TUALATIN VALLEY WATER DISTRICT

WATER SYSTEM STANDARDS

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WATER SYSTEM STANDARDS

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GENERAL PROVISIONS

GENERAL REQUIREMENTS

The following provisions and technical specifications set forth the requirements for construction within the Tualatin Valley Water District. References to "District" shall mean the Tualatin Valley Water District References to "Engineer" shall mean the District Engineer, or his/her authorized representative, for the Tualatin Valley Water District.

PLANS FOR SYSTEM IMPROVEMENTS

All plans for water system improvements must be prepared and sealed by a Project Engineer (references to "Project Engineer" shall mean the Engineer of Record for the Project) registered in the State of Oregon. Changes and/or revisions to plans submitted for water system improvements shall not relieve the Project Engineer from his/her duty as the Engineer of Record from ensuring that the design(s) are adequate to protect public health and safety. Approval of the sealed plans prior to start of any construction is required by the Engineer, or his/her representative. **Plan approvals are only valid for 6 months from the date of approval.** Any changes to approved plans initiated by the Project Engineer or the result of field conditions must be resubmitted and approved by the Engineer.

PERMITS AND CONDITIONS OF PROVIDING SERVICE

The person proposing the improvements shall obtain all required permits. The applicant will apply for any permits required for work within local jurisdiction right-of-ways. (See Washington County Operations Form at the end of the Standard Detail Section.) In addition, any property not currently within the District boundary shall be annexed prior to water service being extended to the site. An extension of water service may be allowed for properties not annexed to the District that receive an approval or endorsement for an extra-territorial water line extension.

SITE ACCESS FOR INSPECTIONS

The Engineer, or his/her representative, shall at all times have access to the project to make routine visual inspections of all pipe and fittings **prior to any backfilling of any trench**. Potholing of buried water lines, not previously inspected by the District's Inspection staff, may be required at the Developer's expense to allow verification that the installation meets the requirements of these Water System Standards. Should any of these inspections reveal that the construction of the water system improvements is not proceeding according to the approved plans and/or the specifications contained herein, the Engineer may order all work stopped and/or all defective work removed. If a revision is necessary, the District will receive revised plans of the project prepared by the Project Engineer before allowing work to resume.

ELECTRONIC "AS-BUILT" DRAWINGS

Upon completion of the project, the Project Engineer who prepared plans shall submit a copy of the electronic file for the Final Plat Map for all subdivisions. For commercial projects, the electronic file shall be the Final Plat Map for the commercial subdivision. In the case of development on existing platted lots, the "As-Built" drawings for the project will be accepted. Electronic files shall be submitted to the District via email as an attached file in AUTOCAD.DWG, or .DXF format to the recipient indicated in the acceptance notification letter sent following the final inspection of the project. Alternatively, electronic files may be submitted on 31/2" IBM 1.44 MB discs, or on CD media using the above indicated format.

GUIDELINES AND DESIGN CRITERIA

The following section is only intended to provide guidelines and design criteria for use in the design of the water system improvements. The Engineer may require that modifications to the design be made for each particular project. The written specifications of these Standards shall have precedence over the drawings in the event of conflicts. In the event that these Standards do not cover a specific situation that may be encountered, the Engineer, or his/her designated representative, shall at his/her discretion determine the appropriate material to use or course of action to be followed. Tualatin Valley Water District may revise these Standards at any time without prior notification.

The Project Engineer for each project should meet with the Engineer, or his/her designated representative, prior to initiating the project design to discuss the sizes of the mains and any other matters particular to the specific project. Pipeline sizes shall be at the discretion of the Engineer. Ten-inch and 14-inch size pipes are not allowed in the District. In general, the following guidelines and design criteria should be followed:

1. All material shall be of new manufacture. No rebuilt, reconditioned, or used material will be allowed.

2. All pipe used within the District will be Tyton-joint ductile iron pipe.

3. Fittings will be mechanical joint, unless otherwise specified hereinafter, or as approved by the Engineer or his/her designated representative.

4. Minimum size mains will be 6-inch, except that 4-inch may be permitted on runs less than 300 feet, when there will not be more than eight services, and when there is no possibility of future extensions or need for a fire hydrant.

5. Fire hydrants will not be connected to mains less than 6-inch diameter.

6. Water mains will generally be located on the south and east side of the street 6 feet from face of curb to pipe centerline. Water mains along looped streets or curved streets **will not** switch sides of the street (on looped streets keep the water main

on either the inside or outside of the loop). Water mains in streets with development only along one side of the street will be placed 6-feet from the face of the curb adjacent to the lots served in order to minimize service line length and to avoid "long-side" connections to fire hydrants. Provide preliminary sketches to the Engineer and request advice regarding water main layout prior to submittal of drawings for approval. Minimum cover over the pipe is 36 inches. The Project Engineer is responsible for the design of the pipe to insure maximum pipe joint deflection is not exceeded.

7. Dead-end mains normally will not be allowed, but when they are permitted, a blowoff assembly will be required. The mains shall extend just outside the edge of pavement to facilitate future extensions. Phase break valves are required near the end of these dead-end lines to avoid water service interruption to customers while mains are being extended.

8. Main extensions will be required to continue the entire distance between opposite boundaries of new subdivisions and will be located within public right-of-way unless the District grants specific exception.

9. Valves will be located, whenever possible, at intersections. In general, sufficient valves should be provided to permit shutting down any section of the line, not exceeding 800 feet, with valve operations in not more than three locations.

10. Valves will be installed in clusters at pipeline intersections. Mechanical joint valves shall be installed at fittings with a pipe spool between the valve and fitting of no less than 1'-0" or greater than 1'-6" in length.

11. Valves 8 inch and smaller will be gate valves.

12. Valves 10 inch and greater will be butterfly valves.

13. Fire hydrants normally will be placed at street intersections. Place fire hydrants at the radius point at intersections or at property lines when placed at mid-block locations. Fire hydrants shall be placed in a planter strip or behind sidewalks. No concrete shall be poured around or within a 4-foot square of the fire hydrant centerline, unless specifically approved by the Engineer. Fire hydrants shall be located such that no part of any single-family residential building is greater than 400 feet from a hydrant, and such that no part of any commercial, industrial, or multiple-family building is greater than 250 feet from a hydrant, both as measured along the most practical accessible route.

14. District policy is to provide water service at a minimum pressure of 50. Available pressure at specific locations may fall outside this range depending on geographic features within a particular pressure zone. Developers will be responsible for construction of a facility (i.e., a vault housing pressure reducing valves [PRVs] and ancillary appurtenances) to reduce pressure where the pressure exceeds 80 psi.

15. Where practical, 5/8" and 3/4" services will be accomplished using double, or U-branch, service connections. Two meters served from a single 1" copper service line will be installed in separate meter boxes, located adjacent to the lot line. One inch and larger meters will be served from a single service line connected to the water main. Water District forces, except as otherwise approved by the Engineer, will install all water meters, meter boxes, vaults, and services. Contact the Engineer for requirements for meters larger than 2-inch size.

16. Meters 1" and smaller will be located in the public utility easement adjacent to the street right-of-way at the property line. Meters 1½" and larger will be located on the Developer's property at the street right-of-way in a dedicated easement measuring 10 feet from each outside wall of the meter vault**. The District has final authority to move or change placement of water meters to best serve the District's requirements.** Backflow devices are required on all services 1½" and larger (see Section "Cross Connection Control and Backflow Assemblies".

    District policy is to provide water service at the edge of the dedicated public right-of-way and the private property line as follows: One meter per single tax lot and dwelling unit. If the structure on a single tax lot is a duplex or triplex, individual meters for each unit will be installed upon request. Tax lots with more than four dwelling units, it is a multi-family use, which is in the District's commercial class and requires a master meter.

    The District places meters at the edge of the public right-of-way. The public right-of-way shall be created by a recorded plat or by a recorded dedication of a separate tract or public utility easement for ingress/egress and utilities. The recorded instrument shall be a covenant running with the land for the benefit of the District, and all other affected utility service providers, in form approved by the District's counsel. It shall provide that no amendment, alteration, or relocation of the public way shall be made without the written consent of the District. The District shall approve the width of the required dedication.

    For protection of its water service to properties and placement of the meter, the District requires a minimum dedication of three feet on each side of the sidewalk and traveled roadway dedicated under the public road or public utility easement recorded in the County Real Property records. Within this three-foot zone, no other utilities can be located. The water system and the meter within the dedicated public right-of-way shall be constructed according to all District standards and the design construction, testing, and acceptance of those improvements to the District's system shall be according to the District's standards and Rules and Regulations.

17. The size of water meters shall be based on the total demand and shall be determined according to methods and procedures outlined in Section 610.4 and 610.8 or Section 610.5 of the Uniform Plumbing Code (UPC) taking into account the fixture units in the plumbing system contributing to the water demand.

18. When it is not possible or practical to install the main within a dedicated public street, an easement shall be provided. In general, a 15-foot wide easement will be adequate where vehicular access is not necessary, and a 20-foot wide easement will be required if vehicular access is necessary. The easement will so state that any damage resulting from a mainline break in the easement will not result in liability to the District.

19. Banking of meters adjacent to the entrance of a private street onto a dedicated public street will be required where possible or practical. Exceptions to this guideline will be made at the discretion of the District Engineer.

20. Any relocation work within existing right-of-way that is a requirement of the development will be performed by District forces at the Owner's expense on a time and materials basis. A deposit in the amount of the estimated cost of the work is required prior to performance of the work.

21. Vaults for meters larger than 2" size and vaults for backflow devices normally are installed in an easement on the customer's property and located out of traffic or sidewalk areas. Submit vault lid and access (sidewalk door) details showing suitability for H-20 loading where vaults must be installed in traffic areas.

22. Any permanent appurtenance that is above sidewalk and/or finish grade shall be 18" minimum distance behind the sidewalk. No permanent appurtenance, structure, or plant materials (trees, shrubs, etc.) are allowed within 18" of District facilities (i.e., water meter boxes, air relief vents, etc.). Fencing, vegetation and shrubs shall be a minimum of 36" from fire hydrants.

23. Repair of any damage to the District's facilities (including buried water lines, valve boxes, meter boxes, combination air-relief valves, etc.) shall be made at the Contractor's expense. The District, at its option, may make the repairs to facilitate maintaining service. In this instance, the Contractor will be billed for the repairs on a time and materials basis.

24. Any hydraulic calculations for the purpose of justifying pipeline sizing shall be made using a Hazen-Williams "C" coefficient of 100.

25. Place a treated 4" x 4" post set with top of post 3-feet above finished grade to mark water line appurtenances in locations outside of established right-of-way (i.e., in fields, easements, etc.).

26. Color coded marker "balls" will be provided by the District for installation at specific locations selected by the District's Inspector.

27. Submit 3 sets of drawings for review and approval (1 full set and 2 partial sets of drawing sheets showing water utility improvements. Include detail-drawing sheets

with District Standard Details as applicable to the project. Drawings shall show locations of driveways, light poles and mailboxes. Details shall clearly show the layout for pedestal mounted mailboxes to ensure that conflicts at water meter locations are avoided. All drawings submitted for review and approval shall be on sheet with a **maximum size of 24" by 36".** The Project Engineer should meet with the Engineer prior to design to discuss the sizes of the mains and any other matter particular to the specific project. Submit the following information with the submittal for approval:

- Subdivision Name
- Owner's Name, Address & Phone and FAX Numbers
- Engineer's Name, Address & Phone and FAX Numbers
- Contractor's Name, Address & Phone and FAX Numbers

28. Provide set of drawings showing mechanical plans of boilers, chillers and other like water consuming mechanical devices; plumbing plans with location of on-site backflow devices; fire line drawings showing plans of antifreeze (either potable or non-potable) loops etc.; landscaping plans showing the layout of the irrigation mains and backflow device(s) and any ornamental or decorative reflecting ponds or water features for all commercial projects for informational purposes.

PREPARATION OF A SUBDIVISION FOR WATER SERVICES

1. Water lines must have been pressure tested in accordance with ANSI/AWWA C600-93 and the District's Construction Specifications, and passed disinfection testing, under supervision of the District Inspector.

2. Prepay per service -- in advance, based on meter size. (Contact the District for fees.) **Submit a copy of the preliminary plat map showing lot numbers 10 days prior to payment of prepay per service fees.**

3. Curbs installed with backfill leveled behind curb, approximately 10 feet, to allow room to install service boxes at proper elevation. A Public Utility Easement of an adequate width shall be provided for meter placement.

4. Property lines and lot numbers marked on curbs with white paint, and offsets stakes (with offset distance to the property corner set by a Surveyor) shall be complete. If no curbs are planned, meter location and grade hubs will be staked for each meter. See Detail Nos. 7 and 8 for water service typical installation.

