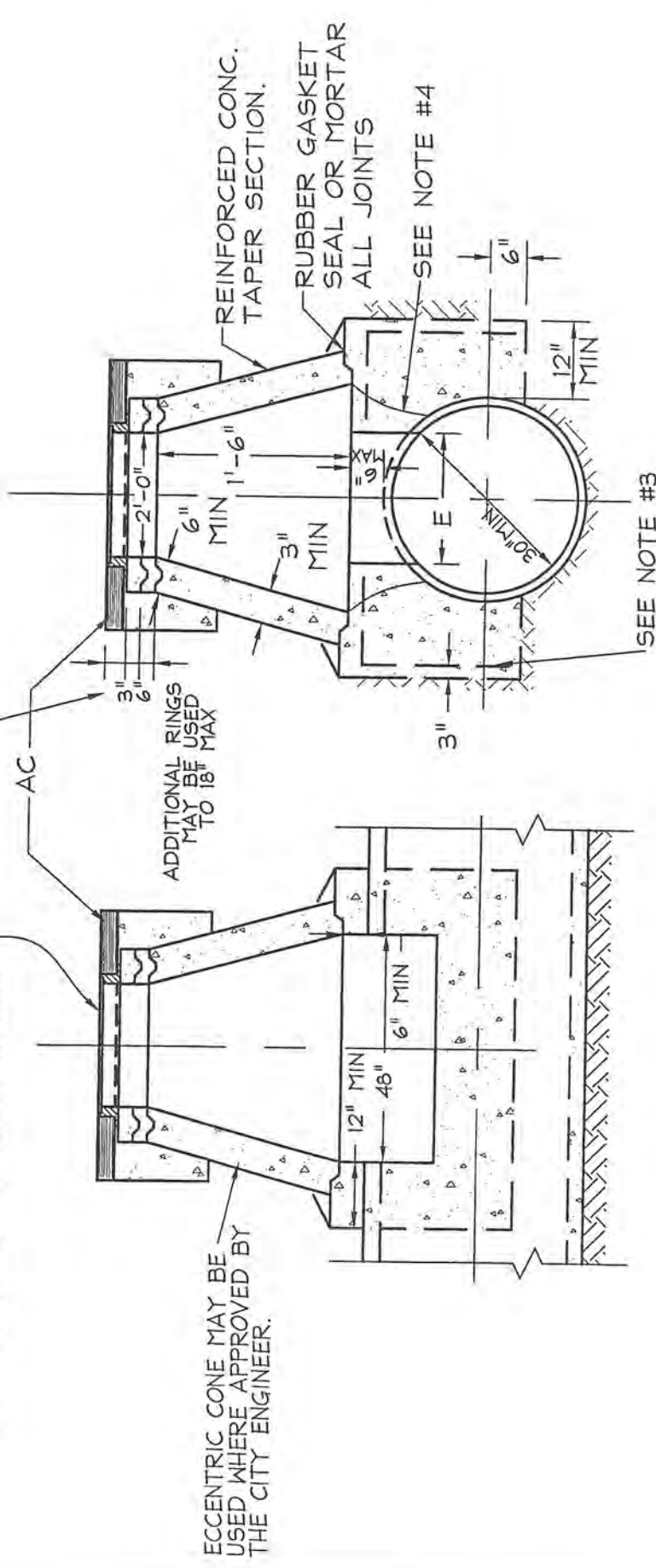
APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

SD-2

C.P. RING AND COVER. SEE DWG SS-3
SET TO FINISH STREET GRADE

24" DIA. GRADE RINGS

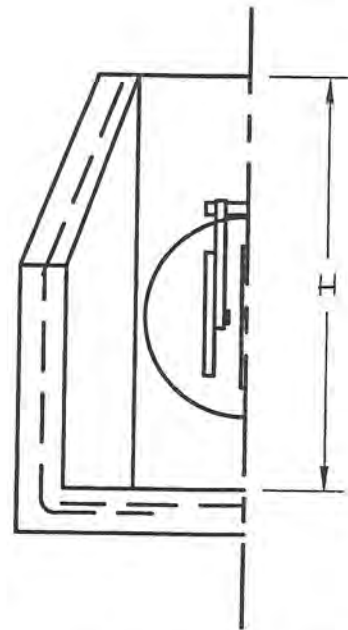
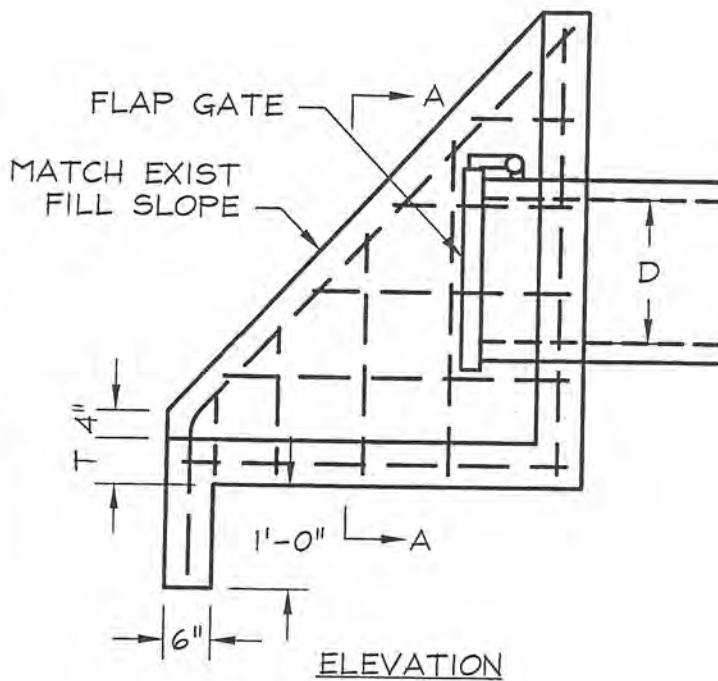
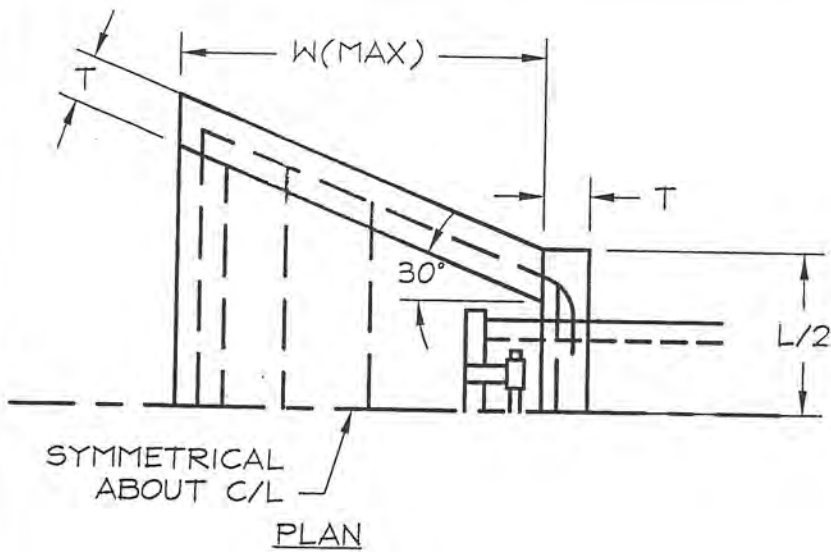


NOTES:

1. PRECAST PIPE, ADJUSTING RINGS AND TAPERED SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH A.S.T.M. C-478.
2. ALL JOINTS BETWEEN PRECAST SECTIONS SHALL BE MORTARED.
3. INTERIOR OF THE MANHOLE SHALL HAVE A SMOOTH TROWELED SURFACE.
4. FOR REINFORCED CONC. PIPES, CUT AND BEND STEEL REINFORCEMENT INTO CAST-IN-PLACE MANHOLE BASE.
5. FOR POURED-IN-PLACE PIPE, USE NO. 4 BARS AT 18" O.C.
6. REINFORCED CONCRETE GRADE RINGS, CONES, PIPE RISERS OR APPROVED PRECAST MANHOLE SECTIONS SHALL CONFORM TO CURRENT A.S.T.M. SPEC NO. C-478.

DIMENSIONS					
PIPE DIA	IN.	30	36	42	48
E	IN.	26	32	38	44
					54 AND GREATER

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL SADDLE-TYPE STORM DRAIN MANHOLE APPROVED: SELBY BECK, DIRECTOR APPROVED: R. WEBER, CITY ENGINEER	
DATE: DEC. 2005	SD-3

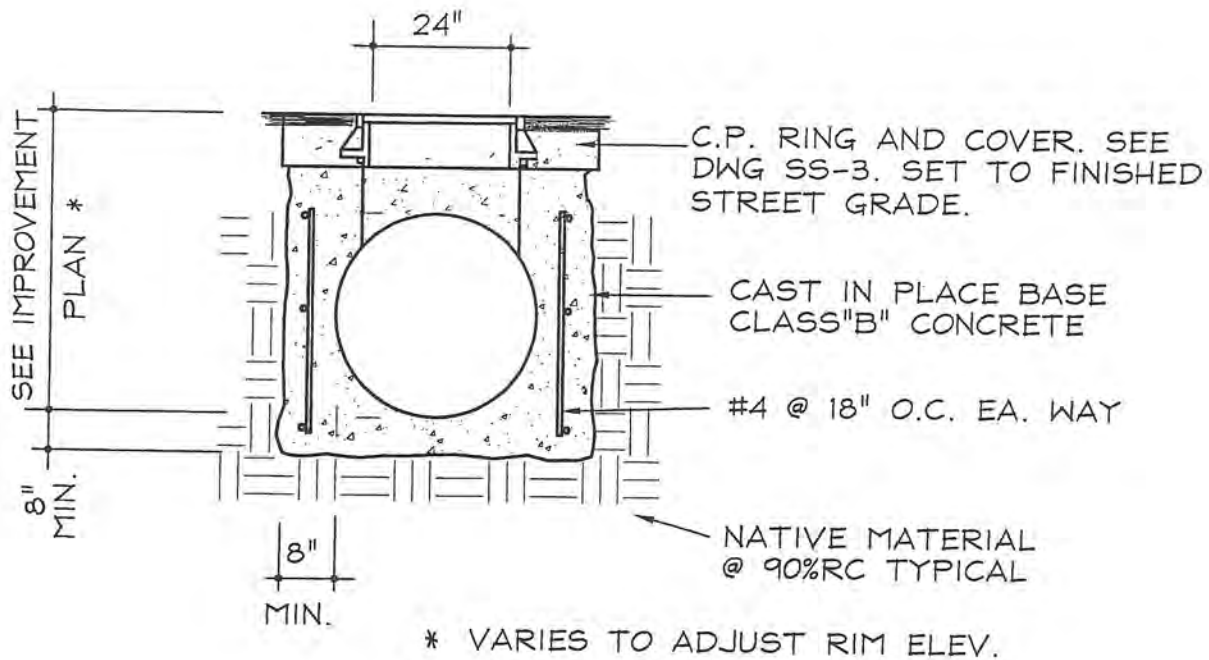


HALF SECTION A-A

NOTES

1. REINFORCING BAR SPACING & HEAD WALL DIMENSIONS SHALL COMPLY WITH SSP D89 OR AS APPROVED BY CITY ENGINEER.

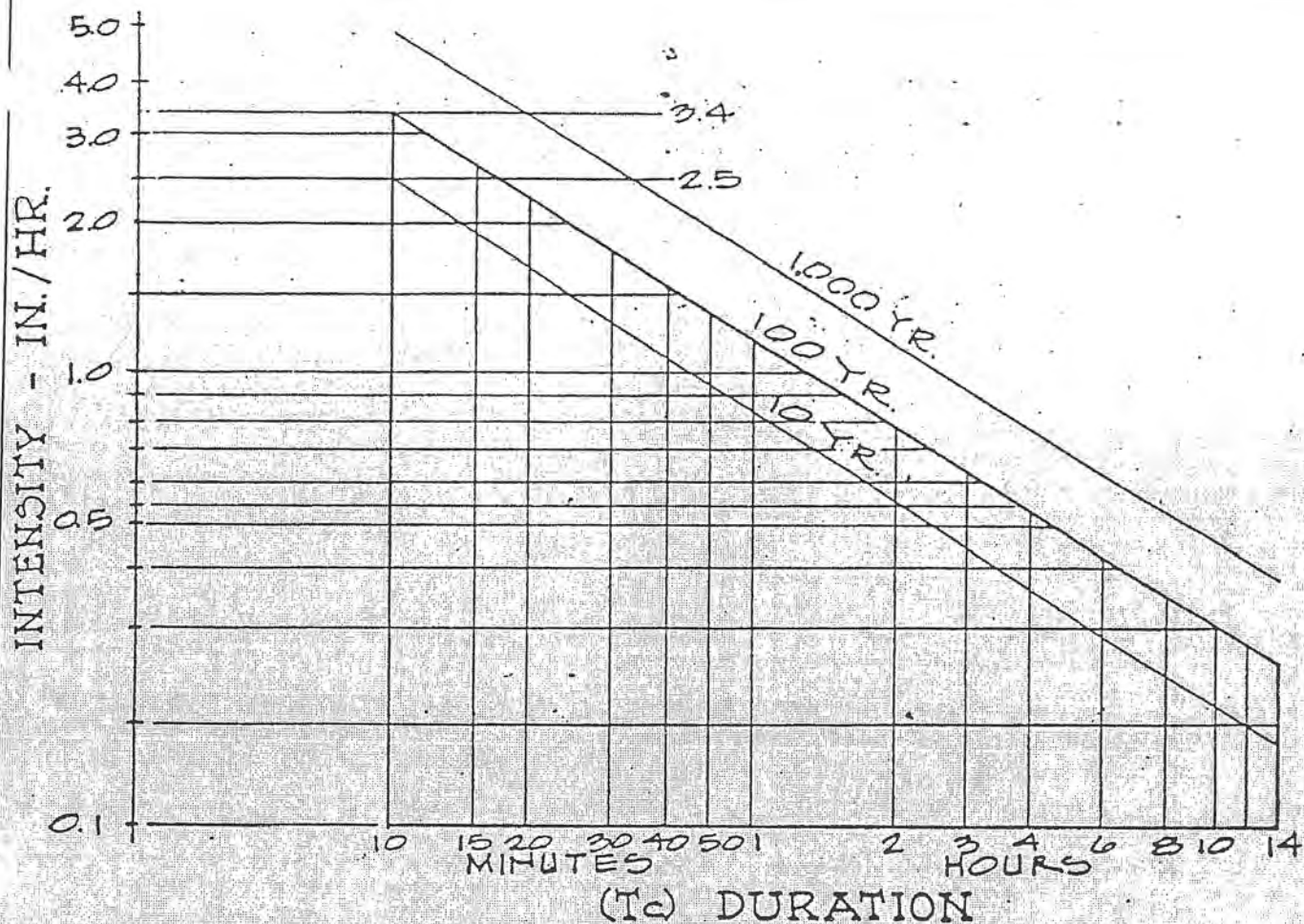
CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
STORM DRAIN OUTFALL	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	SD-4



LARGE DIAMETER
SHALLOW STORM DRAIN MANHOLE
(OFF ROAD)

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL LARGE DIAMETER SHALLOW SD MANHOLE APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	SD-5

REVISED (JUNE 2006)



SLOPE	VELOCITY FT./SEC.		
	OVERLAND	UNPAVED CHANNEL	PAVED GUTTER
< -.005	.25	2-3	1.0-1.7
.005-.015	.50	3-6	1.7-3.0
.015-.030	.75	6-8	3.0-4.2
.030-.060	1.00	8-10	4.2-5.4
.060-.10	1.50	10-13	5.4-7.8
.10-.15	2.00	13-14	7.8-10
.15 - <	3.00	15	10

INSTRUCTIONS

1. SELECT VEL. FROM ABOVE TABLE
2. $T_c = L/V \times 60$, SEE FIG. I-6 OF STREET AND HIGHWAY DRAINAGE VOL. I (ITTE)
3. IN CHART, GO VERTICAL TO STORM FREQUENCY CURVE DESIRED, THEN HORIZ. TO REACH THE INTENSITY.

