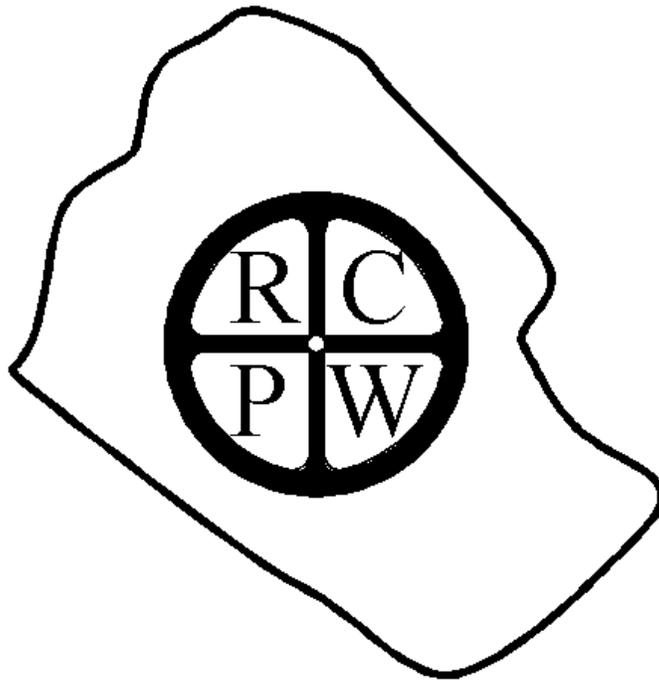

**ROCKINGHAM COUNTY
PUBLIC WORKS DEPARTMENT**



**WATER AND SEWER
SPECIFICATIONS AND STANDARDS**

SEPTEMBER 2004

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1. Introduction

- 1.1. The purpose of this publication is to establish the design standards and construction specifications for the planning, design, construction, and connection of all Rockingham County public (or intended to be public) water and sewer utilities used for residential, commercial and industrial purposes.
- 1.2. The work described herein is under the jurisdiction of Rockingham County, hereinafter referred to as the County. Rockingham County Rules and Regulations for Water and Sewer Service are incorporated into this document by reference.
- 1.3. For projects not initiated by Rockingham County, the terms “owner”, “developer”, and “contractor”, as used in this publication, all refer to the initiating party or its subcontractor. For all projects, the term “inspector”, as used in this publication, refers to an individual employed by the County to represent the County’s interests with respect to construction matters.
- 1.4. These standards have been developed for use by consultants and contractors who work on water and sewer utility projects within the County and for County personnel who review those projects. The standards are not intended as a regulation, but should be followed for all projects involving review and approval through the County which will establish a degree of uniformity for drawings and specifications for all water and sewer utility projects.
- 1.5. The design of all utility systems and extensions or modifications thereto shall be performed under the direction of a registered professional engineer with a current registration in the Commonwealth of Virginia in accordance with Title 54.1, Chapter 3 of the Code of Virginia, 1950, as amended.
- 1.6. Consultants and contractors working on water and sewer utility projects should recognize the fact that State and Federal regulations must be satisfied on all projects. In the event that the County Standards differ from State or Federal Requirements, the more restrictive standard shall be utilized.
- 1.7. When addressing matters of engineering design it is very difficult to generalize without jeopardizing the final product. Consultants should strive for designs that show consideration of details presented herein; however, these details are secondary to good engineering judgment.

2. General Submittal Procedures and Requirements

- 2.1 Two sets of plans (and specifications, as applicable) are required with each submittal. One set will be returned with comments or with final approval for construction. One additional set will be required prior to construction. The project owner and engineer are strongly encouraged to meet with the County Public Works Department to discuss proposed improvements prior to initiating design.

- 2.2 Each submittal shall be accompanied by a completed Application to Construct Water Facilities or Application to Construct Sewer Facilities (see Appendix).
- 2.3 The County will endeavor to review plans and provide comments or approval within 15 days of submittal. The same 15-day guideline will apply to each successive review/comment cycle.
- 2.4 Project approval is valid for six months. Complete resubmittal will be required if construction has not commenced within six months of final approval for construction.
- 2.5. In reviewing applications the County may require such changes, including pipe size and materials/equipment, as it may consider necessary to meet these standards or to facilitate future extensions where circumstances dictate. In addition, the County desires to limit sewage pump station maintenance by requiring a “no net gain” in pump stations. Flow from new development should not be pumped to an existing pump station when the new pump station could serve the entire area. Refer to Appendix A – “Wastewater Pump Station & Force Main Specifications” for additional requirements. No new water pump station shall be approved without a new gravity storage tank.

3. Minimum Plan Requirements

- 3.1. Plan sheets shall measure no larger than 24” wide by 36” long. The top half of the drawings shall show the main line and relevant features in plan and the lower half the main line, ground surface, and relevant features in profile. Scale shall be consistent and shall be a minimum of one inch equals one hundred feet (horizontal) and one inch equals ten feet (vertical).
- 3.2. A cover sheet shall be provided with a vicinity map and the names, addresses, and telephone numbers of the owner/developer and engineer. The cover sheet shall bear an originally signed and dated seal of a registered Virginia professional engineer. Seals and signatures on following sheets may be reproduced.
- 3.3. At a minimum plan sheets shall include the following (where applicable): streets, lots, existing and proposed water and sanitary sewer lines and appurtenances, manhole invert and top elevations (existing and proposed), easement and property lines (existing and proposed), all structures underground or aboveground in the vicinity of proposed line, 100-year flood elevation, all pertinent existing utilities, storm sewers and culverts, scale, and north arrow.

4. Easements, Property, and Permits

- 4.1. Permanent easements in the name of Rockingham County shall be required for all water and sewer lines and appurtenances, except where installed suitably within a public right-of-way of VDOT. All easements shall be a minimum 20 feet in width

when centered on the utility line. When easements are not centered, the width shall be increased to provide a minimum 10' of easement on each side of the utility line. The right of ingress and egress shall be fully provided for in the recorded deed. For water and sewer lines greater than 8 feet deep, minimum permanent easement width shall be increased by 2 feet for each additional foot of trench depth. The County may request to have easements extended to adjacent property for future extension of service. No structures shall be permitted to be constructed within easements, including trees, shrubs, fences, and any obstacles rendering the easement inaccessible by equipment. All permanent appurtenances including pump stations and tanks shall be located on fee simple property dedicated to Rockingham County for this purpose. All utilities shall be constructed within permanent easements or suitable VDOT right-of-way.

- 4.2. In addition to regulatory requirements outlined in Section 2, all necessary permits must be obtained and fees paid prior to construction, including VDOT, railroad, environmental, erosion and sediment control, stormwater, VPDES, and stream crossing. Any bonding required may not be transferred to the County.

5. Acceptance, Dedication, and Warranty

- 5.1. The County will issue a substantial completion document when the following conditions are met:
 - 5.1.1. Materials and equipment have been approved and installed per these specifications and project design documents.
 - 5.1.2. The completed work is functional, has been inspected, and a punch list issued.
 - 5.1.3. Required compaction, pressure/leakage, bacteriological, and pump testing has been successfully completed and documented.
- 5.2. Upon written notification of substantial completion, the owner/contractor must meet the following conditions prior to acceptance by the County:
 - 5.2.1. Punch list items have been satisfactorily corrected and a final inspection performed.
 - 5.2.2. Record plans bearing the seal of a registered Land Surveyor licensed in Virginia shall be submitted to the County. The record plans shall be in accordance with requirements outlined in the Appendix.
 - 5.2.3. All bonding for permits, etc. required on behalf of the contractor has been released and documented to the County.
 - 5.2.4. Contractor's Affidavit of Payment of Claims for the project has been submitted to the County.

- 5.2.5. All utilities and associated easements and property shall be dedicated in writing to the County.
- 5.3. Official acceptance of the facilities into the County system will be provided to the owner/developer in writing upon successful completion of final inspection. Date of final acceptance shall not occur until all County inspection comments have been satisfactorily corrected, bacteriological and pressure/leak testing has been successfully completed, and a Certificate to Operate has been issued by the regulatory agency.
- 5.4. The owner/developer will be responsible for maintenance or repairs as a result of construction or material defects of said facilities from one year from the date of final acceptance, as defined above. All repaired materials and work shall carry an additional one year warranty, commencing from the date of repair. Additional warranty requirements apply to wastewater pump station equipment, as noted in Appendix A – “Wastewater Pump Station & Force Main Specifications”.

6. Design Standards

- 6.1. Scope – The purpose of this guide is to establish minimum basic requirements for water and sanitary sewer systems constructed in and maintained by the County. The purpose of these requirements is to insure that citizens of the County are provided with safe and adequate facilities. Variations from these requirements may be made only if written approval is obtained from the Director of Public Works and the Fire Official. The County reserves the right to establish additional requirements for individual projects if conditions warrant.
- 6.2. Procedures
- 6.2.1. In addition to the requirements set forth herein, all facilities shall also conform to any applicable minimum requirements of other agencies. These include but are not limited to the VDH/ODW, DEQ/OWE, Soil Conservation Service (SCS) and Virginia Department of Transportation (VDOT).
- 6.2.2. Any person(s) firm, corporation or association proposing to construct, expand or establish a water distribution or sewage collection system within the corporate boundaries of the County shall notify the County in writing of their intent.
- 6.2.3. Such notification shall be accompanied by two (2) sets of plans and specifications, the engineer’s design report and calculations, and the appropriate Application (see Appendix).
- 6.2.4. Plans and specifications shall be prepared by or under the direction of a registered Virginia professional engineer. The cover sheet shall bear an originally signed and dated seal of a registered Virginia professional engineer. Seals and signatures on following sheets may be reproduced. The cover sheet

shall indicate and the names, addresses, and telephone numbers of the owner/developer and engineer.

- 6.2.5. Design calculations showing conformance of the project plans and specifications with this document and with all applicable regulatory requirements shall be submitted to the County for approval. Design calculations shall be submitted in report format with narrative.
- 6.2.6. No water or sewer construction shall be started until plan approval is received in writing from the County.
- 6.2.7. Provisions shall be made in system designs to allow for logical extension of services to properties beyond the boundaries of the property being developed. This should include the consideration of pipe sizes and depths as well as access through streets or easements as deemed appropriate by the County.

6.3. Design Requirements

6.3.1. Water Distribution Systems

6.3.1.1. Water Mains

- 6.3.1.1.1. All new water mains shall be sized on the basis on an Average Daily Demand (ADD) of water of not less than that established by VDH/ODW. Any deviation in established ADD rates shall be presented for the County's approval and include a detailed description for the basis of design.
- 6.3.1.1.2. All water mains shall be a minimum of 8" in diameter. Lines installed along state roadways designated as "primary" to have minimum line size of 16". Lines installed along state roadways designated as "secondary" to have minimum line size of 12". A minimum pressure of 20 psi shall be maintained at all points in the distribution system at the peak hourly flow rate or during maximum day demand with a concurrent fire flow demand, whichever is greater.
- 6.3.1.1.3. Water extensions shall not limit the effective storage volumes of any County tank.
- 6.3.1.1.4. The peak hourly flow rate (GPM) shall be computed using $Q=11.4N^{0.544}$ where N = number of equivalent residential connections (ERC). An ERC is equal to the volume of water used by a residential connection, which is 400 GPD.
- 6.3.1.1.5. The maximum day demand shall be 200 percent of the average daily demand (2.0 ADD).

6.3.1.1.6. The minimum fire flow requirement for one and two family dwellings, having a fire area which does not exceed 3,600 square feet, shall be 1,000 gpm for two hours. For townhomes and multiplex units, design fire flow shall be 2500 gpm. For all other uses, design fire flow shall be calculated in accordance with the ISO formula. Refer to the latest edition of the ISO "Guide for Determination of Needed Fire Flow."

6.3.1.1.7 Water mains shall be installed with a minimum 36" cover. Greater depths should be avoided unless required to accommodate crossings. Water main depths shall not exceed 6 feet at any time without written approval from the County, and shall not exceed 10 feet in any case.

6.3.1.1.8 Wherever reasonable, water mains shall be looped to provide improved flow capacity and reliability.

6.3.1.2. Valves

6.3.1.2.1. Valves shall be placed so that a minimum number of customers will be without water while a section of water line is shut off for repairs. At a minimum, valves shall be located at intervals not exceeding 600 feet.

6.3.1.2.2. Air relief valves shall be installed at high points.

6.3.1.3. Fire Hydrants

6.3.1.3.1. Fire hydrants shall be placed to provide adequate fire protection. In single-family residential areas, fire hydrant spacing shall not exceed 600 feet. In multi-family residential, commercial, and industrial areas, this spacing shall not exceed 300 feet. Hydrants shall be installed at all street intersections, public or private. All fire hydrant leads shall be a minimum of 6-inches in diameter and shall be separately valved. Maximum hydrant service lead length shall be 25 feet. Where longer lengths are required, the supply line shall be 8" diameter and constructed in accordance with other water main requirements. In addition to the valve on the hydrant service, an additional valve shall be included on the main line immediately downstream (opposite of supply side) of the hydrant service connection.

6.3.1.3.2. Water system designs should include looped lines as much as possible. Dead end lines shall be equipped with fire hydrants or blow-offs to allow flushing. Not more than one hydrant shall be installed on a 6 inch line.

- 6.3.1.3.3. Structures protected by automatic sprinkler systems, or equipped with a fire department standpipe, shall have a dedicated fire hydrant located within 50 feet of the fire department connection. This fire hydrant shall be located along a fire access road or fire lane. This dedicated hydrant is not credited towards meeting the fire flow requirement.
- 6.3.1.3.4. Any reference to distance shall be measured along an approved path of travel for fire apparatus operating at the site. An approved path of travel for the laying of hose lines shall not be across a four lane roadway. In order to receive credit for existing hydrants, they must be brought into compliance with current standards.
- 6.3.1.3.5. No fire hydrant shall be placed closer than 50 feet from the face or overhang of any building. A minimum 3 foot clear space shall be provided around the circumference of fire hydrants.
- 6.3.1.3.6. Where hydrants are subject to impact by motor vehicles, guard posts or other approved means of protection shall be provided. Guard posts shall comply with the following requirements.
- a) Constructed of concrete filled minimum 4" diameter steel pipe with tops not less than 3 feet above ground.
 - b) Spaced not more than 4 feet on center between posts.
 - c) Set in a concrete footing of minimum 15" diameter and minimum 3 foot depth.
 - d) Located at least 3 feet from the hydrant.

6.3.1.4. Services

- 6.3.1.4.1. Service lines in residential areas shall be a minimum of 1 inch in diameter and installed to the property line. Meter boxes and yolks shall be set in place at the property line. The depth shall be sufficient to prevent freezing, but not so deep as to require extensions or to make maintaining or reading the meters difficult. Installation shall be in accordance with Standard Detail W 3.0 for single meter sets and W 3.1 for double meter sets.
- 6.3.1.4.2. Service lines and meter settings for industrial and commercial users shall be installed to and at the property line at the time the industry or commercial lot is developed. Meters shall be sized to provide the maximum flow required by the customer and shall be installed by the contractor (meter to be provided by the County) within the appropriate setting. For fire line connections, gate valves on both sides of the setting with a full size by-pass line shall also be required.

6.3.1.4.3 Service meters installed in meter boxes shall be set to provide a minimum of 12” and not more than 18” of clearance from the meter box lid to the top of the meter.

6.3.1.5. Pressure Reducing Valves

Pressure reducing valves shall be installed where necessary to reduce excessive water pressure. Reducing valves may be installed on main lines or on individual services. Where installed on services, the reducing valves shall be located within the buildings. Service reducing valves shall not be installed before or within service meter boxes.

6.3.1.6. Placement Requirements

6.3.1.6.1. Parallel Installation – Refer to Section 8

6.3.1.6.2. Crossing – Refer to Section 8

6.3.1.6.3. Sewers or Sewer Manholes – No water pipe shall pass through or come in contact with any part of a sewer manhole.

6.3.1.7. Surface Water Crossing

6.3.1.7.1. All surface water crossings shall be of underwater type. Above water crossings are not permitted. Surface water crossings present special problems and should be discussed with the County before final plans are prepared.

6.3.1.7.2. The pipe shall be of special construction, having flexible watertight joints.

6.3.1.7.3. Valves shall be provided at both ends of the water crossing so that the section can be isolated for tests and repair; the valves shall be easily accessible and not subject to flooding.

6.3.1.7.4. A leak detection meter shall be installed at each crossing. The installation shall include 2” taps on opposite sides of one of the crossing main line isolation valves. A 2” line shall be looped between the taps, with a 2” meter and valve installed on the looped line within a meter box or vault. The leak detection meter shall be installed on the side of the crossing, which provides the easiest access.

6.3.1.7.5. Sample taps shall be available at each end of the crossing and at a reasonable distance from each side of the crossing.

6.3.2. Sewage Collection Systems

6.3.2.1. Design Flows

- 6.3.2.1.1. All new sewer systems shall be designed on the basis of an average per capita flow of sewage of not less than that established by DEQ/OWE. Any deviation from the established per capita rates shall be presented for the County's approval and include a detailed description for the basis of design.
- 6.3.2.1.2. The minimum peak design flow shall be 400 percent of the average design flow for all lateral and submain sewers. A lateral sewer is defined as a sewer that has no other common sewers discharging to it. A submain is defined as a sewer which receives flow from one or more laterals.
- 6.3.2.1.3. The minimum peak design flow shall be 250 percent of the average design flow for all main, trunk and interceptor sewers. A main or trunk sewer is defined as a sewer which receives flow from one or more submain sewers. An interceptor sewer is defined as a sewer which receives flow from a number of gravity mains, trunks, sewage force mains, etc.
- 6.3.2.1.4. Design flows for gravity sewers shall consider potential development of upstream sewershed areas, beyond the proposed development. Where significant future development is possible, ultimate future flows shall be reviewed with the County.

6.3.2.2. Gravity Sewer Design Requirements

- 6.3.2.2.1. All sewer mains shall be a minimum of 8" in diameter. The County may require larger line size.
- 6.3.2.2.2. Sewer laterals which do not exceed 250 feet and serve 6 connections or less on cul-de-sacs or sidewalk collector lines, may be 6" in diameter.
- 6.3.2.2.3. All sewers shall be designed with a minimum of 36 inches of cover and at a sufficient depth to receive sewage from existing and proposed or future development. Any deviation from the minimum depth of cover shall be presented with adequate justification for the County's review.
- 6.3.2.2.4. Lines shall have a uniform slope with a straight alignment between manholes. Minimum grades shall be as follows:

<u>Pipe Diameter (inches)</u>	<u>Minimum Slope (ft./100 ft.)</u>
6	0.49

8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

Slopes greater than these are desirable. Pipe sizes shall not be arbitrarily increased to achieve a flatter grade.