5. Service installation will be scheduled only after **all** the above has been completed.

NOTE: Water service installation is prior to road subgrade and other utility installation. Otherwise, additional development costs may be incurred. The District will not be responsible for restoring finish subgrade. Prepay

per service fee is based on excavation of clean clay materials. Extra cost for excavation of rock material shall be borne by the Developer. The pre-pay per service fee is based upon excess excavation material being spread on-site. Cost for removal of excess excavation material from the site to be borne by the Developer.

If compaction is required for the service trenches, the cost will be borne by the Developer.

WORK IN PUBLIC RIGHTS-OF-WAY

The Contractor shall have the water utility permit **in-hand** prior to construction of the water mains. Contractors shall comply with all rules and regulations of the City, State and County authorities regarding the closing of public streets or highways to use of public traffic. No road shall be closed to the public, except by express permission of the affected regulating authority.

Contractors shall use every reasonable precaution to safeguard the persons and property of the traveling public. It shall be the sole responsibility of the Contractor to furnish, place, and maintain those barricades, barriers, lights, flares, danger signals, and watchmen as are necessary to protect the persons and property of the traveling public. All barricades and obstructions shall be protected at night by signal lights, which shall be suitably distributed and operated from sunset to sunrise.

In the event of interruption to domestic water, sewer, storm drain, or to other utility services as a result of accidental breakage, or as the result of being exposed or unsupported, promptly notify the proper authority. Cooperate with said authority in restoration of the service as promptly as possible and bear all cost of repair. In no case shall interruption of any water or utility services be allowed to exist outside working hours, unless prior approval is received.

Clean all spilled dirt, gravel, or other foreign material caused by construction operations from all streets and roads at the conclusion of each day's operation. Within five days after completion of all paving and gravel shoulder resurfacing, remove all dirt, mud, rock, gravel, and other foreign material from the paved surface. Cleaning shall be by grader and front-end loader, supplemented by washing with water, power brushing, and hand labor.

OPERATION OF VALVES IN DISTRICT'S WATER SYSTEM PROHIBITED

At no time shall the Contractor undertake to close off any lines or open any valves or take any other action which would affect the operation of the existing water system, except as specifically required by the plans and specifications, or with prior approval of the District. Contractor shall request approval at least 48 hours in advance of the time that the interruption of the existing service is necessary.

SANITATION

Contractors shall provide and maintain sanitary facilities for employees.

LAND MONUMENTS

The Contractor shall preserve or replace all existing federal, state, city, county, and private land monuments disturbed by his/her work. Replaced or reset monuments shall be of acceptable type and quality, placed in a manner consistent with recognized engineering and surveying practices.

SUBSTITUTION OF MATERIALS

Whenever any material, article, device, product, fixture, form, type of construction, or process is indicated or specified by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired. This procedure is not to be construed as eliminating from competition other products of equal or better quality by other manufacturers where fully suitable in design, and shall be deemed to be followed by the words "or as approved" or "approved equal". The Contractor may, in such cases, submit complete data to the Engineer for consideration of another material, type, or process, which shall be substantially equal in every respect to that so indicated or specified. Substitute materials shall not be used unless approved in writing.

ACCEPTANCE OF THE PROJECT

The Tualatin Valley Water District reserves the right to withhold installation of water meters until the project has received final acceptance. Acceptance of water system improve-ments, including backflow assembly vaults, water lines, valves, valve boxes, valve extensions, fire hydrants, blow-off assemblies, combination air vacuum relief assemblies and all other appurtenances, will be made upon completion of the following:

1. Compliance with these General Requirements.

2. Installation of the materials and workmanship as herein described.

3. Successful hydrostatic pressure tests, as witnessed and approved by the District Engineer or Inspector.

4. Adequate flushing and chlorination of mains.

5. Samples taken for bacteriological examination shall be tested in a laboratory certified by the Oregon State Board of Health. Mains failing the bacteriological examination shall be reflushed and retested until an acceptable test has been competed.

6. Dedication of any required easements or rights-of-way.

7. Complete second lift of paving (ensure that all valve boxes are raised and flush with surface.

8. Request final inspection of subdivision.

9. Correct any deficiencies on the "punch list" prepared by District staff at the final inspection walk through of the job-site.

10. Submit electronic files, as described in Section "GENERAL REQUIREMENTS" here in before for the project.

11. Meter installation will be possible only after **all** the above has been completed and the meter installation and SDCs have been paid.

    NOTE: The District will consider requests to install water meters prior to placement of the second paving lift during the winter period **(approximately November 15 through March 15)**. The District will verify that hot mix plants are operating under limited conditions and that pavement surface temperatures are below accepted conditions for final paving. A deposit or bond in the amount of 10 percent of the value of the water system improvements in the subdivision, or a minimum of $5,000, shall be deposited with the District prior to release of the subdivision for water meter installation. The Developer will agree to have final paving completed within 30 days of paving conditions returning to acceptable temperature following the winter period.

12. A one-year warranty on the water system improvements for materials and workmanship will exist from the date of final written acceptance of the project to District Standards by Tualatin Valley Water District.

CONSTRUCTION SPECIFICATIONS

Foreword: The Contractor shall furnish all labor, materials and equipment required to complete the work.

When references to the following capitalized abbreviations are made, they refer to Specifications, Standards or Methods of the respective national association or governmental agency.

AASHO	American Association of State Highway Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
ODOT	Oregon Department of Transportation
UL	Underwriter's Laboratories, Inc.

The following abbreviations refer to the technical terms:

B.F.V.	Butterfly Valve
B.O.	Blowoff
CARV	Combination Air/Vacuum Release Valve
D.I.	Ductile Iron (pipe)
Flg.	Flange (fitting)
fps	Feet Per Second
G.I.	Galvanized Iron
G.V.	Gate Valve
M.J.	Mechanical Joint (fitting)
P.E.	Plain End (pipe)
ppm	Parts Per Million
psi	Pounds Per Square Inch (pressure)

TRENCH EXCAVATION AND BACKFILL

A. SCOPE

This Section covers the work necessary for the trench excavation and backfill, complete, except for pipe base and pipe zone backfill which are included under the specification for the pipe.

TYPE OF BACKFILL

Trench excavation and backfill will be divided into the following classifications.

CLASS A BACKFILL

Class A Backfill will, generally, be used in areas where streets are to be constructed after utilities have been installed and trench settlement must be held to a minimum.

CLASS C BACKFILL

Class C Backfill will, generally, be limited to locations where trenches are located in unsurfaced areas.

CLASS D BACKFILL

Class D Backfill will, generally, be limited to traveled roadways and crossings where surfacing replacement will be made shortly after backfill and subsequent trench settlement must be held to a minimum.

CLASS E BACKFILL

Class E Backfill will, generally, be limited to streets and roadways on which gravel surfacing is to be replaced.

B. MATERIALS

TRENCH BACKFILL

CLASS D AND E TRENCH BACKFILL

Class D and Class E Trench Backfill shall be clean, bank or pit-run gravel or crushed rock, having reasonably even gradation from coarse to fine. The maximum size shall be 1½ inches.

FOUNDATION STABILIZATION

Material for foundation stabilization shall be 2½-inch minus crushed rock, with reasonably even gradation from coarse to fine and free from excessive dirt or other foreign material.

WATER FOR TRENCH BACKFILL

It will be the Contractor's responsibility to make all arrangements for a source of water and bear all costs for delivery of the water to the trench site.

COMPACTION EQUIPMENT

Compaction equipment shall be of suitable type and adequate to obtain the densities specified. Compaction equipment shall operate in strict accordance with the manufacturer's instructions and recommendations and shall be maintained in such condition that it will deliver the manufacturer's rated compactive effort.

C. WORKMANSHIP

PAVEMENT, CURB, AND SIDEWALK REMOVAL

Cut all bituminous and concrete pavements, regardless of the thickness, and all curbs and sidewalks, prior to excavation of the trenches, with an approved pavement saw, hydrohammer, or other approved pavement cutter. Width of the pavement cut shall be at least equal to the required width of the trench at ground surface or in conformance with Washington County standards. Pavement and concrete materials removed shall be hauled from the site and not used for trench backfill.

TRENCH WIDTH

The width of trenches in which pipe is to be laid shall be 12 inches greater than the inside diameter of the pipe or 24 inches minimum, unless otherwise approved by the Engineer.

GRADE

Carry the bottom of the trench to the lines and grades shown or established with proper allowances for pipe thickness and for gravel base or special bedding when required. If the trench is excavated below the required grade, restore any part of the trench excavated below the grade with gravel of the type specified for pipe base in Section "Ductile Iron Pipe Fittings". Place the gravel over the full width of the trench in compacted layers not exceeding six inches deep to the established grade, with allowance for the gravel base or special bedding.

SHORING, SHEETING, AND BRACING OF TRENCHES

Erect, maintain, and remove shoring, sheeting and bracing as required by all federal, state and local laws, codes, and ordinances. The most stringent of the requirements shall apply.

Where sheeting and bracing are used, increase trench widths accordingly by the thickness of the sheeting. Keep trench sheeting in place until the pipe has been placed and backfilled at the pipe zone. Shoring and sheeting shall be removed, as backfilling progresses, in a manner that will not damage the pipe or permit voids in the backfill.

LOCATION OF EXCAVATED MATERIALS

During trench excavation, locate the excavated material within the construction easement, right-of-way or specified working area so that the excavated material will not obstruct any private or public traveled roadways or streets. Pile and maintain material from trenches so that the toe of the slope of the material excavated is at least 36 inches from the edge of the trench. It shall be the Contractor's responsibility, however, to determine the safe loading of all trenches with excavated material.

REMOVAL OF WATER

Provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. These provisions shall apply during the noon hour as well as overnight.

Dispose of the water in an approved manner without damage to adjacent property. Drainage of trench water through the pipe under construction is prohibited. The pipe should be plugged so that no groundwater may enter at any time.

FOUNDATION STABILIZATION

When the existing material in the bottom of the trench is unsuitable for supporting the pipe, excavate below the flow line of the pipe, and backfill the trench to subgrade of the pipe base with "Foundation Stabilization" material specified hereinbefore.

PIPE BASE AND BACKFILL IN PIPE ZONE

Pipe base and pipe zone backfill are included in the specification for pipe.

TRENCH BACKFILL ABOVE PIPE ZONE

When backfill is placed mechanically, push the earth, gravel, or other material used in backfilling first onto the slope of the backfill previously placed and allow to roll down into the trench in such a way as to permit free fall of the material into the open trench until at least two feet of cover is provided over the pipe. Under no circumstances allow sharp, heavy

pieces of material to drop directly onto the pipe or the tamped material around the pipe. Do not use backfill material of consolidated masses larger than ¼ cubic foot.

BACKFILL COMPACTION

Compaction of materials shall be by mechanical means. If compaction results indicate that compaction or moisture content is inadequate, material placement shall be terminated and corrective action shall be taken prior to continued placement. Provide results of compaction testing performed by certified testing agency.

CLASS A BACKFILL (COMPACTED NATIVE MATERIAL)

Backfill the entire depth of the trench above the pipe zone with excavated trench materials placed in eight-inch layers. Compact each layer by means of mechanical tampers or vibratory compactors to 95 percent maximum density as determined by AASHO T 99, Method D. Bring the fill to required surface grade, and compact so that no settlement will occur. Remove all boulders and stones two inches in diameter and larger from material used for backfill in the upper 12 inches of the trench.

CLASS C BACKFILL

After the completion of the backfilling of the pipe zone, the excavated trench material may be pushed back onto the trench by mechanical means.

In locations where Class C Backfilling is used, the Contractor shall make his/her own estimate of the amount of backfill material required at the trench so that after normal settling has occurred, the finished surface will meet the existing grade. Neatly place the material over the trench, and remove all excess. Any excess or deficiency of backfill material which becomes apparent after settlement and within the guarantee period shall be corrected by regrading, disposal of excess material, and adding additional material where required,

CLASS D BACKFILL

Backfill entire trench above the pipe zone with Class D Backfill material in lifts not exceeding eight inches loose depth and compact each lift to 98 percent relative maximum density as determined by AASHO T-99 Method "D" Modified, with approved pneumatic or gasoline powered compaction equipment.

Maintain the surface of the backfilled trench level with the existing grade with a one-inch maximum layer of asphalt cold mix until pavement replacement is completed.

CLASS E BACKFILL

Backfill the top 12 inches of the trench above the pipe zone with Class E Backfill material in layers not to exceed eight inches in depth and compact each lift to 98 percent relative maximum density as determined by AASHO T-99 Method "D" Modified. Provide

restoration of shoulders as specified under Section "Surface Restoration".

REPAIR OF TRENCH SETTLEMENT

Any settlement of the finished surfacing during the warranty period shall be promptly repaired by the Contractor.

DRAINAGE CULVERTS

Replace drainage culverts which are removed and are at or near right angles to the trench centerline. If the pipe is damaged during removal, dispose of it and furnish and install new pipe. Dispose of culvert pipe that is in too poor condition to replace because of age, physical condition, or other reasons beyond the Contractor's control, and install new pipe. Material for replacement shall be as specified in Section "Surface Restoration".