NOTE : CURVES ARE BASED ON DATA FROM P.G. & E. RAINFALL RECORDS & U.S. DEPT. OF COMMERCE PRECIP. FREQUENCY ATLAS FOR 'WESTERN' U.S.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

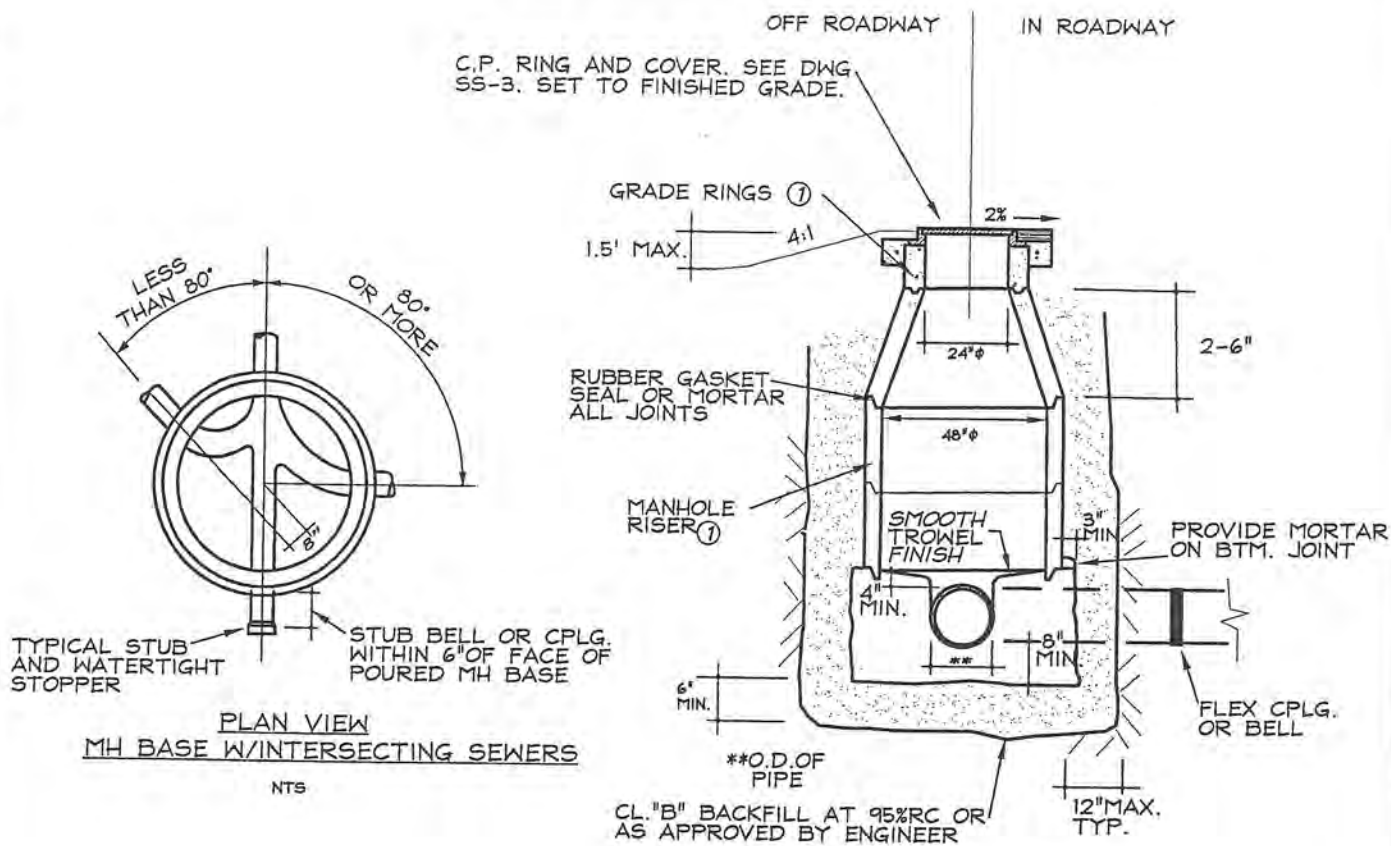
STANDARD DETAIL

RAINFALL INTENSITY CHART

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

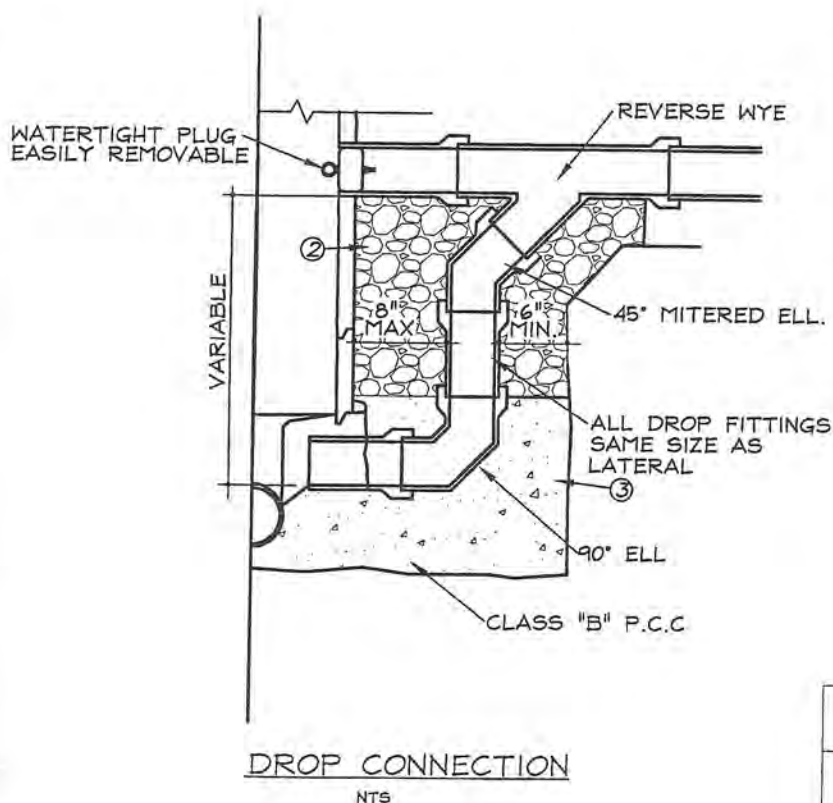
SD-6



ELEVATION
NTS

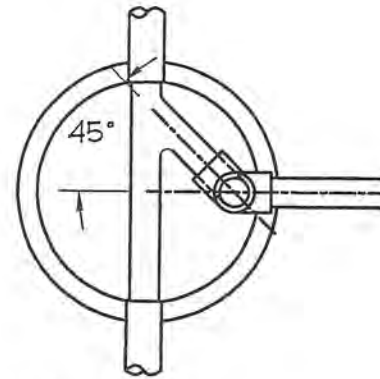
NOTES:

- ① REINFORCED CONCRETE GRADE RINGS, CONES, PIPE RISERS OR APPROVED PRECAST MANHOLE SECTIONS SHALL CONFORM TO CURRENT A.S.T.M. SPEC. No. C-478.
- ② SELECT IMPORT MATERIAL, 100% PASSING $\frac{3}{4}$ " SIEVE & 50% MINIMUM SAND EQUIVALENT.
- ③ ENCASEMENT CONCRETE SHALL BE PLACED AGAINST UNDISTURBED EARTH.
- ④ ALL INLETS AND OUTLETS FROM MANHOLE STRUCTURES SHALL HAVE A FLEXIBLE JOINT WITHIN 2 FEET OF THE STRUCTURE.



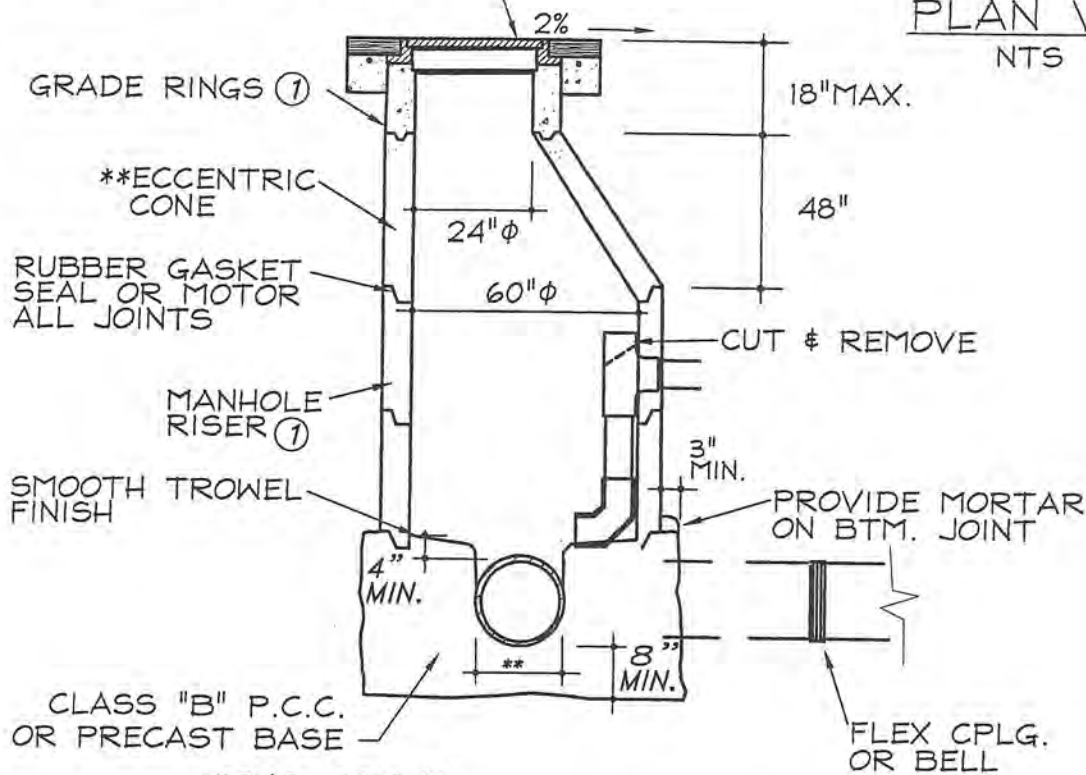
CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
TYPE "A" MANHOLE	
APPROVED: SELBY BECK, DIRECTOR	
PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	SS-1

REVISED (JUNE 2006)



PLAN VIEW
NTS

C.P. RING & COVER. SEE DWG
SS-3. SET TO FINISHED GRADE.



*CONC. COLLAR
IN ROADWAY

**ECCENTRIC CONE WHERE REQUIRED
SHALL BE ORIENTED WITH VERTICAL
SIDE DOWN STREAM

ELEVATION

NTS

NOTES:

- ① REINFORCED CONCRETE
GRADE RINGS, CONES,
PIPE RISERS OR
APPROVED PRECAST
MANHOLE SECTIONS SHALL
CONFORM TO CURRENT
A.S.T.M. SPEC. No. C-478.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL

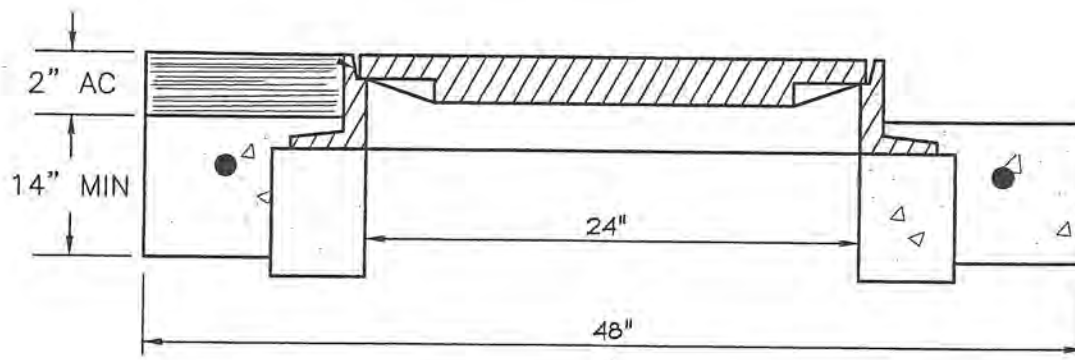
TYPE "B" MANHOLE

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

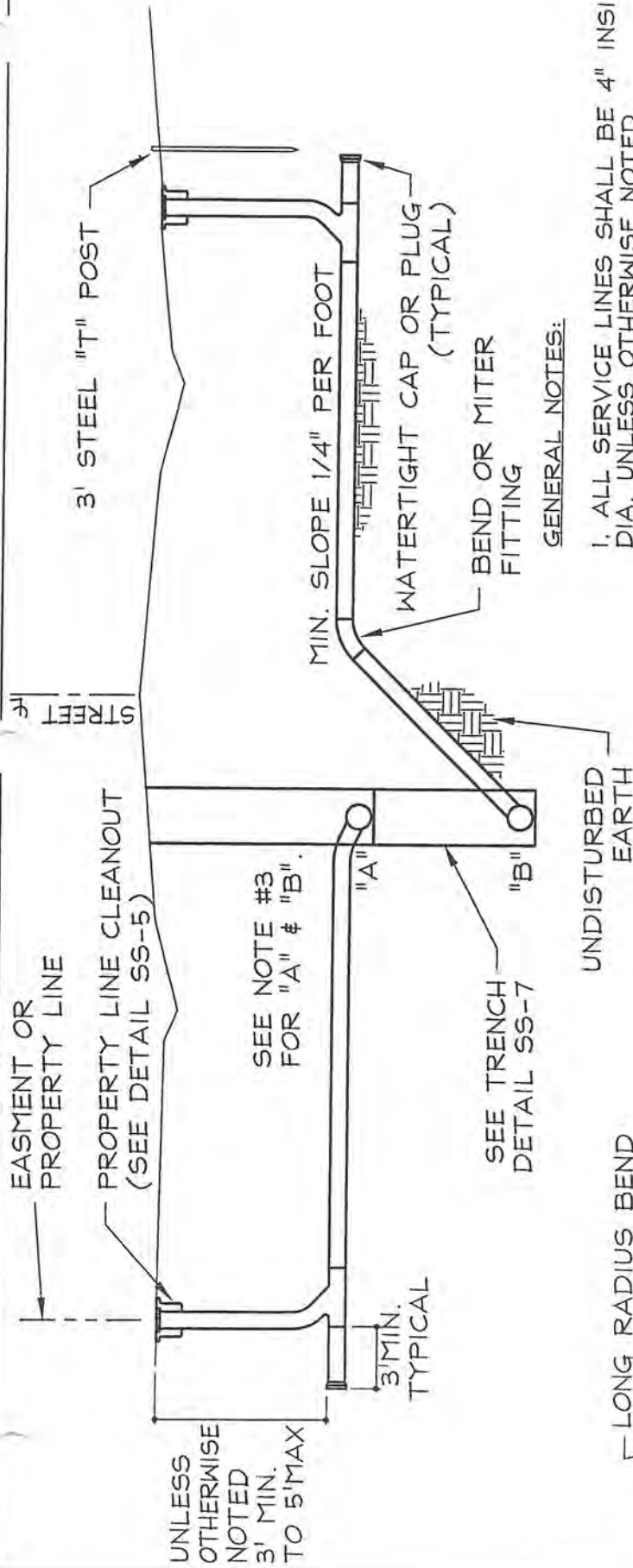
DATE: DEC 2005

SS-2

REVISED (JUNE 2006)

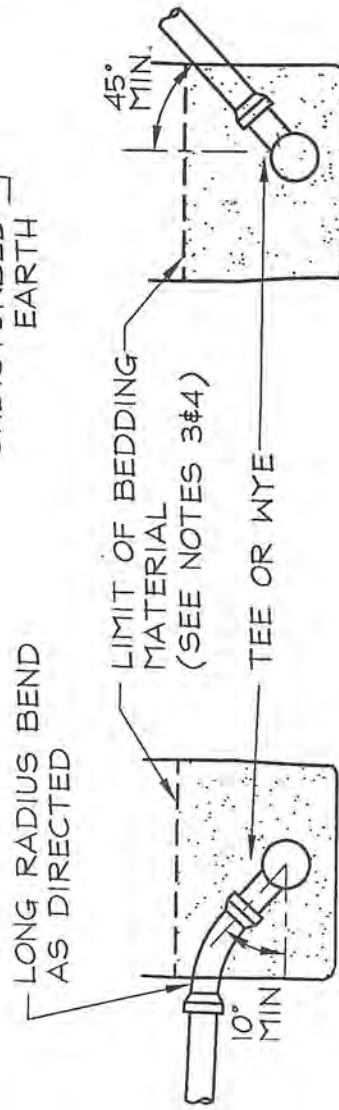


SS-3



GENERAL NOTES:

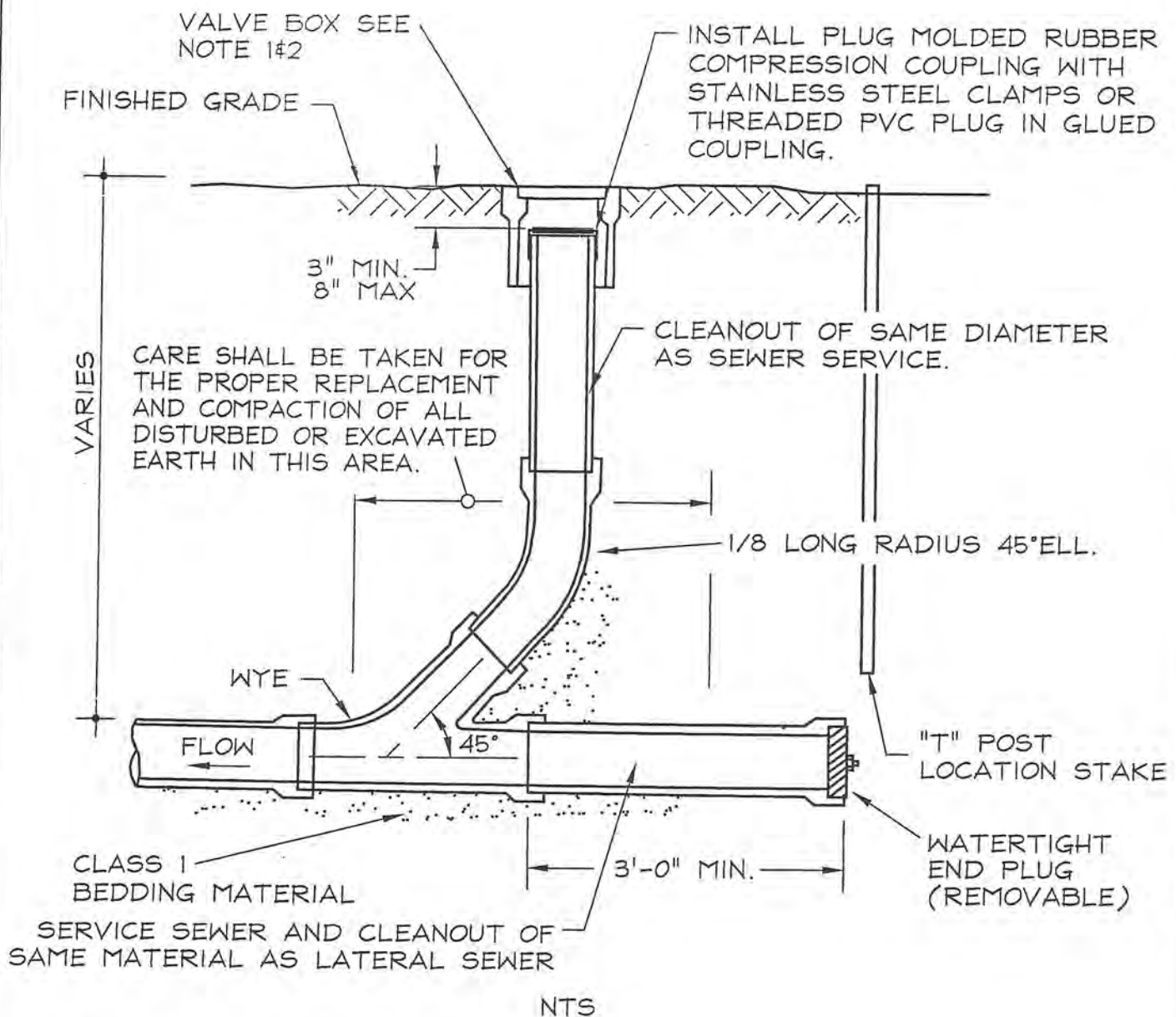
1. ALL SERVICE LINES SHALL BE 4" INSIDE DIA. UNLESS OTHERWISE NOTED.
2. SERVICE SEWER SHALL HAVE MINIMUM 3' COVER AT PROPERTY LINE.
3. PLACE CONCRETE 12" WIDE OR WELL COMPACTED BEDDING MATERIAL 18" WIDE UNDER THE TEE BRANCH, AS DIRECTED. WHEN BEDDING MATERIAL IS USED, PLACE ADDITIONAL BEDDING MATERIAL TO TOP OF BEND, THE FULL WIDTH OF THE TRENCH.
4. BEDDING MATERIAL SHALL BE CLASS 1 BACKFILL IN ACCORDANCE WITH CITY STANDARDS.



