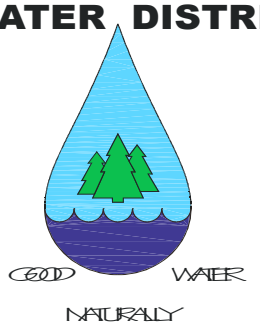
LAKE FOREST PARK
WATER DISTRICT



(Formerly KCWD83)

COMPREHENSIVE WATER SYSTEM PLAN 2005

November 30, 2005

LAKE FOREST PARK WATER DISTRICT

4029 NE 178TH STREET
LAKE FOREST PARK, WA 98155
(206) 365-3211

COMPREHENSIVE WATER SYSTEM PLAN 2005

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LAKE FOREST PARK WATER DISTRICT
COMPREHENSIVE WATER SYSTEM PLAN 2005

TABLE OF CONTENTS

DISTRIBUTION

The distribution system includes water mains, valves, fire hydrants, and services. This section summarizes the District's design and performance standards for distribution works and then describes their operation and status. Findings of a detailed hydraulic analysis follow in a subsequent section.

(a) Design and Performance Standards

All system facilities designed to meet Good Engineering Practice and DOH guidelines as outlined in DOH "Water System Design Manual", dated June 1999, DOH #331-123. Fire flows shall at a minimum meet the current ISO fire flow schedule.

Basic distribution system performance criteria summary:

- Maximum desirable service pressure at 120 psi under static conditions.
- Minimum desirable service pressure at 30 psi at peak hourly demand.
- Minimum residual service pressure at 20 psi during maximum day demand plus fire flow.
- Minimum available fire flow shall be 1,000 gpm at maximum day flow, duration 2 hours
- Minimum water main pressure under any event is 5 psi except for transmission mains adjacent to reservoirs.
- Maximum velocity eight feet per second at maximum day, preferably under peak hour.
- Minimum flushing velocity of 2.5 feet per second for all mains.
- Customers are responsible for reducing pressures that are above 80 psi at service point.

PRV Design and Performance Criteria:

- All PRVs shall be designed with parallel valves to be able to safely carry required minimum and maximum flows without valve needling or hydraulic head loss.
- All PRV stations to include pressure relief capable of limiting downstream pressure increase to less than 25 psi in the event of valve failure.
- All PRV stations to have suitable precast chambers with approved access, ventilation and drainage.

Water Main Design Criteria:

- Loop all new mains for redundancy and water circulation.
- Mains not serving fire hydrants sized for customer demand only to avoid stagnation.
- Eight inch minimum diameter for all mains serving fire hydrants.
- Valve spacing in new water main design not to exceed 350 feet; minimum three valves per cross, and two valves per tee including fire hydrant lateral connections.
- Air/vacuum release valves to be placed at all high points
- Cover depth at three foot minimum, all pipe to be buried with 14 gauge tracer wire for radio location.

- Pipe construction, sleeved ductile iron for sizes six inch or over; 200 psi polyethylene or PVC for smaller size mains not serving fire hydrants. High Density Polyethylene (HDPE) is suitable for transmission mains and undeveloped areas.

Fire Hydrant Design Criteria:

- Fire hydrant spacing in all new construction is not to exceed 700 feet with no more than 350 feet to the farthest property line.
- Commercial and multi-family areas, fire flow less than 2,500 gpm. 400 feet maximum between hydrants. All buildings within 300 feet of one hydrant, or as required by Fire Marshall.
- High fire flow areas, greater than 2,500 gpm. One accessible fire hydrant for each 1,250 gpm of required flow within 150 feet of building. One additional accessible fire hydrant for each 1,250 gpm within 450 feet of building. Buildings having required fire flows of less than 2,000 gpm may have fire hydrants on one side of the building only. When the required fire flow is over 2,500 gpm, the fire hydrants shall be served by a main which loops around the building or complex of buildings and reconnects back into the distribution main.
- All hydrants are to be accessible to fire department pumpers and over roads capable of supporting such fire apparatus. The Fire Marshall shall determine the location of the fire hydrants depending on utility, topography and building location.

Service Connection Design Criteria

- Service meters will be replaced on a periodic basis which may coincide with manufacturers warranty, or may be extended up to 50% based on test sampling of meters removed from service.
- New service lines will be constructed of 200 psi class polyethylene and will have an attached tracer wire with termination in valve boxes for easy location.
- It is the customer's responsibility to provide internal pressure relief. The District will notify all existing customers in advance if a check valve is to be installed in their service.

- Connection Sizes

a. The size of a service connection and meter shall be determined by the required flow and shall not be less than the following (sizing for larger capacities shall be made by the District engineer):

Size of		**Water Pressure (PSI)**							
Water	Service	30	35	40	45	50	55	60	65
Meter	Line	Gallons Per Minute (GPM)							
5/8"	3/4"	5.3	7.5	10.5	12.8	14.3	15.0	16.5	17.3
3/4"	3/4"	7.5	10.5	12.0	13.5	16.5	18.0	21.0	22.5
3/4"	1"	11.3	15.0	17.3	20.3	22.5	24.0	26.3	27.8
1"	3/4"	9.0	11.3	13.5	15.0	18.0	19.5	22.5	24.0
1"	1"	13.5	18.0	20.3	25.5	28.5	30.0	31.5	31.5

b. All multiple unit residences, apartments, manufactured home parks, and motels shall be serviced by one connection and one meter, except that the owner may elect to treat each unit as a separate single residence and in such case there shall be installed an individual meter for each unit at the owner's expense.

c. The pipe size for a service connection shall not be less than the size of the meter as set forth in the water application. At the discretion of the District, larger pipes may be installed to provide water to more than one meter from a single connection, provided such single pipe installation results in an appreciable savings in the total installation costs.

The above items are summarized design standards for the network. Detailed construction standards are delineated in Part Seven of this document.

(b) General Description and Condition

The District's distribution system includes over 12 miles of looping and dead end mains ranging in size from two inch to twelve inch that convey water by gravity from the HGL 449 and HGL 292 reservoirs. **Figure 3-6** is a map of the network illustrates the layout, pressure zones and size. The mains serve 860 service meters and 93 fire hydrants over terrain ranging from a low elevation of 20 feet near Lake Washington up to 350 feet in the north end of the District on 51st Place NE There are also 72 lots in the north end of the District that are presently served by NUD and SWD but are within District boundaries. The highest service elevation of these lots is over 430 feet. The District has plans to assume service for at least some of these lots within the next ten years, and these plans are considered in the hydraulic analysis and plan in the following section.

PART SEVEN - CONSTRUCTION STANDARDS

This section outlines policies and details of the District's standards for construction of water system facilities including water mains, pumping stations, PRV stations, reservoirs, wells, service lines and meters. Please refer to Part III System Analysis for discussion of design, performance and engineering standards.

I. DEVELOPER EXTENSION POLICIES

POLICY

It is the policy of the District to encourage extensions of the water system to serve development within the boundaries of the District. These extensions (a) may be constructed by the District and financed by means of assessments against the property benefited within the limits of a utility local improvement district or (b) may be constructed by the property owner or developer in accordance with these regulations.

STANDARDS FOR WATER SYSTEM DESIGN

All extensions to the water system must at minimum conform to the design standards of the District, and to Washington State of Department of Health Water System Design Manual, 1999 or later.

APPLICATION FOR EXTENSIONS

(a) Application for extension of the District water system to serve newly developed property shall be made by the owner of the property or his agent on the official application form supplied by the District. (See Appendix 7-A). The Application for extension must be submitted to the District and approved by the Commissioners before design and construction.