6.3.2.2.5. Where velocities greater than 15 feet per second are expected, special provisions shall be made to protect pipes against internal erosion by high velocity.

6.3.2.2.6. Sewers on 20 percent slope or greater shall be secured with concrete anchors in accordance with minimum design standards as follows:

<u>Percent Slope</u>	<u>Distance Between Anchors, C/C (ft.)</u>
20-35	36
36-50	24
Over 50	16

6.3.2.2.7. Sewer laterals shall have a minimum of 36” cover. Maximum depth shall be 5 feet, except where required to connect to deeper gravity mains. Any lateral serving a commercial or industrial property, or more than 2 residential units shall be a minimum 6” lateral.

6.3.2.3. Manholes

6.3.2.3.1. Manholes shall be provided on main lines at all intersections with other mains, points of change in alignment or grade, change in pipe size, change in pipe material, and at the end of a line that will be extended at a later date. A cleanout may be used where the line is not to be extended in the near future. The length of line between manholes shall not exceed 400 feet for sewers 15 inches in diameter or less and 500 feet for sewers 18 inches to 30 inches in diameter.

- 6.3.2.3.2 Where lines are to be extended in the future, the upstream terminal manhole shall include a capped stubout of minimum 10 foot length and shaped manhole bench from the future inlet.
- 6.3.2.3.3. Manholes for sewer lines up to 24 inches in diameter shall not be less than 4 feet inside diameter with an access opening of 24 inches. Steps shall be provided.
- 6.3.2.3.4. Manholes shall include a minimum drop of 0.2 feet across the manhole (between invert in and invert out).
- 6.3.2.3.5. An inside drop connection shall be provided for a sewer line entering a manhole at an elevation of 24 inches or more above the invert elevation of the discharge line.
- 6.3.2.3.6. As a minimum, watertight manhole covers shall be used on manhole tops which are below the elevation of the 100-year flood plain. Ventilation shall be provided for continuous watertight section greater than 1,000 feet in length.
- 6.3.2.3.7. Where a smaller sewer joins with a larger one, the relative elevations of the inverts entering the manhole shall be positioned to maintain approximately the same energy gradient by placing the 0.8 depth points of both sewers at the same elevation.

6.3.2.4. Gravity Services

Service laterals shall be minimum 4" diameter and installed to the property line at adequate depth not less than 36" below grade. The location of all services shall be properly marked.

6.3.2.5 Pumped Services

Where individual residential pump stations are proposed for individual services, the pump stations shall be located on the residential lot and owned and maintained by the property owner. Pumps shall be sized by the owner, but shall provide a discharge rate of at least 10 gpm. Residential pump stations shall discharge to a gravity main, unless written permission is granted by the County to connect to a County owned force main. Residential pump stations shall include high level alarm light and horn, and a minimum of 24 hours of emergency storage above high alarm level.

6.3.2.6. Sewers in Relation to Streams, Estuaries, Lakes and Reservoirs

The tops of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, one foot of suitable cover shall be provided where the stream is located in rock and three feet of suitable cover in

other material. Less cover will be considered if the proposed sewer crossing is encased in concrete and will not interfere with future improvements to the stream channel. In paved channels, the top of the sewer lines should be placed below the bottom of channel pavement. Sewers shall remain fully operational during the 25-year flood level. Sewers and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, including the 100-year flood level. Sewers located along streams shall be located outside of the streambed. Sewers entering or crossing streams shall be constructed of watertight pipe. The pipe and joints shall be tested in place and shall exhibit zero infiltration. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no other practical alternative exists. Such sewers on piers shall be constructed in accordance with the requirements for sewers entering or crossing under streams. Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade due to anticipated hydraulic and physical loads, erosion, and impact.

6.3.2.7. Wastewater Pump Stations and Force Mains

Refer to Appendix A – “Wastewater Pump Station & Force Main Specifications”.

7. **Construction Standards – General**

- 7.1. General – The following specifications and standards shall govern all construction and installation of water and sewer lines and appurtenances except as altered or waived by the County and approved by VDH/ODW or DEQ/OWE. It shall be the contractor's responsibility to comply with all local, State, and Federal regulations as well as good construction and management practices.
 - 7.1.1. A pre-construction conference shall be held prior to the start of construction. The contractor and the engineer shall be present to meet with the County representatives, including the inspector, and shall have a work schedule available for the inspector's use.
 - 7.1.2. Traffic Control – It shall be the responsibility of the contractor to take any measures as may be necessary or as directed or required by VDOT, the County, or both.
 - 7.1.3. Erosion and Sediment Control – It shall be the responsibility of the contractor to submit an Erosion and Sediment Control Plan for review and approval by the County, to submit an application for VPDES General Permit for Storm Water Discharges from Construction Activities for review and approval by VA DEQ, and to pay all associated fees.

- 7.1.4. Critical Facilities – Facilities such as fire hydrants and traffic signal control boxes shall not be obstructed at any time.
- 7.1.5. At all times when water line or sewer line installation is in progress, a contractor's superintendent/foreman shall be present and in responsible charge. The superintendent/ foreman shall, in the opinion of the inspector, be reasonably qualified and familiar with means and methods of the respective discipline.
- 7.1.6. Plans – No work shall commence on any water or sewer system until the contractor has in his possession a complete set of plans approved by the County and prepared by the design engineer whose signed seal shall appear on each plan sheet. Any change from the original approved plans requires written approval of the inspector.
- 7.2. Excavation – The contractor shall perform all excavation of dimensions and depths shown on the approved plans or as directed by the County. Excavations shall be open cut except where approved by the County. Existing utilities, structures, fencing, shrubbery, and other features shall be protected during construction, and if damaged or removed by the contractor, repaired or replaced by the contractor at contractor's sole expense.
- 7.2.1. Trench Width – The following table will service as a guide for ordinary trench width (depths not exceeding six feet).

<u>Nominal Pipe Dia.</u>	<u>Minimum Trench Width</u>	<u>Maximum Trench Width</u>
3/4" – 6"	3 times nominal pipe diameter	30"
8"	3 times nominal pipe diameter	32"
10"	Pipe diameter plus 2'	34"
12"	Pipe diameter plus 2'	36"
16"	Pipe diameter plus 2'	38"
18"	Pipe diameter plus 2'	42"
30"	Pipe diameter plus 2'	54"
42"	Pipe diameter plus 2'	66"

- 7.2.2. Rock Excavation – All rock within 6 inches of the finished pipe shall be removed. Rock is generally defined as any material which cannot be excavated by usual hand or machine methods and is more specifically defined as materials which cannot be excavated without drilling, blasting, or boring, or boulders more than one cubic yard in volume. Contractor is responsible for obtaining all necessary permits and insurance for blasting activities.
- 7.2.3. Safety – The contractor is solely responsible for on-the-job safety and this section in no way relieves the contractor of these responsibilities. The County and/or the inspector assume no responsibility for accidents resulting from construction. The contractor is required to employ safe practices and to comply

with safety standards while working in the County. Lack of compliance may result in a work stoppage imposed by the County. The contractor shall be familiar with and comply with all applicable safety standards, including “Virginia Excavation Standard, Construction Industry” adopted by the Commonwealth of Virginia (1926.650), with particular reference to stability of trench excavation. The Contractor shall be familiar with and comply with the OSHA requirements of 29 CFR 1926, Subpart P -- Excavations, as well as OSHA’s confined space standards. The contractor’s attention is also directed to the Overhead High Voltage Line Safety Act (Section 59.1-406, et seq., Code of Virginia). The absence of mention of any safety standard(s) in this Section shall not relieve the contractor of obligations to comply which such standard(s).

- 7.2.4. Permits – No excavations shall be made until proper permits have been obtained from the County and appropriate regulatory agencies.
- 7.2.5. Length of Open Trench – On any day, no trench shall be opened to a length greater than can be reasonably expected to be closed on that day, without approval from the County.
- 7.2.6. Dewatering – Trenches shall be kept free of water during construction. Pumps, dams and/or under drains shall be maintained by the contractor when required by the County. No excavation, installation, or backfilling shall be permitted while water remains in a trench.
- 7.2.7. Trenching – Pipe trenches shall be excavated to a depth that will insure a minimum of 36 inches of cover or as indicated elsewhere in these specifications. Excavation shall be made for bells of all pipes, and shall be of sufficient depth to permit access to the joint for construction and inspection. In no case shall the bells be used to support the body of the pipe.
- 7.2.8. Sheet piling, Shoring, and Bracing – The contractor shall furnish and erect such sheathing, bracing and shoring, and shall furnish necessary signs, barricades and temporary lighting as may be pertinent for the protection of the work, employees, the public, and adjacent structures. Responsibility for preservation of trench banks and other excavated spaces and the prevention of injury to any persons or property shall rest entirely with the contractor. Trench construction and safety shall comply with all applicable local, state, and federal safety regulations, including OSHA. Particular reference is given to Occupational Safety and Health Standards for the Construction Industry, Subpart P.
- 7.2.9. Sidewalk, Curb and Gutter, Drainage Structures – The contractor shall remove and replace only those portions of sidewalk, curb and gutter and drainage structures as is absolutely necessary to complete work.
- 7.2.10. Unstable Subgrade – In the event that unsuitable materials are encountered at or below the level of the pipe bed, such material shall be removed and replaced as directed in writing by the County.

- 7.2.11. Boring and Jacking – Where required, pipe shall be installed by conventional boring and jacking methods. Casing shall be installed so as to prevent the formation or accumulation of water within the casing and shall be constructed with even bearing of pipe load throughout its length. The ends of the casing shall be suitably protected against the entrance of foreign material and sealed.
- 7.2.12. Streets and Pavement – When excavation encroaches on paved areas, all backfilling, compaction, and pavement materials shall be in accordance with VDOT Open Cut Pavement Restoration detail included in the Standard Details. At least one lane of traffic must be maintained at all times. Traffic shall not be blocked or re-routed on public streets without the prior permission of VDOT and notification of the applicable Police, Sheriff, Fire, and Rescue Departments. All trenches within the street are to be backfilled or covered with steel plates at the end of each construction day. Temporarily backfilled trenches are to be maintained by the contractor to prevent damage to crossing vehicles. Damage, if any, will be the responsibility of the contractor. Entrances shall not be blocked without the prior knowledge of the occupant. Established drainage shall be maintained at all times.
- 7.3. Bedding – For sanitary sewer pipe and for all pipe in rock, trench shall be over-excavated to a depth 6 inches below pipe bottom and backfilled with VDOT #68 stone, extending up to the midpoint of the pipe. Over-excavation and backfill shall be increased to accommodate pipe bell ends. When crossing in close proximity over or under existing utility lines, use of a cap or cradle may be required as determined by the inspector. Cap and cradle shall be in accordance with VDOT Road & Bridge Standards Detail UB-1.
- 7.4. Taps – All service taps shall be made with saddles.
- 7.5. All utilities shall have a minimum vertical separation of 18” from all other utilities including storm drains.

8. Construction Standards – Water

(NOTE: Refer Also to Standard Details)

- 8.1. Installation – The installation of water mains and appurtenances shall conform to AWWA Standard C600, latest revision, the manufacturer's recommendations, and the recommendations of the County. All construction within State maintained right-of-way requires approval of the VDOT. Pipe delivered to the site shall be carefully inspected for defects. Any pipe found to be broken or defective prior to or after installation shall be removed and replaced at the contractor's expense. Pipe and fittings may be strung out along the route of construction with the bells facing in the direction in which the work is to proceed. Pipe shall be placed where it will cause least interference with traffic, and shall be subject to VDOT policies within the right-of-way. Pipe shall be carefully handled and lowered into the trench. Special care shall be taken

to insure that each length abuts against the next in such a manner that there is no shoulder or unevenness of any kind in the joint. Pipe insides shall be thoroughly cleaned before laid and shall be kept clean until flushing. The upper end of pipelines shall be provided with a watertight stopper carefully fitted so as to keep dirt and other substances from entering. Stopper shall be kept in the line at all times when laying is not in progress. Repair bands shall not be an acceptable method of repair for new line installation. This includes lines within the one year warranty period.

- 8.1.1. Pipe Material – Water main pipe shall be ductile iron per AWWA C151 Class 52. Fittings shall be of the compact type per AWWA C153.

8.1.2. Deflection at Joints – Maximum deflection, in inches, will be as follows:

Pipe Dia.	D.I. (Mech.)				D.I. (Push On)			
	12' Lgths.	16' Lgths.	18' Lgths.	20' Lgths.	12' Lgths.	16' Lgths.	18' Lgths.	20' Lgths.
4"	21	28	31	34	12	17	19	21
6"	18	24	27	30	12	17	19	21
8"	13	18	20	22	12	17	19	21
10"	13	18	20	22	12	17	19	21
12"	13	18	20	22	12	17	19	21
16"	9	12	13.5	15	7.5	10	11	12

8.1.3. Separation

8.1.3.1 Parallel – Water mains shall have a minimum horizontal separation of 10 feet from any existing or proposed sanitary sewer or storm drain line, measured edge-to-edge. When local conditions prevent a horizontal separation of 10 feet, the water main may, with the County's approval, be laid closer to the sanitary sewer or storm drain line provided that it is a separate trench and that the bottom of the water main is at least 18 inches above the top of sanitary sewer or storm drain line. Where this vertical or horizontal separation cannot be obtained the sanitary sewer or storm drain line shall be constructed of AWWA approved ductile iron water pipe pressure tested in place to 50 psig with no leakage prior to backfilling. Parallel separation between water mains and storm water conveyance channels shall be a minimum of 3 feet from edge of pipe to edge of channel.

8.1.3.2. Crossing – Water mains crossing sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible. When local conditions prevent this separation, the following construction shall be used:

8.1.3.2.1. Sewers passing over or under water mains shall be constructed of AWWA approved ductile iron water pipe, pressure-tested in place to 50 psig without leakage prior to backfilling. The ductile iron sewer pipe shall be a minimum of 10 foot length of pipe with joints equal distance from the crossing pipe. Transition shall be made with mechanical coupling.

8.1.3.2.2. Water mains passing under sewers shall, in addition, be protected by providing a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main; adequate structural support for the sewers to prevent excessive deflection of the joints and settling of or on and breaking water pipe; and the length of both the water pipe and sewer line shall be centered

at the point of the crossing so that joints will be equidistant and as far away as possible.

8.1.3.2.3. Manholes – No water pipe shall pass through or come in contact with any part of a sewer or sewer manhole.

8.1.3.2.4. Storm Water Conveyance Channels – Water mains shall not be installed under Storm Water conveyance channels extending parallel with the channel. Perpendicular crossings are permitted.

8.1.4. Surface Water Crossing – Surface water crossings present special challenges and should be discussed with the County prior to final plan preparation. Water mains passing under surface water shall be of a special type of construction utilizing concrete encasement. Valves shall be located at both ends of the surface water crossing. Valves shall be easily accessible and not subject to flooding.

8.1.5. Appurtenances

8.1.5.1. Valves – Shall be installed on all temporary dead end lines, on small branching mains as close as possible to the larger main, and on loop networks. Valves shall also be placed on water mains so that a break or failure will not affect more than 600 feet of main. All tees shall be isolated by three valves unless otherwise directed by the County. Crosses shall be isolated by four valves. Valves shall be placed on all fire hydrant service lines and on the main line immediately downstream (opposite of supply side) of the hydrant service connection. Nuts and bolts for all valve bodies shall be stainless steel.

8.1.5.2. Valve Boxes – Shall be installed plumb, directly over valves with carefully compacted backfill around the valve box. Valve box covers shall be fully exposed and flush with the finished street or ground surface.

8.1.5.3. Fire Hydrants – Shall be set within the right-of-way, with a minimum of 18 inches above established finished grade to the centerline of the pumper nozzle. Backfill shall be compacted to the established finished grade and the hydrant shall be checked to insure proper working order prior to acceptance. Hydrant bonnet and hose connection caps shall be color coded to indicate hydrant flow, using Devco paint. Marking color shall be light blue for 1500 gpm or greater, green for 1000 gpm to 1499 gpm, orange for 500 gpm to 999 gpm, and red for capacity less than 500 gpm. Hydrant barrels shall be painted silver and marked with a reflective collar between the base of the bonnet and top of hose connections. Hydrants installed on a private fire main, supported by a

fire pump, shall have the above color scheme reversed with the barrel color indicating available flow and bonnet and caps painted silver.

- 8.1.6. Special Crossing – When a crossing is to be installed beneath a highway, railroad, stream, or petroleum or gas pipeline or other major obstruction, all operations and materials shall conform to the requirements of the owner(s) or agencies having jurisdiction over said crossing. The contractor shall obtain approval of all materials and methods to be employed before such work is started, and obtain any required permits.
- 8.1.7. Anchorage – All tees, bends, plugs, and caps shall be substantially braced, blocked, and/or anchored to prevent any movements by providing braces, tie rods, and adequate thrust blocks of 3,000 psi concrete. Blocking shall be placed between solid, undisturbed earth and the fitting to be anchored, and shall be placed so that pipe and fitting joints will be accessible for repair. Concrete shall be Class A3 as specified in VDOT Road & Bridge Specifications. The use of joint restraints (Mega-Lug by EBAA Iron or Romac are approved) are required in addition to concrete blocking where water pressure can exceed 150 psi.
- 8.1.8. Nuts and Bolts – All nuts and bolts for new installation and repairs shall be stainless steel.
- 8.2. Backfilling – After visual inspection by the inspector, all trenches and excavation shall be backfilled on the same day that the trench or excavation was opened. Backfill shall consist of approved materials free from large clods of earth, frozen earth, or stone larger than one inch in diameter, deposited in 6” layers, thoroughly and carefully compacted by mechanical or hand tamper to within 95% of maximum dry density when tested in accordance with ASTM D698 (Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ or 600 kN-m/m³)). If excavated material is unsuitable for backfill, contractor shall provide suitable material at no extra cost, and unsuitable backfill material shall be removed and properly disposed of at no extra cost.
 - 8.2.1. Backfill in trenches outside of proposed pavement areas or street rights-of-way or in other areas when allowed by the inspector shall be compacted to a dry density equal to or greater than the density of the undisturbed soil surrounding the trench.
 - 8.2.2. Backfill under or within 2 feet of existing or proposed pavement, curb and gutter, sidewalk or other asphalt and/or concrete structures shall be backfilled completely with VDOT 21B stone deposited in not more than six-inch layers and compacted to a density of at least 95% of maximum dry density as determined by ASTM D698.
 - 8.2.3. Backfill Testing – The contractor shall demonstrate the adequacy of backfill compaction by performing density testing of the completed trench. Testing

shall be performed at three depths for each test location: surface, mid-depth, and near maximum trench depth. The character of the backfill material will be observed during the excavation for density testing to determine conformance with the specifications. Density testing shall be performed using nuclear field density equipment or conventional weight-volume methods. If the weight-volume method is used, volume shall be determined by using the sand replacement test (ASTM D1556) or liquid displacement methods (ASTM D2167). If nuclear methods are used, the trench correction effect shall be accounted for by recalibrating the nuclear gauge on its calibration block at the location of each test prior to taking the density measurement. The contractor shall furnish all equipment, tools, and labor to prepare test site for testing. Testing shall be performed by an independent testing laboratory qualified to perform such tests and approved by the County. All testing shall be witnessed by the inspector. The test shall be repeated until satisfactory results are obtained.