TYPE "A"

TYPE "B"

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL SEWER	
SERVICE LATERALS APPROVED: SELBY BECK, DIRECTOR APPROVED: R. WEBER, CITY ENGINEER	
DATE: DEC. 2005	SS-4



NOTES:

1. FOR 4" SERVICES, INSTALL ROUND CONCRETE VALVE BOX AND COVER, MARKED "SEWER". INSIDE BOX DIAMETER 7" MINIMUM, 10" MAXIMUM. (TRAFFIC RATED IN DRIVEWAY)
2. FOR SERVICES 6" OR LARGER, INSTALL "CLEAN OUT BRANCH." SEE STANDARD DRAWING S-6.

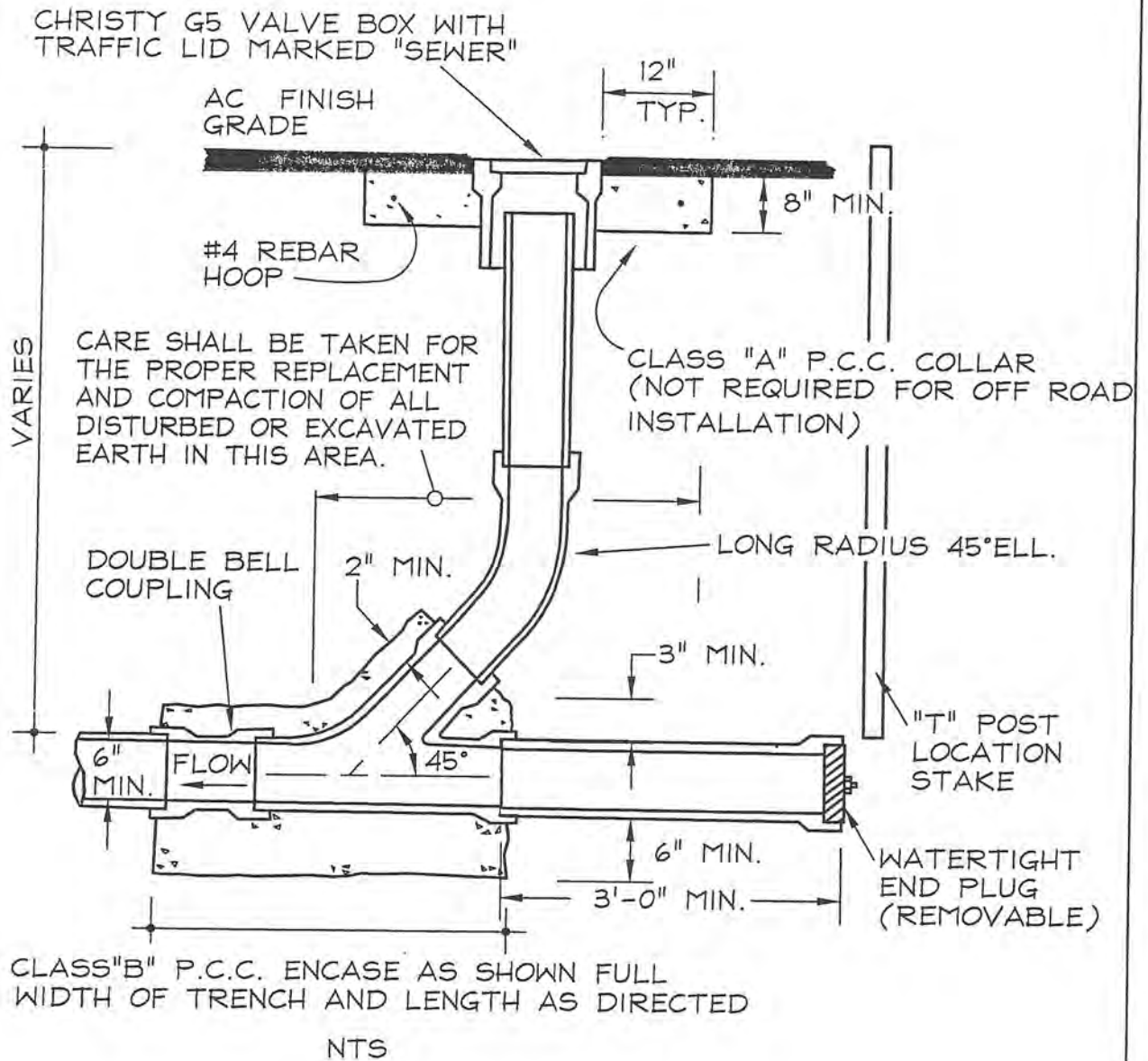
CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL
PROPERTY LINE
CLEANOUT

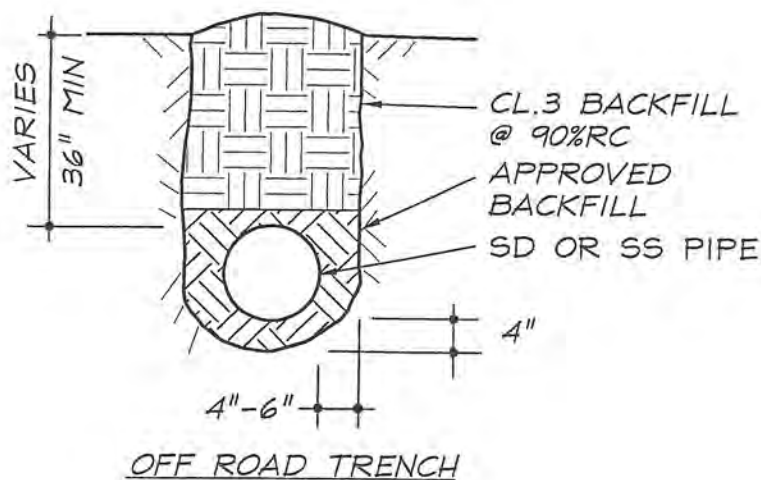
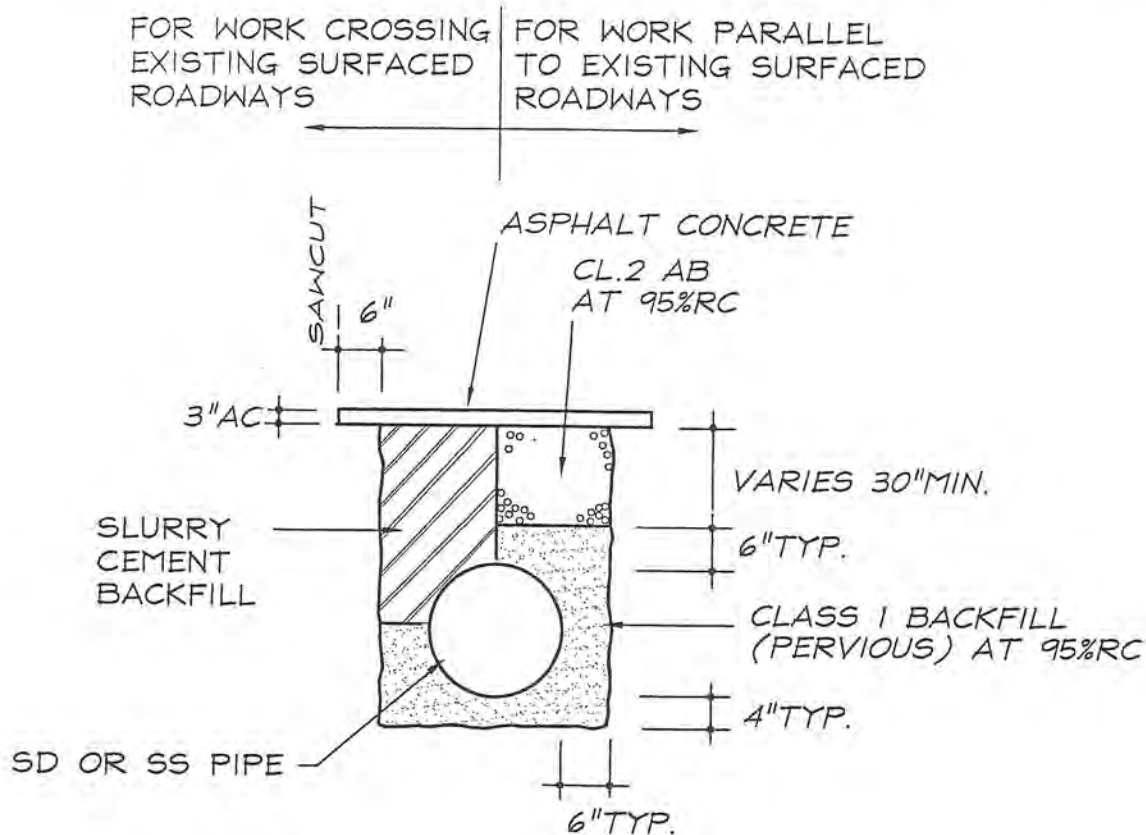
APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

SS-5



CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
CLEAN OUT BRANCH	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	SS-6



NOTES:

1. SANITARY SEWER TRENCH DEPTH CONTROLLED BY SS-4 & JOINT TRENCH LOCATION.
2. STORM DRAIN DEPTH 36" MIN OR AS DIRECTED BY CITY.
3. TYPICAL TRENCH SECTIONS FOR NEW DEVELOPMENTS SHALL BE AS SET FORTH ON THE APPROVED CONSTRUCTION PLANS.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

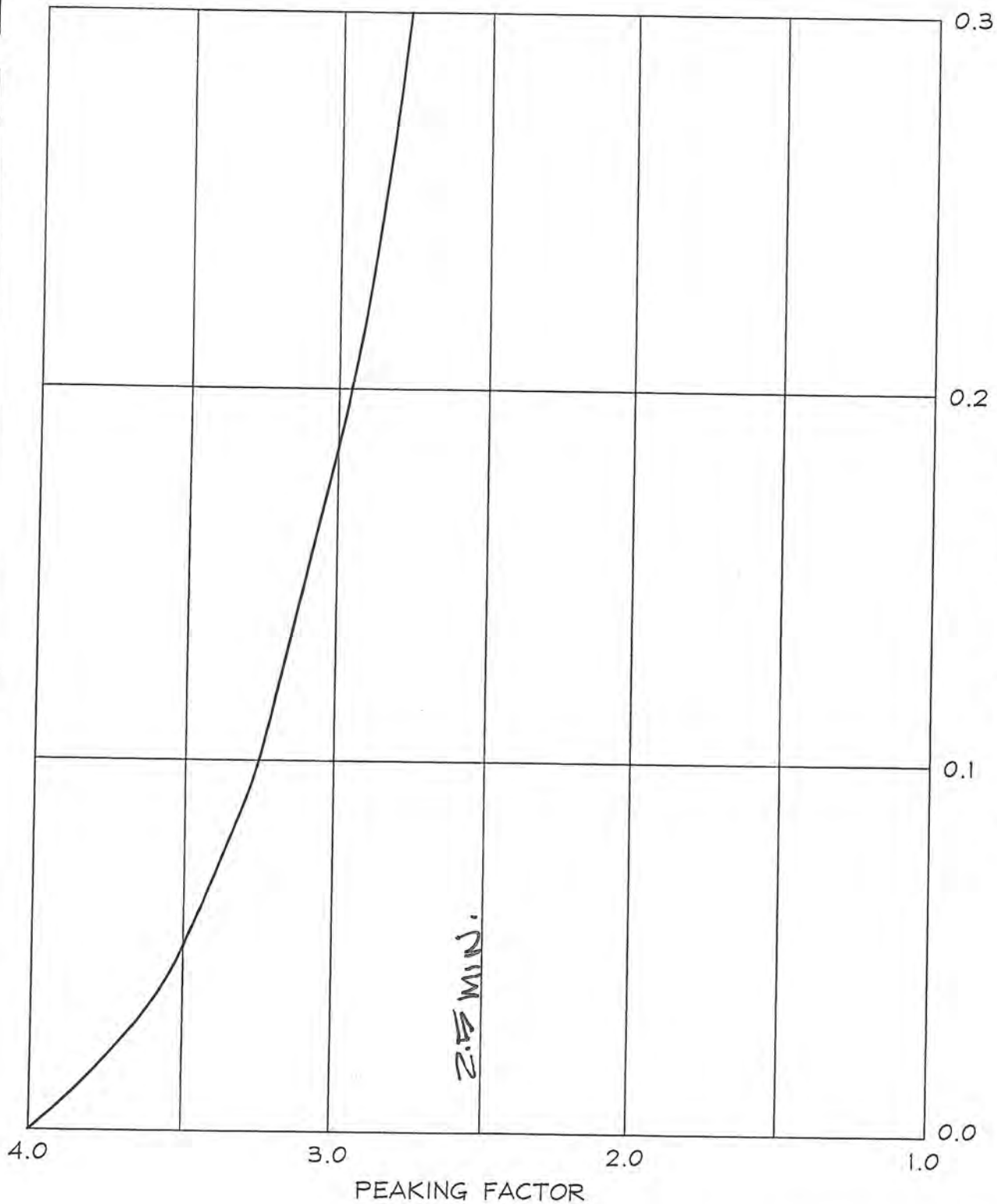
STANDARD DETAIL

TRENCH DETAILS

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

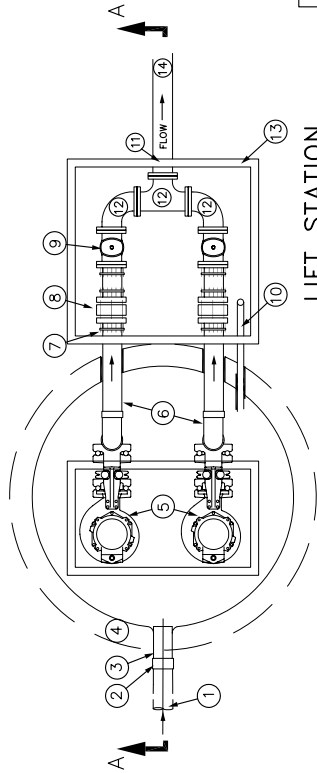
DATE: DEC 2005

SS-7



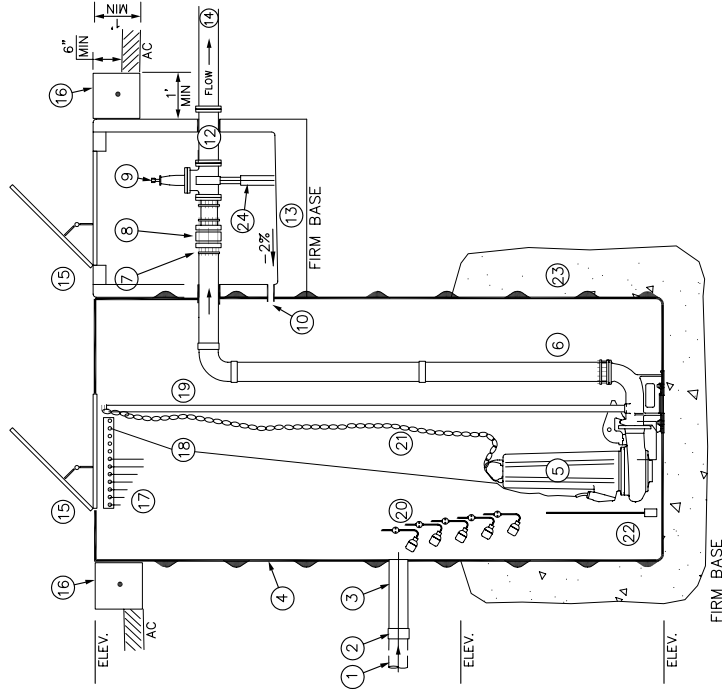
AVERAGE DAILY PROJECT FLOWS (M.G.D.)
RESIDENTIAL SEWAGE PEAK FLOW FACTORS
VS. AVERAGE DAILY FLOW