(b) It is the present policy for the District to contribute for cost of general facilities, such as oversized mains, PRVs and pumping stations, proportionately as the same are considered to benefit other portions of the District. The District engineer will determine, subject to approval of the Commissioners, whether improvements required to be installed by a developer, may be considered general facilities of benefit to other portions of the District, and the amount of the District's fair proportionate share of the cost of such facilities. The Commissioners will determine what amount, if any, will be contributed by the District.

APPROVAL OF WATER MAIN INSTALLED

Installation of water mains shall be by persons approved by the District. Installers must submit evidence of their competence and experience satisfactory to the District Engineer and Operations Manager.

RELATION BETWEEN APPLICANT AND ENGINEERS

It is expected that the applicant will extend normal courtesies to the District Engineer and other District representative in giving reasonable notice of the time and place of work to be inspected. In particular, the applicant shall:

- Notify the District in writing at least 48 hours in advance of the time of beginning of construction; and
- Complete the work, including clean-up, to the point where the work complies with the plans and specifications and is ready for acceptance by the District, within the time limit provided.

WATER SERVICE STUBS

Service stub locations will be referenced and locations marked with a 2 x 4 stake. Wire will be attached to the service stub and the stake. The 2 x 4 stake will be painted white with the word "water" written on that portion facing the street. These reference stakes will be removed by District personnel only. Service stubs will terminate in vertical position 20-inches below finished grade of the lot to make them readily available by hand digging by District personnel. It is understood that if the reference stakes are removed or destroyed and the service stub cannot be located in a reasonable time by other reference information such as plat maps or curb markings. The added expense in locating service stubs will be the responsibility of the deveoper.

It shall be the responsibility of the developer to insure that his contractors and sub-contractors are aware of the conditions of this regulation and act in compliance with these terms.

WATER LINE EXTENSION DISTANCES

Extensions shall be constructed the full width of the property unless otherwise approved by the District Engineer.

VARIANCES

All variances from these requirements must be granted by the Commissioners.

The owner requesting a variance shall make written application to the Board of Commissioners setting forth the name of the owner of the properties to be served, along with the legal description of the property and a dimensioned sketch showing the proposed installation. The application shall state the reasons for requesting the variance and the agreement of the applicant to pay all costs in the expenses of the District incurred in processing the application.

The application for variance shall be accompanied by a fee which shall not be refundable but which shall be applied to the costs and expenses of the District in processing the application.

Upon receipt of the application a date shall be set for a public hearing on the application and notice shall be sent to the property owners situated within 300 feet of the proposed variance facility, containing a brief statement of the proposed variance and the date of hearing, and a similar notice shall be published in the newspaper of record at least 10 days and no more than 20 days prior to the date set for the public hearing.

In considering the application for variance, the Commissioners shall consider the following factors:

a. Whether or not the variance would have an adverse affect upon the accomplishment of the System Plan.
b. Whether or not the proposed variance is consistent with the System Plan.
c. Whether or not there would be adverse effects upon the joining or neighboring properties.
d. Any benefits to the District generally resulting from the proposed variance.
e. Whether or not the applicant will be deprived of a use of his property enjoyed by other property owners similarly situated.

A variance may be granted by the Commissioners only upon written justification. Copies of the written justification shall be mailed to the applicant, all parties entitled to notice and all parties who make a written request for such

II. CONSTRUCTION CONTRACT SPECIFICATIONS

Detailed construction contract specifications provide a framework for tender submissions, agreement between the owner and contractor, general specifications, and detailed specifications.

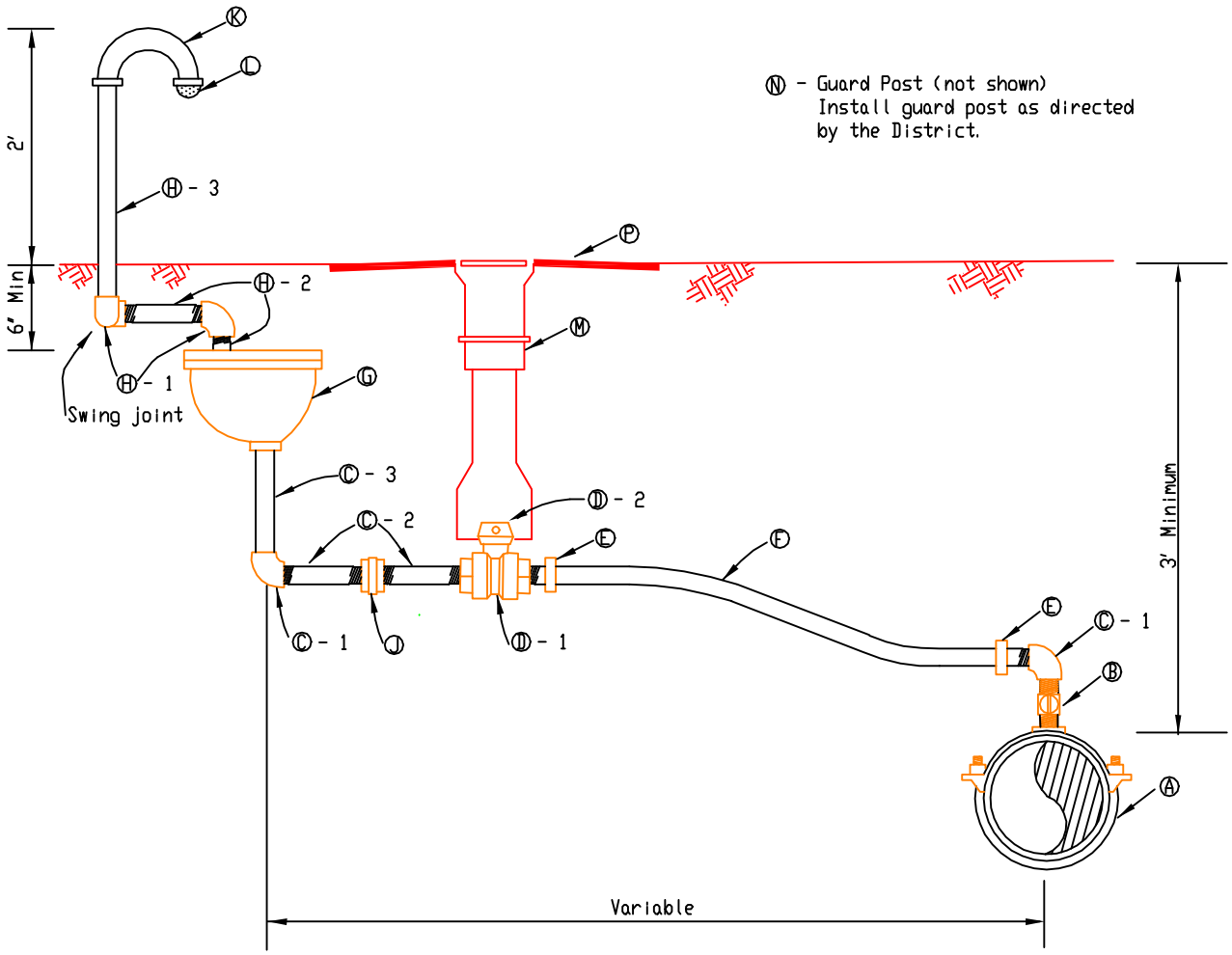
The District has recently updated its construction contract specifications based on the specification used by Cedar River Water & Sewer District with modifications specific to the District. A copy of the contract document appears in **Appendix 7-B.** It is the District's policy to support as much standardization as possible in the development of contract specifications, and it will support regional contract specification initiatives that are practical for District projects.

III. DESIGN DETAILS

Construction design details for the most common infrastructure elements are shown in **Appendix 7-C**. These detailed drawings are intended for use in all projects and are available in both electronic and paper format for developer extension projects. It is the District's policy to support a common standard in design details especially with nearby water purveyors.