8.2.3.1. Normal Testing Frequency – One test shall be performed within the first 500 feet of pipe installed by each crew. This test will be used as an initial evaluation of the compaction methods being used. Beyond the initial 500 feet, one test shall be performed in each 1,000-foot section of pipe installed or fraction thereof. Testing shall progress as each 1,000-foot section is completed. The location of the test within each section shall be selected by the inspector. Testing which indicates that unacceptable material has been incorporated into the backfill, or that insufficient compaction is being obtained shall be followed by expanded testing to determine the limits of the unacceptable backfill.

8.2.3.2. Expanded Testing Requirements – If normal testing within a test section indicated unacceptable backfill, the County may require additional testing within the same test section to determine the limits of unacceptable backfill. Additional testing required shall not exceed testing of 4 additional locations within the test section. Unacceptable backfill within the limits established by the testing shall be removed and replaced by the contractor at no additional cost to the County.

8.3. Patching Portland Cement Concrete Pavement – Existing concrete requiring disturbance shall be removed from area. Undisturbed portions of the existing pavement adjacent to areas to be patched shall be left with vertical, neatly trimmed or sawn edges. In areas from which concrete has been removed, the sub grade shall be dressed, brought to grade, and compacted. Unsuitable subbase material shall be removed, disposed of and replaced with VDOT 21B stone. Where required, reinforcing wire or bars shall be placed and neatly dowelled or bound to undisturbed concrete. Concrete shall be deposited on the subgrade spaded, tamped, or vibrated so that it completely fills the area of the patch and all irregularities in the edges of the adjacent pavement. Joints shall be placed to coincide with joints in the existing pavement, unless otherwise directed. All concrete shall be finished to conform to the cross-section of existing pavement. Portland cement concrete patching shall not be

subjected to vehicular traffic until the compressive strength of the patching material has attained 2,000 psi.

- 8.4. Cleaning and Site Restoration – All areas utilized during the construction activities of the contractor shall be cleaned to the satisfaction of the County. Undesirable materials shall be disposed of off-site by the contractor at no expense to the County. All areas shall be restored to a condition equal to or better than that existing prior to construction.
- 8.5. Erosion and Sediment Control – All disturbed areas not designated for pavement and sidewalk replacement, structural use, and the like shall be stabilized. All stabilization measures and materials shall be in accordance with the specifications contained in the Virginia Erosion and Sediment Control Handbook, latest revision, Virginia Regulations 4VAC50-30 – Erosion and Sediment Control Regulations, and County E&S regulations.
- 8.6. Testing – Water pipe shall be tested prior to service taps being made.
 - 8.6.1. Pressure Tests – All newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure. Pressure tests shall be documented in writing and must be witnessed by the inspector. Pressure and leakage tests shall be in accordance with AWWA C600, Section 4. Test pressures shall be 150 psig or 1.5 times the working pressure, whichever is greater. Testing shall begin on the first valved section of line within ten days after its completion. The pressure and leakage tests shall be conducted concurrently for a duration of 2 hours. Leakage shall be defined as the quantity of water that must be supplied into the valved pipe section to maintain pressure within 5 psig of the specified test pressure. The allowable leakage shall not exceed the values given in the table below. The valved section of the pipe under consideration shall be slowly filled with water and brought to the specified pressure by means of a pump. Before supplying the specified test pressure, all air shall be expelled from the pipe. The contractor shall supply taps for expelling air. Testing shall not begin until at least 7 days after the last concrete anchor has been poured on the section of line being tested. The inspector shall observe all leakage tests. If the pipe fails to meet test requirements, all leaks shall be repaired and defective pipe repaired or replaced at the contractor’s expense. The test shall be repeated until satisfactory results are obtained.

Allowable Leakage Per 1,000 Feet (305 m) of Pipeline* – gallons per hour

Test Pressure (psig)	Pipe Size									
	4	6	8	10	12	14	16	18	20	24
200	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
175	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38
150	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21
125	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01

100 0.30 0.45 0.60 0.75 0.90 1.05 1.20 1.35 1.50 1.80

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

- 8.6.2. Flow Testing – All new hydrants and blow off valves shall be flow tested to demonstrate functionality. Flow tests shall be witnessed by the inspector and shall be documented in writing as to design flow rate and residual pressure. The contractor shall furnish all fitting and gauges as necessary to perform flow testing. The results of the flow test shall be provided to the Fire Official for review and approval prior to color coding.
- 8.6.3. Water for the pressure and flow tests will be furnished by the County without charge to the contractor. If the pressure or flow test is unsuccessful, and in the opinion of the inspector an additional test or tests are required, the contractor will be charged for water used in those additional tests. The volume of water used shall be metered.
- 8.7. Disinfection of Water Mains – New water mains shall be disinfected in accordance with the MOST CURRENT VDH/ODW Waterworks Regulations. Water mains shall be disinfected prior to service taps being made. The County reserves the right to invoice for the water supplied for flushing and testing. The following requirements may be superseded by any new VDH requirements.
- 8.7.1. Flushing – Prior to disinfection all water mains shall be flushed. All valves and hydrants shall be operated during this operation. Flushing velocities shall not be less than 3 feet/second. All flushing activities shall be coordinated with County prior to commencing.
- 8.7.2. Methods of chlorine application
- 8.7.2.1. Continuous Feed Method – Potable water shall be introduced into the pipe at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is a least 50 mg/L. The chlorinated water shall remain in the main at least 24 hours after which the chlorine concentration in the water shall be at least 10 mg/L. All valves and appurtenances shall be operated while the chlorinated water remains in the main.
- 8.7.2.2. Slug Method – Potable water shall be introduced into the main at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the main are exposed to the 100 mg/L chlorine solution for at least three hours. The chlorine residual shall be checked at regular intervals not to exceed 2,000 feet to insure that adequate residual is maintained. Valves and appurtenances shall be operated as the slug passes to insure adequate disinfection.

- 8.7.2.3. Tablet Method – **The Tablet Method is no longer an acceptable method of chlorine application.**
- 8.7.3. Final Flushing – After the required retention period the chlorinated water shall be flushed from the main using potable water. Flushed water shall not be released at such a rate as to cause erosion. Chlorinated water shall not be released so as to cause environmental damage.
- 8.7.4. Bacteriological Sampling- After flushing, water mains shall be tested in accordance with the MOST CURRENT Virginia Department of Health Waterworks Regulations. Samples shall be collected at regular intervals, not exceeding 1,200 feet, throughout the length of the main. The following requirements may be superseded by any new VDH requirements.
- 8.7.4.1. For chlorine application methods requiring residual determination, chlorine residual determinations shall be made using only those methods approved by VDH/ODW.
- 8.7.4.2. Two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipes, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, the disinfection procedure must be repeated. Samples shall be taken from sections spaced at fairly equal distances apart, at a maximum interval of 1,200 feet, plus one set at the end the line and at least one from each branch greater than one pipe length.
- 8.7.4.3. Supervision – The disinfection procedure shall be carried out by the contractor under the supervision of the inspector. Water mains shall be placed in service only after final approval has been issued by the County.
- 8.8. Final Inspection – A final inspection will be performed by the County when all items of work are complete. If any items of work remain incomplete at the time of final inspection, such as cleanup and minor stabilization, a "punch" list will be prepared and a date set for completion of punch list items. All items of work on the punch list must be completed by the contractor prior to acceptance by the County.

9. Construction Standards – Sewer

(NOTE: Refer Also to Standard Details)

9.1. Materials

- 9.1.1. Pipe – Sanitary sewer and lateral pipe shall be one of the following materials, as specified on the plans or otherwise indicated.

9.1.1.1. PVC Pipe

9.1.1.1.1. PVC gravity sewer pipe shall meet the requirements of ASTM D3034 Polyvinyl Chloride (PVC) Sewer Pipe, SDR 35 minimum wall thickness. PVC pipe is only acceptable for gravity sewer mains where bury depths are less than 10 feet and constructed in native soil. Lines greater than 10 feet deep or constructed in fill shall be ductile iron pipe minimum class 350. Fittings and couplings shall be compatible with the pipe and shall be the type normally supplied by the pipe manufacturer. Where high groundwater elevations are possible, sewer lines shall be ductile iron or thicker wall PVC as necessary to resist buoyant forces.

9.1.1.1.2. PVC pressure pipe may be used for sewer force mains and gravity lines requiring thicker wall pipe. PVC pressure pipe shall meet the requirements of AWWA C900 or AWWA C909.

9.1.1.2. Ductile Iron Pipe – Pipe centrifugally cast in accordance with ASA A21.51 (AWWA C151) shall be used for sewer force mains, where bury depths are 10 feet or greater, and where otherwise called for on the plans. Pipe class shall be indicated on the drawings. PVC pressure pipe specified in part 9.1.1.1.2 may be used as an alternative to ductile iron pipe.

9.1.2. Joints

9.1.2.1. PVC Joints

9.1.2.1.1. PVC Gravity Sewer Joints – Shall be of the bell and spigot type and conform to ASTM D3212 and/or Uni-Bell Uni-B-1. Gaskets shall be in accordance with ASTM F477. All bells shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket, which is positively retained. No solvent cement joints will be permitted in field construction except as specifically authorized by the inspector.

9.1.2.1.2. PVC Pressure Pipe Joints – Shall be of the bell and spigot type conforming to ASTM D3139. Gaskets shall be in accordance with ASTM F477.

9.1.2.2. Ductile Iron Joints – Jointing materials for mechanical or slip-on joints in ductile iron pipe shall conform to the requirements of ASA A21.11 (AWWA C111).

9.1.2.3. Plugs or Caps – Plugs or caps used shall be those manufactured specifically for the type of pipe used. They shall be secured such that they will be watertight and will withstand the internal pressure applied by air or exfiltration testing.

9.1.3. Manholes

- 9.1.3.1. Manholes shall be of the precast type conforming to ASTM C478. Minimum inside diameter shall be forty-eight (48) inches with a minimum of five (5) inch thick walls. Exterior shall have a bituminous tar coating. Joints shall be the ASTM C443 O-ring type. Manhole steps shall be provided. All manholes shall have monolithic bases except when a new manhole is built on an existing line. The eccentric design manhole may be used.
- 9.1.3.2. Frames and covers shall have a minimum clear opening of twenty-four (24) inches and shall be of cast iron conforming to ASTM A48M Class 30. Standard frames and covers shall be Capitol Foundry model MH-1678*JC and watertight frames and covers shall be Capitol Foundry model MH-1678*JC-WT. Covers shall be inscribed with the label "SANITARY SEWER".
- 9.1.3.3. Concrete used for shaping of manhole channels shall meet requirements of VDOT Type A3 or C1.
- 9.1.3.4. Manhole pipe joints shall be the flexible type in accordance with ASTM C923.

9.2. Installation

9.2.1. Gravity Sewer Pipe

- 9.2.1.1. Pipe shall be placed in trench in such a manner as to prevent damage to pipe. Under no circumstances shall pipe be dropped or dumped into the trench. Any damaged pipe discovered during delivery or installation shall be immediately removed from the project site.
- 9.2.1.2. Every reasonable precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. Spigot and bell ends of pipe and gaskets shall be cleaned and lubricated according to the manufacturer's instructions. Open ends of the pipe shall be closed by a watertight plug when laying is not in progress.
- 9.2.1.3. Pipe shall be laid upgrade, with bell ends facing in the direction of laying, unless directed otherwise by the inspector. Each piece of pipe shall be laid true to line and grade. The bottom of the trench shall be smoothly graded and bell holes provided so that the aggregate bedding gives uniform support to the barrel of the pipe when in final position. Adjustments to line or grade shall be made by removing or adding granular material under the barrel. In no case shall wedges or blocks be used under the bottom of the pipe. Pipe shall be pushed fully "home" by hand, with a bar and block of wood to cushion the bell or other methods for large diameter pipe.

- 9.2.1.4. Bedding shall consist of 6 inches of VDOT #68 stone.
- 9.2.1.5. A wing nut plug shall be installed and anchored in the new line at the existing manhole as soon as the section is complete. This plug shall remain in the pipe until the new sewer system is completed, tested, and approved by the inspector.
- 9.2.1.6. Tees and laterals shall be fully installed with a minimum of 36" ground cover and slope of 2% unless otherwise approved by the inspector. Diameter of laterals shall be at least 4 inches and shall be the same material as the sewer main but not less than Schedule 40 PVC. Laterals shall be installed from the main to the property lines unless otherwise indicated on the plans. Laterals shall be properly capped and suitably sealed to prevent infiltration of water into connections. Caps or plugs shall be strong enough to withstand pressure testing. Cleanouts shall be provided at ends of all laterals. Additional cleanouts shall be provided after every other bend of 45° angle or greater and such that spacing between cleanouts or end of lateral shall not exceed 50 feet of lateral length. County responsibility for maintenance of lines shall end at the property boundary. Property owner shall be responsible for all lines on private property.
- 9.2.1.7. Nonmetallic sanitary sewer piping shall be installed with tracer wire to be locatable. An insulated copper tracer wire, 18 AWG minimum in size and suitable for direct burial or an equivalent product, shall be utilized. The wire shall be installed in the same trench as the sewer within 12 inches (305 mm) of the pipe and shall be installed from within five feet of the building wall to the point where the building sewer intersects with the existing public system. At a minimum, one end of the wire shall terminate above grade in an accessible location that is resistant to physical damage, such as with a cleanout or at the building wall.

9.2.2. Manholes

- 9.2.2.1. The subgrade and bedding for precast manhole bases shall be prepared the same as for pipe.
- 9.2.2.2. Inverts shall be smooth and semi-circular in shape, conforming to the adjacent sewer section.
- 9.2.2.3. Changes in flow direction within a manhole shall be made with a smooth curve of as large a radius as possible. Maximum angle of flow change shall be 90°, unless written approval is obtained from the County.
- 9.2.2.4. Manhole frames shall be set level on a full bed of non-sag joint sealer at the proper grade. Frame shall be bolted to manhole with four 3/4"

diameter by 3" stainless steel bolts and wedge anchors. In traffic areas, frame shall also be secured with a concrete collar a minimum of 8" thick and exterior radius 12" beyond the frame.

- 9.2.2.5. Manhole Stubouts – Stubouts shall extend a minimum of 12" from the manhole, be 8" minimum diameter, and of the same material as the sewer main, unless otherwise indicated on the drawings. Stubouts shall be sealed, braced, and marked.
- 9.2.3. Force Mains – Shall be in accordance with Appendix A – "Wastewater Pump Station & Force Main Specifications" and installed per water line installation as outlined in Section 8 of these standards.
- 9.2.4. Backfill
 - 9.2.4.1. All backfill material shall be free from mud, refuse, construction debris, organic material, boulders, rock over 2", frozen or otherwise unsuitable material. From one foot above the top of the pipe to the original ground elevation, material containing stones up to 4" in their greatest dimension may be used, unless otherwise specified. Contractor may backfill with the excavated material provided it meets the conditions as stated above, except that all backfill within the public streets shall be VDOT #21B stone. If excavated material is unsuitable for backfill, contractor shall provide suitable material at no extra cost, and unsuitable backfill material shall be removed and properly disposed of at no extra cost.
 - 9.2.4.2. From the top of the bedding material to one foot above the pipe, material shall be deposited on both sides of the pipe simultaneously in 6" layers and compacted into place. Care should be taken to carefully and completely tamp under the sides of the pipe, but to avoid damaging or displacing the pipe during this operation.
 - 9.2.4.3. From the point one foot above the pipe, the remainder of backfilling shall be carried up evenly on both sides of the pipe in layers of not more than 8". Each layer of earth shall be compacted into place by tamping before the next layer is applied.
 - 9.2.4.4. Backfill shall be compacted to 95% of maximum dry density when tested in accordance with ASTM D698 (Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ or 600 kN-m/m³)).
 - 9.2.4.5. Backfill in trenches outside of proposed pavement areas or street rights-of-way or in other areas when allowed by the inspector shall be compacted to a dry density equal to or greater than the density of the undisturbed soil surrounding the trench.

- 9.2.4.6. Backfill under or within 2 feet of existing or proposed pavement, curb and gutter, sidewalk or other asphalt and/or concrete structures shall be backfilled completely with VDOT 21B stone deposited in not more than six-inch layers and compacted to a density of at least 95% of maximum dry density as determined by ASTM D698.
- 9.2.5. Backfill Testing – The contractor shall demonstrate the adequacy of backfill compaction by performing density testing of the completed trench. Testing shall be performed at three depths for each test location: surface, mid-depth, and near maximum trench depth. The character of the backfill material will be observed during the excavation for density testing to determine conformance with the specifications. Density testing shall be performed using nuclear field density equipment or conventional weight-volume methods. If the weight-volume method is used, volume shall be determined by using the sand replacement test (ASTM D1556) or liquid displacement methods (ASTM D2167). If nuclear methods are used, the trench correction effect shall be accounted for by recalibrating the nuclear gauge on its calibration block at the location of each test prior to taking the density measurement. The contractor shall furnish all equipment, tools, and labor to prepare test site for testing. Testing shall be performed by an independent testing laboratory qualified to perform such tests and approved by the County. All testing shall be witnessed by the inspector. The test shall be repeated until satisfactory results are obtained.
- 9.2.5.1 Normal Testing Frequency – One test shall be performed within the first 500 feet of pipe installed by each crew. This test will be used as an initial evaluation of the compaction methods being used. Beyond the initial 500 feet, one test shall be performed in each 1,000-foot section of pipe installed or fraction thereof. Testing shall progress as each 1,000-foot section is completed. The location of the test within each section shall be selected by the inspector. Testing which indicates that unacceptable material has been incorporated into the backfill, or that insufficient compaction is being obtained shall be followed by expanded testing to determine the limits of the unacceptable backfill.
- 9.2.5.2. Expanded Testing Requirements – If normal testing within a test section indicated unacceptable backfill, the County may require additional testing within the same test section to determine the limits of unacceptable backfill. Additional testing required shall not exceed testing of 4 additional locations within the test section. Unacceptable backfill within the limits established by the testing shall be removed and replaced by the contractor at no additional cost to the County.
- 9.2.6. Patching Portland Cement Concrete Pavement – Existing concrete requiring disturbance shall be removed from area. Undisturbed portions of the existing pavement adjacent to areas to be patched shall be left with vertical, neatly trimmed or sawn edges. In areas from which concrete has been removed, the

sub grade shall be dressed, brought to grade, and compacted. Unsuitable subbase material shall be removed, disposed of and replaced with VDOT 21B stone. Where required, reinforcing wire or bars shall be placed and neatly dowelled or bound to undisturbed concrete. Concrete shall be deposited on the subgrade spaded, tamped, or vibrated so that it completely fills the area of the patch and all irregularities in the edges of the adjacent pavement. Joints shall be placed to coincide with joints in the existing pavement, unless otherwise directed. All concrete shall be finished to conform to the cross-section of existing pavement. Portland cement concrete patching shall not be subjected to vehicular traffic until the compressive strength of the patching material has attained 2,000 psi.