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL PEAK FLOW FACTORS	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	SS-8



LIFT STATION
PLAN
NTS

DESIGN HEAD		DESIGN FLOW RATE	
1. ELEVATION AT PUMP	_____	1. OFF-SITE _____	ESFU
2. ELEVATION AT OUTLET	_____	2. ON-SITE _____	ESFU
3. TOTAL HEAD LOSS	_____	3. TOTAL: _____	ESFU
TOTAL HEAD		4. ADF = _____	
		5. PHF = _____	
WET WELL			
1. ELEV. TOP OF WET WELL	_____		
2. ELEV. BOTTOM OF WET WELL	_____		
3. HOURS OF STORAGE	_____		



LIFT STATION
SECTION A-A
NTS

ITEM #	DESCRIPTION
①	_____ IN INFLUENT PIPE
②	RIGID COUPLING, SDR 35
③	INTEGRALLY MOLDED FIBERGLASS HUB, SDR 35
④	_____ FT DIA x _____ FT DEEP CONCRETE WET WELL
⑤	SUBMERSIBLE SEWAGE PUMP
⑥	_____ IN DISCHARGE PIPING, CLASS 350 DUCTILE IRON
⑦	_____ FCA W/ ANCHOR STUDS (TYP)
⑧	_____ IN SWING CHECK VALVE
⑨	_____ IN GATE VALVE
⑩	2" PVC DRAIN
⑪	WALL PENETRATION
⑫	_____ IN D.I. PIPE & FITTINGS, FL
⑬	_____ IN x _____ IN UTILITY VAULT
⑭	_____ IN FORCE MAIN
⑮	SINGLE LEAF ALUMINUM LID, SIZED TO FIT VAULT
⑯	1"x1' CONCRETE CURB, WITH REINFORCEMENT
⑰	CABLE HANGER, 316 SS (TYPICAL ALL SS)
⑱	POWER AND CONTROL CABLES
⑲	_____ IN SS SCHEDULE 40 GUIDE RAIL & BRACKETS
⑳	FIVE FLOAT REDUNDANT SYSTEM, SET IN FIELD
㉑	_____ IN SS LIFTING CHAIN
㉒	PRESSURE TRANSDUCER
㉓	_____ CONCRETE FOR BOUANCY
㉔	PLACE PIPE SUPPORT

PUMP HEAD DESIGN	
LEVEL	INDICATOR
1	REDUNDANT OFF & LOW LEVEL ALARM
2	PUMPS OFF
3	LEAD PUMP ON
4	LAG PUMP ON
5	HIGH LEVEL ALARM

NOTES:

- COMPONENTS, FITTINGS AND OTHER DETAILS SHOWN HEREON, HAVE BEEN DRAWN TO APPROXIMATE DIMENSIONS. SHOP DRAWINGS SHALL BE SUBMITTED TO THE CITY FOR APPROVAL PRIOR TO CONSTRUCTION OF LIFT STATION. SHOP DRAWINGS SHALL SHOW COMPLETE DETAILS OF THE INSTALLATION INCLUDING SIZE, LOCATION, CONCRETE REINFORCEMENT, GRADING, ALL FITTINGS, INCLUDING MANUFACTURERS NAME, MODEL, AND ENGINEERING DATA OF ALL COMPONENTS.
- WET WELL ACCESS DOOR SHALL BE 4" (IN) MINIMUM LARGER THAN PUMP MANUFACTURERS RECOMMENDATION.
- MOUNT WET WELL ACCESS DOOR SO THAT FLOATS WILL BE OPPOSITE INVERT AND FLOAT HANGER IS MOUNTED ON HINGE SIDE OF DOOR.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL

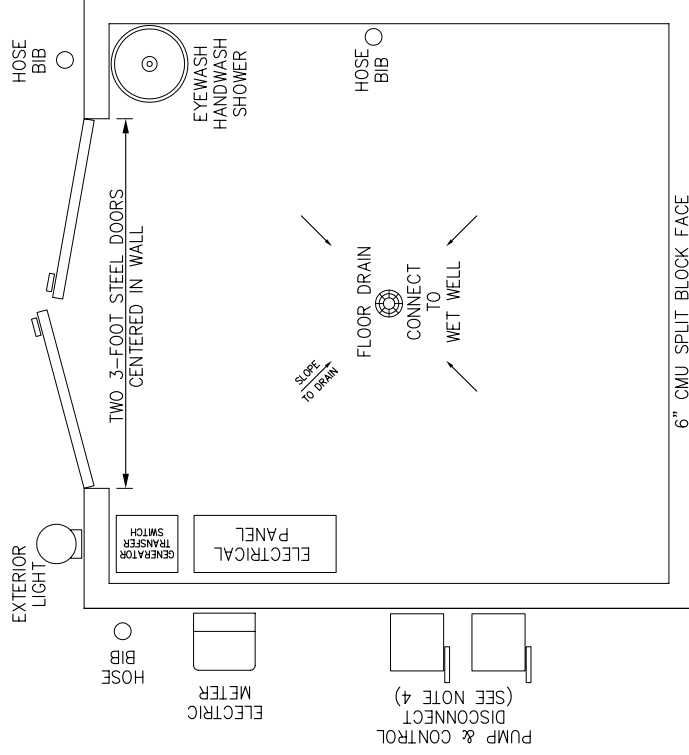
LIFT STATION

PLAN & PROFILE

PREPARED: WEBER, GHIO-CITY ENGINEER

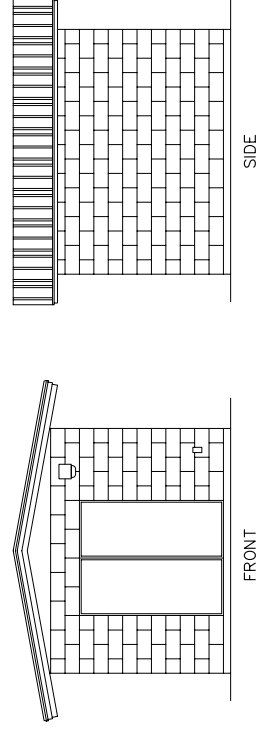
DATE: MARCH 2013

SS-9A

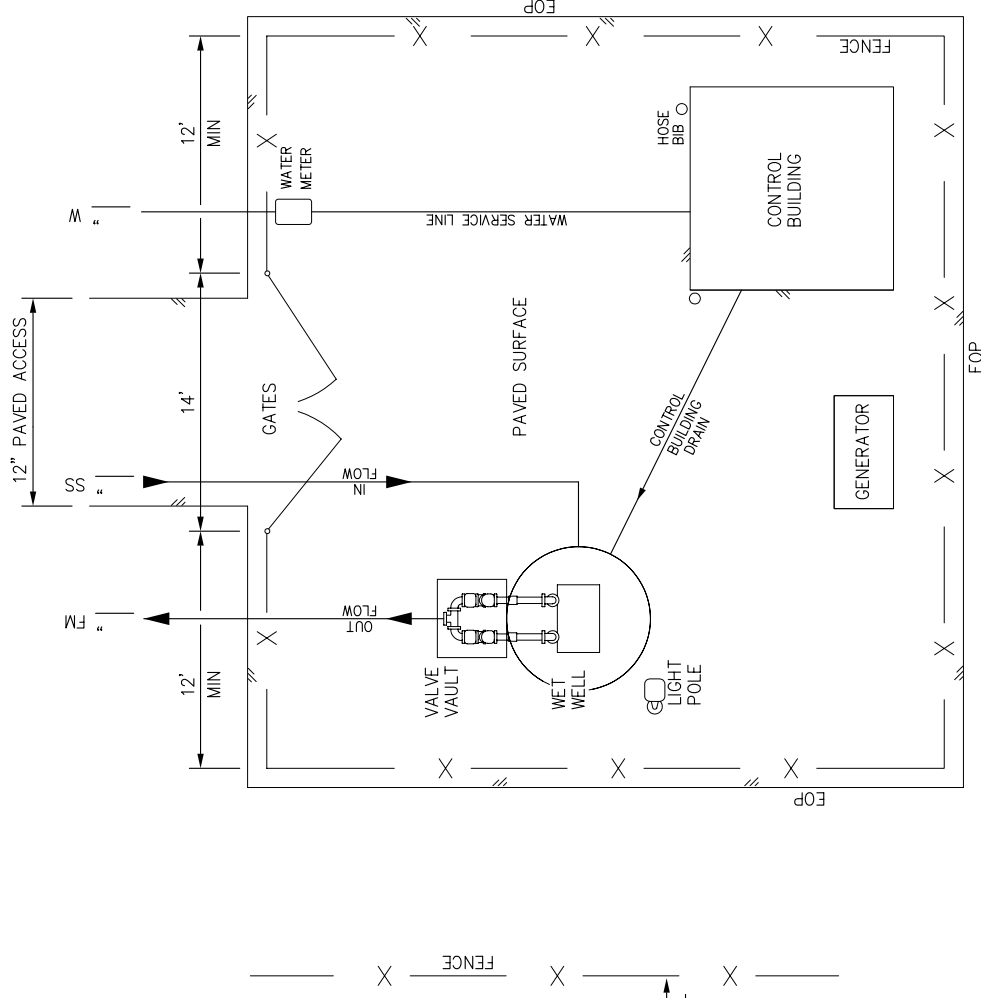


TYPICAL CONTROL BUILDING INTERIOR

NTS



CONTROL BUILDING



TYPICAL LIFT STATION SITE PLAN

NTS

NOTES:

1. WHEN DISTANCE FROM LIFT STATION GATE TO TRAVELED WAY EXCEEDS 100 FEET, TURN AROUND SHALL BE PROVIDED.
2. NO FENCING ALONG LIFT STATION ACCESS ROAD WITHIN EIGHT FEET OF SHOULDER.
3. FENCE AND GATE ENCLOSING LIFT STATION WITH FULL HEIGHT, EARTH-TONE COLORED PLASTIC SLATS.
4. PUMP AND CONTROL DISCONNECTS SHALL BE LOCATED ON CONTROL BUILDING EXTERIOR IF WET WELL IS LESS THAN 25 FEET AWAY. IF DISTANCE TO CONTROL BUILDING IS GREATER THAN 25 FEET, DISCONNECTS SHALL BE LOCATED AT WET WELL.

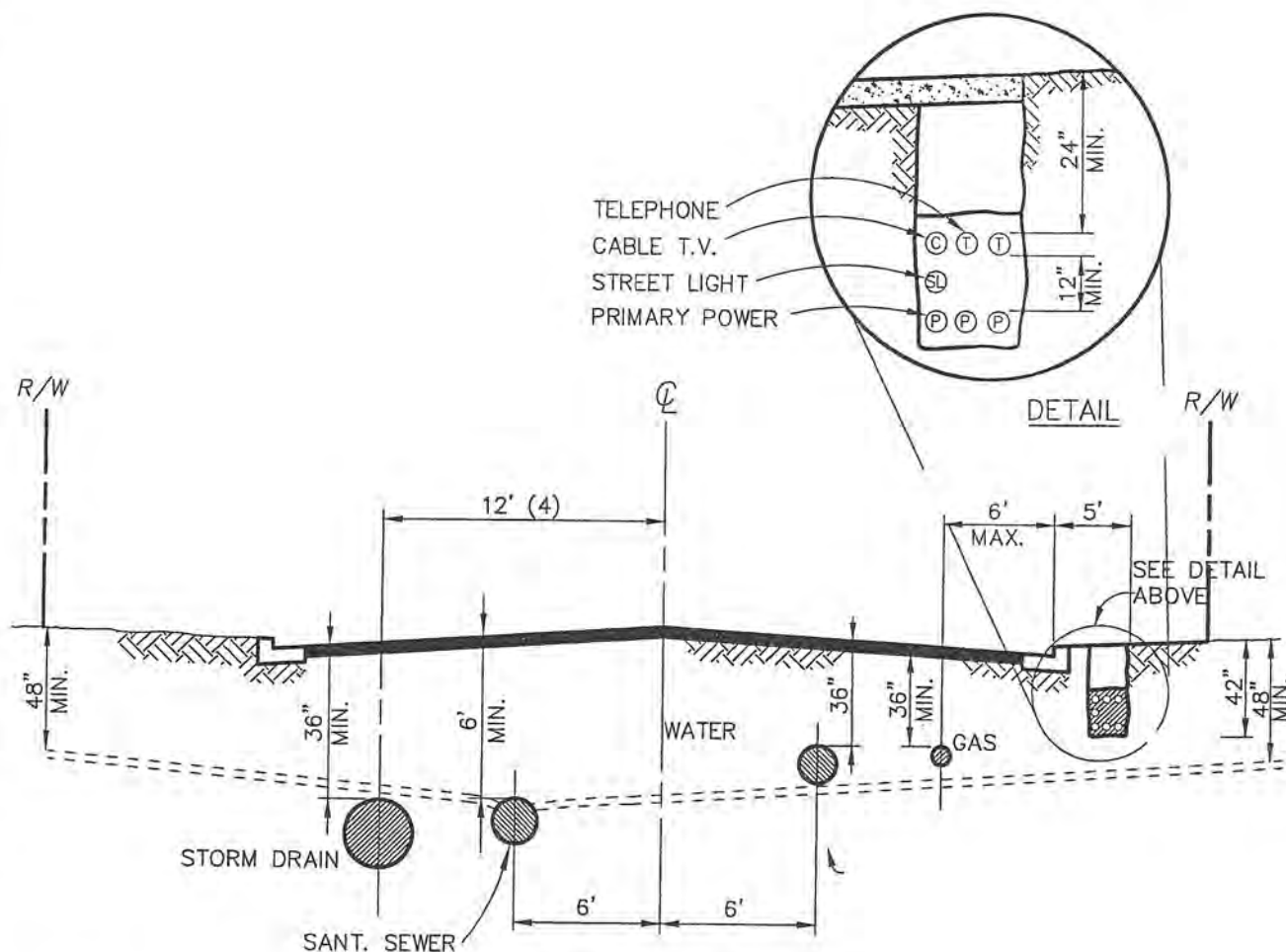
CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL
LIFT STATION
SITE PLAN

PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: MARCH 2013

SS-9B

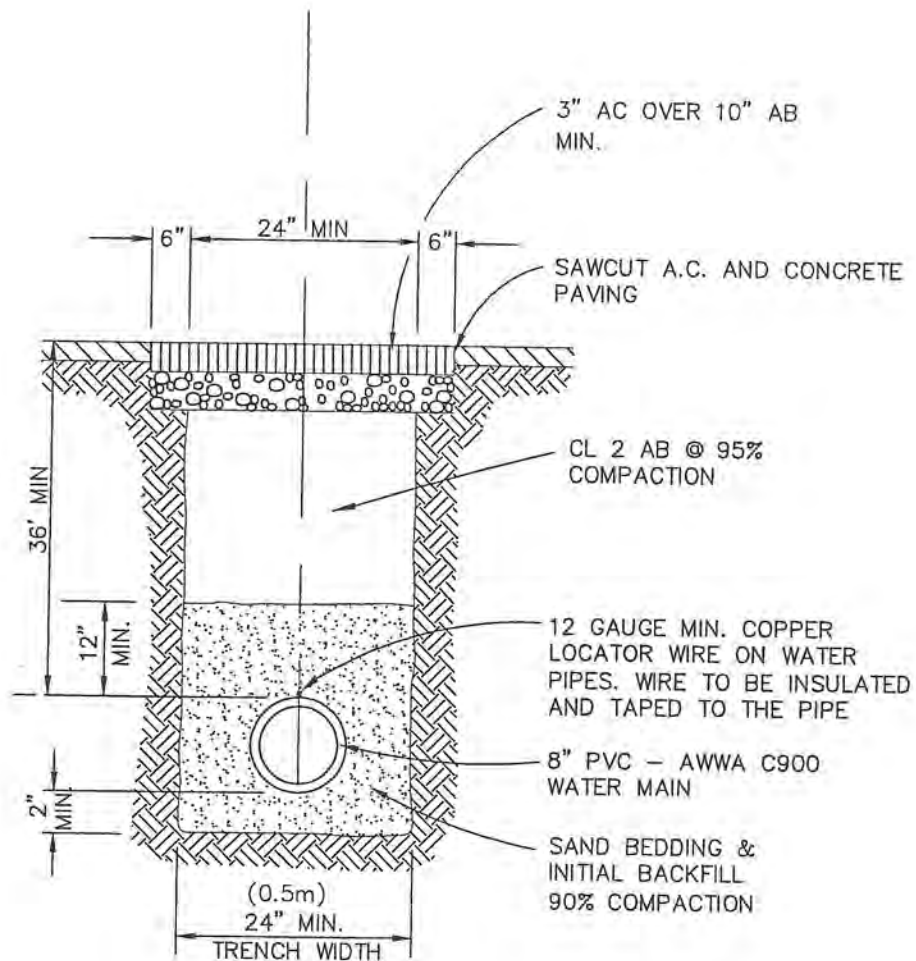


NOTES:

1. FOR ALL SUBDIVISIONS: A COMPOSITE UTILITY PLAN, SIGNED BY A REPRESENTATIVE OF EACH UTILITY, SHALL BE SUBMITTED TO THE CITY ENGINEER FOR APPROVAL ALONG WITH THE CONSTRUCTION DRAWING PACKAGE.
2. JOINT TRENCH (FOR UTILITIES ONLY) MAY BE USED WHERE APPLICABLE PROVIDED STATE AND LOCAL ORDINANCES AND UTILITY COMPANY REQUIREMENTS ARE MET.
3. ALL SEWER MAINS AND LATERALS SHALL CROSS UNDER WATER MAINS AND SERVICES WITH A MINIMUM OF ONE FOOT OF CLEARANCE.
4. DISTANCE TO STORM DRAIN WILL VARY DEPENDANT ON ROAD WIDTH AND APPROVED STORM DRAIN LOCATION.