INDEX OF APPENDICES

APPENDIX 7 - C INFASTRUCTURE CONSTRUCTION DESIGN DETAILS



BILL OF MATERIALS

MARK	QUANTITY	DESCRIPTION
Ⓐ	1	Single Strap Saddle, Romac 101S or Equal with AWWA taper tap
Ⓑ	1	1" Corporation Stop, AWWA inlet MIP
Ⓒ - 1	2	1" x 90° Brass Elbow
Ⓒ - 2	2	1" Brass Nipple
Ⓒ - 3	1	1" Brass Pipe
Ⓓ - 1	1	1" Ball Valve
Ⓓ - 2	1	Operating Nut
Ⓔ	2	1" MIP x Pack Joint Adaptor
Ⓕ	1	1" HI-Mol Pipe
Ⓖ	1	1" Air and Vacuum Valve, screwed, APCO No. 143C or equal
Ⓗ - 1	2	1" x 90° GIP Elbow
Ⓗ - 2	2	1" GIP nipples
Ⓗ - 3	1	1" GIP
Ⓙ	1	1" Brass Union
Ⓚ	1	1" Return Bend, open pattern
Ⓛ	1	1" Beehive Strainer
Ⓜ	1	18"x24" Valve Box, Seattle Std. or APWA #67
Ⓝ	2	Standard 9" Concrete Guard Posts (see Hydrant Guard Post Detail)
Ⓟ	1	2'x2' Asphalt Pad

7

1" AIR & VACUUM RELEASE VALVE ASSEMBLY

NO SCALE

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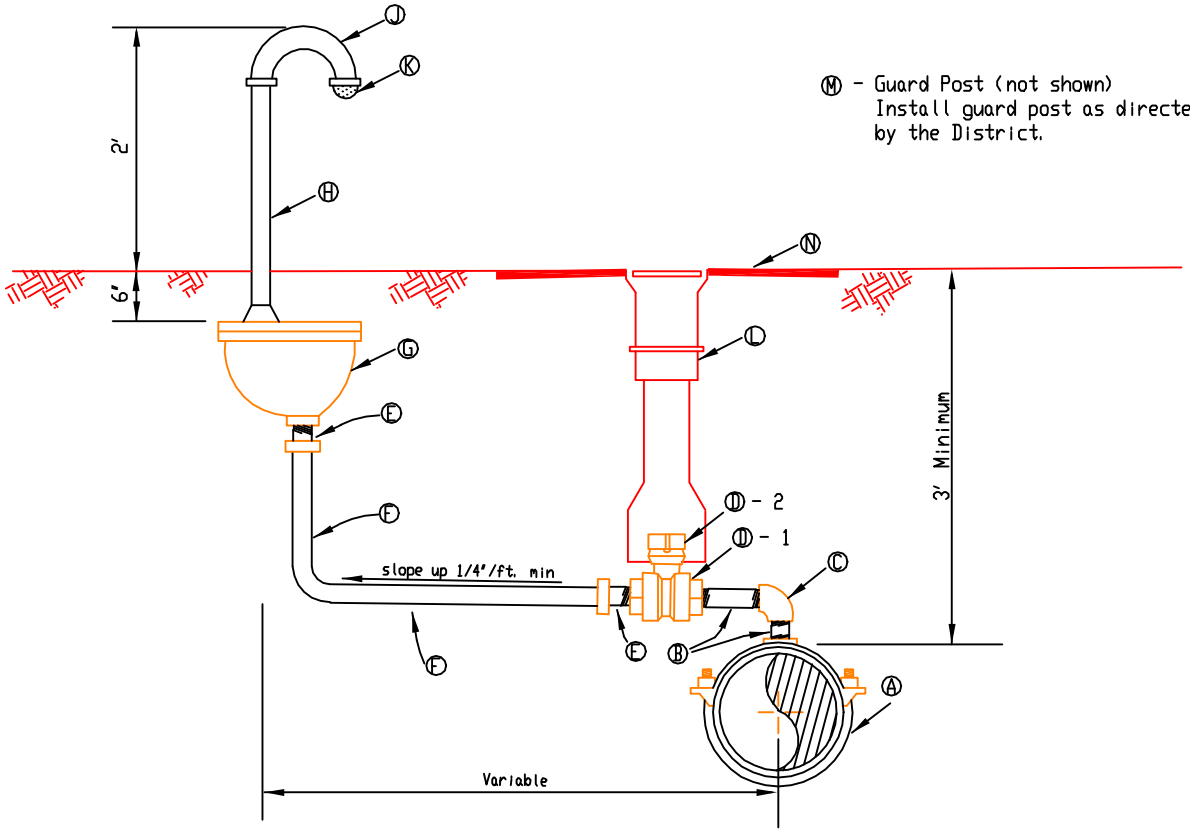
WDETAVR1.DWG

LAKE FOREST PARK WATER DISTRICT

STANDARD WATER DETAILS



BILL OF MATERIALS

MARK	QUANTITY	DESCRIPTION
Ⓐ	1	C.I. Tee, 2" IPT Tap or Romac (202 S) wide band stainless steel Saddle with 2" IPT
Ⓑ	2	2" Brass Nipple
Ⓒ	1	2" x 90° Brass Elbow
Ⓓ - 1	1	2" Ball Valve with Ford QT-67 Adapter
Ⓓ - 2	1	Operating Nut
Ⓔ	2	2" MIP Pack Joint Adaptor
Ⓕ	2	2" HI-Mol Pipe
Ⓖ	1	2" Air and Vacuum/Combination Air Release Valve - APCO No. 145C or equal
Ⓗ	1	2" GIP
Ⓙ	1	2" Return Bend, Open Pattern
Ⓚ	1	2" Beehive Strainer
Ⓛ	1	18"x24" Valve Box, Seattle Std. or APWA #67 (See Detail #10)
Ⓜ	2	Standard 9' Concrete Guard Posts (see Hydrant Guard Post Detail)
Ⓝ	1	2'x2' Asphalt Pad

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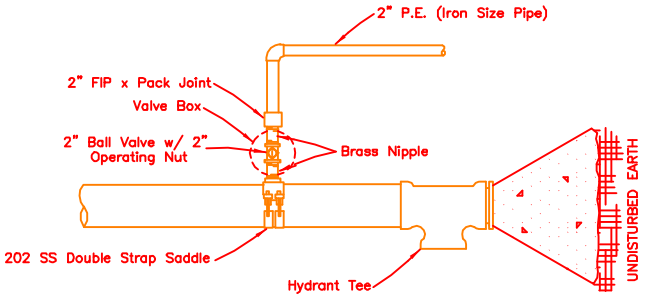
2" AIR & VACUUM RELEASE VALVE ASSEMBLY