Replace culvert pipe to the proper lines and grades. Do not replace culverts until the proposed pipeline is installed and the proper backfilling of the trench has been completed to the subgrade of the culvert.

SETTLEMENT

Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the one-year warranty period will be considered to be caused by improper compaction methods and shall be corrected at no additional cost to the Water District. The Contractor shall restore any structures damaged by excessive settlement to their original condition.

TESTING

Testing of backfill compaction shall include a test at the surface and at 2-foot increments below the surface. The compaction testing shall utilize a Proctor prepared using a sample of rock selected from material being used for trench backfill. Compaction testing shall be conducted every 25-feet or as directed by the District Engineer. Any trench backfill showing visible failure shall be rejected

SURFACE RESTORATION

A. SCOPE

This section covers the work necessary for all required replacement of pavement, curbs, sidewalks, rock surfacing, and drainage facilities, that were removed during construction. This section presents the minimum requirements for surface restoration. Requirements of this specification or those of the local jurisdiction, whichever is more stringent, are applicable.

B. MATERIALS

ROCK FOR SURFACE REPLACEMENT AND LEVELING COURSE

Rock shall be crushed gravel or rock meeting the following quality standards.

Abrasion (AASHO T 96)	Maximum Wear	35 Percent
Fractured Face	Min. of Particles	75 Percent

The aggregate shall consist of uniform quality, clean, tough, durable fragments of rock or gravel, free from flat, elongated, soft or disintegrated pieces, and other objectionable matter occurring either free or as a coating on the stone.

The gradation of 3/4-minus aggregates to be furnished shall be as indicated below.

GRADATION

PERCENT PASSING	TOP COURSE
1 inch square sieve	100
3/4 inch square sieve	90-100
1/2 inch square sieve	65-100
1/4 inch square sieve	40-60
U.S. No. 40 sieve	8-23
U.S. No. 200 sieve (Wet Sieving)	0-10
Sand Equivalent	40 min.

All percentages are by weight

ASPHALT CONCRETE

Asphalt concrete mix conforming to the standard specifications for highway construction of the Oregon State Highway Department Class C. Asphalt cement shall be 85-100 penetration paving asphalt conforming to ASTM D 946.

ASPHALT PRIME

Liquid asphalt for use as a prime coat under asphalt concrete shall be RC-70 or MC-70 liquid asphalt conforming to AASHO M 81 or M 82.

CONCRETE

Concrete for curbs, sidewalks, pavement, and miscellaneous construction shall conform to ASTM C 94, Alternate 3, and shall have a design mix proportioned for 3,000 pounds per square inch compressive strength at 28 days. Concrete mix shall contain no less than 5½ sacks of cement per cubic yard.

CONCRETE FORMS

All forms for curbs and sidewalks shall be two-inch dimensioned lumber, plywood, or metal forms. Forms on the face of the curb shall have no horizontal form joints within seven inches of the top of the curb. The Engineer shall approve all forms.

REINFORCING STEEL

Conform to ASTM A 615, Grade 40.

PIPE FOR STORM SEWER AND CULVERT REPLACEMENT

Extra-strength concrete pipe conforming to ASTM C 14 for pipe 15 inches and under, and in kind for pipe greater than 15 inches.

C. WORKMANSHIP

CONSTRUCTION PROCEDURE

The Engineer reserves the right to vary the classes of backfill and the type of resurfacing as best serves the interest of the District or County. Trench backfill shall be as specified in Section "Trench Excavation and Backfill".

Replace all pavement damaged during construction with asphalt concrete regardless of original type unless otherwise specified.

REMOVAL OF PAVEMENT, SIDEWALK, CURBS, AND GUTTERS

Removal of all pavement, sidewalks, curbs, and gutters shall conform to Section "Trench Excavation and Backfill".

STREET MAINTENANCE

Maintain all trenches as specified under Section "Trench Excavation and Backfill".

ASPHALT CONCRETE PAVEMENT REPLACEMENT

SUBGRADE

Bring the trench to a smooth, even grade at the correct distance below the top of the existing pavement surface so as to provide adequate space for the base and/or leveling course. Trim existing pavement to a straight line to remove any pavement which has been damaged or which is broken and unsound to provide a smooth, sound edge for joining the new pavement.

Compact the subgrade to 100 percent of the maximum density, AASHO T-99, Method "D" Modified. Accomplish supplementary compaction where required with approved mechanical vibrating or power tampers.

LEVELING COURSE

Place without segregation enough leveling course material to obtain a thickness of two inches after compaction. Compact to the required depth of finished pavement and for proper matching with the adjacent existing pavement. Place the leveling course for the full width of the trench where pavement was disturbed, including bituminous surface shoulders. Compact the leveling course to 100 percent of the maximum density, AASHO T-99, Method "D" Modified.

PRIME COAT

After the leveling course has been compacted, apply an asphalt prime coat, specified before, to the edges of the existing pavement. Also, tack coat cast iron manhole frames and cleanout frames below grade.

ASPHALT CONCRETE

Place the asphalt concrete on the prepared subgrade over the trench to a depth of not less than four inches, or the depth of the adjacent pavement, whichever is greater. Place asphalt concrete after the prime coat has set. If the thickness is greater than four inches, place the surfacing in two lifts.

Spread and level the asphalt concrete with hand tools or by use of a mechanical spreader, depending upon the area to be paved. Bring each lift of the asphalt concrete to the proper grade and compact by rolling or the use of hand tampers where rolling is impossible.

Roll with power rollers capable of providing compression of 350 pounds per linear inch. Begin rolling from the outside edge of the replacement progressing toward the existing

surfacing, lapping the existing surface at least ½ the width of the roller. If existing surfacing bounds both edges of the replacement, begin rolling at the edges of the replacement, lapping the existing surface at least ½ the width of the roller and progress toward the center of the replacement area. Overlap each preceding track by at least ½ the width of the roller and make sufficient passes over the entire area to produce the desired result.

The finished surface of the new compacted paving shall be flush with the existing surface and shall conform to the grade and crown of the adjacent pavement. Sand seal edges at cut lines or other seal method per requirements of the local jurisdiction.

SURFACE SMOOTHNESS

The surface smoothness of the replaced pavement shall be such that when a straightedge is laid across the patched area between the edges of the old surfacing and the surface of the new pavement, the new pavement shall not deviate from the straightedge more than ¼ inch.

WEATHER CONDITIONS

Asphalt shall not be applied to wet existing pavement surfaces. Asphalt shall not be applied during rainfall, sand or dust storms, or any imminent storms that might adversely affect the adhesive ability of the material. Asphalt concrete shall not be placed when the atmospheric temperature is lower than 40 degrees F., during heavy rainfall, or when the surface upon which it is to be placed is frozen or wet.

PROTECTION OF STRUCTURES

Provide whatever protective coverings may be necessary to protect the exposed portions of the bridges, culverts, curbs, gutters, posts, guard fences, road signs, and any other structures from splashing oil and asphalt from the paving operations. Remove any oil, asphalt, dirt, or
any other undesirable matter that may come upon these structures by reason of the paving operations.

Where water valve boxes, manholes, catch basins, or other underground utility appurtenances are within the area to be surfaced, the resurfacing shall be level with the top of the existing finished elevation of these facilities. If it is evident that these facilities are not in accordance with the proposed finished surface, notify the proper authority in order to have the facility altered before proceeding with the resurfacing around the obstruction, unless otherwise approved. Protect all covers during asphalt application.

EXCESS MATERIALS AND CONTRACTOR'S RESPONSIBILITY

Dispose of excess materials. Repair all settlement of pavement over trenches for a one-year period. Warranty period to begin at the time the project is accepted by the District.

ROCK SURFACING

Where gravel shoulders have been disturbed, place crushed rock surfacing material, as specified herein, for the full width of all streets, driveways, parking areas, street shoulders, and other areas disturbed by the construction. Rock shall be of the quality and gradation specified for leveling course under "Materials". Spread the rock by "tailgating" and supplement by hand labor where necessary. Level and grade the rock to conform to existing grades and surfaces.

SIDEWALKS AND CURBS

Replace concrete sidewalks and curbs to the same section, width, depth, line and grade as that removed or damaged. Cut ends of existing curb to a vertical plane. Prior to replacing the sections, properly backfill and compact the trench to prevent subsequent settlement.

ASPHALT DRIVEWAYS AND WALKS

Replace asphalt driveways and walks in accordance with "Asphalt Concrete Pavement Replacement".

STORM SEWERS, CULVERTS, AND CATCH BASINS

All storm sewers, catch basins, or culverts that are removed because of interference with new construction shall be removed so as to do the least possible damage to the pipe or basin. Dispose of culvert pipe that is in too poor condition for replacing because of age, physical condition, or other reasons and install suitable pipe as approved by the Engineer.

Replace all pipe on a four-inch thick 3/4" minus crushed gravel base to the lines and grades established by the Engineer. Also replace culvert headwalls of all types to a condition at least equivalent to their original shape or form.

Reinstall catch basins in their original locations and reconnect to the drainage system in a manner equal to the original. If the existing catch basins are damaged beyond repair by the operations, construct new basins of similar size, cross section, and design as the original.

DUCTILE IRON PIPE AND FITTINGS

A. SCOPE

This Section covers the work necessary for the furnishing and installing the ductile iron pipe, fittings and imported granular material for pipe base and pipe zone, complete. Ductile iron pipe and ductile iron and cast iron fittings furnished shall be manufactured in the United States of America.

B. MATERIALS

JOINTS

Pipe joints shall be Tyton^{tm} push-on joints, as licensed by U.S. Pipe and Foundry Company, except where specifically shown or detailed otherwise. Fitting joints shall be mechanical joint ends, except where specifically shown or detailed otherwise.

MECHANICAL JOINT FITTINGS

Mechanical joint fittings shall be ductile iron short pattern or cast iron fittings shall conforming to AWWA C110 and shall be of a class at least equal to that of the adjacent pipe. Mortar lining for fittings shall be the same thickness specified for pipe. Alternatively and the District preference, ductile iron fittings shall be provided with a 6-8 mil nominal thickness coating and lining of fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550 and C116/A21.16. Bolts shall be domestic Cor-Ten or ductile iron tee-head bolts.

PUSH-ON DUCTILE IRON PIPE

Push-on joint ductile iron pipe shall be cement-mortar lined and conform to AWWA/ANSI C151/A21.50 AND C104/A21.4 and shall be U.S. **Tyton joint pipe**, as manufactured by United States Pipe and Foundry Company and Pacific States Cast Iron Company, or as approved. The type and thickness class shall be as tabulated below unless otherwise required by the District Engineer:

Pipe Size	Pipe Class
10” diameter and smaller	52
12” diameter through 16”	51
18” diameter and larger	50

The rubber ring gaskets shall conform to ANSI A21.11, be suitable for the specified pipe sizes and pressures, and shall be furnished with the pipe. A non-toxic vegetable soap lubricant shall be supplied from the pipe manufacturer in sufficient quantities for installing the pipe furnished.

FLANGED FITTINGS

Flanged fittings shall conform to ANSI B16.12 and shall be faced and drilled 125-pound ANSI. The fittings shall be cement-mortar lined to the same thickness specified for pipe. Alternatively and the District preference, ductile iron fittings shall be provided with a 6-8 mil nominal thickness coating and lining fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550 and C116/A21.16. Flange bolts and nuts shall be Grade 2 conforming to Section A.1 of AWWA C153 or C110, standard course thread and domestic cadmium plated.

GASKETS

Gasket material for flanged joints in ductile iron pipe shall be consist of 1/8-inch thick, full-face one-piece, cloth-inserted, rubber gaskets conforming to Section 4 of AWWA C207 and ANSI B16.21. The gasket shall be cut, with holes to pass bolts. Gasket material shall be free from corrosive alkali or acid ingredients.

PUSH-ON JOINTS RESTRAINT FOR DUCTILE IRON PIPE

Push-on joints shall be restrained using Field Lok™ gaskets utilizing stainless steel locking segments vulcanized into the gaskets to grip the pipe to prevent joint separation.

MECHANICAL JOINT RESTRAINT FOR DUCTILE IRON PIPE

Mechanical joint restraint shall be an integral part of the follower gland. Individually activated wedges that increase resistance to pullout as pressure or external force is increased shall be provided as joint restraint. The joint restraint ring and wedge components shall be constructed of grade 60-42-10 ductile iron conforming to ASTM Aaa536. Wedges shall be heat-treated to a minimum hardness of 370 BHN. The dimensions of the follower gland shall be compatible with joint bells conforming to ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.52/C153. The restraint shall be Series 1100 restraint device as manufactured by EBAA Iron, Inc., or equal. The District will allow the use of restraint devices for fittings as trademarked by One Bolt, or approved equal.

FULL BODY SLEEVES FOR BURIED SERVICE

Full body sleeves shall be ductile iron sleeves with mechanical joint components in accordance with AWWA C111/ANSI A21.11. Ductile iron bolts and nuts shall be furnished.