- 9.2.7. Erosion and Sediment Control – Disturbed areas shall be uniformly graded and seeded upon completion of the installation of pipe. 4” of topsoil shall be provided in grass or lawn areas. Positive drainage shall be maintained. All disturbed areas not designated for pavement and/or sidewalk replacement, structural use, and the like shall be stabilized. All stabilization measures and materials shall be in accordance with the specifications contained in the Virginia Erosion and Sediment Control Handbook, latest revision, Virginia Regulations 4VAC50-30 – Erosion and Sediment Control Regulations, and County E&S regulations.

9.3. Testing

- 9.3.1 General – All sewer lines shall be tested for both displacement or structural faults and for water tightness. All tests shall be documented in writing and shall pass prior to acceptance.
- 9.3.2. Alignment Testing – A light will be flashed between manholes by means of a flashlight or reflection of sunlight with a mirror. If the illuminated interior to the pipe shows poor alignment, displaced pipe, blockage or other defects, the defects shall be corrected. All costs involved shall be born by the contractor.
- 9.3.3. Deflection Testing – All PVC gravity sewer lines shall be subject to vertical deflection testing as deemed necessary by the inspector. The maximum allowable deflection following completion of backfill shall not exceed 5% of the pipe's internal diameter. Deflection testing shall be conducted using a properly sized Go-No-Go Mandrel or by other methods as may be adopted by the County. Any sewer sections failing to meet deflection requirements shall, at the contractor's expense, be corrected.
- 9.3.4. Water tightness Testing:
- 9.3.4.1. Sanitary Sewer Pipe – Pipe will be tested with low-pressure air performed in accordance with ASTM F1417 and the procedures set forth as follows and in the presence of the inspector.

- 1) Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- 2) If the pipe to be tested is submerged in ground water, insert a pipe probe by boring or jetting into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the backpressure due to ground water submergence over the end of the probe. All gauge pressures in the test should be increased by this amount.
- 3) Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
- 4) After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
- 5) After stabilizing the internal pressure at 4.0 psig, reduce the internal air pressure to 3.5 psig, and start stopwatch. Determine the time in seconds that is required of the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding times for runs of single pipe diameter and are indicated in minutes and seconds as follows.

Sanitary Sewer Air Test Table

Specification Time Required for a 1.0 psig Pressure Drop For Size and Length of Pipe Indicated for Q = 0.0015

Pipe Dia. (In.)	Min. Test		Longer Lengths	Lengths								
	Time	Length		100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.47 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	
24	22:40	99	13.67 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	

Specification Time for Length (L) Shown (min:sec)

NOTE: The air test may be dangerous to perform if a line has been improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 lbs. is exerted on an 8 inch plug by an internal pipe pressure of 5 psig, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be very dangerous. As a safety precaution, pressurizing equipment shall include a regulator set at 10 psig to avoid over pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

- 9.3.4.2. Sanitary Sewer Manholes – Manholes shall be tested for infiltration by vacuum testing in the presence of the inspector. Manholes shall be tested after assembly and after backfilling. Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn. Installation and operation of vacuum equipment and indicating devices shall be in accordance with equipment specifications for which performance information has been provided by the manufacturer and approved by the DEQ/OWE.

A measured vacuum of 10 inches of mercury shall be established in the manhole. The time for the vacuum to drop to 9 inches of mercury shall be recorded.

Acceptance standards for leakage shall be established from the elapsed time for a negative pressure change from 10 inches to 9 inches of mercury. The maximum allowable leakage rate for a 4 foot inside diameter manhole shall be in accordance with the following:

Manhole Depth	Min. Elapsed Time for a Pressure Change of 1 inch Hg
10 feet or less	60 seconds
> 10 feet but < 15 feet	75 seconds
> 15 feet but < 25 feet	90 seconds

For manholes 5 feet inside diameter, add an additional 15 seconds and for manholes 6 feet inside diameter, add an additional 30 seconds to the time requirements for 4 foot diameter manholes.

If the manhole fails the test, necessary repairs shall be made and the vacuum test shall be repeated until the manhole passes the test. If a manhole joint material is completely pulled out during the vacuum test, the manhole shall be disassembled and the joint material replaced.

- 9.3.5. Force Mains – Pipe shall be tested in accordance with water pipe pressure testing requirements outlined in Section 8 of these standards.

9.4. Final Inspection

A final inspection will be performed by the County when all items of work are complete. If any items of work remain incomplete at the time of final inspection, such as cleanup and minor stabilization, a "punch" list will be prepared and a date set for completion of punch list items. All items of work on the punch list must be completed by the contractor prior to acceptance by the County.

APPENDIX A

**WASTEWATER PUMP STATION &
FORCE MAIN SPECIFICATIONS**

WASTEWATER PUMP STATION AND FORCE MAIN SPECIFICATIONS**1 GENERAL REQUIREMENTS**

1. **General:** This document is an integral part of the Rockingham County Public Works Department - Water and Sewer Specifications and Standards and defines additional requirements for all wastewater pump stations and force mains to be constructed within Rockingham County or connected to the County's sanitary sewer system.
2. **Acceptability:** Rockingham County strongly discourages the construction of pump stations and force mains, where reasonable gravity conveyance alternatives exist. Prior to submitting plans and specifications for a pump station design, a Preliminary Engineering Report (PER) shall be submitted to Rockingham County Public Works Department and DEQ. The PER shall address initial and ultimate feasible service area, peak flows, impact on downstream system, force main detention times, and odor control. PER shall also consider lifecycle cost analysis comparing pump station and gravity sewer alternatives including construction, operating, and maintenance costs. Rockingham County will evaluate all requests for pump station installations in the best long term interests of the County.
3. **References:** All work shall conform to the most recent requirements of the following:
 - 1) Sewage Collection & Treatment (SCAT) Regulations
 - 2) Virginia Department of Environmental Quality (DEQ)
 - 3) Environmental Protection Agency (EPA)
 - 3) BOCA Code
 - 4) Occupational Safety and Health Administration (OSHA)
 - 5) National Electric Code (NEC)
 - 6) Local codes.

2 SUBMITTALS

1. **Preliminary Engineering Report (PER):** Parties interested in constructing wastewater pump stations within Rockingham County or to connect to County wastewater facilities shall submit a PER for review by the County and DEQ. At a minimum, the PER shall include the following:
 - a) Description of proposed service area and development.
 - b) Maps showing location of service area, maximum sewershed, and relation to existing wastewater facilities.
 - c) Flow projections for startup and ultimate build out of design service area and maximum possible sewershed.
 - d) Description of proposed utilities and alternatives considered with life cycle cost evaluation of alternatives.
 - e) Force main alignment and preliminary profile.
 - d) Preliminary pump calculations and selection.

- e) Preliminary pump station layout, including wetwell diameter and depths.
2. Plan Submittal: Following approval of the PER by DEQ and Rockingham County Department of Public Works, design plans shall be submitted for review. Submittal shall comply with all requirements of the Rockingham County Public Works Department - Water and Sewer Specifications and Standards. Additionally, the following information shall be included:
- a) Pump sizing calculations showing static and dynamic head loss and force main velocities. If the force main includes any intermediate high spots above the discharge elevation, calculations shall consider head conditions to the high spots as well as the entire force main. Include charts showing system head curve, pump curve, lead and lag pump operating points, and pump efficiency.
 - b) Wetwell sizing calculations, including initial and ultimate level settings, detention times, and minimum pump cycle times.
 - c) Force main detention time calculations at initial and ultimate flows.
 - d) Wetwell and vault buoyancy calculations.
 - e) Generator sizing calculations.
 - f) Downstream gravity sewer evaluation at peak flow conditions allowing for inflow and infiltration.
 - g) Complete plans and specifications for all proposed wastewater facilities. Station plans shall include site plan, mechanical plan and sections, and control building detail. Site layout shall show 25 year and 100 year flood plain boundaries and buffer zone limits. Plans and profiles shall be provided for all force mains and gravity lines.
3. Equipment Submittals: Submittals shall be provided to Department of Public Works for approval of all equipment listed in Part 4 of this section. A minimum of four copies of each submittal shall be provided, with two copies to be returned and two retained by the Department. Submittals shall be provided for approval a minimum of three weeks prior to commencing work on the items being submitted .
4. Operation and Maintenance Manual: Two copies of a complete hard-covered, ring bound, loose-leaf Operation and Maintenance Manuals shall be provided to the Department of Public Works, prior to the acceptance of any pump station by Rockingham County. The Manual shall have previous approval from DEQ and provide all necessary and recommended operational procedures and maintenance activities.

In addition to “as-built” system drawings, the manuals shall include internal wiring diagrams and operating and maintenance literature for all components provided under this section. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing, and maintenance of each component and/or instrument.

3 DESIGN

1. General: Pump stations shall be of the submersible pump wetwell design including controls building, flow metering station, emergency generator, and other components as described herein and within other sections of the Rockingham County Public Works Department - Water and Sewer Specifications and Standards. In special situations, suction lift stations may be allowed with approval from the Public Works Department. In such cases, specific equipment requirements will be determined based on discussions and agreement with the Public Works Department. Allowed deviations from the equipment specifications of this section shall not relieve responsibility from complying with design and other requirements of the specifications.

2. Station Capacity: Pump stations shall have adequate capacity to accommodate peak flows from ultimate build out of the design service area. Flow projections shall be submitted estimating startup and ultimate flows, considering maximum allowable densities permitted by zoning ordinances. Peak flows shall be calculated using a minimum 2.5 peaking factor. For stations serving less than 25 acres, or with average daily design flows less than 20 gallons per minute (gpm), a 4.0 peaking factor shall be used. Stations shall include redundant pumps, per DEQ requirements. For duplex pump stations, each pump shall be capable of discharging design peak flow.

Flow projections shall also be provided for build out of the total possible sewershed. The County, at its discretion, may participate in the project to allow service to an expanded area.

3. Force Main Design: Force mains shall be sized to minimize power requirements for pumping. As such, force main alignment shall be selected considering routes which minimize intermediate high spots. Force main velocity shall not exceed 5 feet per second at ultimate design pump flow. Where significantly higher future pump rates are planned, parallel force mains shall be considered. Per DEQ requirements, minimum force main velocity shall be 2 feet per second to achieve scouring velocity. Force mains which provide less than 2 feet per second velocity at startup pump rate will be allowed, provided scouring velocity can be achieved by operating multiple pumps. In such case, controls shall provide automatic operation of pumps once per day for scouring.

Combination air/vacuum release valves shall be provided at all high spots in force main. Orifice in air release valves shall be sized to allow for an air exhaust or inlet rate of at least 10 percent of maximum ultimate pump discharge rate. Plug valves shall be provided along force main at maximum 1000 foot intervals.

Receiving manhole and all manholes within 600 feet downstream of the force main discharge shall receive a corrosion resistant protective coating.

4. Pump Selection: Pumps shall be selected to minimize power requirements and pumping costs through the range of station design flows. Where station flows are expected to increase significantly from startup to service area build out, consideration should be given to variable speed pumps or triplex pump systems. Calculations shall be submitted estimating pumping energy requirements and operating costs at current energy rates. Calculations shall compare energy requirements for fixed speed versus variable speed operation. System head shall be calculated using minimum level in wetwell ("All Pumps Off") and shall consider head conditions to the end of the force main as well as any intermediate controlling high spots.

Pumps shall be selected such that design operating point is within 15% of maximum pump efficiency. Pump efficiencies shall not be less than 60%. Pumps shall be selected to minimize motor speeds and shall not exceed 1800 RPM. Pump motors shall be sized such that they are non-overloading along the entire impeller curve (full range of flows).

Where the station design includes planned future change in discharge rate to accommodate ultimate flows, every effort should be made to minimize future modifications. Effort should be made to select pumps which will allow impeller replacement to meet future discharge conditions. In such case, initial motors shall be sized to be non-overloading along the entire range of flows for the future impeller. All station electrical components shall be sized for maximum future loads.

5. Wetwell Levels: Wetwell levels shall provide for a minimum "All Pumps Off" level to maintain full pump submergence, or greater if recommended by pump manufacturer. "Lead Pump On" level shall provide for an effective working volume (volume above "All Pumps Off" level) so that each pump will start a maximum of three times per hour. In a duplex pump system, this volume will be 2.5 times the minimum pump rate. Additional level settings shall be provided for "Lag Pump On" and "High Level Alarm", with minimum 0.5 feet difference between each. The "High Level Alarm" shall be at least 0.5 feet below the invert of the wetwell inlet.

6. Odor Control: Wetwells shall be sized such that maximum average detention time is 30 minutes at startup flows. Wetwell shall be vented to atmosphere with a passive carbon filter installed at outlet. Vent outlet shall be above the 100 year flood plain.

Force mains should be sized such that detentions times will be less than 24 hours at initial design flows. Where significantly higher future station discharge rates are planned, parallel force mains shall be considered to minimize initial detention times and active force main volumes.

7. Pump Station Site: Pump station shall be located such that the control building, emergency generator, and all equipment which could be damaged by flooding are located above the 100 year flood plain. Effort should be made to locate the wetwell and vaults above the 100 year flood plain. Where the wetwell and vaults are below the said flood level, they shall be equipped with flood tight hatches. The layout shall provide for a single gravity sewer inlet to the wetwell.

The pump station property shall comply with all applicable zoning and subdivision ordinances. The property shall be sufficient to provide a 50 foot buffer around the wetwell. Layout shall allow for service vehicle access around the wetwell, vaults, control building, and generator. Site layout shall include paved access road, minimum parking space for one service vehicle, and vehicle turn-around within property. Security fencing shall be provided around property boundary. Refer to Standard Detail S 2.0 – “Typical Pump Station Layout” for additional details.

8. Wetwell & Vaults: Wetwell and vaults shall be precast concrete construction and designed for H2O traffic loading. Wetwell and vaults shall be designed with adequate extended footers or ballast to resist flotation. Calculations shall be submitted verifying flotation resistance. Calculations shall assume external water level to top of structure, interior is completely dry, and shall not include weight of equipment or piping. Flotation resistance shall provide a minimum factor of safety of 25% under indicated design conditions.

All vaults above the 100 year flood plain shall include hinged water-tight aluminum access hatches of minimum 36” x 36” size for entry, or larger as required for direct overhead access and removal of pumps, check valves, and meters. Access hatches for all vaults below 100 year flood plain shall be flood tight. All vaults shall be provided with drains to the wetwell and check valves.

All piping within wetwell shall be supported from wetwell wall at minimum 8 feet on center. Pipe penetrations through wetwell wall shall be restrained at elbow and through wall. Pump guide rails shall be supported from wetwell or discharge piping as recommended by pump manufacturer, but at distances not greater than 10 feet separation. All hardware within wetwell shall be stainless steel. All piping within vaults shall be supported from slab with adjustable pipe stands or concrete supports. At a minimum, supports shall be provided at all check valves, tees, and meter locations. Flexible connections shall be provided in all vaults to aid disassembly of piping and prevent strain which could result from differential settlement of piping or vaults. All wall penetrations shall be made through flexible boots.

Compound pressure gauges shall be provided on the pump side of each check valve. Additional pressure gauge shall be provided on the tee or common piping downstream of the check valves. An automatic air release valve shall be provided at this location with drain to the wetwell. Isolation plug valves shall be provided downstream of each check valve within the vault.

9. Flow Metering: A magnetic type flow meter shall be provided at the discharge of all pump stations. Meter shall be located in a separate vault downstream of the valve vault. A minimum straight pipe length of 10 pipe diameters upstream and 5 pipe diameters downstream of the meter shall be provided. Meters shall be sized such that measured flow rate through the tube is between 1 and 10 feet per second at initial design discharge rate. An isolation plug valve shall be provided downstream of the meter vault, on the site.
10. Emergency Pump Connection: An emergency pump connection shall be provided and connect to the force main between the valve vault and meter vault. A plug valve shall be provided at the force main connection. A minimum 3” drain line from the connection to the wetwell shall also be provided with plug valve. The

pump connection shall consist of a vertical section of ductile iron pipe extending approximately 36" above grade with a female Godwin pump connection coupling.

11. Potable Water: Potable water service shall be supplied to all pump stations. After metering, water service shall be routed through a reduced pressure zone (RPZ) backflow preventer located within the control building. The RPZ installation shall comply with all VDH and other applicable regulations. The drain port of the RPZ shall be connected with an air gap funnel and piped to the building drain line. All water fixtures shall be downstream of the RPZ. A hose bibb shall be provided within the control building and a yard hydrant provided adjacent to the wetwell. All fixtures shall be provided with vacuum breakers.
12. Primary Electric Service: All stations shall be provided with 480 volt, three phase closed delta or four wire wye electric service. A minimum 10 KVA transformer shall be provided for single phase electric service within the control building and for other site fixtures. Service size shall be rated for at least 50% greater than expected maximum station load, considering ultimate conditions.
13. Standby Electric Service: An emergency generator and automatic transfer switch shall be provided for standby power. The generator shall be sized to operate both lead and lag pumps during power outage. Sizing shall be based on ultimate motor sizes for station. To avoid unnecessarily high starting loads, controls shall ensure that no more than one pump starts simultaneously. Where natural gas service is available, generators shall operate on natural gas supply and shall be sized accordingly. Elsewhere, generator shall be diesel fueled with fuel tank sized to supply 48 hours of continuous operation.
14. Force Main Discharge Termination: Force main discharge connection shall provide a smooth transition of flow into receiving manhole. At 10 feet before the receiving manhole a reducer fitting shall be installed in the force main and the main increased to twice its standard pipe diameter. The 10 foot section of increased main shall be installed at 1% slope and shall enter the manhole with invert at approximately 0.2 feet above the invert of the outlet pipe. The manhole bench shall be shaped to provide a smooth transition to the outlet pipe.