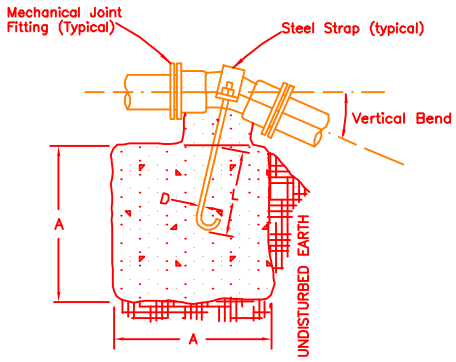
NO SCALE

LAKE FOREST PARK WATER DISTRICT

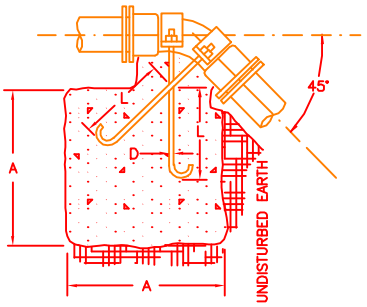
STANDARD WATER DETAILS



CONCRETE BLOCKING & 2" MAIN EXTENSION

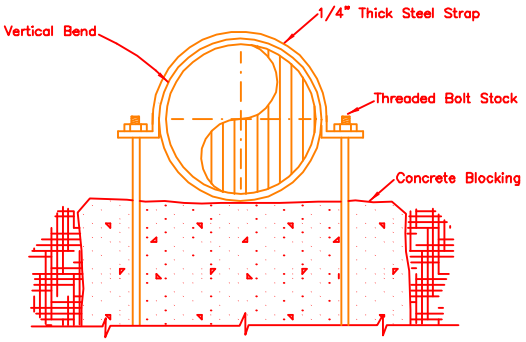


BLOCKING FOR 11-1/4°, 22-1/2° & 30° VERTICAL BENDS



BLOCKING FOR 45° VERTICAL BENDS

VERTICAL BLOCKING					
PIPE SIZE	VERT.BEND	CU.FT.	A	D	L
4"	11-1/4°	8	2.0'	3/4"	1.5'
	22-1/2°	11	2.2'	3/4"	2.0'
	30°	17	2.6'	3/4"	2.0'
	45°	30	3.1'	3/4"	2.0'
6"	11-1/4°	11	2.2'	3/4"	2.0'
	22-1/2°	25	2.9'	3/4"	2.0'
	30°	41	3.5'	3/4"	2.0'
	45°	68	4.1'	3/4"	2.0'
8"	11-1/4°	16	2.5'	3/4"	2.0'
	22-1/2°	47	3.6'	3/4"	2.5'
	30°	70	4.1'	3/4"	2.5'
	45°	123	5.0'	3/4"	2.0'
12"	11-1/4°	32	3.2'	3/4"	2.0'
	22-1/2°	88	4.5'	7/8"	3.0'
	30°	132	5.1'	7/8"	2.5'
	45°	232	6.1'	3/4"	2.5'
16"	11-1/4°	70	4.1'	7/8"	3.0'
	22-1/2°	184	5.7'	1-1/8"	4.0'
	30°	275	6.5'	1-1/4"	4.0'
	45°	478	7.8'	1-1/8"	4.0'
20"	11-1/4°	91	4.5'	7/8"	3.0'
	22-1/2°	225	6.1'	1-1/4"	4.0'
	30°	330	6.9'	1-3/8"	4.5'
	45°	560	8.2'	1-1/4"	4.0'
24"	11-1/4°	128	5.0'	1"	3.5'
	22-1/2°	320	6.8'	1-3/8"	4.5'
	30°	480	7.9'	1-5/8"	5.5'
	45°	820	9.4'	1-3/8"	4.5'



TYPICAL CROSS-SECTION

NOTES:

1. Concrete Blocking is based on 250 PSI Pressure and 2500 PSI Concrete Strength.
2. Bolts and nuts shall be cleaned and painted with Coal Tar Preservative.

CONCRETE BLOCKING FOR VERTICAL BENDS

CONCRETE BLOCKING

NO SCALE

(2)

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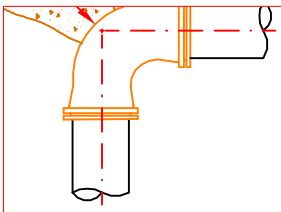
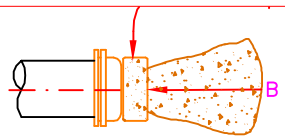
LAKE FOREST PARK WATER DISTRICT

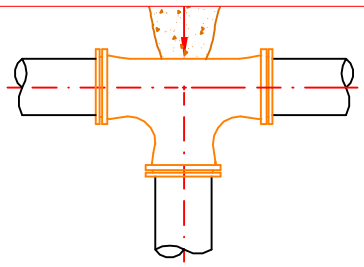
STANDARD WATER DETAILS



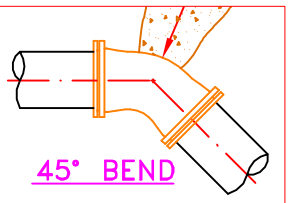
90° BEND



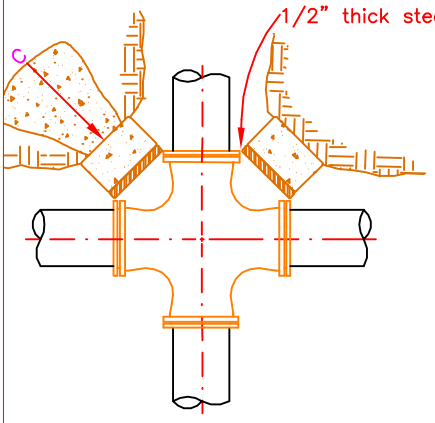
CAP



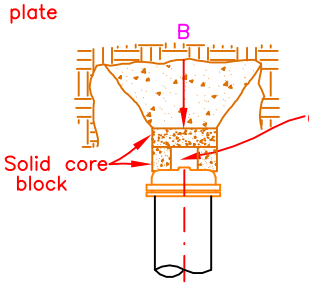
TEE



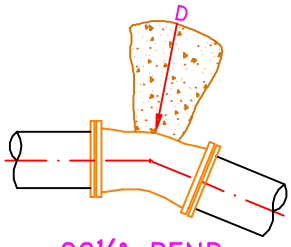
45° BEND



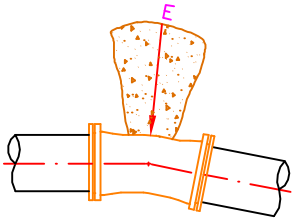
UNBALANCED CROSS



TAPPED TEE



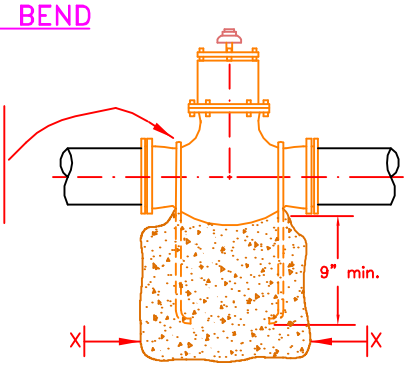
22½° BEND



11¼° BEND

THRUST BLOCK							
		MIN. BEARING AREA AGAINST UNDISTURBED SOIL–SQ.FT.					
PE EE	PRESSURE PSI	A	B	C	D	E	X (100 PSI)
	200	2/(1)	1/(NONE)	1/(NONE)	NONE	NONE	NONE
	300	3/(2)	2/(2)	2/(1)	1/(1)	NONE	
	200	4/(3)	3/(2)	3/(1)	1/(1)	1(NONE)	NONE
	300	6/(4)	4/(3)	3/(2)	2/(1)	1(NONE)	
	200	7/(5)	5/(3)	4/(3)	2/(2)	1/(1)	3/(2)
	300	11/(3)	8/(5)	6/(4)	3/(2)	2/(1)	
"	200	11/(8)	8/(6)	6/(4)	3/(2)	2/(1)	4/(3)
	275	16/(11)	11/(7)	9/(6)	5/(3)	3/(2)	
"	200	16/(11)	11/(8)	9/(6)	5/(3)	3/(2)	5/(4)
	250	24/(16)	17/(11)	13/(9)	7/(5)	4/(3)	
"	200	22/(13)	16/(11)	12/(8)	6/(4)	3/(2)	7/(6)
	250	33/(22)	23/(16)	18/(12)	9/(6)	5/(3)	
"	200	29/(19)	21/(14)	16/(11)	8/(6)	5/(3)	10/(7)
	225	23/(16)	23/(16)	17/(12)	9/(6)	5/(3)	
"	200	36/(24)	26/(17)	20/(13)	10/(7)	5/(4)	13/(9)
"	200	45/(29)	32/(21)	24/(16)	13/(8)	7/(4)	16/(11)
"	200	64/(43)	46/(30)	35/(23)	18/(12)	9/(6)	23/(16)

2 – 1/2" dia. rods for 10" size and smaller
2 – 1" dia. rods for sizes larger than 10"



GATE VALVE

NOTE
Additional blocking must be provided if gate valve is at end of line during test.