MECHANICAL COUPLINGS FOR NON-BURIED SERVICE

Mechanical couplings, not a part of the pipe itself, shall be ductile iron couplings with rubber rings and ductile iron bolts and nuts. Couplings shall be Dresser, Smith-Blair, or as approved.

TAPPING SLEEVES

Tapping sleeves shall be ductile iron, epoxy-coated steel, or stainless steel fittings as specified hereinafter: Branch outlet from tapping sleeve shall be Schedule 10 material thickness, minimum.

Size-on-Size:

For size-on-size taps, tapping sleeves shall be MJ type sleeves as manufactured by JCM 432, Ford FTSS, Mueller H-304, Smith Blair 665, or Romac SST III (with stainless steel flanges) all stainless steel tapping sleeves, or equal.

Size by Reduced Size Outlet:

Tapping sleeves for pipe sizes equal to or less than 12 inches shall be JCM Model 452 stainless steel 2-piece sleeves with outlet seal or Romac SST III, Ford FTSS, Mueller H-304, Smith Blair 665, or equal.

Tapping sleeves for pipe sizes greater than 12 inches shall be fabricated epoxy-coated steel with stainless steel bolts or JCM Model 532 stainless steel outlet sealed.

Small Taps:

Taps 1" and smaller shall be tapped directly on the ductile iron pipe. See Section "WATER SERVICE CONNECTIONS" for corporation stops materials and workmanship.

IMPORTED GRANULAR MATERIAL FOR PIPE BASE AND PIPE ZONE

For pipe 18 inches in diameter and smaller, use clean crushed rock with a maximum size of 3/4-inch, uniformly graded from coarse to fine. Clean beach, pit-run, or reject crusher-run sand may be substituted for gravel in trenches with no groundwater in the pipe zone.

COLOR CODED MARKER BALLS

Color coded (blue) marker balls shall be Omni Marker Model 161 water markers as manufactured by Industrial Technology, Inc., Mineral Wells, TX. The markers shall contain three orthogonal tuned circuits. These passive circuits, when excited by the standard marker locator, shall produce a uniform, spherical RF field in every direction. The markers shall not require any particular orientation when buried to produce a uniform signal and may be simply tossed into the trench or excavation and covered.

CASING PIPE, SPACERS AND SEALS

Casing Pipe

Casing pipe shall be smooth steel conforming to ASTM A36 with minimum yield strength of 36,000 psi. The minimum wall thickness shall be as required by the jurisdiction governing the highway, railroad, or stream bed (for creek crossings) in question. In no case shall the casing wall thickness be less than ¼-inch.

Casing Spacer

Casing spacers shall be 12-inches wide, 2-piece construction, all stainless steel. The spacer shall have a minimum of 4 runners through 14" pipe size, 6 runners through 36" sizes and 7 runners through 48" sizes to secure carrier pipe within the casing and to resist movement of the pipeline. Casing spacers shall be as manufactured by Cascade Manufacturing, Calpico, Inc., or approved equal.

Casing Seals

Casing seals shall be Model "C" custom pull-on casing ends, as manufactured by Calpico, Inc., or approved equal.

C. WORKMANSHIP

PREPARATION OF TRENCH

Grade

Grade the bottom of the trench by hand to the line and grade to which the pipe is to be laid, with proper allowance for pipe thickness and for greater base when specified or indicated. Pipe will have a minimum 36 inches of cover. Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support the pipe on solid and undisturbed ground at every point between bell holes, except that the grade may be disturbed for removal of lifting tackle.

Imported Granular Base

Provide imported granular base under all pipes where granular fill is used. Place granular base for the pipe in the trench to a minimum of four inches. Trenches to be provided with a granular base for the pipe will be designated by the Engineer during construction. Grade the top of the base to the bottom of the pipe ahead of pipe laying for the full width of the trench. Base shall provide a firm support along entire pipe length.

Bell (Joint) Holes

At the location of each joint, dig bell (joint) holes of ample dimensions in the bottom of the trench and at the sides where necessary to permit the joint to be made properly and to permit easy visual inspection of the entire joint.

Removal of Water

Provide and maintain ample means and devices at all times to remove and dispose of all water entering the trench excavation during the process of pipe laying.

LAYING

Distributing Pipe

Distribute material on the job from the cars, trucks, or storage yard no faster than can be used to good advantage. In general, distribute no more than one week's supply of material in advance of the laying.

Unsuitable Conditions for Laying Pipe

Do not lay pipe in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

Handling Material

Provide and use proper implements, tools, and facilities for the safe and proper prosecution of the work. Lower all pipe, fittings and appurtenances into the trench, piece by piece, by means of a crane, slings, or other suitable tools or equipment, in such a manner as to prevent damage to the pipeline materials and protective coatings and linings. Do not drop or dump pipeline materials into the trench.

Cleaning Pipe and Fittings

Remove all lumps, blisters, and excess coal tar coating from the bell and spigot ends of each pipe. Wire brush the outside of the spigot and the inside of the bell and wipe clean, dry, and free from oil and grease before the pipe is laid. Wipe the ends of mechanical joint pipe and fittings and of rubber gasket joint pipe and fittings clean of all dirt, grease, and foreign matter.

Placing of the Pipe in the Trench

Do not allow foreign material to enter the pipe while it is being placed in the trench.

Push-on Joint Pipe

After the first length of push-on joint pipe is installed in the trench, secure pipe in place with approved backfill material tamped under and along sides to prevent movement. Keep ends clear of backfill. After each section is joined, place backfill to the springline to prevent movement.

Joining Push-on Joint Pipe and Mechanical Joint Fittings

Lay and join pipe with push-on type joints in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for the installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstances.

Mechanical joint fittings vary slightly with different manufacturers. Install the particular fittings furnished in accordance with the manufacturer's recommendations. In general, the procedure shall be as hereinafter specified. Clean the ends of the fittings of all dirt, mud, and foreign matter by washing with water and scrubbing with a wire brush, after which, slip the gland and gasket on the plain end of the pipe. If necessary, lubricate the end of the pipe to facilitate sliding the gasket in place. Then guide the fitting onto the spigot of the pipe previously laid.

Flange Fittings

Bolts for flange fittings shall be full-nut installation (i.e., three full threads showing past nut). Flange fittings shall be fully wrapped with 3 layers of 3 mil PVC sheet.

Valve and Fitting Installation

Completely encapsulate the completed valve and fitting installations with 4 layers of 4 mil PVC to fully cover the valve and fitting body and 6-inches beyond the ends prior to placing pipe base and pipe zone material. Secure PVC to valve to prevent entry of backfill materials under the wrap.

Bell End to Face Direction of Laying

Unless otherwise directed, lay pipe with bell end facing in the direction of the laying.

For lines on steep slopes, face bells upgrade only, as directed by the Engineer.

CUTTING PIPE

General

Cut pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe.

Ductile Iron Pipe

Cut pipe with milling type cutter or saw. Do not flame cut.

Dressing Cut Ends

Dress cut ends of push-on joint pipe by beveling, as recommended by the manufacturer.

ALIGNMENT

Straight Line Placement

Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of one inch horizontally or vertically.

Permissible Deflection of Joints

Wherever it is necessary to deflect pipe from a straight line either in a vertical or horizontal plane, to avoid obstructions, or where long radius curves are permitted, the amount of deflection allowed shall not exceed the values in the following table.

MAXIMUM DEFLECTION PERMITTED*
18-FOOT LENGTH PIPE

	MECHANICAL JOINT**		PUSH-ON JOINT	
	Maximum Deflection		Maximum Deflection	
Dia. In.	Angle Degrees and Min.	Defl. In.	Angle Degrees	Defl.
4	8-18	31	5	18
6	7-07	27	5	18
8	5-21	20	5	18
10	5-21	20	5	18
12	5-21	20	5	18

* The maximum deflection shall be whichever is less, the table or that recommended by the pipe manufacturer.
** Safe deflection for 150 pounds pressure. For higher pressure, reduce tabulated deflection 10 percent for each 150 pounds added pressure.

ANCHORAGE

Limiting Pipe Diameter and Degree of Bend

On all pipelines four inches in diameter or larger, securely anchor by suitable thrust blocking, all tees, plugs, caps, and all bends and at locations where unbalanced forces exist, as determined by the Engineer.

Thrust Blocking

Provide reaction or thrust blocking, as shown, or as directed. The concrete mix shall have a compressive strength of not less than 3,000 pounds per square inch. Place blocking between the undisturbed ground and the fitting to be anchored. The bearing surface shall be as shown on Detail No. 20. Place the blocking so that the pipe and fitting joints will be accessible for repairs, unless otherwise shown.

DEFINITIONS OF PIPE ZONE

The pipe zone shall be the full width of the trench from the bottom of the pipe to a point six inches above the top of the barrel.

IMPORTED GRANULAR BACKFILL AT PIPE ZONE

After the pipe is in place and ready for backfilling, place imported granular backfill material for pipe zone at approximately the same rate on each side of the pipe such that the elevation of the backfill on each side of the pipe is approximately equal at all times. Compact the backfill by tamping in six-inch lifts to the horizontal centerline of the pipe. Each layer shall be compacted to at least 95 percent of its maximum density as determined by AASHO T-99. Particular attention shall be given to the backfilling and tamping procedures to assure that no unfilled or uncompacted areas occur beneath the pipe. The remainder of the backfill in the pipe zone shall be placed without compacting by layers. After backfilling to the top of the pipe zone, compact the native material to at least 95 percent of its maximum density as determined by AASHO T-99 as approved by the Engineer.

INSTALLATION OF MARKER BALLS

Marker balls shall be installed at all dead end lines, large diameter pipelines (16" and larger), and any area within the District deemed to be a difficult to locate area, as directed by the District Inspectors.

HYDROSTATIC TEST

The Contractor shall perform pressure and leakage tests on all newly laid pipe in accordance with District Standards. The Contractor shall furnish all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The District Engineer or Inspector will monitor the tests. The length of pipeline sections for testing will be determined by the District Engineer.

The following equipment and materials are necessary for the above tests:

AMOUNT	DESCRIPTION
2	Approved graduated containers

2	Pressure gauges measuring from 0-200 psi in 2-pound increments
1	Hydraulic force pump approved by the Engineer. Suitable hose and suction as required

The tests shall be conducted after the trench has been backfilled or partially backfilled with the joints left exposed for inspection, or when completely backfilled, as permitted by the Engineer. Where any section of pipe is provided with concrete reaction blocking, do not make the pressure tests until at least five days have elapsed after the concrete thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be cut by two days.

Conduct pressure tests in the following manner, unless otherwise approved by the Engineer. After the trench has been backfilled or partially backfilled as hereinbefore specified, fill the pipe with water, expelling all air during the filling. The test pressure shall be a minimum of 150 pounds per square inch or 1½ times the normal working pressure at the lowest section of line.

DURATION

The duration of each pressure test shall be 60 minutes, unless otherwise directed by the Engineer.

PROCEDURE

Fill the pipe with water and apply the specified test pressure by pumping, if necessary. Then valve off the pump and hold the pressure in the line for the test period. At the end of the test period, operate the pump until the test pressure is again obtained. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to restore the test pressure may be measured accurately.

LEAKAGE

Leakage shall be defined as the quantity of water necessary to restore the specified test pressure at the end of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{SDP^{1/2}}{133{,}200}$$

In the above formula:

L = Allowable leakage, in gallons per hour
S = Length of pipe tested
D = Nominal pipe diameter, in inches
P = Average test pressure, in psi

CORRECTION OF EXCESSIVE LEAKAGE

Should any test of pipe laid disclose leakage greater than that allowed, locate and repair the defective joints, pipe, or appurtenances and retest the pipeline. Leakage must be within the specified allowance.

STERILIZATION

Pipeline intended to carry potable water shall be disinfected before placing in service. Disinfection procedures shall conform to AWWA C651 as hereinafter modified or expanded and the requirements of any governing agency having jurisdiction.

FLUSHING

Before disinfecting, flush all foreign matter from the pipeline. Provide hoses, temporary pipes, ditches, etc., as required to dispose of flushing water without damage to adjacent properties. Flushing velocities shall be as least 2.5 fps. For large diameter pipe where it is impractical or impossible to flush the pipe at 2.5 fps velocity, clean the pipe in place from the inside by brushing and sweeping, then flush the line at lower velocity.

DISINFECTION MIXTURE

Disinfection shall be accomplished using the continuous feed method with a mixture of chlorine-water solution having a free chlorine residual of 40-50 ppm. The disinfection mixture shall be prepared by injecting (1) a liquid chlorine gas-water mixture (2) dry chlorine gas, or (3) a calcium sodium hypochlorite and water mixture into the pipeline at a measured rate while fresh water is allowed to flow through the pipeline at a measured rate so that the chlorine-water solution is of the specified strength.