4 PRODUCTS

1. Pressure Pipe: All pressure pipe within the pump station property limits shall be ductile iron pressure class 350 with cement mortar lining. All pipe and fittings within structures or above grade shall be flanged connection, and all buried pipe shall have mechanical joint connection. Force main piping beyond site shall be AWWA C900 polyvinyl chloride (PVC) pipe with pressure rating at least twice maximum design working pressure, except where force main extends through casings or stream crossings. All other piping shall be in accordance with other sections of Water and Sewer Specifications and Standards.
2. Isolation Valves: All isolation valves in pump discharge and force main piping shall be eccentric plug valves with cast iron body. Valves shall be capable of bubble tight closure but adjustable to stop positions partially closed for throttling. Underground valves shall be fitted with a standard 2 inch operating nut. Exposed valves shall be provided with a handwheel or lever handle for operation. Valve liners and seats shall be of a material suitable for use with an abrasive sanitary sludge.
3. Check Valves: Check valves on pump discharge line shall be swing type with external lever and spring and conform to AWWA C508. Valves shall include interior coating according to AWWA C550.
4. Reduced Pressure Zone Backflow Preventer: Backflow preventer shall consist of two independent check valves, relief port, four test ports, and an in-line strainer. The body of the unit shall be bronze construction and shall be supplied with ball type shutoff valves. The units shall be Hersey Model FRPII (3/4 inch - 2 inch) or approved equal. Units shall conform with ASSE 1013.
5. Pumps: The sewage pumping units shall be vertical, non-clogging, centrifugal sewage pumps with bottom inlet and side discharge. The pumps shall be direct driven by integral squirrel cage, electric induction

motors. Each pump shall include motor, bearings, quick removal system, anchor bolts and all accessories specified herein. The wastewater pumps shall be submersible type as manufactured by Wilo-EMU, Flygt, or Fairbanks Morse. Manufacturer shall provide warranty of pump as indicated in Part 6 of this Section.

The volute casing shall be constructed of ASTM A48 minimum Class 40B cast iron (GG25) capable of prolonged resistance to raw sewage. Suction and discharge flanges shall be 125# and meet ANSI standard B16.1. All nuts, bolts, washers, and other fastening devices supplied with the pumps shall be stainless steel. All mating surfaces requiring a watertight seal shall be machined and fitted with Buna-n O-rings. The casing shall be provided with an AISI 304 (1.4308) stainless steel wear ring which is drive fitted to the bottom suction inlet.

Pump impellers shall be of the solids handling non-clog type. The impeller vane shall be smooth, finished throughout, and shall be free from sharp edges. Pump impellers shall be manufactured from ASTM A48 Class 40B cast iron (GG25) with ceramic coating. Impellers shall be key driven such that the impeller cannot unscrew or be loosened by torque from either forward or reverse rotation. The impeller shall be capable of passing a three inch solid non-deformable sphere through the bottom inlet and out between the two shrouds. The impeller shall be provided with an AISI 329 (1.4462) duplex stainless steel wear ring which is drive fitted to the suction eye of the impeller.

Each pump shall be furnished with a motor suitable for dry pit or wet pit installation under full load conditions, without adding or removing any items to the motor's interior or exterior. The motor shall be squirrel cage, induction type enclosed in a watertight housing suitable for use and compatible with all variable frequency drive systems, without de-rating the motor output power. The motors shall be oil-filled with moisture resistant NEMA Class F or H insulation and Class H slot liners and constructed to NEMA B design standards. The copper wound stator shall be triple dipped in epoxy enamel and baked to withstand a temperature of 155 degrees (or 180 degrees) Centigrade as defined in NEMA Standard MG-1. The rotor shall be statically and dynamically balanced after fabrication. The constructed motor shall be certified for continuous duty with a service factor of 1.15 and shall be non-overloading over the entire range of the impeller. Motors shall be capable of sustaining 15 starts per hour (unlimited starts with VFD) at a minimum ambient temperature of 40°C. The motor shall be cooled via the internally circulated oil by means of a pump/motor shaft mounted oil circulation impeller and heat exchanger which shall transfer a minimum of 85% of the heat generated by the motor to the pumped liquid. Thermal switches shall be furnished to monitor stator temperatures. Thermal switches shall automatically de-energize the motor when its temperature exceeds a preset limit as recommended by the manufacturer.

6. Controls Building: Controls Building shall be provided with minimum interior dimensions of 10 foot by 12 foot and 8 foot interior height. Standard building shall be precast concrete type as manufactured by The Clear Flow Company of Waynesboro, Virginia. Alternate masonry construction buildings will be allowed if required to match surrounding area. Building shall include breaker panel, transformer, one interior ceiling mounted wet-location fluorescent light, exhaust fan, heater, exterior double doors, exterior GFI receptacle, and minimum two interior GFI receptacles. Building shall also include switch controlled 150 watt HPS wallpack light with photocell, mounted above the entrance door. Precast building shall have a false brick finish and be installed on a gravel foundation, as recommended by manufacturer.
7. Generator: Standby generator shall be liquid cooled engine driven design with weatherproof sound attenuated enclosure. Engine shall be natural gas fueled where service is available and diesel fueled with double walled fuel tank elsewhere. Engines shall comply with current EPA clean air emission standards. Engine shall be provided intake air filter with replaceable cartridges and exhaust silencer. The engine shall have a heavy duty lead acid battery set, battery charging DC alternator with a transistorized voltage regulator, and blanket type battery heater. Engine speed shall be governed by a mechanical governor to maintain alternator frequency within +/-5% from no load to full load alternator output. Steady state regulation is to be 0.5%.

Provide a weather resistant, sound attenuated enclosure of HR4P steel with electrostatically applied powder coated baked polyester paint. The enclosure shall have a resulting sound level of 77 dBA at 25 feet

with the genset running under full load. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel. Air handling will be sized and designed by the manufacturer for 0.5" static pressure drop through enclosure. Intake openings shall be screened to prevent the entrance of rodents. The system shall include a cooling and combustion air inlet silencer system, equipment enclosure section, and a cooling air discharge silencer section. A critical type silencer, companion flanges, and flexible stainless steel exhaust fitting shall be furnished. Acoustical foam shall be provided between all supports and inside doors and sound baffles on air intake and air discharge.

An automatic transfer switch shall be provided by generator manufacturer with NEMA 1 enclosure for location in the control building. The transfer switch shall have outputs to the SCADA system as indicated in the Lift Station Control Panel Specifications of these standards. A remote monitoring panel shall also be provided for the generator and interface with the SCADA system.

Generator shall be manufactured by Caterpillar Inc. of Peoria, Illinois. Manufacturer shall provide warranty and service contract as indicated in Part 6 of this Section.

8. Wetwell and Vaults: Wetwell and vaults shall be of precast construction and conform to ASTM C 478. All concrete shall be rodded or vibrated to minimize honeycombing and assure watertightness. Items delivered and installed at the site shall be structurally sound and free from cracks or major surface blemishes. Joints shall be the O-ring joint conforming to ASTM C 443 or butyl rubber rope meeting AASHTO M 198, Type B. Pipe connections shall be made by means of an approved flexible, watertight gasket or boot.

Access doors shall be cast in structure lids. Door panels shall be stainless steel or aluminum diamond plate, reinforced to withstand an H20 load. Frame shall be constructed of 1/4 inch thick one piece extruded aluminum. A bi-tuminous coating shall be applied to the frame exterior where it will come into contact with concrete. Doors shall automatically lock in the open position and release by handles. Hold open arm shall incorporate a stainless steel spring assist. Lifting handle, hinges, and all fastening hardware shall be stainless steel. Unit shall lock with a stainless steel slam lock with removable key. Door shall be either water-tight or flood-type as indicated in Part 3 of this Section.

9. Coatings: All exposed piping and valves within vaults or above grade shall receive a primer and intermediate coat of Devran 224HS high build epoxy. Finish Coat shall be Devthane 379 Aliphatic Urethane Gloss Enamel. Coatings shall be as manufactured by ICI Devoe Coatings and applied according to the manufacturers product data sheet.

Interior of wetwell and all piping within shall receive two coats of MC-TAR coal tar epoxy as manufactured by Wasser Corporation.

Force main discharge manhole and all manholes within 600 feet downstream of discharge shall receive a minimum 2 inch coating of Quadex QM-1s Restore to provide a factory blended, single component, high strength cement based, polypropylene fiber reinforced, shrinkage compensated mortar.

10. Flowmeter: Magnetic flowmeter shall be composed of both a flowhead mounted in the pipe and a signal conditioning and transmitter module which shall be mounted remotely at the pump station control building. Unit shall measure, indicate, and totalize flow and shall be as manufactured by Danfoss. Process connection shall be 150 pound ANSI B16.5 RF flanges. Measuring tube shall be stainless steel with liner as recommended by manufacturer for use with an abrasive sanitary sludge.

The totalizer transmitter shall have a 16-bit microprocessor, which evaluates the signals from the flowhead sensors, and transmits standard process signals proportional to flow rate. Unit shall have zero flow cutoff capability and internal diagnostic functions. Unit shall be mounted remotely in the control building and shall have NEMA 4X enclosure. Unit shall be capable of automatic recognition of sensor type and calibration data. Unit shall have (1) 4-20 mA signal output indicating magnitude of flow rate and local display.

11. Controls: Refer to Lift Station Control Panel Specifications in these standards.

5 STARTUP & TESTING

1. General: A minimum 48 hours notice shall be provided to County, prior to all testing activities. County's representative shall be present for all tests. All equipment shall be tested off-line, prior to attempting to placing station in operation. Potable water shall be used for all pump and leak testing.
2. Wetwell: Wetwell shall be leak tested by static exfiltration method, prior to backfilling and applying interior coating. Wetwell shall be filled with water and allowed to soak for a minimum 24 hours. Water level shall be "topped off", and exfiltration test commence. Maximum allowable water loss after 24 hours shall be 0.2%, excluding evaporation. A pan or other vessel shall be filled and floated in wetwell during test to measure evaporation loss.
3. Pumps: The services of a factory trained field service technician shall be provided to inspect the completed installation, make all adjustment necessary to place the system in satisfactory operation, and instruct the operating personnel in the proper care and operation of the equipment.

The field tests shall determine the head, discharge flow and overall efficiency characteristics of each pumping unit and in addition, shall demonstrate that under all conditions of operation each unit:

- a) Has not been damaged by transportation or installation.
- b) Has been properly installed.
- c) Has no mechanical defect.
- d) Is in proper alignment.
- e) Has been properly connected.
- f) Is free of overheating of any parts.
- g) Is free of all-objectionable vibration and noise.
- h) Is free of overloading of any parts.
- i) Indicates seal failure alarm.
- j) Indicates motor over-temperature and locks out pump.

A startup report shall be issued to the County from the field service technician verifying that the equipment is installed and functioning properly. Report shall include the measured voltages and amperages (on each leg) and flow for each pump.

4. Controls: Refer to Lift Station Control Panel Specifications in these standards.
5. Generator: The supplier of the electric generator and associated items shall provide factory trained technicians to checkout the completed installation and to perform an initial startup inspection to include:
 - a) Ensuring the engine starts (both hot and cold) within the specified time.
 - b) Verification of engine parameters within specification.
 - c) Set no load frequency and voltage.
 - d) Test all automatic shutdowns of the engine-generator.
 - e) Perform a load test of the electric plant; ensuring full load frequency and voltage are within specification by using pump and building load.

- f) Make all adjustment necessary to place the system in satisfactory operation.

A startup report shall be issued to the County from the field service technician verifying that the equipment is installed and functioning properly.

6. Piping: All gravity and pressure piping shall be tested in accordance with Part 9 of Rockingham County Public Works Department - Water and Sewer Specifications and Standards.

6 WARRANTY

1. General: All work and materials shall be guaranteed against defect for a minimum period of one year, commencing to run upon date of acceptance by Rockingham County Public Works Department. At end of one year period, a warranty inspection shall be performed and attended by representatives of Rockingham County Public Works Department and station provider. Any deficiencies noted at that time or prior shall be corrected without cost to Rockingham County.
2. Pumps: The pumps and motors will be covered by a full five (5) year non-prorated warranty that shall comprise the following terms: The initial 5 years from start-up of the equipment shall be covered 100% for parts and labor. This warranty shall not be limited by hours of running time or operation from variable speed drives.

Additionally, the pump manufacturer shall warrant the mechanical seal to be free from defects in materials and workmanship and against wear for the life of the pump. Should the mechanical seal fail due to normal use, the pump manufacturer shall repair or replace the seal and any resulting pump damage. This warranty shall be in written form and shall be from the pump manufacturer to the Owner. Warranties from component providers or other third parties shall not be acceptable.

3. Generator: The standby electric generating system components, complete engine-generator and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of 12 months. Such defective parts shall be repaired or replaced, at the manufacturer's option, free of charge for travel and labor.

In addition to the one year warranty, a five year service contract shall be provided by the generator supplier. Service contract shall include annual inspection and maintenance of the unit.

7 SPARE PARTS

1. General: All spare parts recommended by equipment manufacturer shall be provided. In addition, an adequate supply of consumable items (such as grease and oil) shall be supplied to last for one year of normal operation and maintenance.
2. Pumps: One spare pump shall be provided to Rockingham County Public works Department. Pump shall be identical to models furnished and installed in pump station.

At a minimum and in addition to the spare pump, the pump manufacturer shall furnish one set of the following spare parts:

- a) Impeller and casing wear rings
- b) Mechanical seal or seal repair kit with all seal faces and o-rings
- c) Upper and Lower Bearings set
- d) O-Ring Set

A written description of each spare part and the storage recommendations shall be provided.

8 ACCEPTANCE

1. General: Acceptance of pump station and force main by Rockingham County Public Works Department will only occur after:
 - a) All materials has been satisfactorily tested.
 - b) All major equipment has been started-up by factory trained field technicians and Start-Up Reports have been received.
 - c) Controls have been demonstrated
 - d) All spare parts have been received.
 - e) Approved Operation and Maintenance Manuals have been received.
 - f) Record Documents have been received

The pump station and force main may not be placed in operation, nor any wastewater received, prior to acceptance by the Department.

END OF SECTION

APPENDIX B

**WASTEWATER LIFT STATION
CONTROL PANEL SPECIFICATIONS**

Section is Not Included:

Contact Public Works Department for Most Current Controls Specifications

APPENDIX C
FORMS & NOTICES

**ROCKINGHAM COUNTY PUBLIC WORKS DEPARTMENT
20 EAST GAY STREET
HARRISONBURG, VA 22080
540-564-3020**

APPLICATION TO CONSTRUCT WATER FACILITIES

Plans for the referenced project are hereby submitted for review.

Note: Submittal is required both before and after obtaining VDH/ODW approval.

Date: _____

Project name _____

Resubmittal: No ___ Yes ___ VDH/ODW Approval Obtained _____

Prior Submittal Date(s): _____

Owner/Developer: _____

Contact Name: _____

Address: _____

Phone/Fax: _____

Consulting Engineering Firm: _____

No. Proposed Connections: _____ Design Population: _____

Average Daily Demand (GAL): _____

Lowest Elevation: _____ Highest: _____ Pressure Zone: _____

Zone Effective Storage (Pre, GAL): _____

Water Source/Permitted Capacity: _____

Pipe Length: 4" _____ 6" _____ 8" _____ 10" _____ 12" _____

15" _____ 18" _____ 24" _____ No. Fire Hydrants: _____

Storage Tank: No ___ Yes ___

Size (GAL): _____ Overflow Elev.: _____

Pump Station: No ___ Yes ___

No. Pumps: ___ Size (HP): ___

=====
Project Hereby Approved for VDH/OWP Submittal: Yes ___ No ___

Comments Attached

Project Hereby Approved for Construction: Yes ___ No ___

Comments Attached

Signed: _____

Date: _____

Name: _____

Rockingham County Public Works Department

**ROCKINGHAM COUNTY PUBLIC WORKS DEPARTMENT
20 EAST GAY STREET
HARRISONBURG, VA 22080
540-564-3020**

APPLICATION TO CONSTRUCT SEWER FACILITIES

Plans for the referenced project are hereby submitted for review:

Date: _____

Project name: _____

Resubmittal: No ___ Yes ___
Prior Submittal Date(s): _____

Owner/Developer: _____

Contact Name: _____

Address: _____

Phone/Fax: _____

Consulting Engineering Firm: _____

No. Proposed Connections: _____ Design Population: _____

Design Flow (MGD): _____

Drainage Basin Name/Area: _____

Percent of Basin Proposed for Development: _____

Wastewater Treatment Facility: _____

Collection System Limiting Capacity (Pre, MGD): _____

Treatment Capacity (Pre, MGD): _____

Gravity Pipe Length: 8" _____ 10" _____ 12" _____

15" _____ 18" _____ 24" _____ No. Manholes: _____

Pump Station: No ___ Yes ___

No. Pumps: ___ Size (HP): ___

Force Main Length: _____ Diameter: _____

DEQ/OWE Approval Required: Yes ___ No ___

Project Hereby Approved for Construction: Yes ___ No ___
Review Comments Attached

Signed: _____ Date: _____

Name: _____

Rockingham County Public Works Department

**ROCKINGHAM COUNTY PUBLIC WORKS DEPARTMENT
20 EAST GAY STREET
HARRISONBURG, VA 22080
540-564-3020**

REQUIREMENTS FOR RECORD PLANS

After completion of construction of the water and/or sewer facilities from approved plans and after final inspection, the developer or owner responsible for the construction shall prepare record plans. Two digital sets and one printed set of the record plans shall be submitted to the County. One digital set shall be in Autodesk AutoCAD (*.dwg) format and the other in Adobe Acrobat (*.pdf) format. The digital Adobe Acrobat and printed sets shall bear the seal of a registered Land Surveyor licensed by the state of Virginia.