OTE

. Square feet of concrete thrust – block area based on safe bearing load of 2000/(3000) pounds per square feet.

2. Areas must be adjusted for other size pipe, pressures and soil conditions.

3. Concrete blocking shall be cast in place and have a minimum of 1/2 square foot bearing against the fitting.

4. Block shall bear against fittings only and shall be clear of joints to permit taking up or dismantling joint.

5. Contractor shall install blocking adequate to withstand full test pressure as well as to continuously withstand operating pressure under all conditions of service.

SAFE BEARING LOADS IN LBS./SQ. FT.

The safe bearing loads given in the following table are for horizontal thrusts when the depth of cover over the pipe exceeds 2 feet.

SOIL	SAFE BEARING LOAD LBS./SQ. FT.
*Muck, peat, etc.	0
Soft caly	1,000
Sand	2,000
Sand and gravel	3,000
Sand and gravel cemented with clay	4,000
Hard shale	10,000

*In muck or peat, all thrusts shall be restrained by piles or tie rods to solid foundations or by removal of muck or peat and replacement with ballast of sufficient stability to resist thrusts.

CONCRETE BLOCKING

NO SCALE

1

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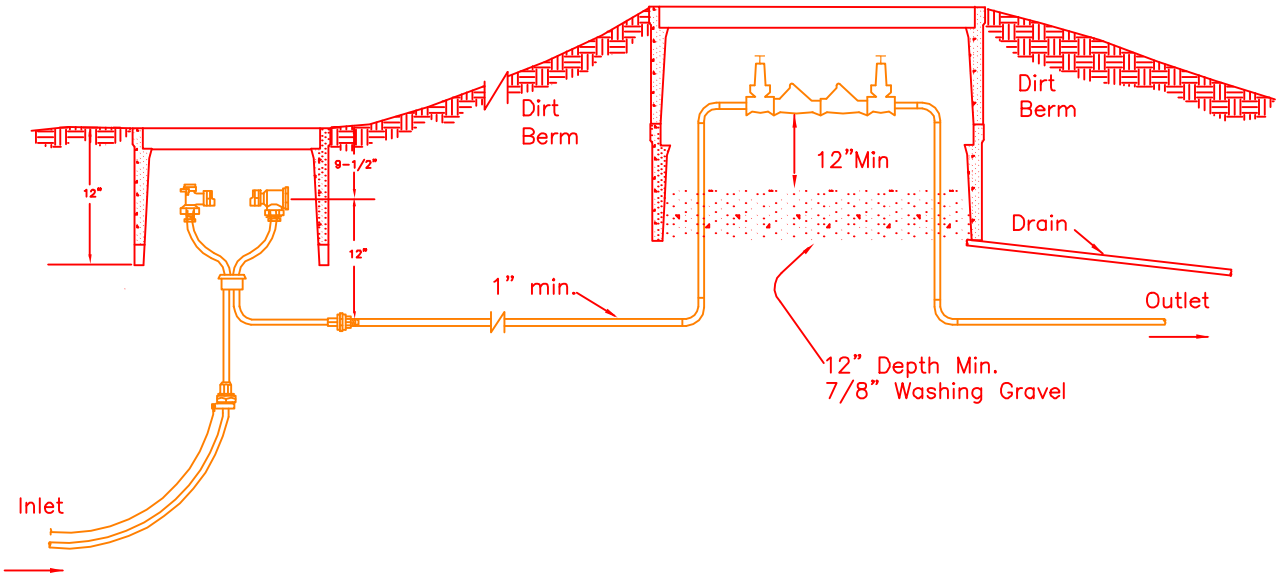
LAKE FOREST PARK WATER DISTRICT



1. Brooks #65–S Meter Boxes or equal
2. Drain pipe to be PVC, diameter to be equal to supply line, with 2" minimum ID
3. Drain pipe to daylight, no bends allowed
4. Test cocks to be provided with plugs to prevent clogging; after testing cocks will be replaced with plugs
5. Approved Double Check Valve Assembly by Department of Health
6. Meter and service size as required
7. Call Water District for final inspection

DOUBLE CHECK VALVE INSTALLATION
LAWN IRRIGATION

NO SCALE

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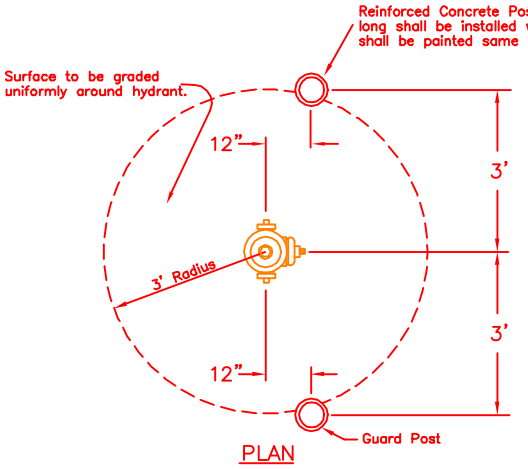
WDETDBCV.DWG

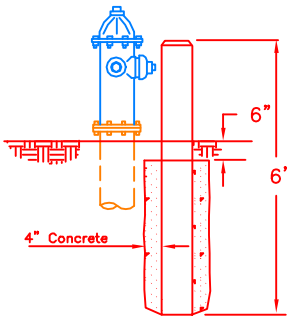
LAKE FOREST PARK WATER DISTRICT

STANDARD WATER DETAILS



PLAN

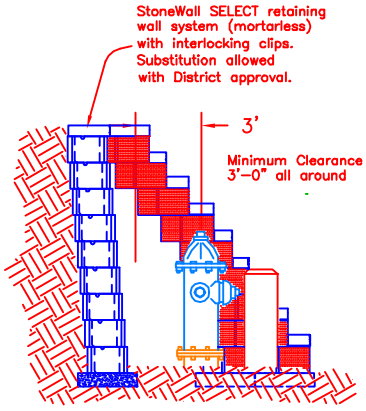
Top of Guard Posts to be level with bonnet flange. Both Guard Posts to be same elevation. Guard Posts are to be plumb.



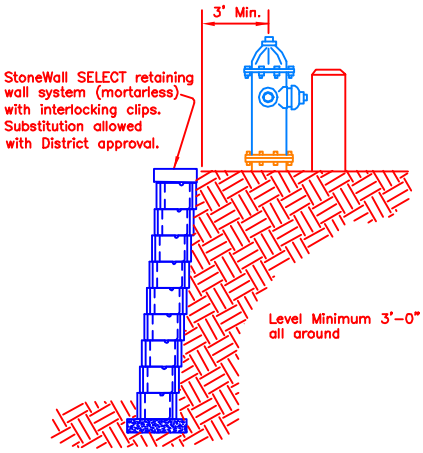
NOTE: If concrete is not specified, earth backfill shall be compacted in 6" layers.