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL UTILITY LOCATIONS	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	W-1

REVISED (JUNE 2006)



CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL

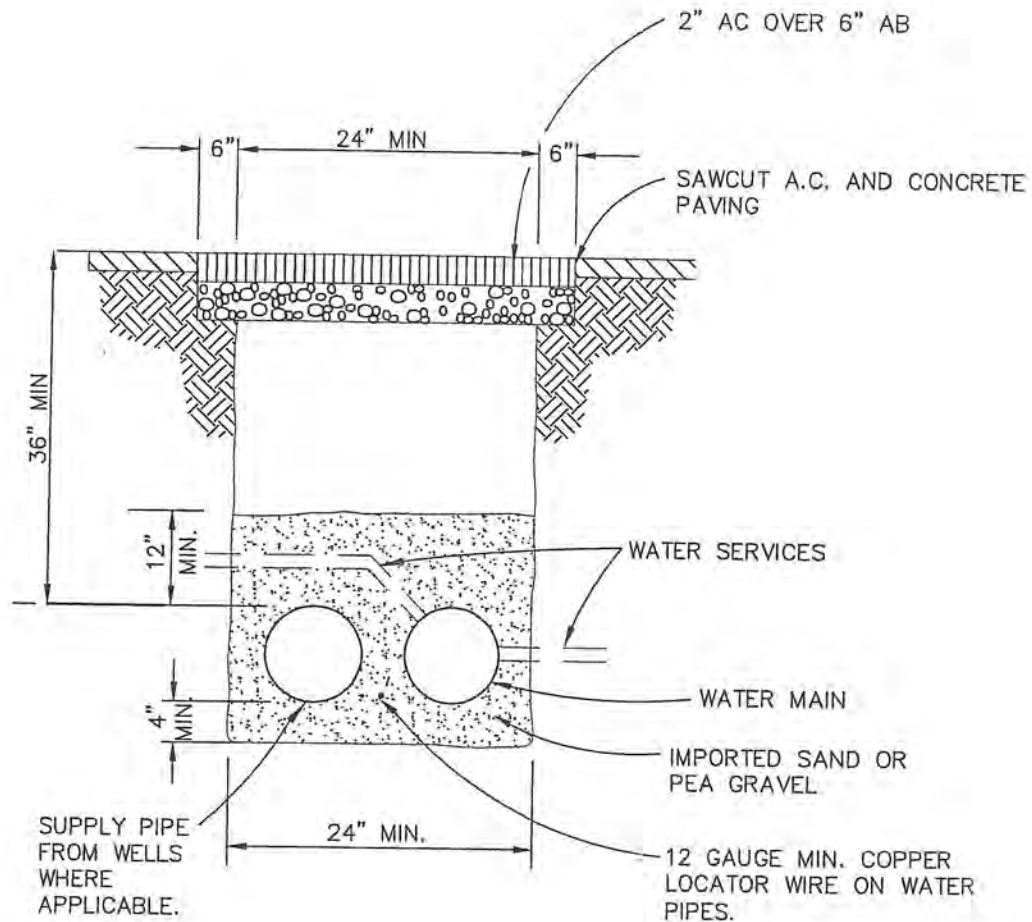
TRENCH DETAIL

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

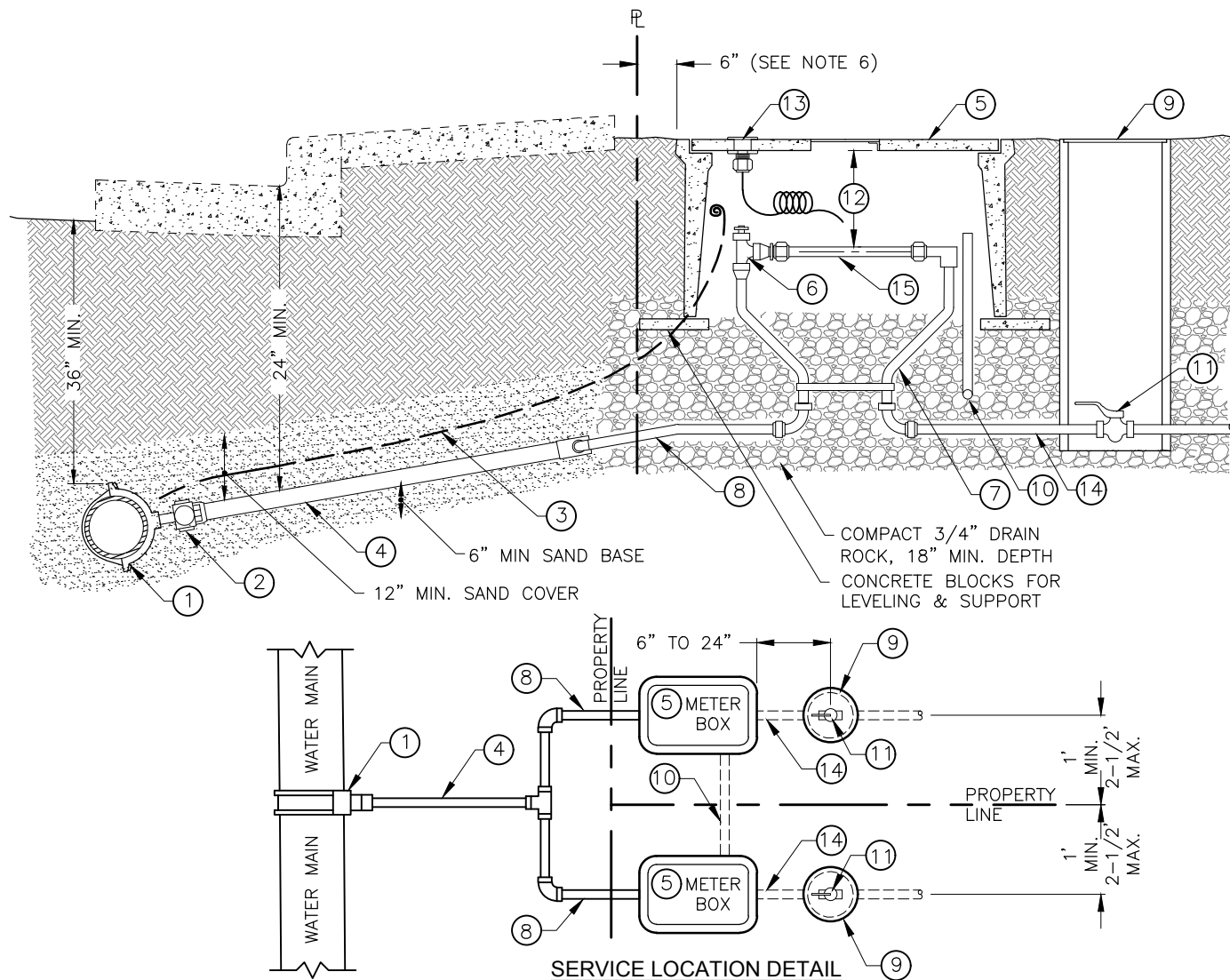
W-2

REVISED (JUNE 2006)



CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL WATER TRENCH	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	W-3

REVISED (JUNE 2006)



KEY NOTES

No.	DESCRIPTION
1.	SERVICE SADDLE, (SEE NOTE 8)
2.	CORPORATION STOP, (SEE NOTE 9).
3.	LOCATOR WIRE, (SEE NOTE 7).
4.	SERVICE LINE, (SEE NOTE 3).
5.	METER BOX, (SEE NOTES 5 & 6).
6.	ANGLED METER STOP, (SEE NOTE 10).
7.	METER SETTER, (SEE NOTE 12)
8.	METER LINE, (SEE TABLE, NOTE 3)
9.	CUSTOMER VALVE BOX, (SEE NOTE 4).
10.	1" SCH. 80 PVC CONDUIT w/(2) 90° SWEEPS BETWEEN METERS.
11.	BALL VALVE, (SEE NOTE 11)
12.	9" - TOP OF METER BOX TO CENTER LINE OF IDLER
13.	TRANSMITTER, (BY CITY)
14.	SCH. 80 PVC.
15.	3/4" OR 1" IDLER, OR METER FURNISHED BY CITY.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL
W-4
WATER SERVICE FOR 3/4" OR 1" METER

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO—CITY ENGINEER

DATE: 05.26.2016

SHT. 1 OF 2

NOTES:

1. THIS STANDARD DETAIL APPLIES TO NEW CONSTRUCTION WITH THE FOLLOWING CONFIGURATIONS IN THE TABLE BELOW.
2. ALL P.E. FITTINGS SHALL HAVE S.S. INSERTS. ALL PIPE CONNECTIONS SHALL BE COMPRESSION TYPE: MUELLER, FORD, "PACK JOINT"; OR EQUAL.
3. PIPING FROM WATER MAIN TO METER BOX SHALL BE LAID STRAIGHT IN TRENCH AND BE POLYETHYLENE CTS WEST FLEX GOLD, SIZE SHALL BE PROVIDED AS SHOWN IN THE TABLE BELOW.

	METER SIZE	SETTER / METER LINE SIZE	SERVICE PIPE (FROM MAIN TO METER OR TEE)	NOTES
SINGLE CUSTOMER, (NON-RESIDENTIAL)	3/4" OR 1"	1"	1"	ADD THREAD SIZE & LENGTH ADAPTER TO 3/4" METER TO MATCH 1" SETTER
SINGLE RESIDENCE, (WITH FIRE SPRINKLER)	3/4"	1" (IF REQUIRED BY SPRINKLER DESIGN)	1-1/2"	1" METER (IF REQUIRED BY SYSTEM DESIGN)
DUAL RESIDENCE, (WITH FIRE SPRINKLERS)	3/4"		2"	

4. CUSTOMER VALVE BOX SHALL BE "CHRISTY", MODEL F8, (OR EQUAL), w/ADS EXTENSIONS, (AS REQUIRED), WITH A "CHRISTY" MODEL 8FLD LID. SUBJECT TO APPROVAL BY THE CITY ENGINEER. ALL VALVE BOXES TO BE LOCATED OUTSIDE OF TRAFFIC AREAS UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER. VALVE BOXES LOCATED WITHIN TRAFFIC AREAS SHALL HAVE A TRAFFIC RATED LID.
5. METER BOX SHALL BE "CHRISTY", MODEL B30, (OR EQUAL) WITH A "CHRISTY" MODEL B30G LID, w/(1) 1-3/4" PRE-CAST HOLE, SUBJECT TO APPROVAL BY THE CITY ENGINEER. INSTALL 1/4" RODENT SCREEN AT BOTTOM OF METER BOX. ALL METER BOXES TO BE INSTALLED OUTSIDE OF TRAFFIC AREAS UNLESS APPROVED BY THE CITY ENGINEER. METER BOXES LOCATED WITHIN TRAFFIC AREAS SHALL HAVE A TRAFFIC RATED LID.
6. VARIANCES TO METER LOCATION SHALL BE APPROVED BY CITY ENGINEER.
7. LOCATOR WIRE, USE 12 GA. COPPER WIRE INSULATED FOR ALL SERVICE ASSEMBLIES. TIE TO LOCATOR WIRE ON MAIN LINE FROM ANGLE STOP VALVE.
8. SERVICE SADDLE: STAINLESS STEEL DOUBLE-STRAP (4 BOLTS) BRONZE SADDLE, FOR 1", 1-1/2" OR 2" TAP, (OR EQUAL). AS APPROVED BY THE CITY ENGINEER. MUELLER, JONES, ROMAC (OR EQUAL) FOR C-900 PVC.
9. CORPORATION STOP: 1", 1-1/2" OR 2" BALL TYPE CORPORATION STOP, STRAIGHT COUPLING. MUELLER, FORD, JONES OR EQUAL, AS APPROVED BY THE CITY ENGINEER.
10. ANGLED BALL METER STOP: SHALL BE LOCKABLE IN OFF POSITION.
11. BALL VALVE, MUELLER, FORD, JONES, (OR EQUAL)
12. 12" COPPER METER SETTER, FORD, MUELLER, MCDONALD (OR EQUAL), 10-3/4" MIN. LAY LENGTH.

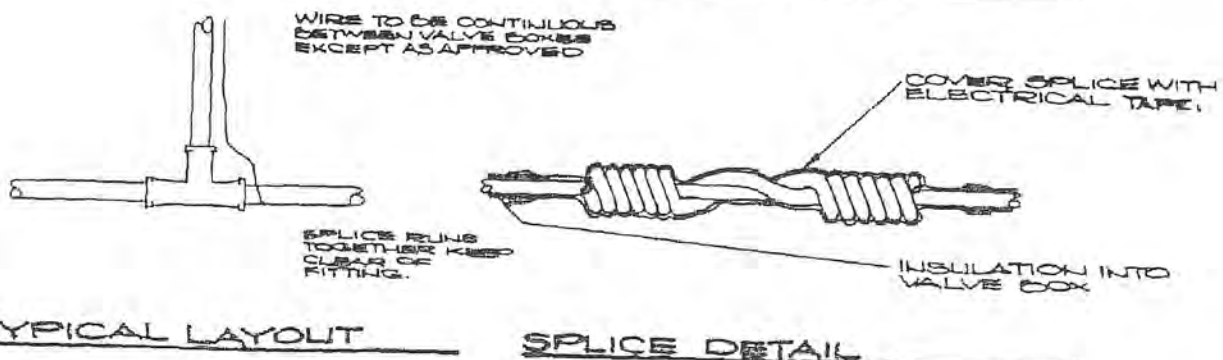
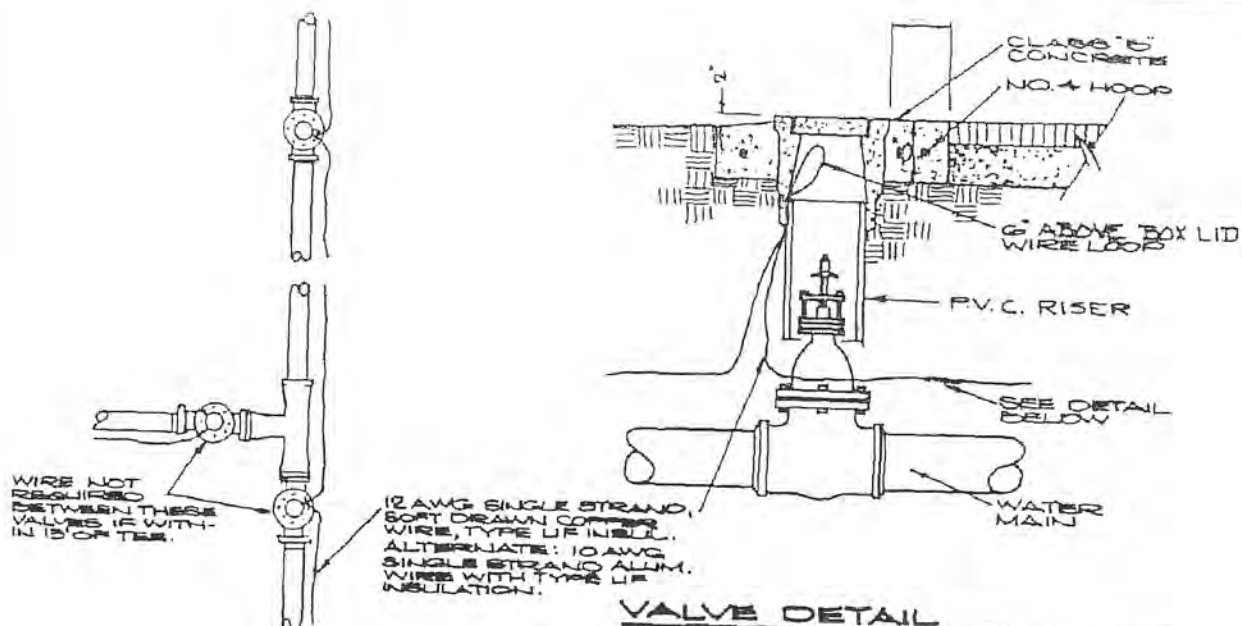
**CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT**