Record information shall be based on accurate, field-obtained information to show actual conditions of the finished construction. The record plans shall show all revised and permanent changes to the plans and/or specifications. The record plans shall include all plan sheet requirements mentioned in (3. Minimum Plan Requirements) including the following:

1) Water Line Construction

- a) Scale accurately and locate on the plan sheet, the line and all installed fittings, such as elbows, tees, crosses, and reducers, and all cradle, encasement, service connections, or special construction.
- b) Show exact measurements and location of all valve boxes, fire hydrants, meter boxes, blow-offs, air releases, blind or blank-flanged fittings and plugged termination of lines.
- c) The measurements taken for these locations shall be taken from at least two reasonable adjacent and available, fixed and permanent objects such as fire hydrants, centers of sanitary or storm sewer manhole covers, corners of buildings, power poles, etc. (If a power pole is used, the I.D. number shall be recorded on the record drawings.)

2) Sewer Line Construction

- a) Scale accurately and locate all manhole inverts and top casting elevations and annotate numerically the exact elevations of the same as determined by field survey after construction.
- b) Scale accurately the length of all lines between manholes and annotate numerically the exact lengths and grades of all lines, as determined after construction. Grades shall be accurately noted to 0.01% slope, as calculated by field measured length and difference between invert elevations. A note may be added stating "Sewer grades have been calculated according to field measured manhole invert elevations".
- c) Scale accurately and locate concrete cradles, encasements, or special construction.
- d) Scale accurately and locate the sewer service laterals and cleanouts including invert elevation in reference to top of cleanout.

3) Pumping Stations, and all other Comparable Construction and Building Structures

- a) Record plans and specifications shall accurately indicate all approved deviations and changes regarding changes in location, type of equipment used, and material used.
- b) Accurate listings of the name of the manufacturer of all operating equipment installed, together with model or style numbers, ratings, capacities, and other pertinent information shall be provided as part of the record plans.
- c) A minimum of three complete sets of shop drawings and operation and maintenance manuals shall be submitted as a part of the record plans on the project. This shall include all operating equipment, and all Certificates of Inspections, Approvals, Warranties and Guarantees of Equipment. A listing of materials and installations, required by the approved project specifications, shall be submitted as a part of the record plans.

NOTICE TO PROPOSED DISCHARGERS

Restaurants, bakeries, and other facilities involved in preparation of food have the potential to discharge oil and grease to the sanitary sewer system. It is the discharger's responsibility to install and properly maintain such pretreatment devices necessary to assure that concentration of oil and grease discharged to the sanitary sewer system do not exceed 300 parts per million (ppm) as required by Section 16A-5 (c)(12) of the County Code.

Oil and grease contribute to increased levels of BOD and suspended solids when present in waste discharged to the sanitary sewer. In addition to other charges for sewer and water services, there will be charged to individual users a strong waste charge for suspended solids when concentrations exceed 275 milligrams per liter and for BOD when concentrations exceed 250 milligrams per liter. These charges are in accordance with the County Code.

Accordingly, a monitoring manhole will be required to facilitate verification of compliance with the specified discharge limits.

Additionally, Section P-1002 of the BOCA National Plumbing Code (BOCA) requires the provision of traps or interceptors for oil, grease, sand and other substances harmful or hazardous to the building drainage system, the public sewer or sewage treatment plant or processes shall be provided.

Discharges of oil and grease greater than 300 ppm shall constitute a violation of the County Code. Such violation shall result in enforcement action subject to the provisions of the Code. In addition, such violation may result in the discontinuance of County water and/or sewer service (including plugging the sewer line) upon seven (7) days written notice of any violations to the customer or without notice if the County determines the violations pose an immediate threat to the health, safety or welfare of the public, or the environment or the County sewer system.

22 DEC 2004

INSTRUMENT USAGE WAIVER

By signing this waiver, I, _____, hereby acknowledge that the Rockingham County Department of Public Works does not guarantee the accuracy of its instruments used during a fire flow test and I accept responsibility for errors which may occur as a result of a fire flow test performed by _____ on _____. I also agree that by signing this waiver, if I am not confident in the accuracy of the instruments used in the fire flow test identified above, it is my responsibility to have the instruments calibrated prior to using flow information obtained from the instruments in hydraulic calculations.

By

Signature

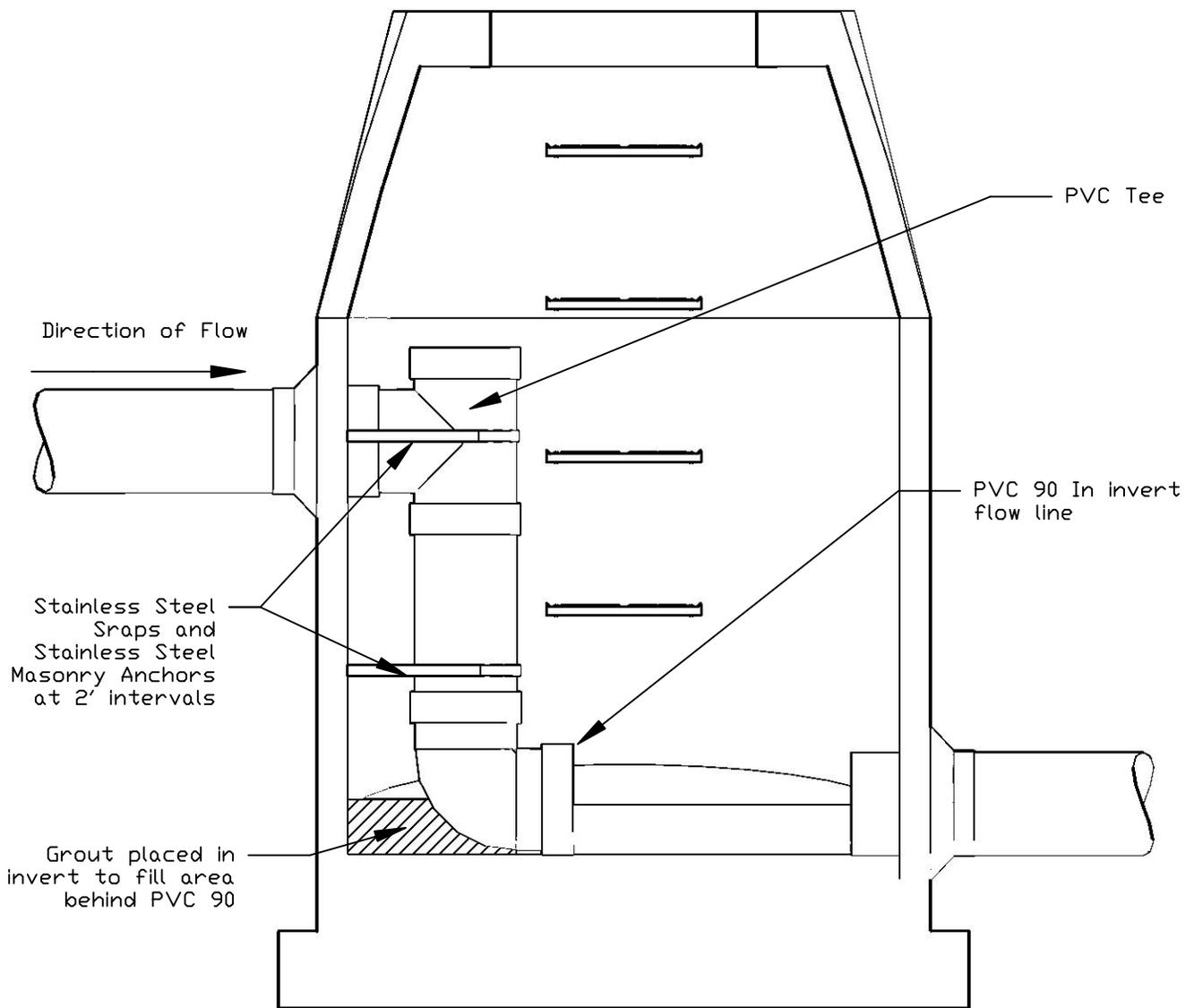
Date

Public Works Representative

Project Name: _____

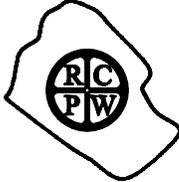
Hydrant/Location: _____

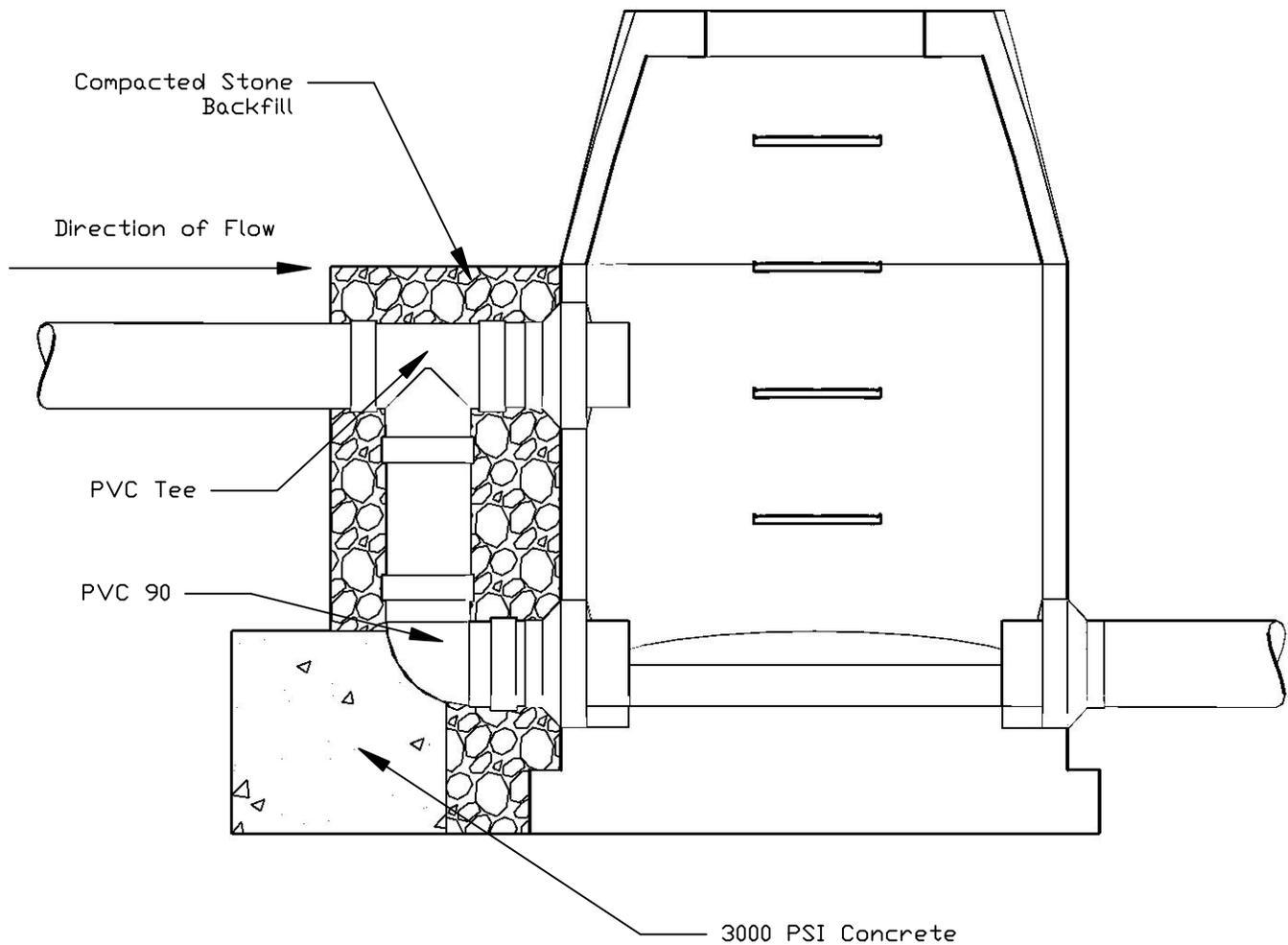
STANDARD DETAILS



Drop connection shall be provided for a sewer line entering a manhole at an elevation of 24 inches or more above the invert elevation of the discharge line. (Ref. to County specification 6.3.2.3.5)

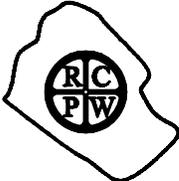
*Inside drop to be used where inlet pipe is 8 in or less in diameter and only one drop connection per manhole is required. Where inlet pipe diameter is greater than 8 in or for multiple drop connection applications, an outside drop is required. See outside drop connection details (DS 2.0).

REVISIONS				Sewer Manhole Inside Drop		SCALE: None
DATE	BY					
				 ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL		DS 1.0
DATE: 5/18/10	BY: NAP					
APPR:	BY:					

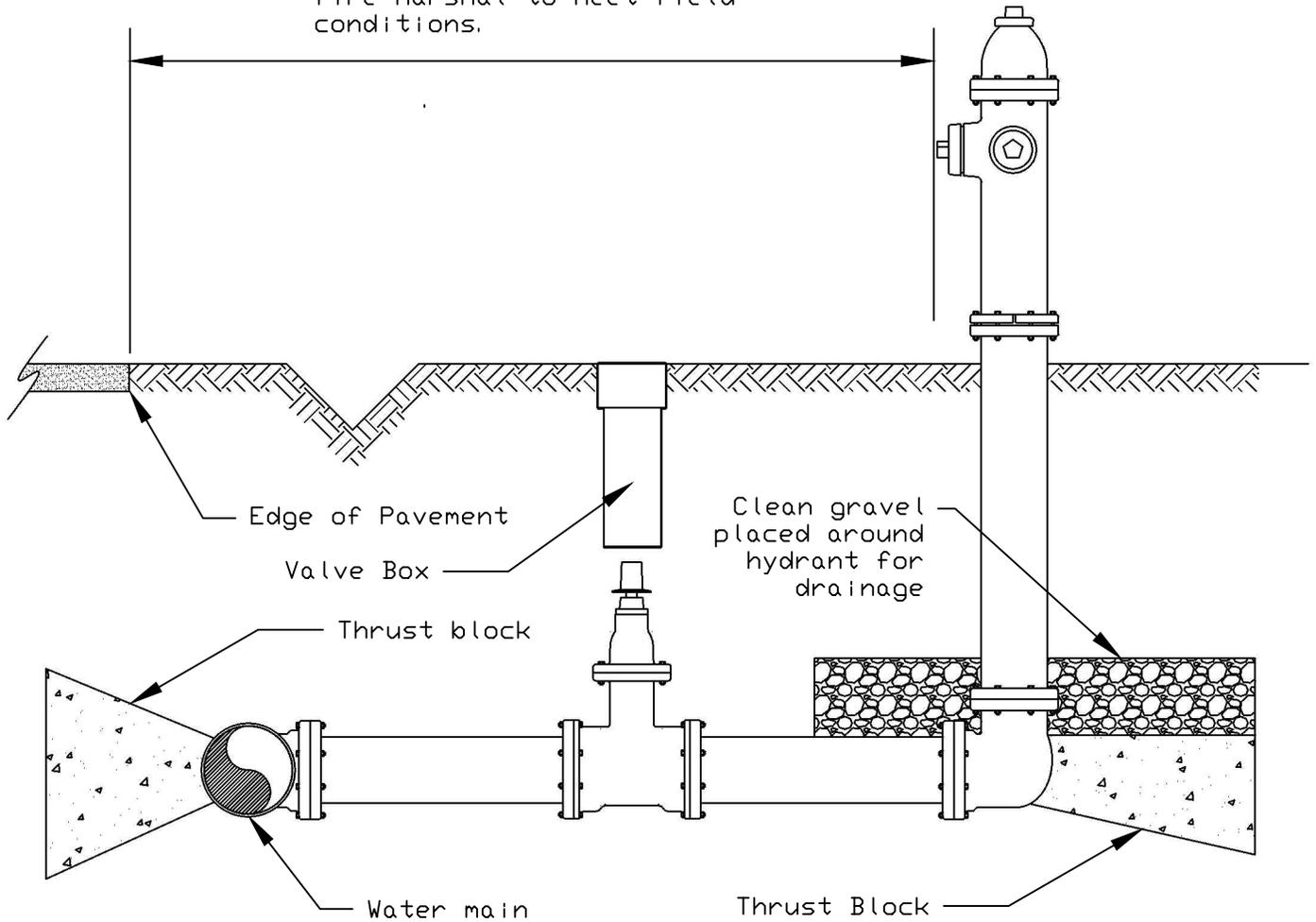


Drop connection shall be provided for a sewer line entering a manhole at an elevation of 24 inches or more above the invert elevation of the discharge line. (Ref. to County specification 6.3.2.3.5)

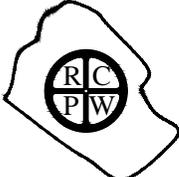
*Outside drop to be used where inlet pipe is greater than 8 inches in diameter or where more than one drop connection per manhole is required. For single drop connections 8 inches in diameter or less, see county detail DS 2.0.