ELEVATION

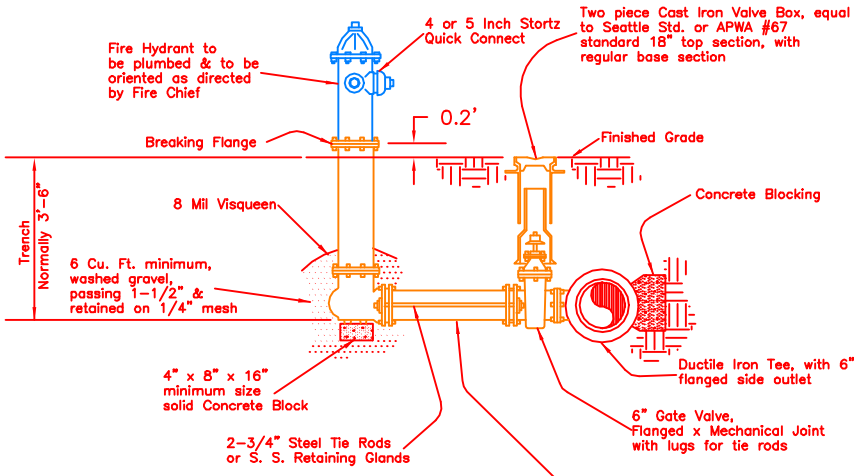
FIRE HYDRANT GUARD POSTS



FIRE HYDRANT IN CUT



FIRE HYDRANT IN FILL



NOTES:
Hydrant shall be prime coated with Steelcote SR-53 heavy duty-brush type or approved equal. Top coats shall be Steelcote acid and oil resistant enamel No. 44-68, color-white, brush type or approved equal.

Stencil on the face of hydrant barrel the distance from hydrant to gate valve in feet and inches with 2" black letters.

Steel Tie Rods shall have a length to fit between lugs. Apply a heavy coat of coal tar preservative on tie rods, nuts and bolts.

Hydrant type: Mueller 5.25" or Approved Equal

FIRE HYDRANT ASSEMBLY

FIRE HYDRANT LOCATION IN CUT OR FILL

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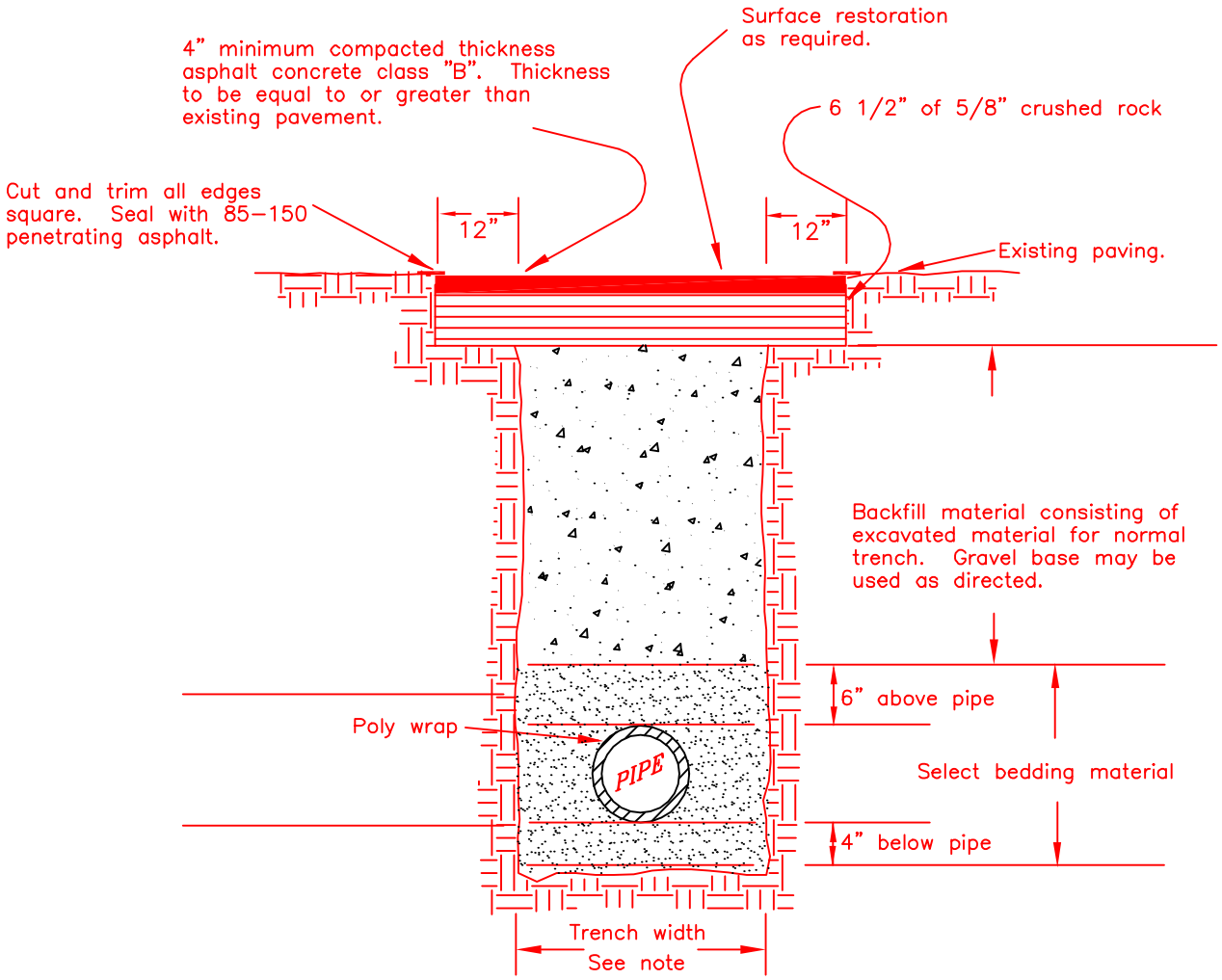
FIRE HYDRANT ASSEMBLY.DWG

NO SCALE

LAKE FOREST PARK WATER DISTRICT

STANDARD FIRE HYDRANT DETAIL



NOTE:
Minimum trench width shall be the pipe O.D. + 12" (6" each side of pipe)

Maximum trench width:
15" diameter and smaller: 40"
18" diameter and larger: 1–1/2 x I.D. + 18"