**STANDARD DETAIL
W-4
WATER SERVICE FOR 3/4" OR 1" METER**

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO—CITY ENGINEER

DATE: 05.26.2016

SHT. 2 OF 2



LOCATOR WIRE DETAIL

NO SCALE

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

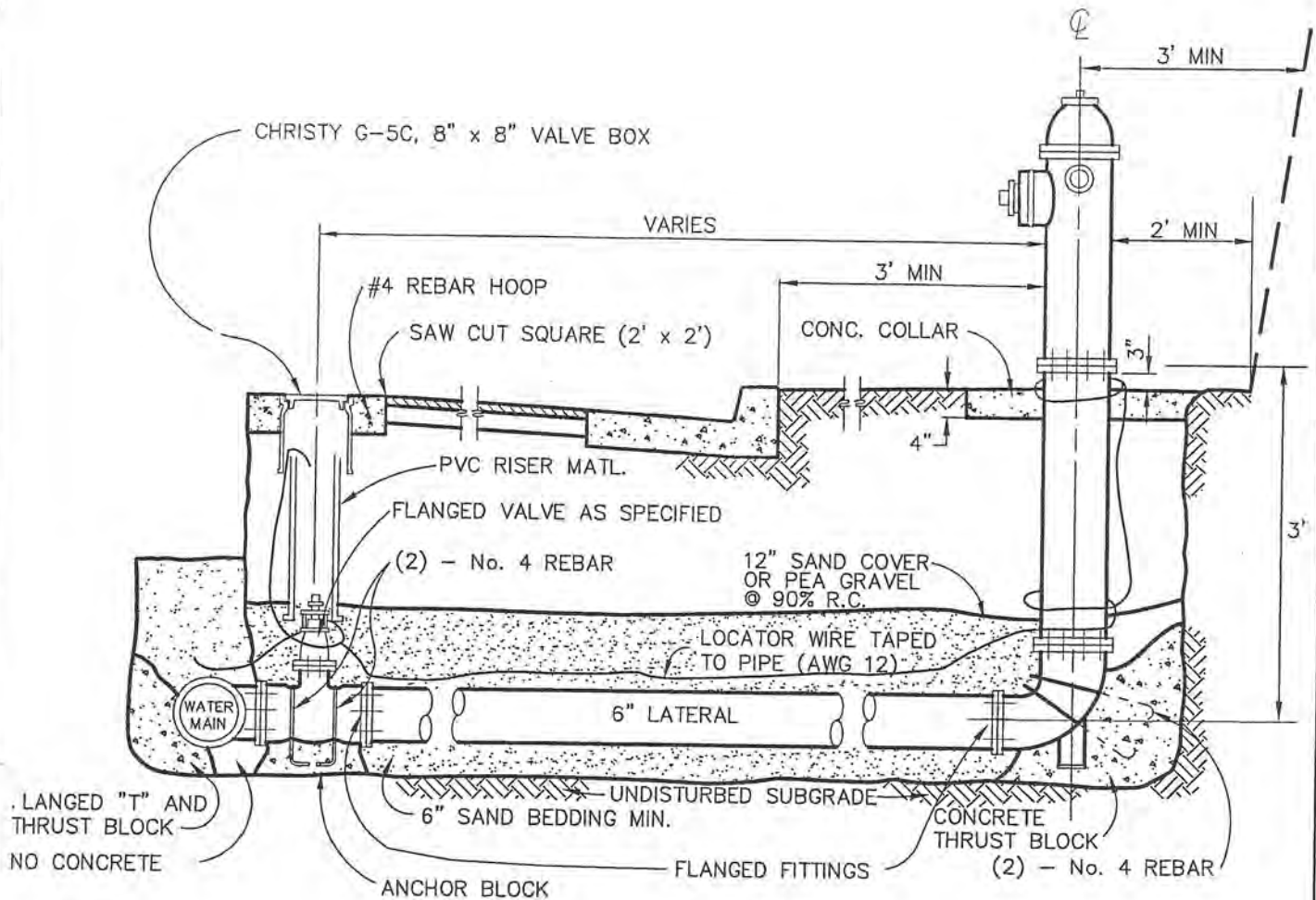
STANDARD DETAIL

LOCATOR WIRE

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

W-5



NOTE:

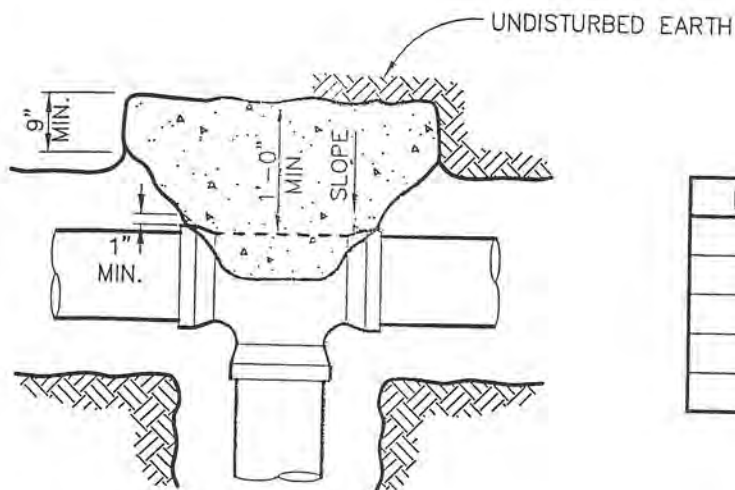
1. VALVE BOX SHALL BE SET IN SQUARE CONCRETE COLLAR EXTENDING 8" BEYOND BOX AND SHALL BE NOT LESS THAN 8" THICK, AND SHALL CONTAIN ONE NO. 4 HOOP. SEE VALVE DETAIL.
2. DETAILS SHOWN FOR VALVES ON HYDRANT LATERALS SHALL APPLY TO VALVES ON MAINS.
3. GATE VALVES SHALL BE ATTACHED DIRECTLY TO MAIN LINE TEE BY FLANGED CONNECTION.
4. FIRE HYDRANT INSTALLATION SHALL BE CONSTRUCTED WITH FLANGED CONNECTIONS FROM TEE TO HYDRANT.
5. HYDRANT BREAK-OFF BOLTS TO RISER SHALL BE GRADE A307A. FINISHED HEX NUTS SHALL CONFORM TO ASTM A563. TRIPAC FASTENER HYDRANT BREAK-OFF BOLTS OR EQUAL.
6. HYDRANT LOCATIONS SHALL BE SUBJECT TO APPROVAL OF FIRE CHIEF.

HYDRANT CLOW MEDALLION WET BARREL HYDRANT AND BASE W/ 5-1/4" SEAT. PAINT YELLOW.

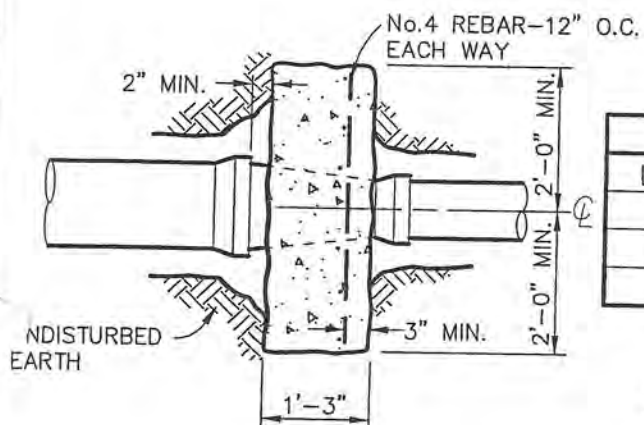
VALVES 6" RESILIENT SEAT GATE VALVE.

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
FIRE HYDRANT	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	W-6

REVISED (JUNE 2006)



PIPE SIZE	BEARING SIZE
12"	15 S.F.
10"	11 S.F.
8"	7 S.F.
6"	4 S.F.
4"	2 S.F.

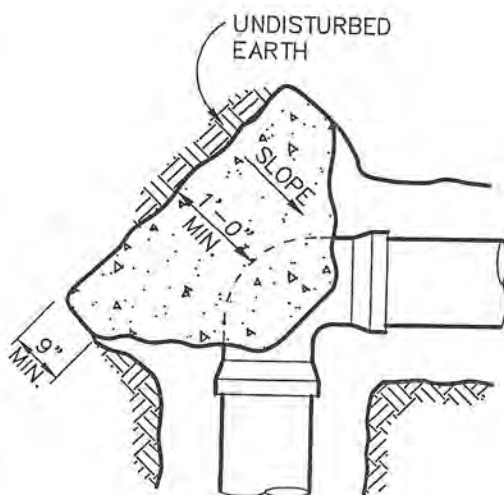


REDUCER SIZE		
LARGE END	SMALL END	BEARING AREA
12"	8"	9 S.F.
12"	10"	5 S.F.
8"	6"	4 S.F.

NOTE:
BEARING AREA SHALL BE AGAINST UNDISTURBED EARTH.
CONCRETE SHALL BE PLACED BEHIND BELLS OF FITTINGS.

BEARING AREAS SHOWN IN TABLE ARE BASED ON
ALLOWABLE SOIL PRESSURE OF 1500 PSF, AND ON 120 PSI
WATER PRESSURE.

CONCRETE SHALL BE CLASS A CONCRETE PER SECTION 90
OF THE STATE STANDARD SPECIFICATIONS.



PIPE SIZE	BEARING AREA			
	11-1/4° BEND	22-1/2° BEND	45° BEND	90° BEND
12"	3 S.F.	6 S.F.	12 S.F.	21 S.F.
10"	2 S.F.	4 S.F.	8 S.F.	15 S.F.
8"	2 S.F.	3 S.F.	5 S.F.	10 S.F.
6"	1 S.F.	2 S.F.	3 S.F.	4 S.F.
4"	1 S.F.	1 S.F.	1 S.F.	2 S.F.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL

THRUST BLOCK

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

W-7

REVISED (JUNE 2006)



PLAN

1/2" x 5" THREADED GALV. CINCH ANCHOR BOLTS (REDHEADS) WITH NUTS & WASHERS WELD 1-1/2" x 1-1/2" x 1/4" x 1-1/2" ANGLE CLIPS TO PIPE

- ③ AIR VAC. VALVE
- ② CORP STOP
- ① COUPLER

LINE MUST HAVE CONTINUOUS POSITIVE SLOPE TO SURFACE

CORPORATION STOP



WHEN WATER MAIN IS LESS THAN 36" DEEP: USE MUELLER No.15020 QUARTER BEND CORPORATION STOP, OR APPROVED EQUAL.

SADDLE AND CORPORATION STOP AS PER WATER SERVICE CONNECTION (DWG G-6) EXCEPT TAP MUST BE MADE ON TOP OF PIPE

- ① JONES 2605 1" x 3/4" COUPLER OR APPROVED EQUAL (COMP. ADAPTER)
- ② MUELLER 1" CURB STOP BALL VALVE OR APPROVED EQUAL
- ③ APCO 142C - 1" OR 144C - 2" OR CRISPIN A10 - 1" OR A20 - 2" OR APPROVED EQUAL
- ④ RISE MUST BE MINIMUM 18" BELOW GUTTER OR DITCH FLOW LINE
- ⑤ LOCATOR WIRE 12 AWG INSULATED

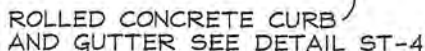
CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

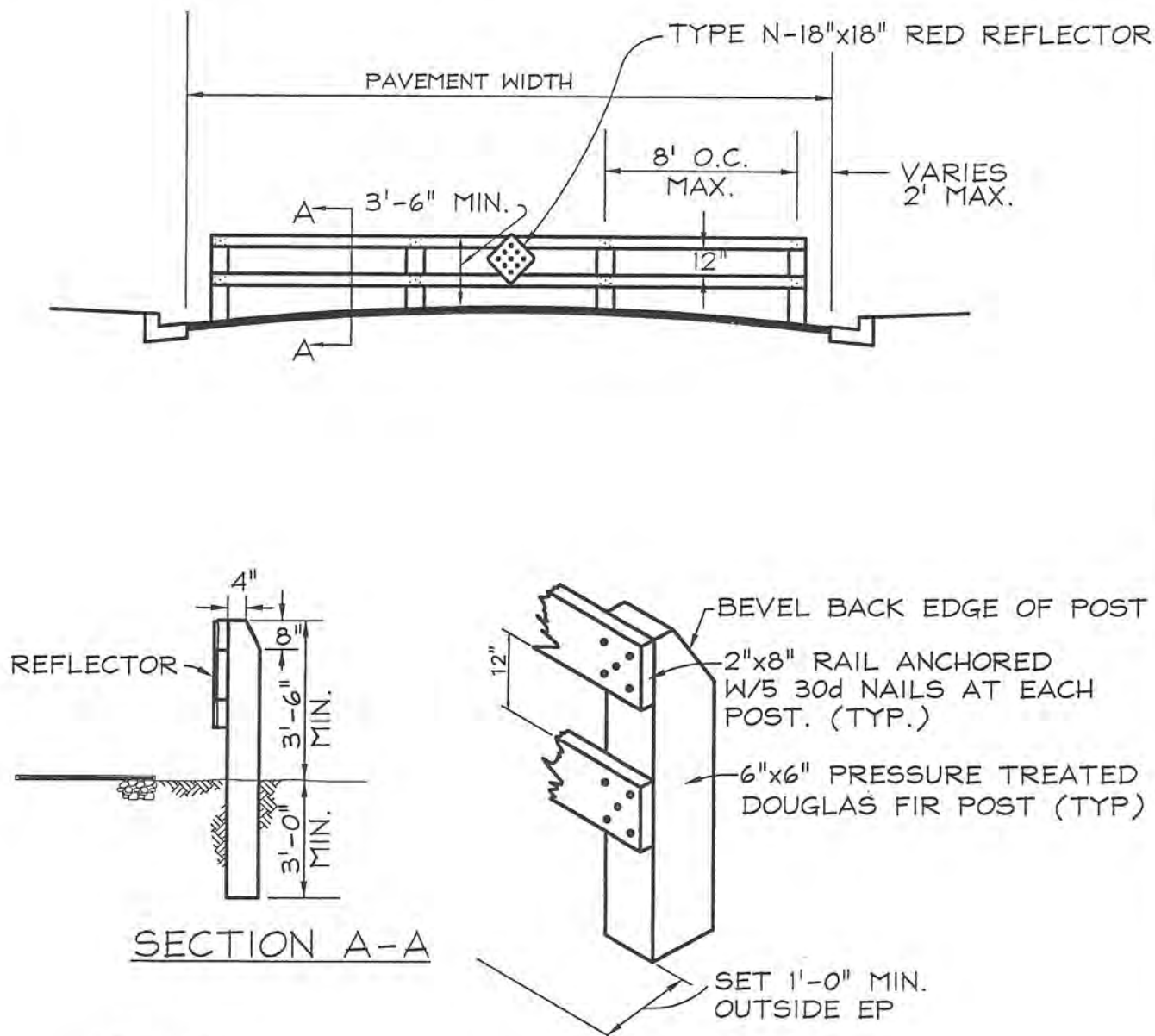
STANDARD DETAIL
AIR & VACUUM
RELEASE VALVE

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

W-8



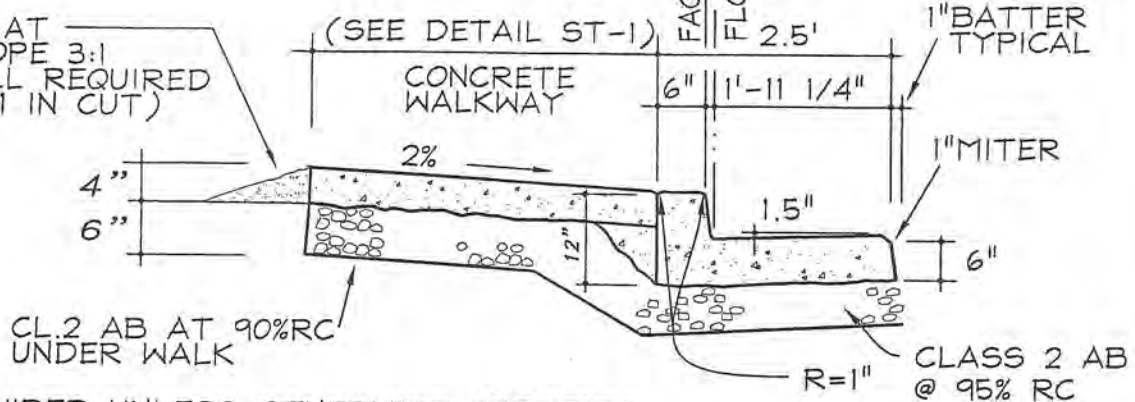


NOTES:

1. RAILS TO BE 2" x 8" CLEAR DOUGLAS FIR S4S AND POSTS TO BE 6"x 6" P.T. DOUGLAS FIR.
2. BUTT ALL RAIL JOINTS ON CENTER OF POST.
3. ALL EXPOSED WOOD SHALL BE PAINTED ENAMEL WHITE, 2 COATS OR APPROVED EQUAL
4. STANDARD TYPE-N, 18"x18" REFLECTOR TO BE CENTERED ON BARRICADE.

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
WOOD BEAM BARRICADE	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	ST-2

TOP SOIL AT
80%RC SLOPE 3:1
WHERE FILL REQUIRED
(SLOPE 2:1 IN CUT)

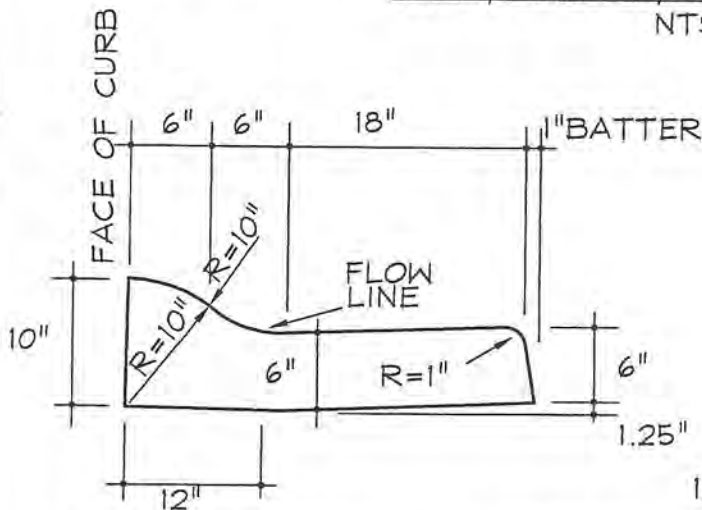


NOTES:

1. CURB REQUIRED UNLESS OTHERWISE SPECIFIED.
2. LOCATE 1/2" TRANSVERSE EXPANSION JOINTS OF ASPHALT IMPREGNATED CELOTEX IN SIDEWALK, CURB AND GUTTER AT 20' INTERVALS MAXIMUM.
3. ALL CONCRETE TO BE CLASS "B" OR BETTER.
4. FORMS SHALL BE APPROVED BY PUBLIC WORKS DIRECTOR PRIOR TO PLACEMENT OF CURB & GUTTER.