The liquid chlorine gas-water mixture shall be applied by means of an approved solution feed chlorinating device. Dry chlorine gas shall be fed through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine or the gas itself must provide means for preventing the backflow of water into the chlorine cylinder.

If the calcium hypochlorite procedure is used, first mix the dry powder with water to make a thick paste, then thin to approximately a one-percent solution (10,000 ppm chlorine). If the sodium hypochlorite procedure is used, dilute the liquid with water to obtain a one-percent solution.

The following proportions of hypochlorite to water will be required:

PRODUCT	QUANTITY	WATER
Calcium Hypochlorite[1]	1 lb.	7.5 gal.

(65-70 percent Cl)		
Sodium Hypochlorite[2] (5.25 percent Cl)	1 gal.	4.25 gal.

[1]Comparable to commercial products known as HTH, Perchloron, and Pittchlor
[2]Known as liquid laundry bleach, Clorox, and Purex

Chlorine-water solution used for disinfection with a free chlorine residual in excess of 100 ppm will not be allowed without specific approval by the Engineer or his/her authorized agent.

POINT OF APPLICATION

Inject the chlorine mixture into the pipeline to be treated at the beginning of the line through a corporation stop or suitable tap in the top of the pipeline. Water from the existing system or other approved source shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the pipe that the combined mixture shall contain 40-50 ppm of free available chlorine. Valves shall be manipulated so that a strong chlorine solution in the line being treated will not flow back into the line supplying the water. Use check valves if necessary.

RETENTION PERIOD

Treated water shall be retained in the pipeline long enough to destroy all nonspore-forming bacteria. With proper flushing and the specified solution strength, 24 hours is adequate. To minimize damage to cement mortar lining in ductile iron pipe and fittings, disinfection solution contact time shall not exceed 60 hours. At the end of the 24-hour period, the disinfection mixture shall have a strength of at least 10 ppm of chlorine. Do not place the concentrated quantities of commercial sterilizer in the line before it is filled with water.

Operate all valves, hydrants, and other appurtenances during disinfection to assure that the disinfection mixture is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise may not receive the treated water.

After chlorination, flush the water from the line until the water through the line is equal chemically and bacteriological to the permanent source of supply.

DISPOSAL OF DISINFECTION WATER

Dispose of disinfection water in an approved manner. Do not allow disinfection

water to flow into a waterway without adequate dilution or other satisfactory method of reducing chlorine to a safe level.

PURITY TEST

After disposal of the disinfection mixture, there will be a 24-hour retention period prior to the taking of samples for the bacteriological test. The Contractor's representative under the District's supervision will take the purity samples. Twenty-four hour advance notification is required for scheduling of the samples.

VALVES AND VALVE BOXES

A. SCOPE

This section covers the work necessary for furnishing and installing the gate valves, butterfly valves, and valve boxes, complete.

B. MATERIALS

GATE VALVES

Valves shall be iron body, bronze mounted, resilient seat, NRS valves with o-ring seals, and shall open when the stem is rotated counterclockwise. Unless otherwise shown, valves shall have two-inch square wrench nut. Valve ends and valve sizes shall be as shown. Valves shall conform to AWWA C509 and C515 for ductile iron body valves..

Joint materials for mechanical joint or push-on joint for ductile iron pipe shall conform to AWWA C111. Joint materials for flanged joints shall conform to subsection "GASKETS" in Section "DUCTILE IRON PIPE AND FITTINGS". Bolts for mechanical joint shall be domestic Cor-Ten or ductile iron tee-head bolts. Bolts and nuts for flanged fittings shall conform to Section A.1 of AWWA C153, standard course thread and domestic plated.

Only the valves from the following manufacturers shall be provided for installation in the District's facilities:

- Kennedy
- M & H
- Clow
- American Flow Control
- Mueller

BUTTERFLY VALVES

Butterfly valves shall be the rubber-seated type, suitable for direct-burial service and suitable for 150 psi working pressure and 150 psi pressure differential across the valve. Valve ends shall be as shown. Furnish all joint accessories with valve. Valve shall be equipped with iron body and 304 stainless steel shaft with 304 stainless steel journals. Shaft and disc seals shall be designed for a bottle-tight seal. Valve disc shall be either cast iron alloy conforming to ASTM A 436, Type 1, or chrome-edged cast iron with Bun-N rubber seat bonded to the valve body, or shall be cast iron with rubber disc seat and 304 stainless steel mating surface attached to the valve body in accordance with AWWA C504, Section 4.5.5.3. Valve operator shall be as specified below. Except as herein noted, the butterfly valve shall conform to AWWA C504 for Class 150B. Only the valves from the following manufacturer's

shall be provided for installation in the District's facilities:

- Kennedy
- M & H
- Mueller
- American Darling
- Dresser

BUTTERFLY VALVE OPERATORS

The butterfly valve shall be furnished with totally enclosed, integral valve operator designed to withstand a minimum of 300 foot-pound input torque without damage to the valve or operator. Operators shall be fully gasketed and grease packed and designed to withstand submersion in water to a pressure of 10 psi. Valves shall open with a counterclockwise rotation of an AWWA nut. A minimum of 30 turns of the operating nut shall be required to move the disc from a fully opened position to a fully closed position. Operators shall have two-inch square wrench nut and located on the road centerline side of the pipe.

Joint materials for mechanical joint or push-on joint for cast iron pipe shall conform to AWWA C111. Joint materials for flanged joints shall consist of 1/8-inch thick, full-faced, one-piece, cloth-inserted, rubber gaskets conforming to Section 4 of AWWA C207 and C116/A21.16. Bolts and nuts shall conform to Section 4 of AWWA C207.

VALVE BOXES FOR BURIED GATE AND BUTTERFLY VALVES

Valve boxes shall be one-piece, cast iron type as manufactured by Olympic Foundry, or approved equal. The valve box and cover shall be No. VB910 with a "W" cast into the top. Six-inch D3034 PVC pipe shall be used as a spacer for the lower portion of the valve box, length as necessary. See Detail Nos. 3, 4, and 5 for typical setting details.

EXTENSION STEMS FOR VALVE OPERATORS

Where the depth of the operating nut is more than three feet, operating extensions shall be provided to bring the operating nut to a point 18 inches below the surface of the ground or pavement. The extension shall be constructed of steel. The operator extension shall have a steel disc attached to allow centering of the stem in the valve box. A disc shall be located directly below the top operator nut and no less than 6 feet apart if the extension is 8 feet or more in length.

C. WORKMANSHIP

VALVES

Before installation, the valves shall be thoroughly cleaned of all foreign material, and shall be

inspected for proper operation, both opening and closing, and to verify that the valves seat properly. Valves shall be installed so that the stems are vertical, unless otherwise directed. Joints shall conform to AWWA C600 or AWWA C603, whichever is applicable. Valves shall be installed in accordance with "Standard Detail No's. 3 and 4". Joints shall be tested with the adjacent pipeline. If joints leak under test, valves shall be disconnected and reconnected, and the valve and/or the pipeline retested.

Faces of flanges shall be cleaned thoroughly before flanged joint is assembled. After cleaning, the gasket shall be inserted and the nuts tightened uniformly around the flange. If flanges leak under test, the nuts shall be loosened, the gasket reset or replaced, the nuts retighten, and the valve and/or pipeline retested. After tightening nuts, three full threads shall be showing on the end of the bolt where it is exposed beyond the nut.

VALVE BOXES

Center the valve boxes and set plumb over the wrench nuts of the valves. Set valve boxes so that they do not transmit shock or stress to the valves. Set the valve box covers flush with the surface of the finished pavement as shown, or such other level as may be ordered by the Engineer. Cut extensions to the proper length so that the valve box does not ride on the extension when set at grade. Valve boxes shall be installed in conformance with "Standard Detail No's. 3 and 4".

Backfill shall be the same as specified for the adjacent pipe. Place backfill around the valve boxes and thoroughly compact to a density equal to that specified for the adjacent trench and in such a manner that will not damage or displace the valve box from proper alignment or grade. Misalign valve boxes shall be excavated, plumbed, and backfilled at the Contractor's expense. Where the valve is located outside of the asphalt pavement and in road shoulder or a landscape or dirt area, the Contractor shall pour a 2' x 2' x 4" concrete pad around the valve box.

PRESSURE REDUCING VALVES AND APPURTENANCES

A. SCOPE

This section covers the work necessary for the furnishing and installation of pressure reducing valves, complete with appurtenances.

B. MATERIALS

PRESSURE REDUCING VALVES

Pressure reducing valves (PRV) shall maintain a constant downstream pressure regardless of varying inlet pressure. The PRV shall be a hydraulically operated, diaphragm-actuated, globe pattern valve, equipped with a resilient, synthetic rubber disc forming a tight seal against a single removable seat insert. The diaphragm assembly containing the valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall be a nylon fabric bonded with synthetic rubber. The rubber shall not be used as a seating surface. No packing glands or stuffing boxes are permitted, nor will valves with pistons to operate the valve or pilot controls. Repairs shall be possible without removing the valve from the pipeline.

The pilot control shall be direct-acting, adjustable, spring-loaded, normally open, diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting. A fixed orifice shall be included in the control system. The main valve and body shall be of cast iron construction (ASTM A48); main valve trim shall be brass (QQ-B-626), bronze (ASTM B61) and 303 stainless steel; and the pilot control system shall be of cast bronze (ASTM B62) with stainless steel trim. The PRV shall be furnished with an internal and external 12 mil protective coating with and FDA approved epoxy resin. The epoxy powders shall be applied using the fusion method and cured in accordance with the manufacturer's recommendations.

Valves shall be of a pressure rating to accommodate the upstream pressure including an allowance of 100 psi for surge. Valves shall be Clayton 90G-01AB or 90G-01AS as manufactured by Cal-Val Co., Newport Beach, CA 92663, or approved equal.

See table at the end of this specifications section.

CAST IRON "Y" STRAINERS

Cast iron "Y" strainers shall be installed upstream of the pressure reducing valves to protect the regulator solenoid valves and control orifices from rust, dirt and scale. Strainers 1" through 2" shall be Apollo International TCG Series, or equal, 250 lb. WSP-rated

strainers constructed from high-tensile ASTM A-126 Class B cast iron with blow-off connections and easily removable cylindrical screens. A tapered seat allowing screens to be self-cleaning and tight fit shall be provided. Self-cleaning shall be accomplished by opening the blow-off connection.

Strainers 3" and larger shall be Class 125 or 250, as applicable for the system pressure at the location of the device, Apollo International FC! or FC2 Series, or equal and shall be furnished with flanged connections. Materials of construction shall be as for the TCG Series strainers.

Summary of PRV Features

Cal-Val 3" and Smaller (90G-01)

Item	Description
1	Clayton 100-01 Hightail Globe Valve (Main Valve)
2	X58 Restriction Fitting
3	CRD Pressure Reducing Control Pilot (Range)
B	CK2 Shutoff Cocks (Isolation Valves)
C	CV Speed Control Valve (Closing)
S	CV Speed Control Valve (Opening)
Y	X43Y Strainer (Outside Valve Body)
\	X101 Valve Position Indicator

Cal-Val 4" and Larger (90G-01)

	Item	Description
	1	Clayton 100-01 Hightail Globe Valve (Main Valve)
	2	X58 Restriction Fitting
	3	CRD Pressure Reducing Control Pilot (Range)
**	4	CRL Pressure Relief Pilot (Range)
	B	CK2 Shutoff Cocks (Isolation Valves)
	C	CV Speed Control Valve (Closing)
	S	CV Speed Control Valve (Opening)
	Y	X43Y Strainer (Outside Valve Body)
	\	X101 Valve Position Indicator

** Add CRL (pressure sustaining feature) as needed on a case-by-case basis. Verify with Tualatin Valley Water District prior to ordering.

FIRE HYDRANTS

A. SCOPE

This section covers the work necessary for the furnishing and installing the fire hydrants, complete.

B. MATERIALS

HYDRANTS

Fire hydrants shall be nominal 5¼-inch main valve opening with six inch bottom connections and equipped with two 2½-inch hose nozzles and one 4½-inch pumped nozzle. Operating nut shall be 1½-inch national standard pentagon nut. The main valve shall be equipped with o-ring seals and shall open when turned to the left or counterclockwise. Hydrants shall be of the break-flange or safety-top type. Hydrants shall conform to AWWA C502, and this specification. The normal depth of bury shall be 4 feet. Nozzle threads shall be American National Standard. The inlet connection shall be mechanical joint. Hydrants shall be yellow above the ground line. Hydrants shall be Kennedy K-81 Guardian, Waterous Pacer, or approved equal.

Only the following hydrants shall be provided for installation:

- Mueller Centurion or Super Centurion
- Kennedy K-81
- Clow Medallion
- Waterous Pacer
- M & H Style 129

BASE BLOCK

Solid precast concrete pier block having nominal dimensions of 8-inch thickness by 16-inch square base.