RIGID PIPE
TYPICAL TRENCH SECTION

NO SCALE

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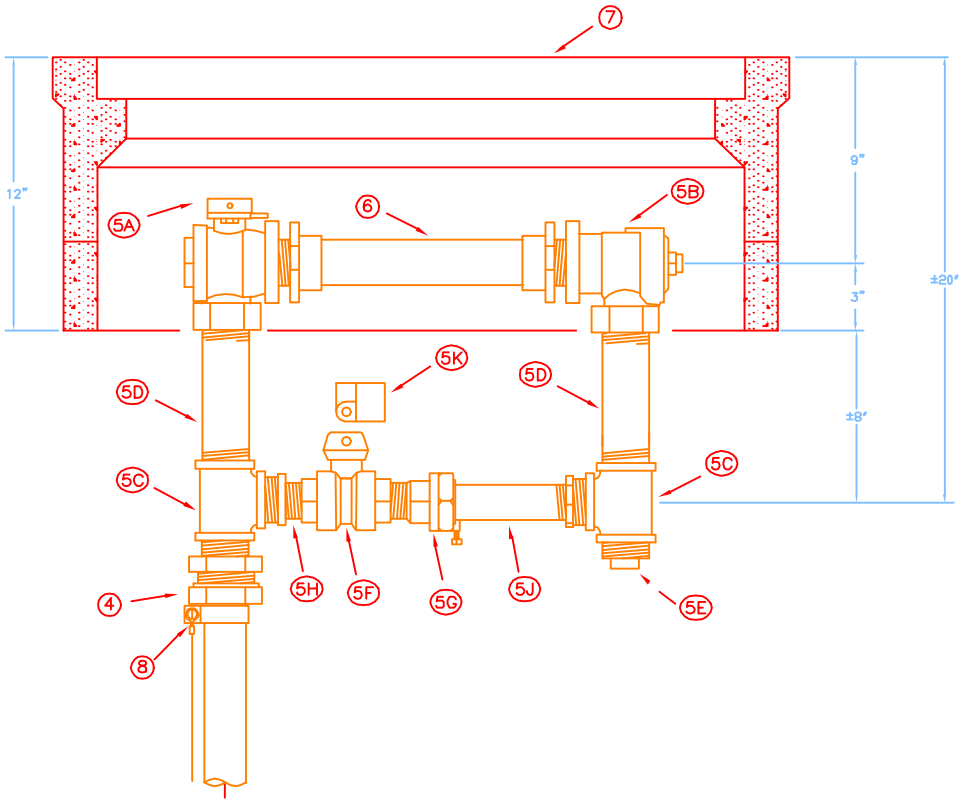
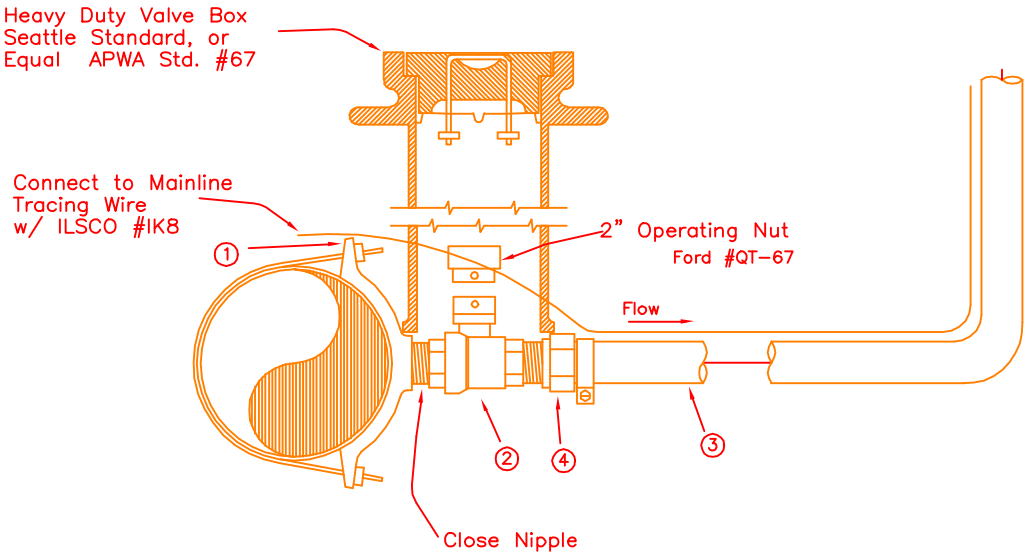
Pipe Install, Trench Section.dwg

LAKE FOREST PARK WATER DISTRICT

STANDARD WATER DETAILS





6

1-1/2" and 2" Water Service Detail

NO SCALE

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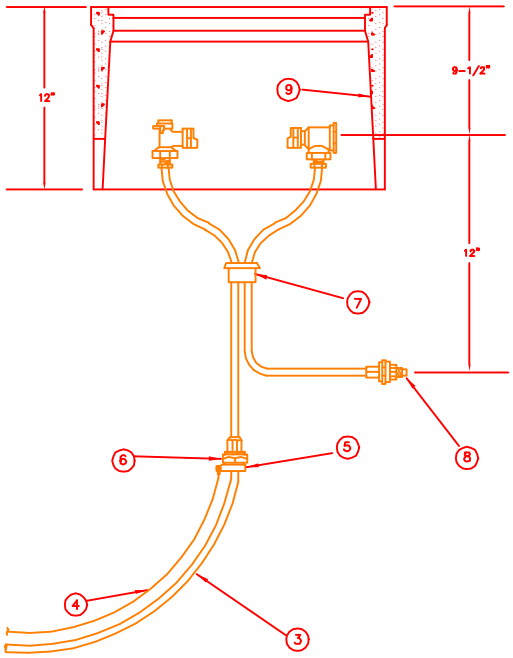
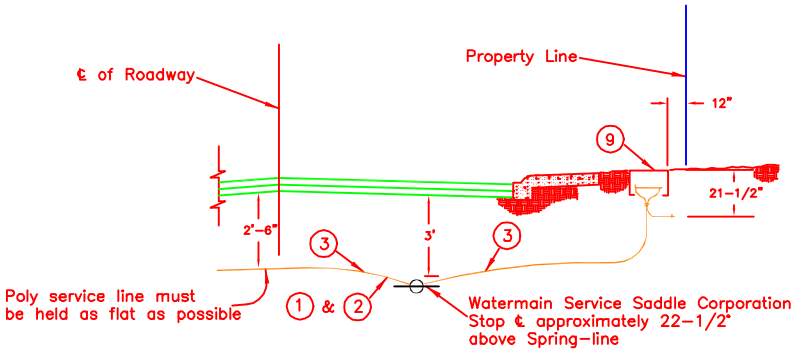
LAKE FOREST PARK WATER DISTRICT

STANDARD WATER DETAILS



TYPICAL SINGLE SERVICE



TYPICAL ROADWAY SECTION

TYPICAL SERVICE NOTES

SERVICE LOCATION: So that conflicts with other underground utilities are not encountered, location is to be determined simultaneously with other utilities and be approved by the Water District before installation.

INSTALLATION: Faulty installation or poor workmanship not corrected by the Developer will be corrected by the District. The cost of such corrections will be charged to the Develoer.

BENDS: No sharp bends shall be permitted with plastic pipe.

SERVICES: Installations shall be in accordance with the service detail drawing.

SADDLES: Saddles are to be used with PVC or DI. CL. 50 watermain. DI CL. 52 or thicker may be tapped directly to install corporation stop.

METER: Meter is to be furnished and installed by the District.

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1" – SINGLE WATER SERVICE DETAIL

NO SCALE

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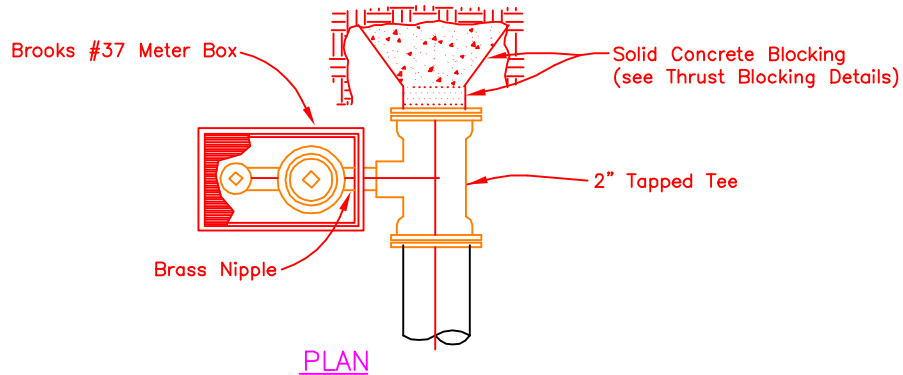
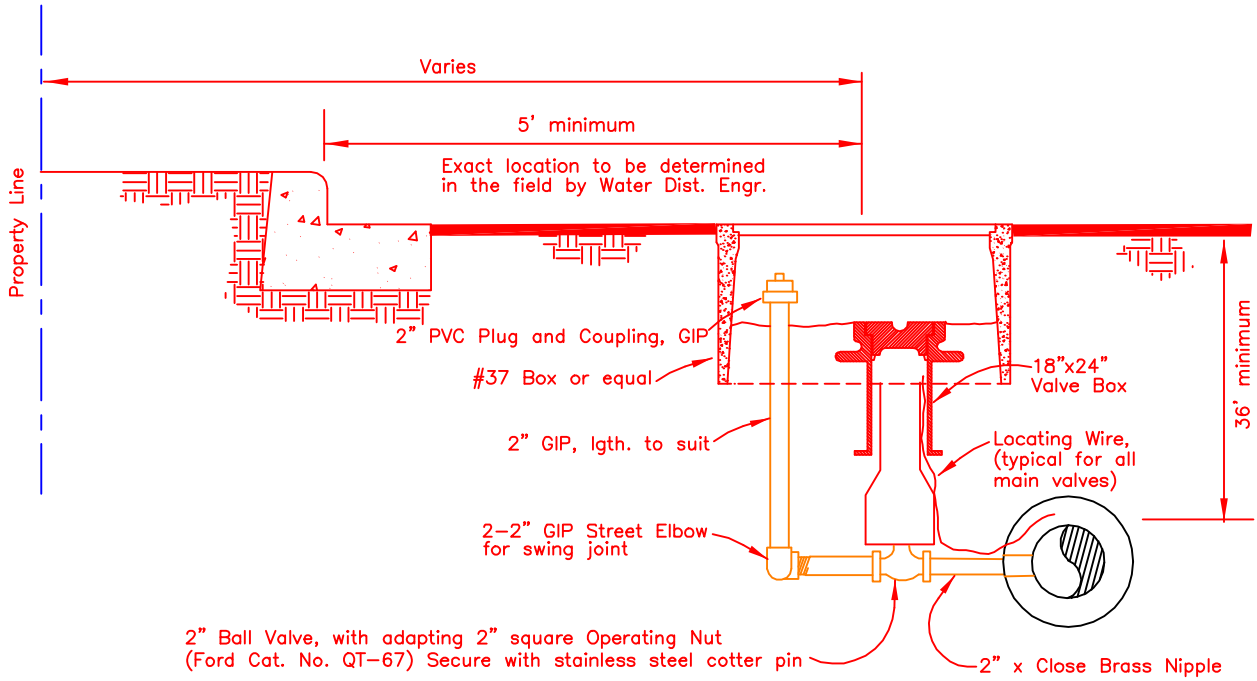
LAKE FOREST PARK WATER DISTRICT