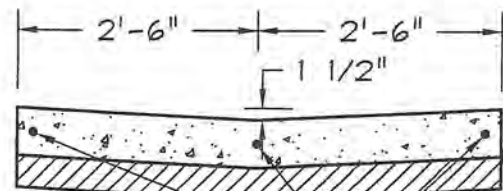
CURB, GUTTER, & WALKWAY DETAIL

NTS



ROLL CURB & GUTTER

NTS



1/2" ϕ REINFORCING BAR

4" AB
@ 95% RC

6" CONC.

V-GUTTER

NTS

NOTES:

1. VERTICAL CURB & GUTTER TO BE USED AT ALL CURB RETURNS.
2. 1/4" EXPANSION JOINT AT BOTH ENDS & MIDPOINT OF CURB RETURN.
3. 1/4" WIDE EXPANSION JOINTS AT 20' INTERVAL MAXIMUM.
4. 1/8" SCORED CONTROL JOINTS AT 10' INTERVAL MAXIMUM.
5. GUTTER PAN WIDTH MAY BE CHANGED WITH APPROVAL OF CITY ENGINEER.

CITY OF PLYMOUTH
PUBLIC WORKS DEPARTMENT

STANDARD DETAIL

CURB, GUTTER & WALKWAY

APPROVED: SELBY BECK, DIRECTOR
PREPARED: WEBER, GHIO-CITY ENGINEER

DATE: DEC 2005

ST-4

REVISED (JUNE 2006)

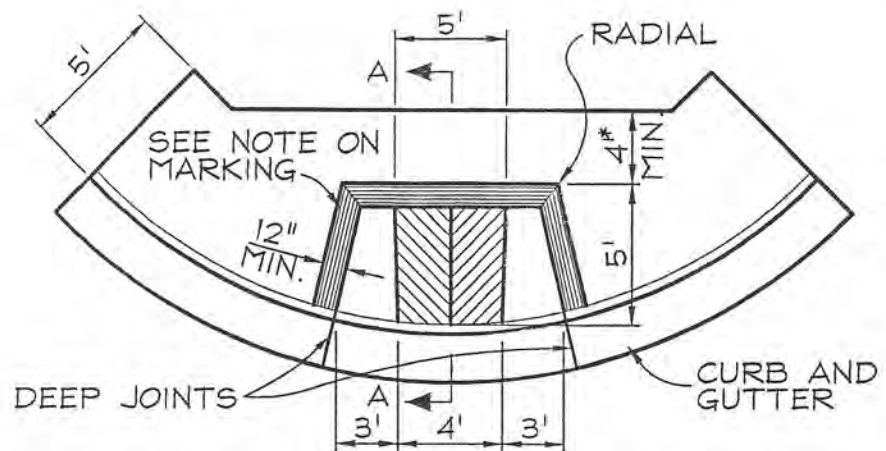
SLOPE - RAMP WIDTH SHALL NOT EXCEED 1" RISE IN 12" OF RUN, OR 8.33% MAX. SLOPE.

FINISH - CENTER RAMP SHALL HAVE HERRINGBONE GROOVES IN ACCORDANCE W/CALTRANS CURRENT STD. DETAILS. REMAINING RAMP SHALL BE NON-SLIP HEAVY BROOM FINISH OR EQUAL TO PROVIDE CONTRASTING FINISH WITH ADJACENT SIDEWALK.

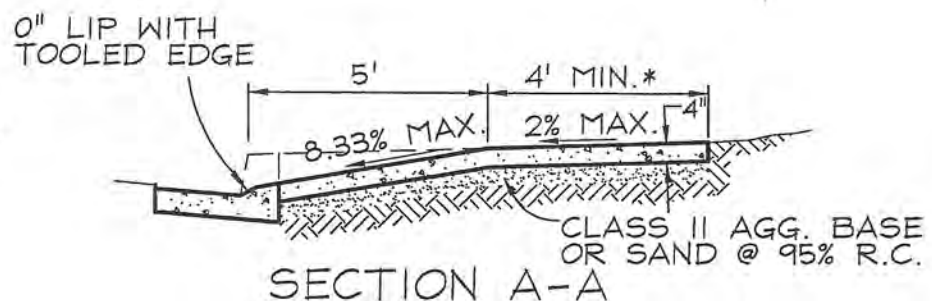
CONCRETE - SHALL CONFORM TO SECT. 73 OF CALTRANS STD. SPECIFICATIONS.

MARKINGS - SEE CURRENT CALTRANS STD. DETAILS. MARKINGS SHALL BE APPROVED BY PUBLIC WORKS DIRECTOR PRIOR TO PLACEMENT OF CONCRETE.

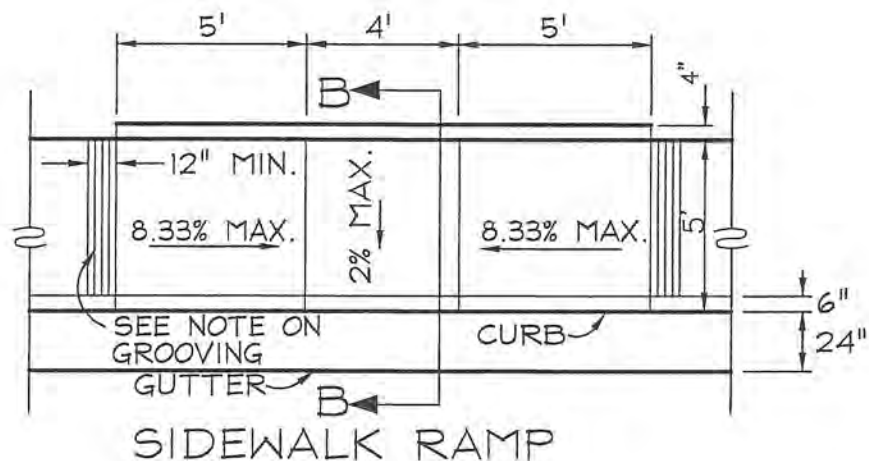
*MAYBE REDUCED BY BUILDING OFFICIAL WHEN CIRCUMSTANCE WARRANT VARIANCE.



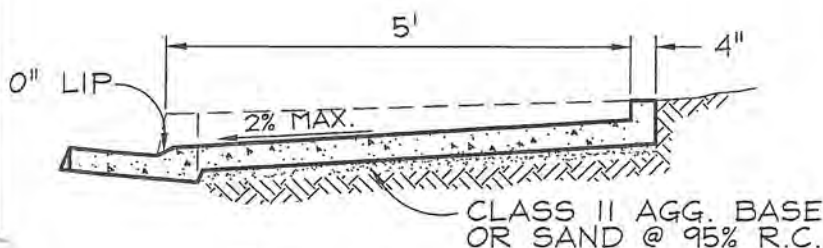
CURB RETURN RAMP



SECTION A-A

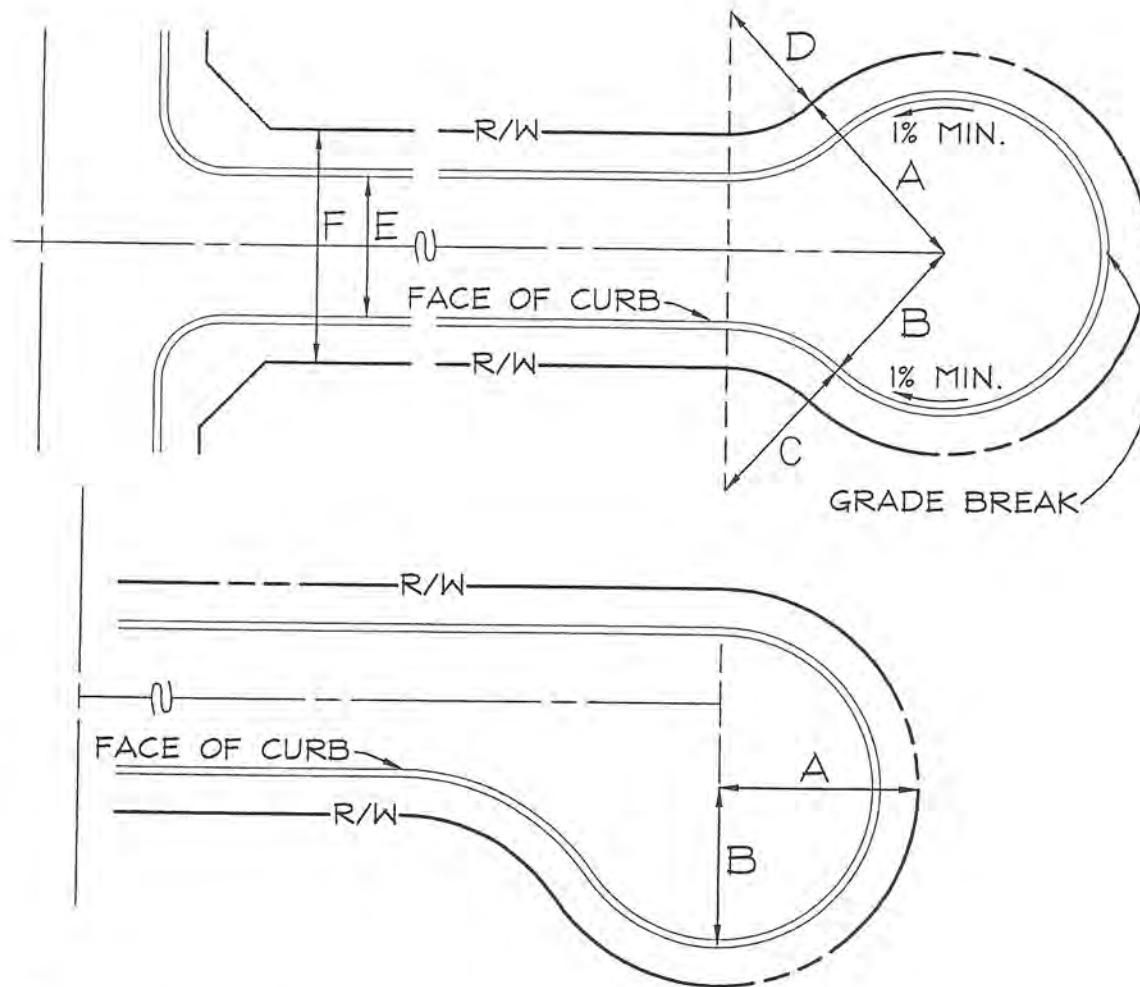


SIDEWALK RAMP



SECTION B-B

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
WHEELCHAIR RAMP	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	ST-5



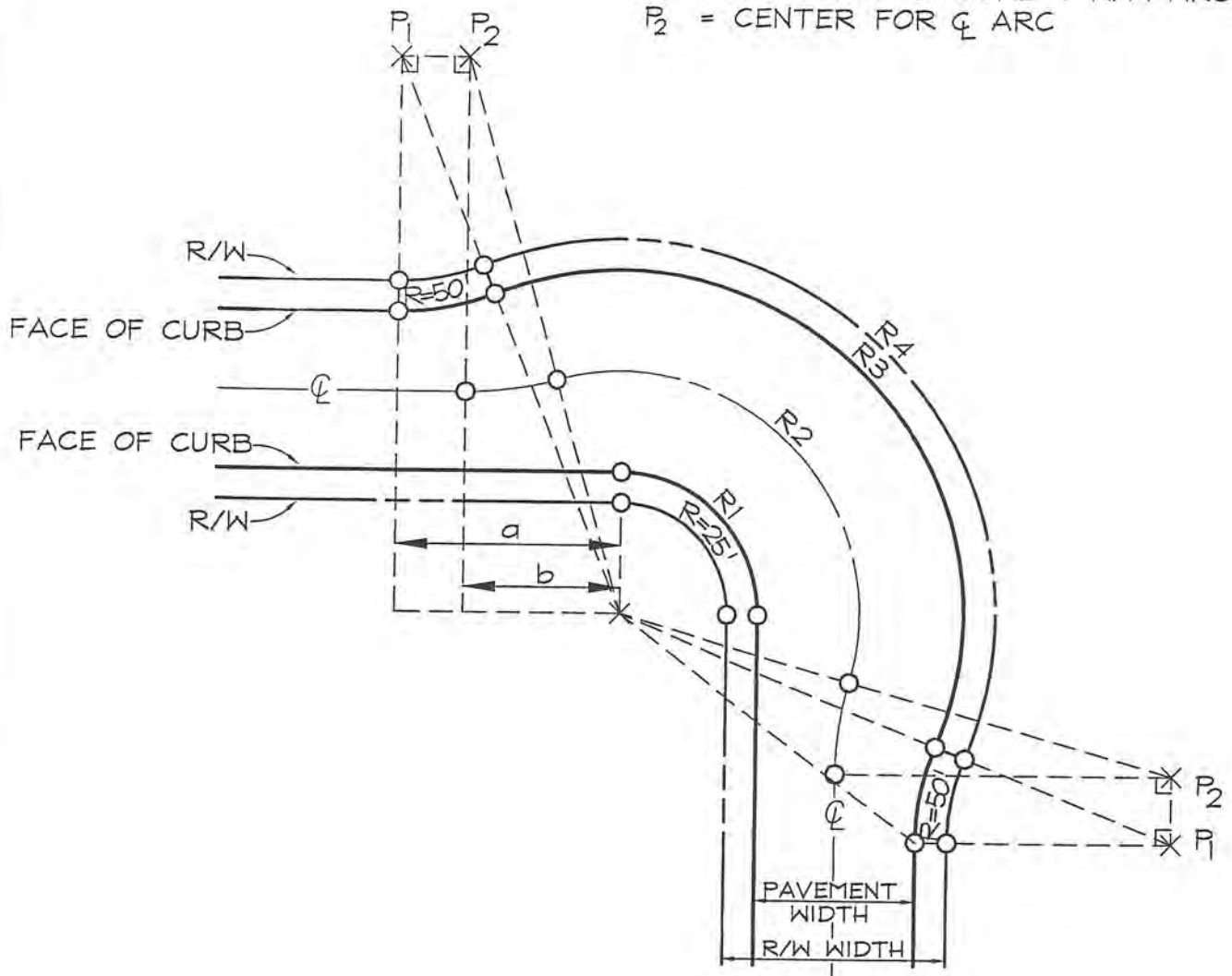
NOTES:

1. NO MORE THAN 20 SINGLE FAMILY RESIDENCES MAY BE SERVED BY A CUL-DE-SAC STREET (OR A TEMPORARY DEAD-END STUBBED STREET).
2. DIMENSION E & F SUBJECT TO SPECIFIC PROJECT APPROVAL.

TABLE OF DIMENSIONS					
A	B	C	D	E	F
50'	40'	32'	20'	32'	50'

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
RESIDENTIAL CUL-DE-SAC	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	ST-6

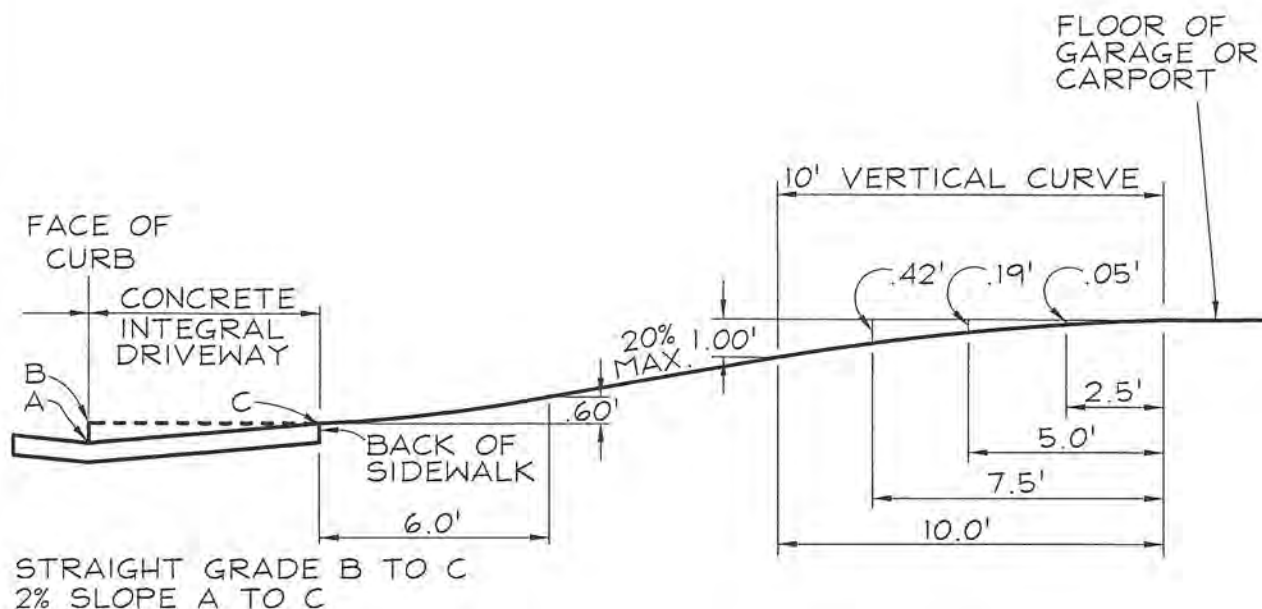
P_1 = CENTER FOR CURB & R/W ARCS
 P_2 = CENTER FOR ϕ ARC



R/W WIDTH	PAVEMENT WIDTH	R ₁ CURB	R ₂ CL	R ₃ CURB	R ₄ R/W	a	b	P ₁ TO P ₂
60'	40'	35'	60'	85'	95'	52.91'	37.10'	15.81'
50'	32'	25'	60'	79'	85'	62.91'	47.10'	15.81'

NOTE: KNUCKLE DIMENSIONS TO VARY PROPORTIONALLY WITH OTHER R/W AND PAVEMENT WIDTHS. OTHER R/W & PAVEMENT WIDTHS SUBJECT TO APPROVAL OF CITY ENGINEER.