GRAVEL FOR DRAINAGE

Washed 3/4-inch crushed rock or graded river gravel free of organic matter, sand, loam, clay, and other small particles that will tend to restrict water flow through the gravel.

CONCRETE FOR THRUST BLOCKING

3,000 psi ready mix concrete.

THRUST RESTRAINT

Thrust at the fire hydrants shall be restrained using MJ restrained joint follower glands as manufactured by EBBA Iron Works. See Section “DUCTILE IRON PIPE AND FITTINGS” for specification.

C. WORKMANSHIP

Construction and installation shall conform to "Standard Detail Nos. 100, 101 and No. 102" and to provisions of Section 3.7 of AWWA C600, except where otherwise specified.

LOCATION AND POSITION

Locate as shown or directed so as to provide complete accessibility and minimize possibility of damage from vehicles or injury to pedestrians. **Improperly located hydrants shall be disconnected and relocated at the Contractor's expense. See Detail No. 100.**

When placed behind the curb or sidewalk, set hydrant barrel so that no portion of the pumper hose nozzle cap will be less than 18 inches from the gutter face of the curb or backside of the sidewalk. Set all hydrants plumb and nozzles parallel with, or at right angles to, the curb. With the pumper nozzle facing the curb, set hydrants so that the safety flange is a minimum of three inches and a maximum of six inches above finished ground or sidewalk level to clear bolts and nuts, and as directed.

EXCAVATION

Do not carry below sub-base grade. Refill overexcavated areas with gravel, and compact to provide firm foundation.

BASE BLOCK

Place on firm, level sub-base to assure uniform support.

INSTALLATION OF HYDRANTS

Place hydrant carefully on base block to prevent the base block from breaking. When ductile iron pipe is used, jointing procedures shall conform to Section 4.2 of AWWA C600. After hydrant is in place and connected to the pipeline, place temporary blocks to maintain the hydrant in a plumb position during subsequent work.

GRAVEL FOR DRAINAGE

Place gravel around base block and hydrant bottom after hydrant has been blocked in place. Top gravel shall be not less than six inches above hydrant drain opening. Do not connect

drainage system to sewer.

NOTE: **USE MEGALUGS IN LIEU OF CONCRETE THRUST BLOCKING AND THRUST TIES IN ALL CASES FOR FIRE HYDRANTS ONLY, UNLESS OTHERWISE APPROVED BY THE DISTRICT ENGINEER**.

WATER SERVICE CONNECTIONS

A. SCOPE

The work included in this section is applicable to 2-inch and smaller water service connections. The work includes trench excavation and backfill, furnishing and installing service clamps, corporation or valves, meter vaults or boxes, meter yokes or connections, meters, service connection piping, fittings, and appurtenances within the designated limits, testing, flushing, and other incidental work as required for a complete installation. For installation of water service connections above 2-inch contact the District Engineer for installation specifications and Details.

B. MATERIALS

EXCAVATION

Excavation shall conform to the requirements of Section "Trench Excavation and Backfill".

BACKFILL

Material excavated from the trench shall be used for trench backfill. Select backfill material for use in the pipe zone (full width of the trench from the bottom of the pipe to a point six inches above the top of the pipe) shall contain no material larger than one inch in diameter.

CORPORATION STOPS

Corporation stops for 3/4-inch and one-inch copper service lines shall have CC thread inlet and flared copper or compression connection outlet and shall be Ford F600, or as approved. Corporation stops for 1½-inch and 2-inch copper services shall be Mueller H-15023, or as approved.

TAPPING SADDLES

Romac Style 202S, Smith-Blair No. 313, or equal, double- or triple-strap service saddle tapped for FIPT and with and neoprene gaskets. Service saddle shall have an epoxy-coated ductile iron boss with stainless steel straps. Service saddle shall be adequate for use with the size, type, and class of the water pipe. The service saddle may be deleted at the discretion of the Engineer.

BRANCH PIECE

For use with a double service, Ford U-28-43-14" or Mueller H-15363 (compression), 1" copper flare x 3/4" IPT x 3/4"IPT, or approved equal.

METER BOXES AND COVERS

Brooks, or approved equal, meter box with concrete cover and cast iron reading lid:

For 5/8-inch by 3/4-inch size meter - Brooks No. 4, or equal.
For 1-inch size meter - Brooks No. 37, or equal.
For 1½-inch size meter - Carson No. 1730-18-5BML.
For 2-inch size meter - Carson No. 1730-18-5BML.

ANGLE VALVES

For 3/4" - Ford KV23-332W by copper fitting (flare) or KV43-332WQ (compression), or equal.
For 1" - Ford KV23-444W by copper fitting (flare) or KV43-444WQ (compression), or equal..
For 1½" - Mueller H-14277, or equal.
For 2" - Mueller H-14277, or equal.
For 3/4" U-branch - Ford KV13-332W , or equal.

METER RESETTER

For 3/4" service - Ford V42-9", or equal.
For 3/4" service - Ford V42-12", or equal.
For 1" service - Ford V42-12", or equal.
For 1½" service - Ford VVF66-12Bx13", or equal.
For 2" service - Ford VVF77-12Bx17", or equal.

Resetter for 1½" and 2" services shall be provided with 1" Hi-inline bypass except for irrigation service. Bypass valve shall be equipped with padlock wings.

GALVANIZED PIPE FITTINGS

Galvanized pipe shall be standard weight with threaded ends and couplings, and shall conform to ASTM A120. Galvanized fittings for use with ferrous pipe having American Standard Pipe threads shall conform to Federal Specifications WW-P-406. Galvanized pipe and fittings shall not be used for buried service.

COPPER TUBE

Copper tube used for 3/4-inch and one-inch service connections shall be Type K, soft, seamless, conforming to ASTM B88. Copper tubing must be of domestic manufacture.

C. WORKMANSHIP

TRENCH EXCAVATION AND BACKFILL

Conform to the requirements of Section "Trench Excavation and Backfill". Backfill material in the trench to within six inches of service connection pipe or line. Cover over pipe shall be as indicated on "Standard Detail No. 10".

CONNECTION TO MAIN

Taps shall be made in the pipe by experienced workmen using tools in good repair with proper adapters for the size of pipe being tapped.

PREPARATION OF TRENCH

Grade the bottom of the trench by hand to the line grade to which the pipe is to be laid, with proper allowance for special bedding. Special bedding, as specified in Section "Cast Iron Pipe and Fitting", will be required at all locations where the trench bottom is not uniform and smooth or where it presents rocks or projections that might be detrimental to the service connections pipe. The trench bottom shall form a continuous and uniform bearing for the pipe. Provide and maintain ample means to remove water entering the trench during the laying operation to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill around the pipe zone. Do not lay pipe in water. A six-inch layer of imported earth or other approved material will be required over pipe in areas where suitable trench-side material is not available. Trench excavation and backfill shall conform to application of Section "Trench Excavation and Backfill".

GALVANIZED PIPE

Galvanized pipe shall be cut with proper tools. All pipe threads shall be neatly cut with sharp tools and joining procedure shall conform to the best accepted methods. After cutting, all pipe shall be reamed. Pipe and couplings shall be joined with an application of an approved non-toxic pipe compound. Galvanized pipe will not be used if copper tubing or brass piping can be used for the application. Galvanized pipe will not be used for buried service.

COPPER TUBING

The copper tubing shall be cut with square ends, reamed, cleaned, and made up tightly. Care shall be taken to prevent the tube from kinking or buckling on short radius bends. Kinked or buckled sections of copper tube shall be cut and the tube spliced with the proper brass fittings at the Contractor's expense.

INSTALLATION OF METER BOXES

Meters and meter boxes shall be installed as shown or as directed. Finish grade of completed meter enclosure shall be so as to allow a minimum of one inch and a maximum of four inches clearance from the top of the meter to the meter box. Meter boxes shall be set or constructed plumb, with the top set horizontally. Lightly compacted earth backfill shall be placed inside of the meter boxes to depth indicated. Grade adjustments of the meter boxes shall be by using standard extension sections for the box specified. Backfill around meter boxes as specified for adjoining pipe. Provide adequate space to allow for sidewalk installation.

Installation of meters will be withheld until the Water District has accepted the project. Prior to connection of the meter, the angle valve shall be opened and the service line flushed of all foreign materials.

Depending on the elevation difference between the meter and the proposed building to be served, the Water District may require a gate valve or backflow-preventing valve on the customer side of the meter at the meter box. Installation to be approved by the Engineer.

DISINFECTION

When directed by the District Engineer, fill line with liquid laundry bleach such as Clorox or Purex for 10 minutes minimum, then flush prior to hydrostatic testing.

HYDROSTATIC TEST AND LEAKAGE

Test service connections and service connection pipe by either testing in conjunction with the main at the test pressure required for the main, or by testing at the normal hydrostatic main pressure after the main has been completely installed and tested. Inspect visually for leaks and repair any leaks before backfilling. Duration of the test shall be at least 30 minutes.

AIR AND VACUUM RELEASE VALVE ASSEMBLY

A. SCOPE

This section covers the work necessary for furnishing and installing air and vacuum release valve assemblies, complete.

B. MATERIALS

SERVICE SADDLES (FOR 1-1/2" AND LARGER SERVICES)

Romac Style 202S, Smith-Blair No. 313, or equal, double- or triple-strap service saddles tapped for FIPT and with and neoprene gaskets. Service saddle shall have an epoxy-coated ductile iron boss with stainless steel straps. Service saddle shall be adequate for use with the size, type, and class of the water pipe. Taps for 1" air and vacuum release valve assemblies shall be direct tapped (see Section "DUCTILE IRON PIPE AND FITTINGS".

AIR AND VACUUM RELEASE VALVES

An air valve is required when the pipe has a high point of one diameter or more than the rest of the installation. The air and vacuum release valves shall be constructed to permit the escape of large volumes of air when the line is being filled with water, to permit smaller amounts of accumulated air to be released under normal operating conditions, and so that air may re-enter the line to break any vacuum caused by the water leaving the line rapidly. The valves shall be designed to operate under working pressures of 150 psi and shall have been tested at a pressure not less than 300 psi. The air and vacuum release valves shall be similar to APCO heavy-duty combination air release valves, as manufactured by the Valve and Primer Corporation, Chicago, Illinois:

For 1" size - Model No. 143C
For 2" size - Model No. 145C

The valve inlets shall have iron pipe threads.

VAULT

Carson meter box, or approved equal.

For 1" size - Model No. 1730D-P15L
For 2" size - Model No. 1730D-P15L

PIPE AND MALLEABLE IRON FITTINGS

See Standard Detail Nos. 601 and 602, Air Release Valve Assembly. The pipe used for the air release valve assemblies shall be brass or copper tubing as shown.

GRAVEL

Place a minimum of 12" of gravel beneath the air release valve. Gravel shall be 3/4-inch minus gravel with reasonable, even gradation from coarse to fine and free from excessive dirt or other foreign material.

MISCELLANEOUS MATERIALS

Provide all miscellaneous materials not specified herein, but necessary to accomplish the construction as shown. All such materials shall be of the best commercial quality and suitable for the intended use.

C. WORKMANSHIP

TAPPING PIPE

The pipe shall be tapped and service saddle installed by experienced workmen using tools in good repair with proper adapters for size main being tapped. The tapping machine shall be of a type approved by the Engineer. For 1½" and 2" taps service saddles shall be utilized and installed as recommended by the manufacturer.

PIPING

Cut pipe with sharp tools and ream ends of all cut sections. An approved joint compound shall be applied to the threads of all pipe, fittings, and valves prior to joining. After threaded joints are made up, the exposed threads and pipe shall be given a protective coating of tarset, a coal-tar epoxy, manufactured by Pittsburgh Coke and Chemical Company, or Bitumastic 300, as manufactured by Koppers Company, Inc. Protective coating shall be applied in conformance with the manufacturer's printed directions and recommendations.

VAULT

Compact thoroughly the gravel beneath the concrete box. Set the box so that it conforms to elevation of the existing ground. Install concrete top to allow minimum of 6 inches clearance between the street ell and the concrete top.

TESTING

Air valve assemblies shall be tested in conjunction with the pipeline.

DISINFECTION

Air valve assemblies shall be sterilized in conjunction with the pipeline disinfection.

PRECAST CONCRETE VAULTS

A. SCOPE

This section covers the work necessary for furnishing and installing precast concrete vaults**.** This section shall apply to vaults for:

- Meters larger than 2" in size
- Backflow devices
- Pressure reducing devices

B. MATERIALS

BASE ROCK

Base rock shall conform to "IMPORTED GRANULAR MATERIAL FOR PIPE BASE AND PIPE ZONE" in Section "DUCTILE IRON PIPE AND FITTINGS".

CONCRETE

Concrete shall conform to "CONCRETE" in Section "SURFACE RESTORATION".