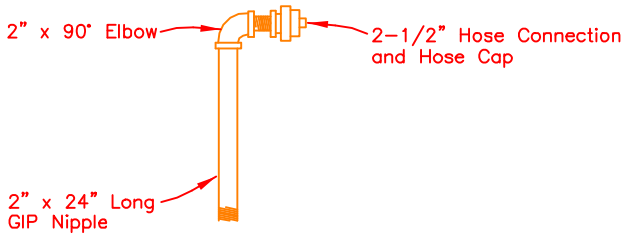
STANDARD WATER DETAILS



PLAN



SECTION



BLOW-OFF EXTENSION ADAPTOR
(As called for on Plans)

2" BLOW-OFF ASSEMBLY

NO SCALE

4

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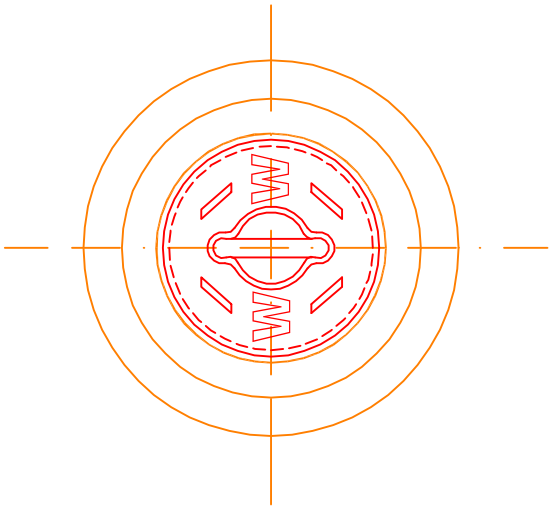
WDET2BO.DWG

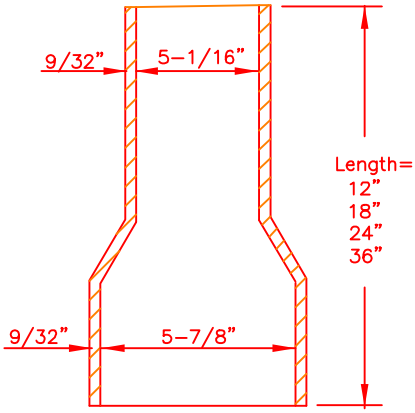
LAKE FOREST PARK WATER DISTRICT

STANDARD WATER DETAILS

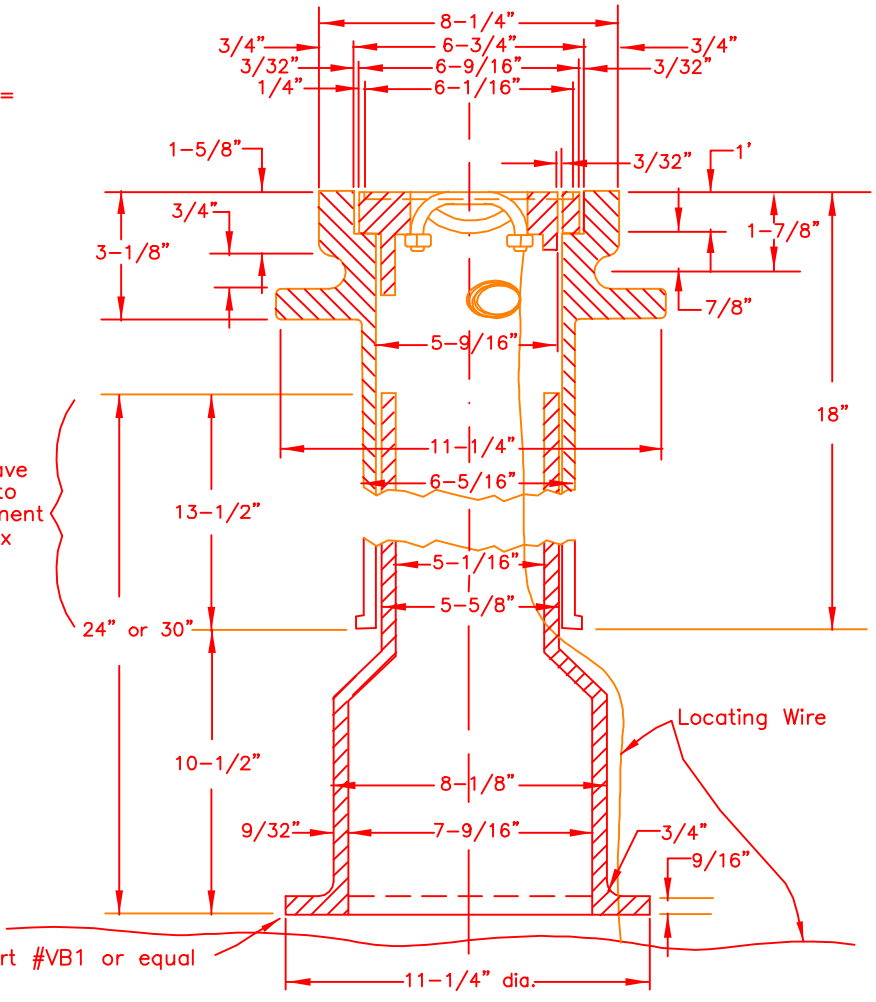
NOTE
Locating wire to run outside of Valve Box base and inside of Valve Box top, and to extend 1' above top of Valve Box lid



PLAN



EXTENSION



Base Section will have 12" of adjustment to accommodate pavement overlays & valve box raises to grade

Olympic Foundry Part #VB1 or equal

SECTION

Heavy Duty Valve Box (Domestic Only)
(Machined top & lid)
Seattle Standard
or equal APWA Std. #67

VALVE BOX

NO SCALE

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Valve Box.dwg

LAKE FOREST PARK WATER DISTRICT

STANDARD WATER DETAILS