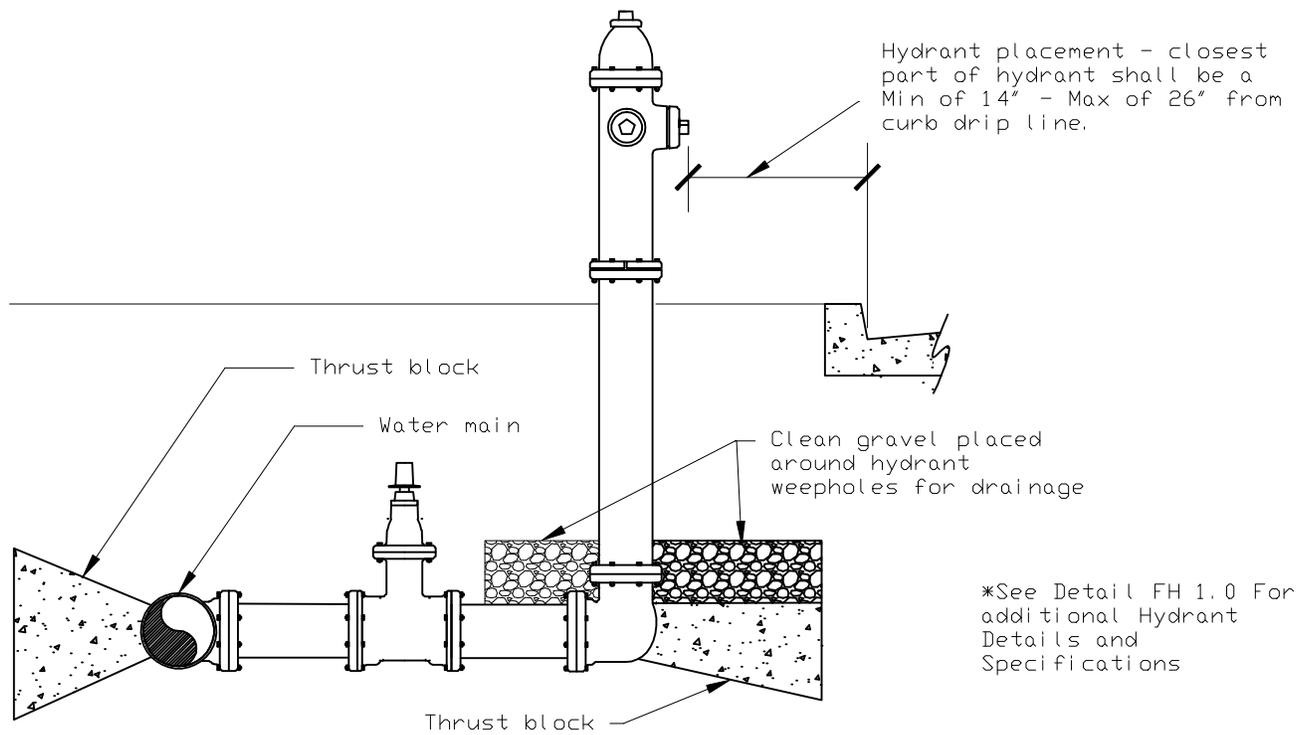
REVISIONS		Sewer Manhole Outside Drop	SCALE: None
DATE	BY		
		 ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL	DS 2.0
DATE: 5/18/10	BY: NAP		
APPR:	BY:		

8' 0" Max, or as approved by
fire marshal to meet field
conditions.

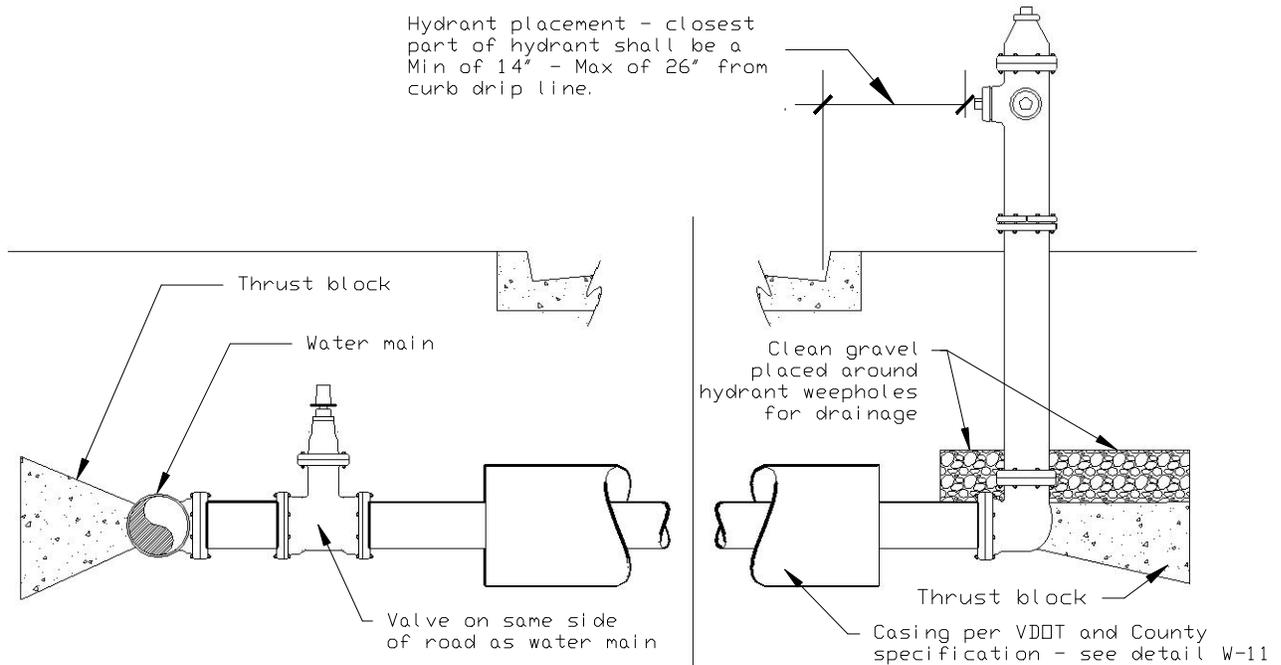


- * Approved Kennedy Hydrant Assembly or American Darling
- * The use of mechanical joint restraints (Megalug or equivalent) are required at all fittings
- * 3000 psi concrete thrust blocks to be placed at all tees and bends.
- * Foster type adapters may be used in lieu of spool pieces where space is a factor.

REVISIONS				Fire Hydrant Detail - Edge of Pavement		SCALE: None	
DATE	BY						
1/5/11	NAP			 ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL		FH 1.0	
8/17/16	ELS						
DATE: 5/24/10 BY: NAP							
APPR:	BY:						

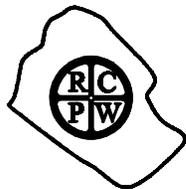


Hydrant - Same Side of Road as Water Main



Hydrant - Opposite Side of Road from Water Main

REVISIONS			
DATE	BY		
DATE: 5/18/10		BY: NAP	
APPR:		BY:	



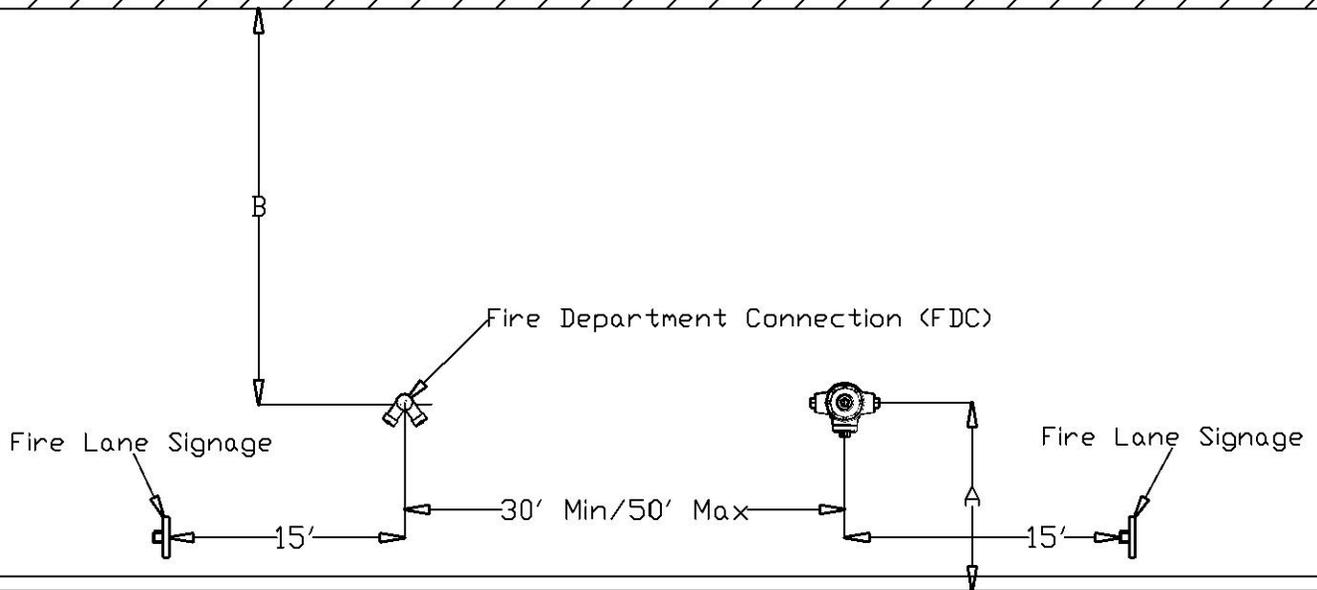
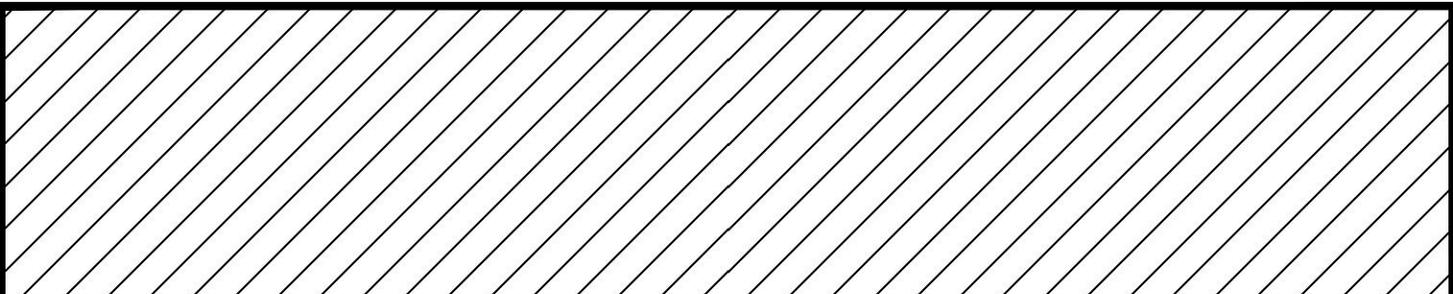
Fire Hydrant Details - Curb and Gutter

**ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL**

SCALE:

None

FH 2.0



Fire Lane designated and marked per Rockingham County Standard

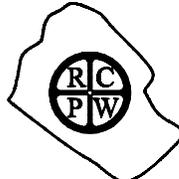
A - Hydrant placement from EOP or face of curb per county standards or as approved by Fire Marshal

B - FDC placed 50' min from exterior of building or wall structure

* Top of FDC 18" min/48" max above finished grade

* FDC May be located on either side of the hydrant in accordance with the above dimensions

REVISIONS			
DATE	BY		
DATE: 5/19/10	BY: NAP		
APPR:	BY:		

Fire Department Connection (FDC) Detail		SCALE:
 <p>ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL</p>		None
		FH 3.0

CAST IRON FRAME AND COVER
 A.Y. McDONALD 74M32A OR
 CAPITOL FOUNDRY EQUAL. TOP
 OF FRAME LEVEL WITH
 FINISHED GRADE.

MB-6 PLASTIC METER BOX
 (18" I.D. x 12")

PROPERTY
 LINE

6"

CLEANOUT ADAPTER
 & THREADED PLUG

SET HEIGHT
 AS REQUIRED

3" GRAVEL BED
 VDOT #26 STONE

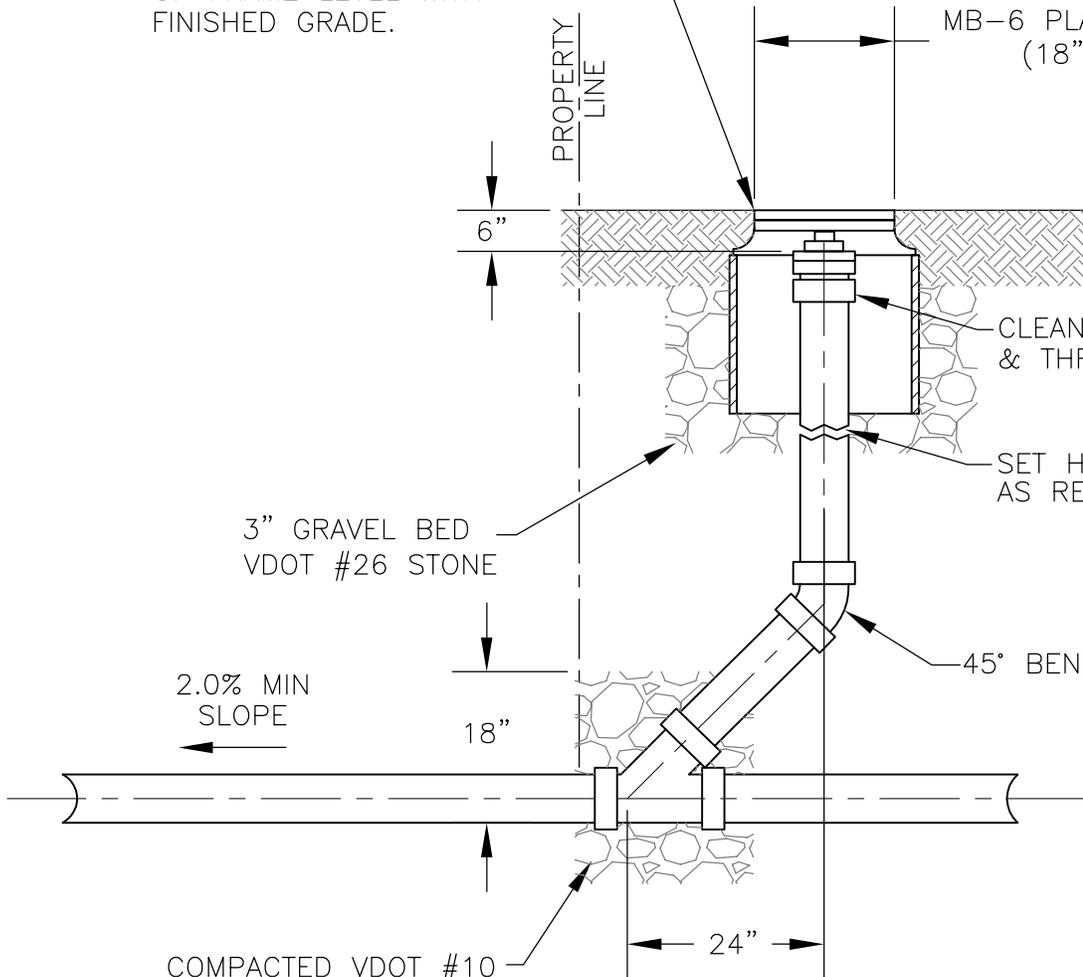
45° BEND

2.0% MIN
 SLOPE

18"

24"

COMPACTED VDOT #10
 STONE OR SAND
 TO SUPPORT RISER



REVISIONS			
DATE	BY		
DATE: 01/07/05		BY: R.A.S.	
APPR:		BY:	