PRECAST CONCRETE VAULT

The precast concrete vault shall be furnished to the dimensions shown on the Drawings and as specified herein. The vault shall be as manufactured by Utility Vault Co., Wilsonville, OR, Pipe, Inc., Portland, OR, or approved equal, with precast concrete top section, center section, extension section, and base section. Vaults shall be equipped with a ladder meeting the requirements of OSHA, as applicable**,** and as shown on the Drawings. Ladder extension shall extend 40 inches above the top rung of ladder. Ladders shall be fabricated steel with deformed rungs and shall be hot-dipped galvanized after fabrication. Vaults six (6) feet and greater in depth shall be equipped with a Utility Vault Company Model 1672, or equal, aluminum ladder extension. Provide a sump and sump pump for vaults where drain to daylight is not possible. The sump for the vault shall conform to dimensions shown on Detail 310 and/or 320. Provide pipe blockouts in walls at location shown on the Drawings. The top section shall be furnished with a Bilco aluminum sidewalk door, Type J or JD; Syracuse Castings Sales Corporation, Type CH or CHD; L.W. Products, Type "S" or "D"; or equal with size and location as shown on the Drawings. The sidewalk door shall be furnished with: a channel frame with an anchor flange around the perimeter; a 1½-inch drain coupling; aluminum diamond plate cover to withstand a live load of 300 pounds per square foot; equipped with compression springs to assist operation; automatic hold-open arm with release handle, a locking hasp, and a snap lock with removable handle. Furnish sidewalk door with 316 stainless steel hardware and forged brass hinges with stainless steel pins. Aluminum in contact with concrete shall be coated with bituminous coating.

The drain from the sidewalk door shall be stubbed-out to the exterior of the vault. Ladder and accessories shall be hot-dipped galvanized after fabrication. Preformed plastic gaskets for horizontal vault joints shall be Kent Seal No. 2 manufactured by Hamilton Kent Manufacturing Company, Box 178, Kent, OH 44230; Ram-Nek, manufactured by K.T. Snyder Company, Inc., Central National Bank Bldg., Houston, TX 77002; or equal, meeting all the requirements of Federal Specification SS-S-00210. Prior to backfilling around vaults grout all joints using non-shrink grout.

Seal all wall penetrations for pipes and conduits using nonshrink grout. Patch wall areas with rock pockets showing, using nonshrink grout.

Dampproof the exterior below grade walls and base with Type A, A.C. Horn Dehydratine 4, with CrystalSeal, a water based blend of penetrating ingredients that react with the free lime in the concrete and crystallize with the calcium hydroxides to seal the vault, or equal. Asphalt compound of brush or spray consistency conforming to Federal Specification SS-A701 or ASTM D449 may be used with the Engineer's approval. Vaults damp-proofed using clear compounds, such as CrystalSeal, shall be marked in black paint as having received such a coating. The markings shall indicate the type of material used.

Sump pump shall be Grundfos Model KP250 1/3 HP stainless steel sump pump with a free floating liquid level switch with normally open contact that closes on rising liquid level. Pump shall be equipped with 1-1/4” discharge and miscellaneous piping for discharge including an inline check valve and isolation gate valve (size equal to the discharge line size) downstream of the check valve. Provide power source at a voltage compatible with the sump pump motor. Conduit for power shall be a minimum of 2' from any other pipe penetration.

C. WORKMANSHIP

EXCAVATION AND BACKFILL

Excavation for vaults shall conform to Section "TRENCH EXCAVATION AND BACKFILL".

BASE ROCK

Remove water from excavation. Place base rock conforming "IMPORTED GRANULAR BASE" in Section "DUCTILE IRON PIPE AND FITTINGS".

PLACING PRECAST SECTIONS

If material in bottom of excavation is unsuitable for supporting unit, excavate and backfill with "FOUNDATION STABILIZATION" as specified in Section "TRENCH EXCAVATION AND BACKFILL" to required grade. Set units to grade at locations shown on the Drawings.

Place precast vaults in conformance with details shown on the Drawings.
Install preformed plastic gaskets for vault sections in accordance with manufacturer's

instructions and the following:

1. Carefully inspect precast vault sections to be joined.
2. Do not use sections with chips or cracks in the tongue.
3. Use only primer furnished by gasket manufacturer.
4. Install gasket material in accordance with manufacturer's instructions.
5. Completed vaults shall be rigid and watertight.
6. Top of vault lid shall be 6-inches above adjacent finished landscape grade.

PIPE PENETRATIONS

Opening in vault walls shall be no larger than 2-inches greater than flange diameter of pipe being installed. Opening in knockout shall be made using a core drill or a series of smaller diameter drill holes along the circumference of the opening at no more than 2-inch centers.

CROSS CONNECTION CONTROL AND BACKFLOW ASSEMBLIES

GENERAL REQUIREMENTS:

An approved customer-owned and -maintained backflow prevention assembly shall be installed on each service line to a consumer's water system at or near the property line when any of the following conditions exist:

1. There is an auxiliary water supply, which is, or can be, connected to potable water piping. If the auxiliary supply is a well and the well is abandoned per State of Oregon Water Resources Department requirements and a copy of a certificate to that effect is provided to the District, no backflow device is required behind the meter.

If the waterline transmitting water from the well to the building is abandoned, cut and capped and thus leaving the well to be used only for irrigation. The cut and capped end of the waterline shall be housed in a box with a removable lid (Brooks No. 37, or equal) to accommodate an annual inspection to verify the well remains abandoned.

If the waterline transmitting water from the well to the building is left intact, water service cannot be provided from the Tualatin Valley Water District's facilities until an RP type device* is installed at the meter and a test report is filed with the District.

* When a backflow assembly is installed behind the meter, thermal expansion may occur due to heating of water in the building's hot water heater. The uniform plumbing code requires additional equipment to be installed to control the thermal expansion (See Section 608.3 of the UPC). Note this reference to the UPC is provided for convenience of the reader only.

2. There is piping for conveying liquids other than potable water, and where that piping is under pressure and installed in proximity to the potable water piping.

3. There is intricate plumbing, which makes it impractical to ascertain whether or not a cross connection exists.

4. There is a pipeline one and one-half inches (1½") or larger, nominal pipe size, supplying public water to the premises.

5. There is structure more than thirty feet (30') in height (as measured between the highest peak of that structure and the elevation of the service at the public water main to those premises).

6. There is a risk of back siphoning or back pressure.

7. There is a cross connection or a potential cross connection.

8. There is an irrigation/sprinkler system (See Detail BF10).

9. The owner of a mobile apparatus, to which the Tualatin Valley Water District supplies water, shall provide for backflow prevention by installing a backflow prevention device assembly or provide an approved air gap separation on the mobile apparatus. (See Detail BF500).

10. When there is a standby fire line/sprinkler system a double check detector assembly (DCDA) will be the minimum protection required. In addition:

a. Any system with provision for adding foamite or toxic fire retardants, whether directly connected or not, will require a reduced pressure principle detector assembly (RPDA) at the property line.

b. Any system connected to or with provisions for connecting to an unapproved auxiliary water supply will require a reduced pressure principle (RPDA) at the property line.

c. Any system that utilizes antifreeze will require a reduced pressure principle backflow assembly (RP) on the antifreeze loop.

d. Any system with private fire hydrants will require a double check detector assembly (DCDA) at the property line.

e. Residential flow through and multipurpose sprinkler systems require no backflow device to be installed.

Backflow prevention assemblies shall be installed at the property line (on private property outside of public easements).

Backflow prevention assemblies, where required for protection of the public water system, shall meet the requirements set forth in the current Oregon Administrative Rules, Chapter 333-61-070, Uniform Plumbing Code and the Tualatin Valley Water District requirements. The Oregon Health Division, Drinking Water Section, provides a list of approved assemblies.

TYPES OF BACKFLOW ASSEMBLIES:

There are seven types of backflow prevention assemblies, which Tualatin Valley Water District will allow as protection of the public water system:

- Double check assembly (DC)
- Double check detector assembly (DCDA)
- Reduced pressure principle backflow assembly (RP)
- Reduced pressure principle detector backflow assembly (RPDA)
- Pressure Vacuum Breaker assembly (PVB)
- Atmospheric Vacuum Breaker assembly (AVB)
- Air Gap

The type of backflow prevention assembly required is determined by the aforementioned rules and codes, based on the type of premises to which water service is being provided. The approved types of assemblies are listed below together with some of the types of premises that must be protected by each type of assembly. However, these lists are not comprehensive. They are only **intended to give basic guidelines.** Contact the Engineer or Cross Connection Control Coordinator for additional information.

1. DOUBLE CHECK BACKFLOW ASSEMBLY

An approved double check backflow (See Detail Nos. BF100, BF101, BF102, & BF103) assembly shall be required on the service connection at the following locations:

- **a.** Multi-story buildings which are in excess of 30 feet above the water main at the service connection.
- **b.** Shopping centers or large retail stores.
- **c.** Restaurants or fast food establishments.
- **d.** Any tax lot that is served by two water services supplied by Tualatin Valley Water District.
- **e.** Any water service that is one and one-half inches (1½") or larger nominal pipe size.

2. DOUBLE DETECTOR CHECK BACKFLOW ASSEMBLY

An approved double detector check backflow assembly (See Detail Nos. BF200 & BF201) shall be required on the service connection at the following locations:

- **a.** Standby fire sprinkler system line.
- **b.** Water line to private fire hydrant.
- **c.** The detector meter shall be a Model 25 Badger Recordall meter that complies with ANSI/AWWA C710. Meter shall be provided with Badger Meter Read-O-Matic generator calibrated for reading in cubic feet, except for Sherwood system shall be in gallons. Remote registers will be provided by others.

3. REDUCED PRESSURE BACKFLOW ASSEMBLY

An approved Reduced Pressure Backflow Assembly: (See Detail Nos. RP300, RP301, BF302 & BF303) shall be installed above ground on the service connection at the following locations:

- **a.** Any tax lot that has an auxiliary water supply on or available to it. This will include any above or below ground water source. (The most commonly encountered type of auxiliary water supply is a private well.)
- **b.** Commercial buildings which are located within an industrial zone.
- **c.** Hospitals, medical centers and clinics.
- **d.** Mortuaries and nursing homes.
- **e.** Fueling stations and/or automotive service facilities.
- **f.** Sewage pump and lift stations.
- **g.** Dry cleaners and commercial laundries.
- **h.** Any water system which has a pump to supplement pressure.

i. Irrigation systems which are designed to use chemical injection.

4. REDUCED PRESSURE DETECTOR BACKFLOW ASSEMBLY

An approved Reduced Pressure Detector Backflow Assembly (See Details Nos. BF202 & BF203) shall be installed above-ground on the standby sprinkler system service connection:

a. The system has provisions for adding foamite or toxic fire retardants whether directly connected or not.

b. The system is connected to or may have provisions to connect to an unapproved auxiliary water supply.

c. The detector meter shall be a Model 25 Badger Recordall meter that complies with ANSI/AWWA C710. Meter shall be provided with Badger Meter Read-O-Matic generator calibrated for reading in cubic feet, except for Sherwood system shall be in gallons. Remote registers will be provided by others.

5. PRESSURE VACUUM BREAKER ASSEMBLY

An approved Pressure Vacuum Breaker Backflow Assembly (See Detail No. BF10) shall be installed above-ground on the irrigation system service connection:

a. Irrigation sprinkler systems.

6. ATMOSPHERIC VACUUM BREAKER ASSEMBLY

An approved Atmospheric Vacuum Breaker Backflow Assembly (See Detail No. BF10) shall be installed above-ground on the irrigation system service connection:

a. Irrigation sprinkler systems.

7. AIR GAP

A physical separation between the free flowing discharge end of a potable water supply pipeline and an open or non-pressure receiving vessel shall be provided. The "Approved Air Gap" (See Detail No. BF501) shall be a minimum of twice the diameter of the supply pipe measured vertically above the overflow rim of the vessel and in no case less than one inch (1"). The air gap shall be installed away from walls or any other obstruction that may restrict the air flow into the outlet pipe and that may nullify the effectiveness of the air gap to prevent backsiphonage.

A properly maintained approved air gap is the best means available for protection against backflow, however, an air gap is not always practical.

a. Normally used on water tanker trucks.

INSTALLATION OF DEVICES:

Backflow prevention assemblies shall be installed at the water service connection on the customer side of the meter when used for premise containment. All reduced pressure principle backflow assemblies should have a strainer installed in front of the device. This strainer should be cleaned and inspected once per year. Whenever a backflow assembly is used for premise containment, a closed plumbing system is developed and special

precautions should be taken for thermal expansion.

Following are installation standards:

DOUBLE CHECK BACKFLOW ASSEMBLIES

1. Two and one-half inch (2½") and smaller double check valve assemblies used for system containment shall be installed at the water service connection on the customer side of the water meter (See Detail Nos. BF101 and BF102).