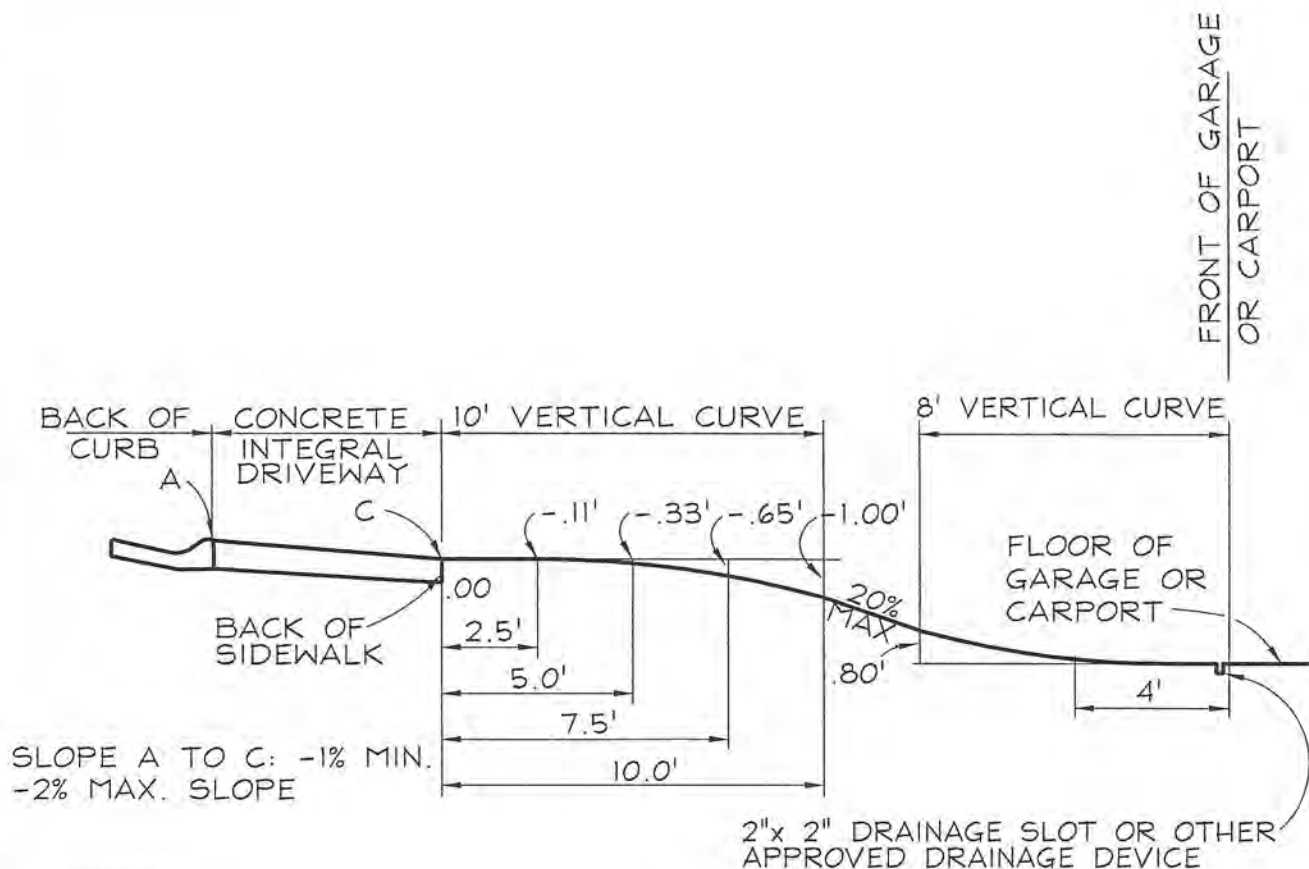
CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
INTERSECTION BULB	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	ST-7



NOTE:

1. MAXIMUM RISE, AND THE RUN, SHALL BE MEASURED FOR THE WORST CONDITION BETWEEN THE BACK OF THE SIDEWALK AND THE FINISHED FLOOR AT THE GARAGE OR CARPORT ENTRANCE.
2. NON-INTEGRAL DRIVEWAY RAMPs MUST BE POURED AS SOON AS PRACTICABLE AFTER CONSTRUCTION OF CURB AND GUTTER.
3. WHENEVER POSSIBLE BUILDING DESIGNERS AND ENGINEERS SHOULD ATTEMPT TO MAXIMIZE A PARKING AREA ADJACENT TO GARAGE WHEN LAYING OUT DWELLINGS AND THEIR DRIVE ACCESS TO THE PUBLIC STREET.
4. IMPROVEMENTS BEHIND ROAD R/W ARE RECOMMENDATIONS ONLY AND ARE SUBJECT TO SITE PLAN APPROVAL & DIRECTION OF THE BUILDING OFFICIAL.

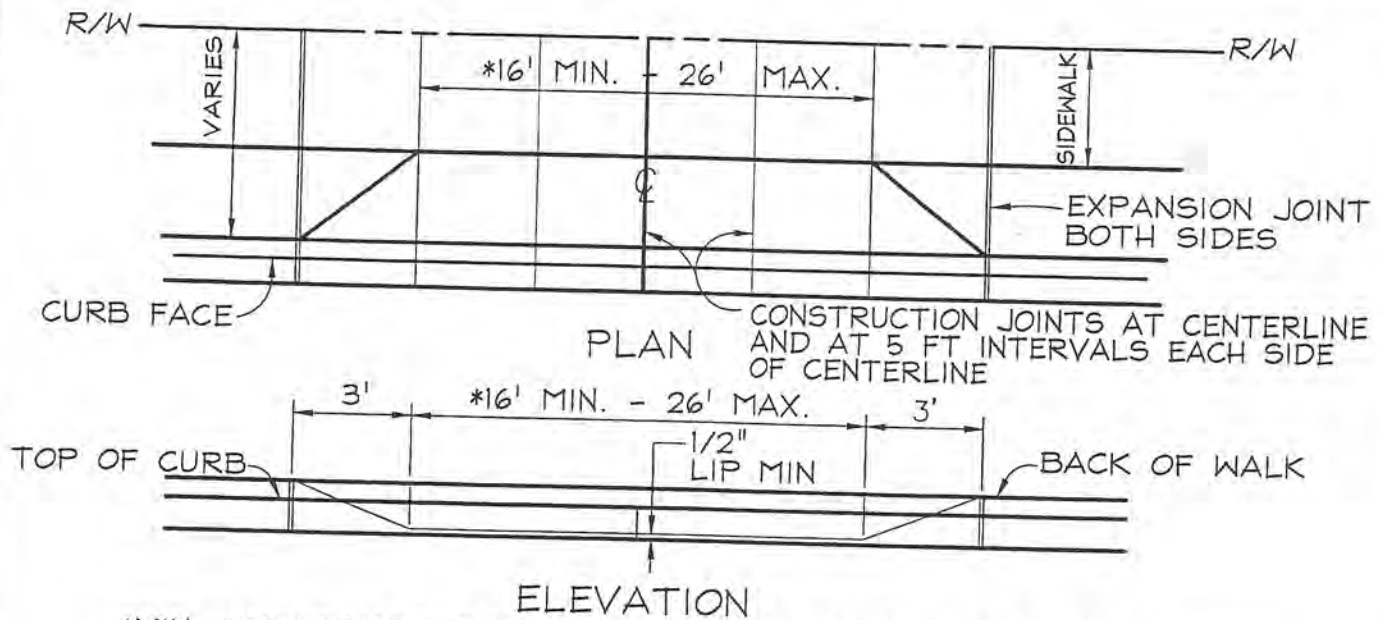
CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
UP SLOPE DRIVEWAY	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: AUG 2009	ST-8



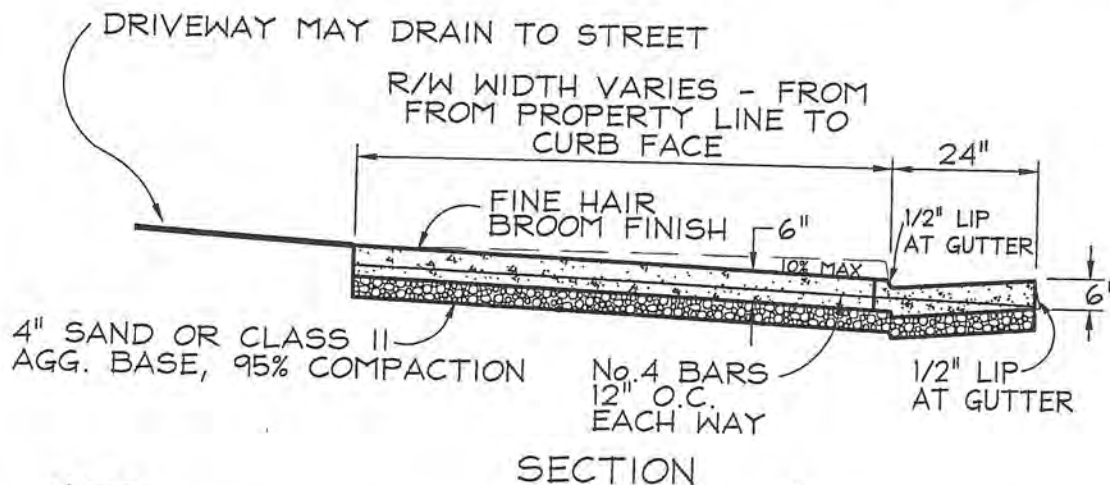
NOTES:

1. MAXIMUM RISE, AND THE RUN, SHALL BE MEASURED FOR THE WORST CONDITION BETWEEN THE BACK OF THE CURB AND THE FINISHED FLOOR AT THE GARAGE OR CARPORT ENTRANCE.
2. DRIVEWAY RAMPS SHALL BE PLACED AS SOON AS PRACTICABLE AFTER SITE GRADING IS COMPLETED.
3. WHENEVER POSSIBLE BUILDING DESIGNERS AND ENGINEERS SHALL MAXIMIZE PARKING AREAS ADJACENT TO GARAGE WHEN LAYING OUT DWELLINGS AND DRIVEWAY ACCESS TO PUBLIC STREETS.
4. IMPROVEMENTS BEHIND ROAD R/W ARE RECOMMENDATIONS SUBJECT TO SITE PLAN APPROVAL & DIRECTION OF BUILDING OFFICIAL.

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
DOWN SLOPE DRIVEWAY	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: AUG 2009	ST-9



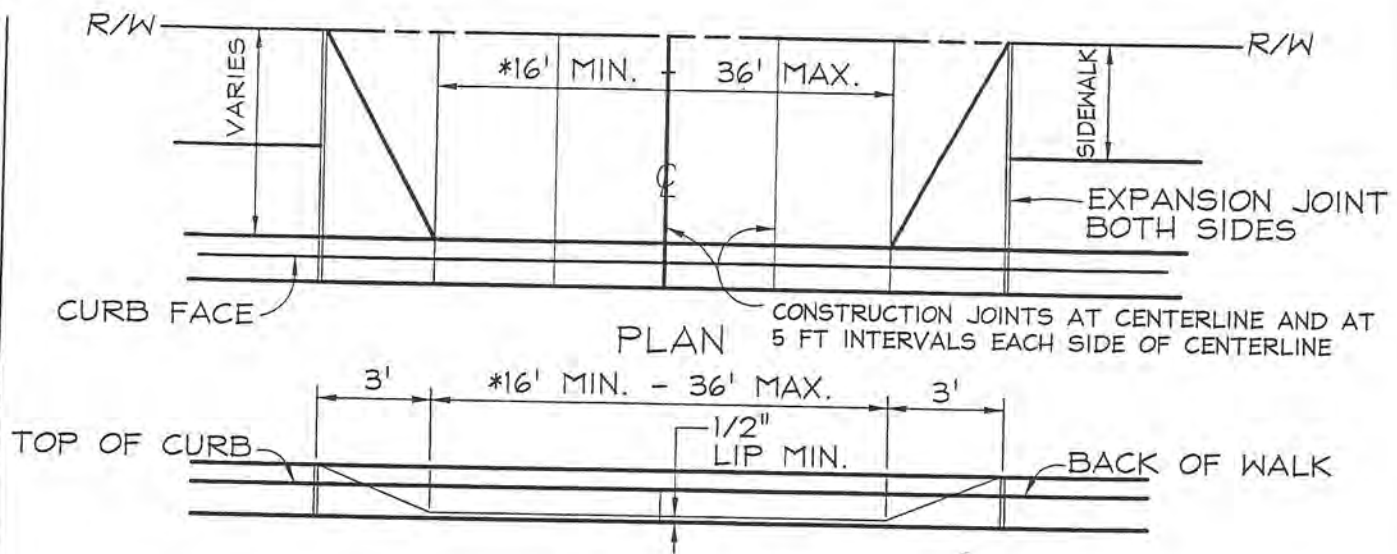
*MIN. DRIVEWAY WIDTH OF 30' FOR TWO-WAY TRAFFIC. REDUCED DRIVEWAY WIDTHS MAY BE USED WITH APPROVAL OF THE BUILDING OFFICIAL.



NOTES:

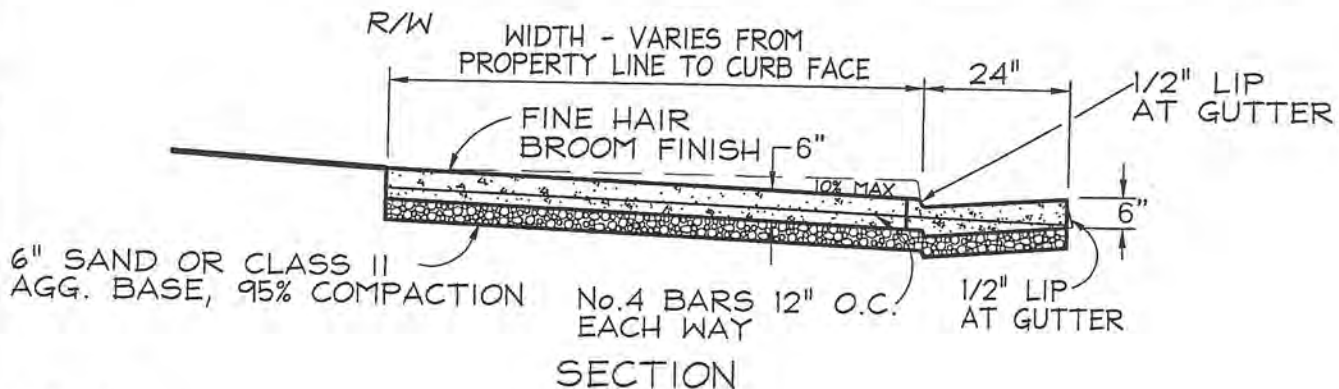
1. CONCRETE - 6" THICK IN DRIVEWAY AND SIDEWALK IN DRIVEWAY AREA. CONCRETE SHALL BE CLASS B CONCRETE IN ACCORDANCE WITH THE STATE STANDARD SPECIFICATIONS.
2. DRIVEWAY DEPRESSIONS IN NEW CURB AND GUTTER WILL NOT BE PERMITTED WITHOUT A RAMP.
3. ALLOWABLE FRONTAGE - MAX 50% OF STREET FRONTAGE, AND NOT MORE THAN TWO DRIVEWAYS. SUBJECT TO APPROVAL OF BUILDING OFFICIAL.
4. MULTI-UNIT DEVELOPMENTS - SHALL USE #4 REBAR AND CLASS A CONCRETE THROUGHOUT THE DRIVEWAY SECTION.
5. 12' MIN. DRIVEWAY ONLY WITH PRIOR APPROVAL OF BUILDING OFFICIAL.
6. DRIVEWAY TO CONFORM W/ EXIST SIDEWALK.
7. WHERE HIGH STREET CROWN EXIST, DRIVEWAY RAMP MAY BE EXTENDED TO BACK OF SIDEWALK.

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
RESIDENTIAL DRIVEWAY	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	ST-10



ELEVATION

*MIN. DRIVEWAY WIDTH OF 30' FOR TWO-WAY TRAFFIC. REDUCED DRIVEWAY WIDTHS MAY BE USED WITH APPROVAL BY THE CITY ENGINEER.



NOTES:

1. CONCRETE - 6" THICK IN DRIVEWAY AND SIDEWALK IN DRIVEWAY AREA. CONCRETE SHALL BE CLASS B CONCRETE IN ACCORDANCE WITH THE STATE STANDARD SPECIFICATIONS.
2. DRIVEWAY DEPRESSIONS - IN NEW CURB AND GUTTER WILL NOT BE PERMITTED WITHOUT A RAMP.
3. CONSTRUCTION JOINTS - SHALL BE 1/2" MIN. DEEP AND CORRESPOND WITH LINES IN ADJACENT WALK.
4. INDUSTRIAL DRIVEWAYS - SHALL BE COMMERCIAL D/W STANDARD OR AS DIRECTED BY BUILDING OFFICIAL.

CITY OF PLYMOUTH PUBLIC WORKS DEPARTMENT	
STANDARD DETAIL	
COMMERCIAL DRIVEWAY	
APPROVED: SELBY BECK, DIRECTOR PREPARED: WEBER, GHIO-CITY ENGINEER	
DATE: DEC 2005	ST-11