- **a.** One inch (1") and smaller double check valve assemblies shall be installed in a Brooks meter box 1419 Series or equal. One and one-half inch (1½") and 2" double check valve assemblies shall be installed in a Carson 1730D P15L meter box or equal. Two and one-half inch (2½") double check valve assemblies shall be installed in a Brooks 2436 (HDPE), or Brooks 2448 (ABS) meter box, or equal.
- **b.** The meter box shall be installed on a crushed rock base or ¾" or 1" minus.
- **c.** The device shall be installed in such a way as the test cocks are easily accessible and the check valves may be removed without removing the device.
- **d.** Unions shall be installed on the inlet and outlet piping (See Detail BF101 and BF102).
- **e.** The device must be protected from freezing during cold weather.
- **f.** Plugs to be installed on test cocks of below-ground installations (no dissimilar metals).

2. Three-inch (3") Double Check Backflow Assemblies and larger may be installed in a vault below ground (See Detail BF100) or with the Engineer's approval for above ground installation (See Detail BF103).

Vault Installation (Detail BF100)

- **a.** Below ground vaults shall be in accordance with Section "Precast Concrete Vaults" of the Construction Specifications in this manual.
- **b.** Inlet piping shall be ductile iron Class 52, spool with flange by plain end.
- **c.** The double check backflow device must be flanged and shall be an Oregon State Health Department and Tualatin Valley Water District approved device.
- **d.** The connection between the downstream piping and the backflow device must be made with a flange coupling adapter.
- **e.** Clearance between the device and interior vault wall must be a minimum of twelve inches (12"). The clearance between the test cock side of the device and the interior vault wall must be a minimum of twenty-four inches (24").
- **f.** A minimum clearance of three inches (3") is required from a fully opened stem to the top of the vault lid when "OS&Y" valves are used.
- **g.** Clearance from the bottom of the backflow device to the floor shall be a minimum of twelve inches (12") and the device must be supported with

"Stand-On" pipe stands.

h. The vault must be free from standing water. A rodent screen is required if a drain line to daylight is approved. If a drain line is not approved, then a sump pump will be required. See Subsection **Precast Concrete Vaults** in the Construction Specifications.

i. Plugs to be installed on test cocks for below-ground installations (no dissimilar metals).

Above Ground Installation (Detail BF103)

a. Must have the Engineer's approval.

b. Backflow assembly must be flanged

c. Underground 90 bends shall be restrained with mega-lug retainer glands and concrete thrust blocking. Above ground 90 bends shall be flanged.

d. Inlet and outlet piping shall be ductile iron Class 52 flanged by Plain End.

e. Backflow assembly must be installed horizontal and plumb.

f. Concrete slab shall be six inch (6") minimum thickness and 3000 psi strength concrete.

g. Concrete slab shall be poured on four inch (4") leveling course of 3/4" crushed rock and compacted.

h. The clearance for the backflow assembly shall be twelve inches (12") between the assembly and the interior wall. The clearance between the test cock side of the assembly and the interior wall shall be twenty-four inches (24"). The clearance between the bottom of the assembly and the floor of the vault shall be a minimum of twelve inches (12") to a maximum of sixty inches (60").

i. Backflow assembly shall be supported by "Stand-On Pipe Supports" or equal.

j. Enclosure shall include an adequate bore sighted drain.

k. Enclosure shall be insulated or have a heat source to keep the enclosure at 40^{o} F. Wiring shall be installed to local code.

l. All structures to comply with local building codes.*

m. A door or other approved access shall be provided.

***** The industry has available manufactured housing for backflow devices. Noted manufacturers are: HydroCowl; Hot Box; and N.W. Utilities Products. Your local supplier may have information on these and other products.

REDUCED PRESSURE BACKFLOW ASSEMBLIES

1. All reduced pressure backflow assemblies shall be installed above ground, horizontal and plumb and in a location approved by Tualatin Valley Water District (See Detail Nos. BF300, BF301, BF302 and BF303).

1", 1-½" and 2" Reduced Pressure Backflow Assemblies (Detail BF301 and BF302)

a. 1", 1-½" and 2" assemblies may be threaded. Piping material to meet local plumbing code.

b. Piping shall include a union for ease of removal.
c. A minimum of twelve inches (12") from bottom of device to the floor.
d. Enclosure shall be installed on concrete pad.
e. Enclosure shall comply with local building codes.*
f. Enclosure shall be insulated and/or have a heat source to keep enclosure at 40^{o} F.
g. Enclosure to have a bore sighted drain. The drain size of the 1" RP is 1-½" and for the 1-½" and 2" size RP's are 2".

***** The industry has available manufactured housing for backflow devices. Noted manufacturers are: HydroCowl; Hot Box; and N.W. Utilities Products. Your local supplier may have information on these and other products.

2½" Reduced Pressure Backflow Assemblies and Larger (Detail BF300 & BF303)

a. 2½" and larger assemblies must be flanged.
b. Underground 90 bends shall be restrained with megalug retainer glands and concrete thrust blocking. Above ground 90 bends shall be flanged.
c. Inlet and outlet piping shall be ductile iron Class 52, flanged by Plain End.
d. Concrete slab shall be six inches (6") minimum thickness, 3000 psi strength concrete.
e. Concrete slab shall be poured on four inch (4") leveling course of 3/4' crushed rock and compacted.
f. The clearance for the backflow assembly shall be twelve inches (12") between the assembly and the interior wall. The clearance between the test cock side of the assembly and the interior wall shall be twenty-four inches (24"). The clearance between the bottom of the assembly and the floor shall be a minimum of twelve inches (12") and a maximum of sixty inches (60").
g. Backflow assembly shall be supported by "Stand-On Pipe Supports" or equal.
h. Enclosure shall include a bore-sighted drain, sized per relief valve discharge requirements (See Detail BF304).
i. Enclosure shall be insulated or have a heat source to keep the enclosure at 40^{o} F. Wiring shall be installed to local code.
j. All structures to comply with local building code.*
k. A door or other approved access shall be provided.

***** The industry has available manufactured housing for backflow devices. Noted manufacturers are: HydroCowl; Hot Box; and N.W. Utilities Products. Your local supplier may have information on these and other products.

STANDBY FIRE LINES:

All fire lines shall be protected with a minimum of a double check detector assembly (DCDA). If the fire line has provisions for adding foamite or toxic fire retardants or any system connected to or with provisions for connecting to an unapproved auxiliary water supply, the public water system must be protected with an reduced pressure principle

detector check assembly (RPDA). Backflow assemblies used for fire line protection must be installed on the owner's property (i.e. just behind the right of way or property line). When it is not possible to locate the assembly at the property line, an easement may be required.

Installation of Reduced Pressure Principle Detector Assemblies:

1. Installation of backflow assemblies shall be installed in a vault, above finished grade (See Detail nos. BF202 and BF203), or as approved by the District Engineer.
   a. All piping and backflow assemblies shall be installed per Tualatin Valley Water District Standards.
   b. 2½", 3" and larger assemblies shall be flanged.
   c. Underground 90' bends shall be restrained with megalug retainer glands and concrete thrust blocking. Above ground 90' bends shall be flanged.
   d. Inlet and outlet piping shall be ductile class 52 flanged by plain end.
   e. Concrete slab shall be 6" minimum thickness 3000 PSI strength concrete.
   f. Concrete slab shall be poured on 4" crushed rock compacted.
   g. The clearance for the backflow assembly shall be 12" from the backside of the assembly to the wall and 24" from the detector meter to the wall and a minimum of 12" to a maximum of 60" from the floor to the bottom of the assembly.
   h. The backflow assembly shall be supported by "Standon pipe supports" or equal.
   i. Enclosures shall include a bore-sighted drain, sized adequately for relief valve discharge (See Detail BF304).
   j. Enclosures shall be insulated or have a heat source to keep the enclosure at 40^{o} F., wiring shall be installed to local codes.
   k. All structures to comply with local building codes.*
   l. A door or other approved access shall be provided.
   m. The detector meter shall be a Model 25 Badger Recordall meter that complies with ANSI/AWWA C710. Meter shall be provided with Badger Meter Read-O-Matic generator calibrated for reading in cubic feet, except for Sherwood system shall be in gallons. Remote registers will be provided by others.

   * The industry has available manufactured housing for backflow devices. Noted manufacturers are: HydroCowl; Hot Box; and N.W. Utilities Products. Your local supplier may have information on these and other products.

Above ground vault installation where backfill and final landscaping can be provided, (See Detail BF203). The assembly installation shall remain the same as noted above.

Installation of Double Check Detector Assembly:

1. Three-inch (3") Double Check Backflow Assemblies and larger may be installed in a vault below ground (See Detail BF200) or with the District Engineer's approval above ground (See Detail BF201).

Below Grade Vault Installation (BF200)

a. If installed below ground the vault must be a Utility Vault Company vault or equal, and installed as per Section **"Precast Concrete Vault"** of the Construction Specifications.
b. Inlet and outlet piping 5 feet minimum beyond vault shall be ductile iron, Class 52, spool with flange by plain end.
c. The double check backflow device must be flanged and an Oregon State Health Department and Tualatin Valley Water District approved device.
d. The connection between the down stream piping and the backflow device must be made with a flanged coupling adapter.
e. Clearance on the backside of the device to the vault wall must be a minimum of 12", clearance from the test cock side of the device to the vault wall shall be a minimum of 24".
f. OS&Y valve clearance from a fully opened stem to the top of the vault lid must be 3" minimum.
g. Clearance form the bottom of the backflow device to the floor shall be a minimum of 12" and the device supported with "Standon" pipe supports.
h. The vault must be free from standing water, if able to run to daylight, a drain line with a rodent screen is required. If Connected to a storm drain a check valve must be installed to prevent storm water from backing into the vault. If unable to use either a daylight drain or storm drain, a sump pump will be required. See Section **"Precast Concrete Vaults"** for sump pump specifications.
i. The detector meter shall be a Model 25 Badger Recordall meter that complies with ANSI/AWWA C710. Meter shall be provided with Badger Meter Read-O-Matic generator calibrated for reading in cubic feet, except for Sherwood system shall be in gallons. Remote registers will be provided by others.

Above Ground Installation (Detail BF201)

j. Tualatin Valley Water District Engineer shall approve installation.
k. Backflow assembly must be flanged.
l. Underground 90^{o} bends shall be restrained with megalug retainer glands and concrete thrust blocking. Above ground 90^{o} bends shall be flanged.
m. Inlet and outlet piping shall be ductile iron Class 52 flanged by plain end.
n. Backflow assembly must be installed horizontal and plumb.
o. Concrete slab shall be 6" minimum thickness, 3,000 psi strength concrete.
p. Concrete slab shall be poured on 4" leveling course of ¾" minus compacted crushed rock.
q. The clearance for the backflow assembly shall be 12" from the backside of the assembly to the wall and 24" from the test cock side of the assembly to the wall and 24" minimum from floor to the bottom of the assembly.
r. Backflow assembly shall be supported by "Standon" pipe supports, or equal.
s. Enclosure shall include an adequate bore sighted drain to daylight.
t. Enclosure shall be insulated, or have a heat source, to keep enclosure at 40^{o} F. Wiring shall be to local electrical code.

u. All structures to comply with local building codes.
v. A door or other approved access shall be provided.
w. The detector meter shall be a Model 25 Badger Recordall meter that complies with ANSI/AWWA C710. Meter shall be provided with Badger Meter Read-O-Matic generator calibrated for reading in cubic feet, except for Sherwood system shall be in gallons. Remote registers will be provided by others.

WASHINGTON COUNTY
DEPARTMENT OF LAND USE AND TRANSPORTATION
HILLSBORO, OR 97123

APPLICATION FOR PERMITS TO OCCUPY OR PERFORM OPERATONS WITHIN THE RIGHT-OF-WAY OF COUNTY AND DEDICATED ROADS

PLEASE PROVIDE THE FOLLOWING:

THREE SETS OF CONSTRUCTION PLANS

DATE OF APPLICATION:_____

TYPE OF WORK:_____

LOCATION OF WORK:_____[Tns___Rng___Sec___]

NAME OF APPLICANT (AGENCY): **TUALATIN VALLEY WATER DISTRICT**

CONTACT PERSON: **STU DAVIS**

PHONE NUMBER: **503/642-1511**

ADDRESS: **P.O. BOX 745**
BEAVERTON, OR 97075

CONTRACTOR (IF APPLICABLE):_____

PROPOSED START & COMPLETION DATES:_____

SUBDIVISION INVOLVED:_____

The applicant hereby applies to the Operations Division of the Washington County Department of Land Use and Transportation for permission to perform operations within the right-of-way under Washington County jurisdiction. This is subject to and with full knowledge of the appropriate General Provisions contained in "Washington County, Department of Land Use and Transportation, Rules and Regulations for Pole Line, Buried Cable, Pipe Line and Miscellaneous Operations and/or Facilities Permits" as supplemented and modified by the Standards so attached and any special provisions. It shall be the obligation of the applicant to obtain the Standards, Rules and Regulations from the Operations Division before commencement of work under any permit. Individual permits will be issued following receipt of construction drawings or plans.