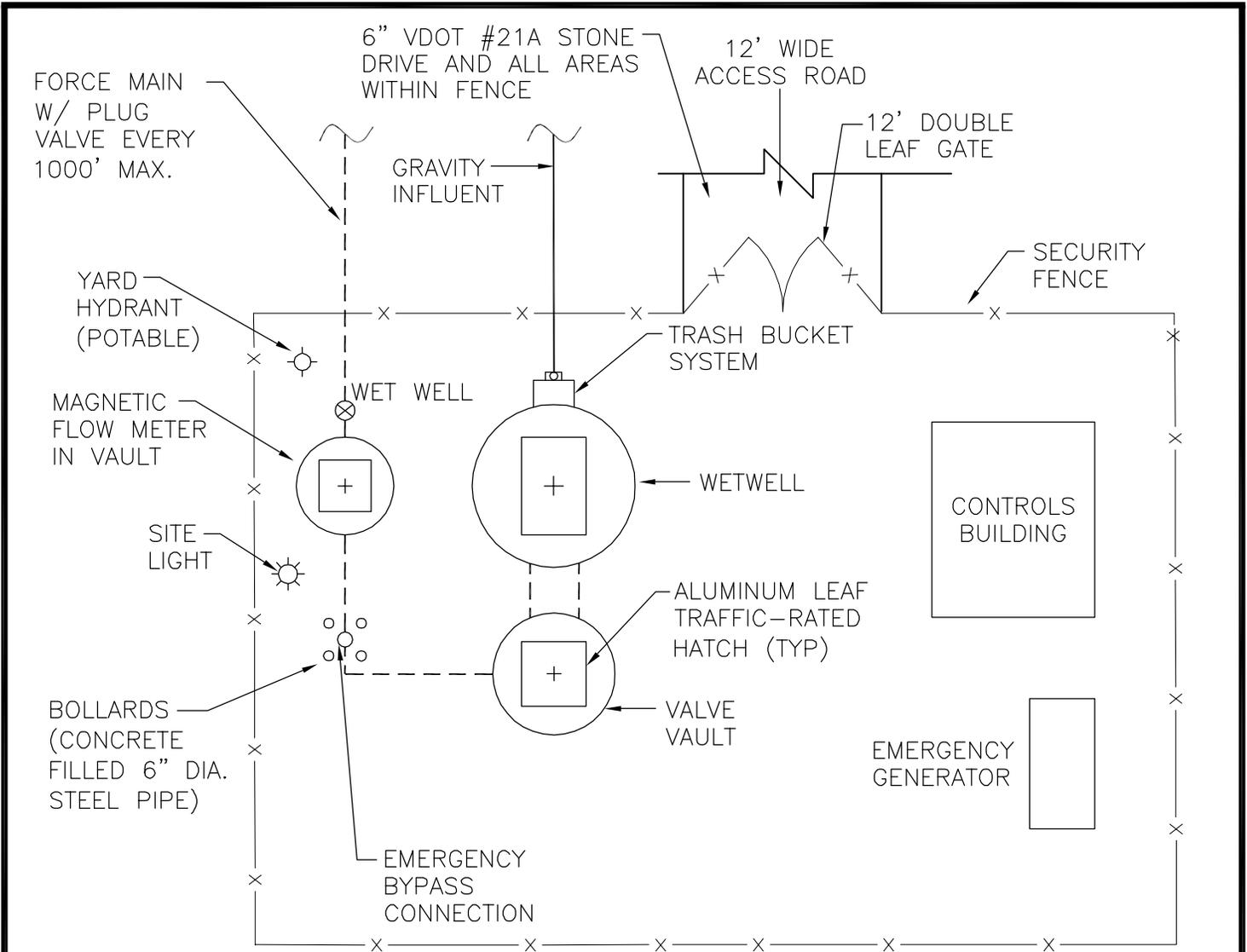


SANITARY CLEANOUT

**ROCKINGHAM COUNTY
 DEPARTMENT OF PUBLIC WORKS
 STANDARD DETAIL**

SCALE:
 None

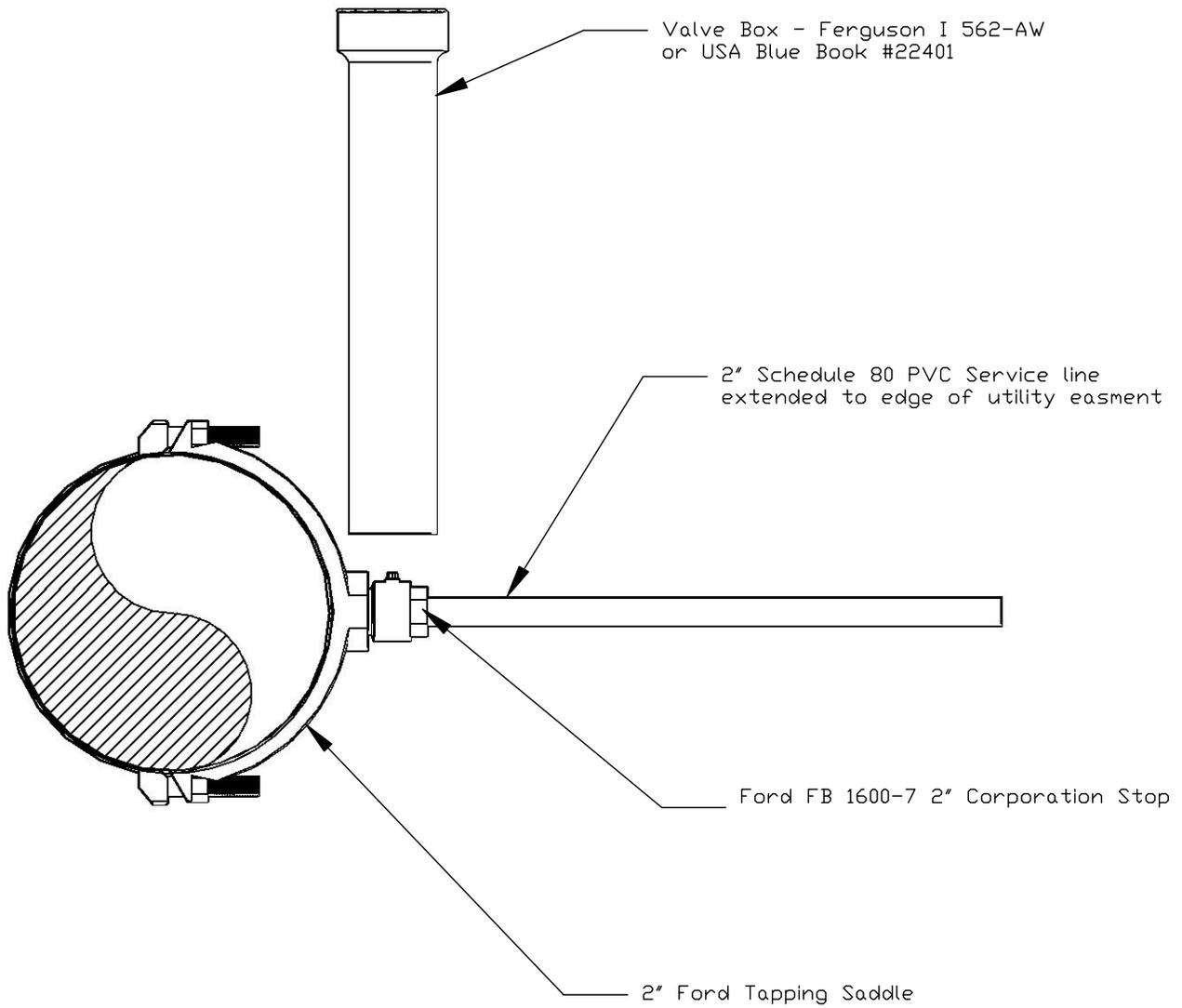
S 1.0



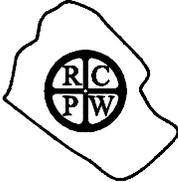
NOTES:

1. FIVE FOOT CLEARANCE SHALL BE MAINTAINED BETWEEN FENCE AND ALL ABOVE GROUND APPURTENANCES.
2. INSTALL PLUG VALVE ON FORCE MAIN EVERY 1000' MIN + JUST OUTSIDE FLOW MTR VAULT.
3. ALL VAULTS SHALL DRAIN BACK TO WET WELL.
4. ELECTRICAL UTILITY POWER SUPPLY SHALL BE 3-PHASE. PUMP MOTORS SHALL BE HIGH EFFICIENCY 3-PHASE.
5. STAINLESS STEEL HOIST AND BASE SOCKET SHALL BE PROVIDED AND SIZED FOR PUMP.
6. SECURITY FENCE SHALL BE 8' HIGH CHAIN LINK PRIVACY FENCE WITH 3 STRANDS BARBED WIRE. LOCATE 6" INSIDE PROPERTY LINE.

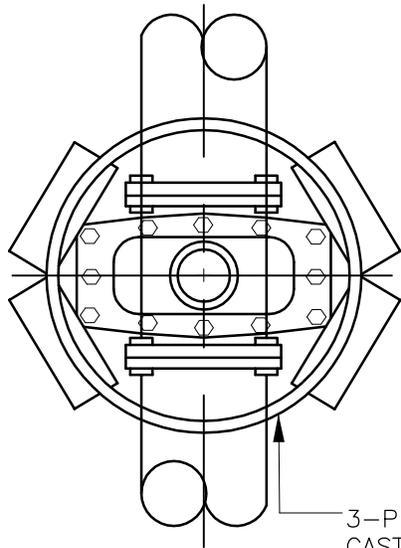
REVISIONS		TYPICAL SEWER PUMP STATION LAYOUT	SCALE: None
DATE	BY		
02/08	RJ	 ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL	S 2.0
DATE: 12/21/04 BY: AS			
APPR:	BY:		



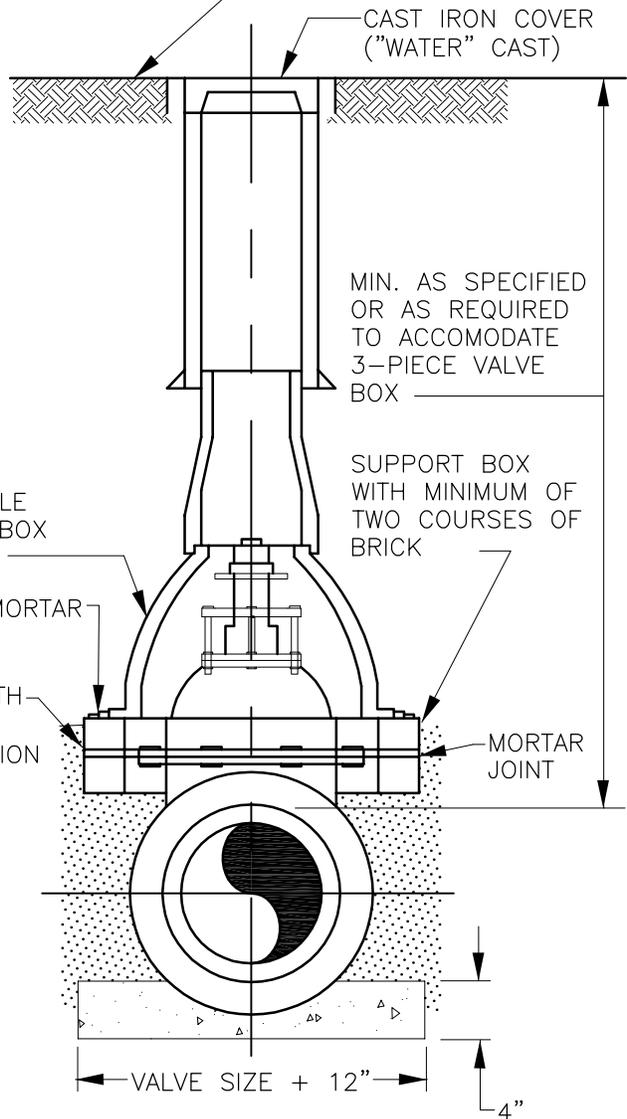
*Homeowner to install check valve at pump vault

REVISIONS				Force Main Residential Connection		SCALE:
DATE	BY					None
DATE: 5/23/10		BY: NAP			ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL	
APPR:		BY:				

ON VDOT R/W, RECESS TOP 4" MINIMUM.
ELSEWHERE, MATCH EXISTING OR PROPOSED
FINISHED GRADE.



3-PIECE ADJUSTABLE
CAST-IRON VALVE BOX
WITH ROUND BASE.



MIN. AS SPECIFIED
OR AS REQUIRED
TO ACCOMMODATE
3-PIECE VALVE
BOX

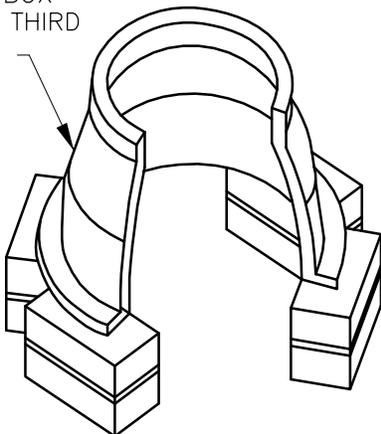
SUPPORT BOX
WITH MINIMUM OF
TWO COURSES OF
BRICK

MORTAR

MORTAR
JOINT

BOTTOM OF TOP BRICK SHALL BE EVEN WITH
TOP OF BONNET BOLT FLANGE (BASE SIZE
SHALL BE SUFFICIENT TO PERMIT INSTALLATION
AS SHOWN)

VALVE BOX
LOWER THIRD
SHOWN



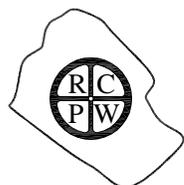
VALVE AND PIPE
OMITTED FOR CLARITY.

SUPPORT VALVE WITH SOLID CONCRETE
BLOCK.

NOTES:

1. 4-12" GATE VALVE SHALL BE MUELLER 2360 SERIES (250 PSI), OR KENNEDY 4571-4071.
2. CONNECTION BETWEEN LOWEST AND MIDDLE VALVE BOX SECTION SHALL BE SMOOTH AND SHALL NOT ALLOW VERTICAL FORCES TO BE TRANSMITTED.

REVISIONS			
DATE	BY		
DATE: 09/01/04 BY: P.H.S.			
APPR:	BY:		

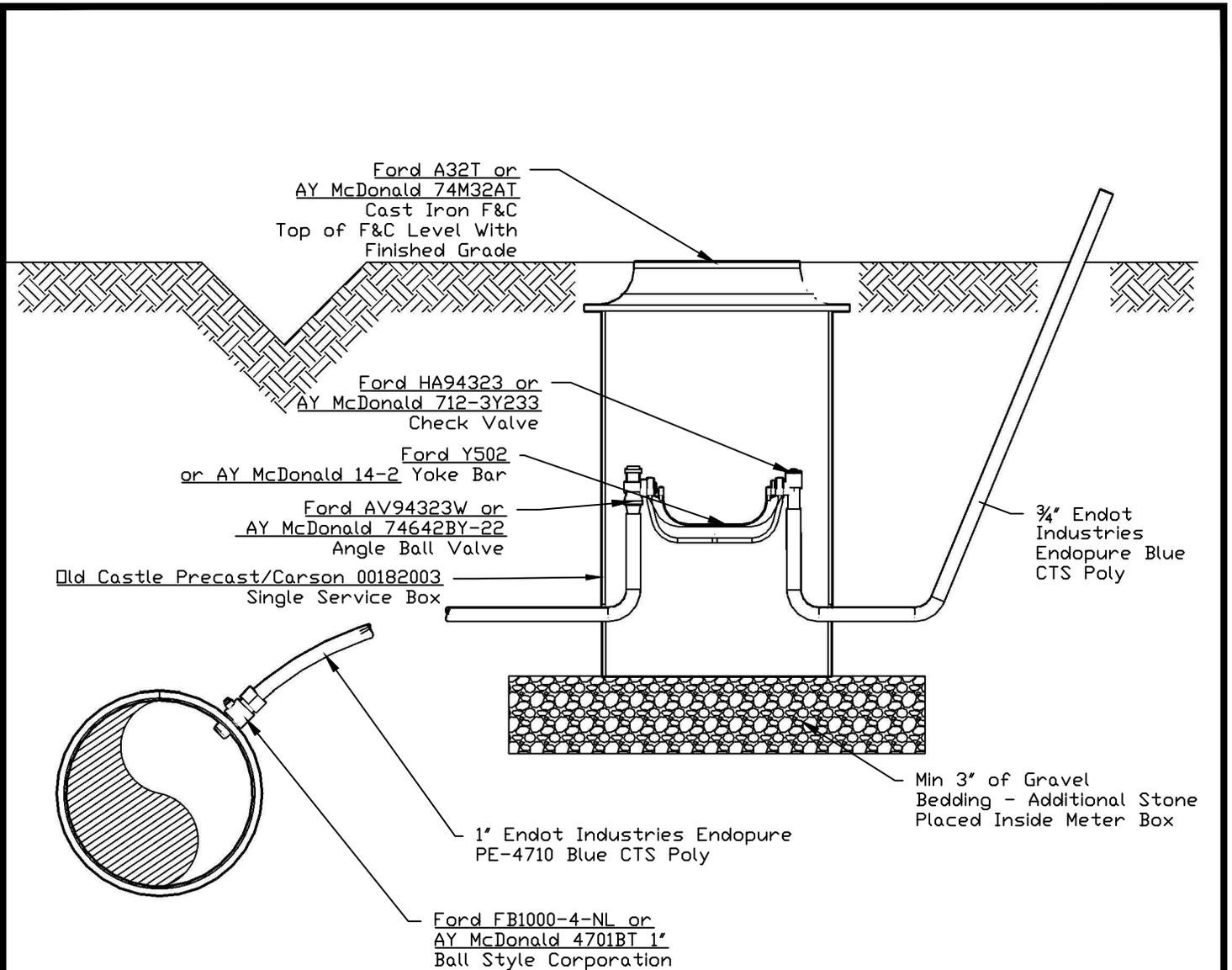


VALVE/VALVE BOX INSTALLATION

ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL

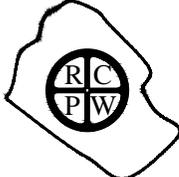
SCALE:
None

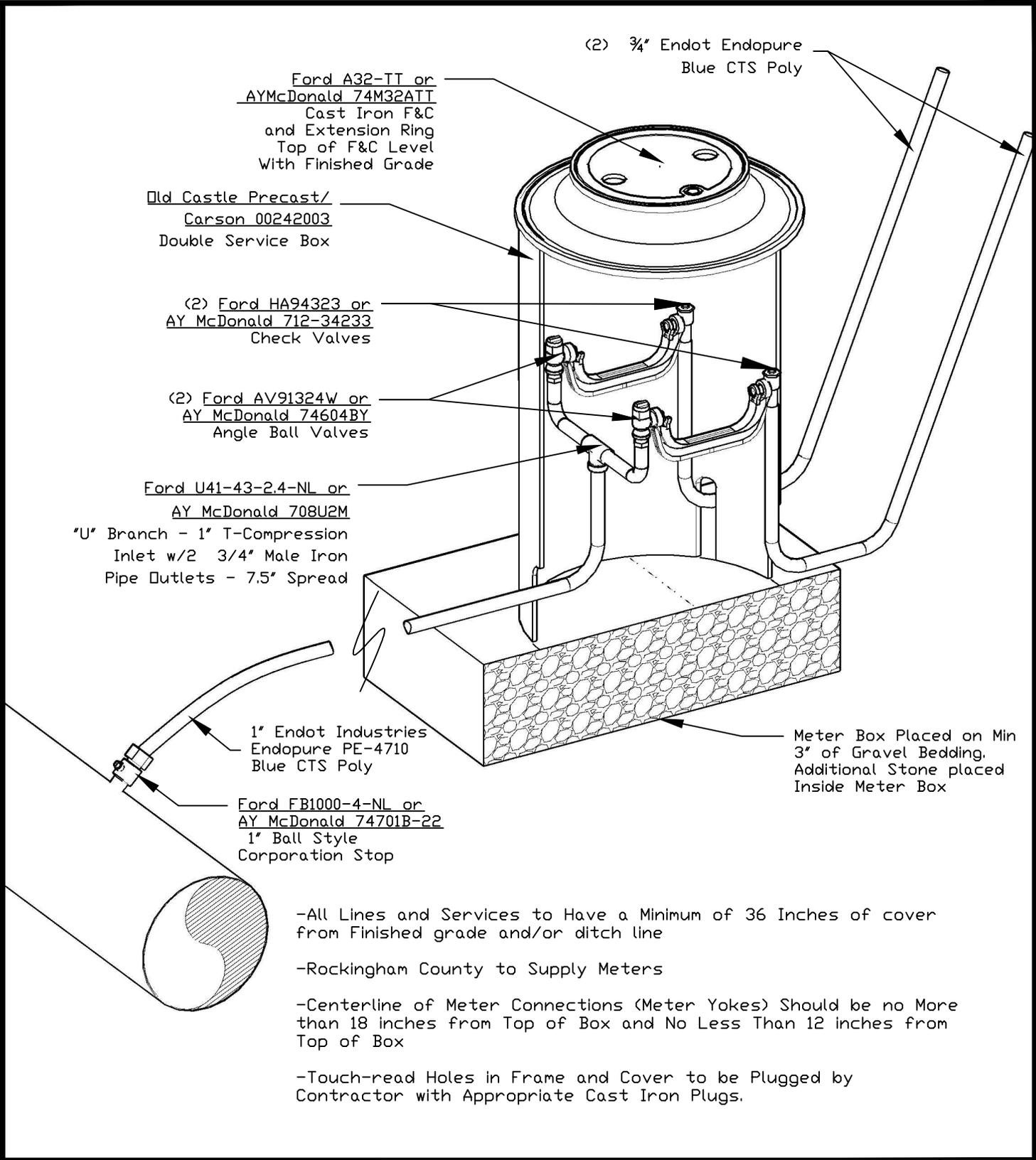
W 1.0



Notes:

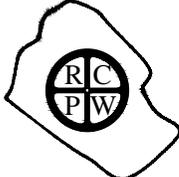
- All lines and services to have a minimum of 36" of cover from finished grade and/or ditch line.
- Centerline of meter connection (meter yoke) should be no more than 18 Inches from top of meter box and no less than 12 Inches from top of box
- Touch-read hole in F&C to be plugged by contractor with an appropriate cast iron plug
- Meter to be supplied by Rockingham County

REVISIONS				Single Meter Set		SCALE:	
DATE	BY					None	
12-17-14	NAP			 <p>ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL</p>		W 3.0	
DATE: 5/19/10	BY: NAP						
APPR:	BY:						



REVISIONS			
DATE	BY		
12-17-14	NAP		
DATE: 5/23/10	BY: NAP		
APPR:	BY:		

Double Meter Set

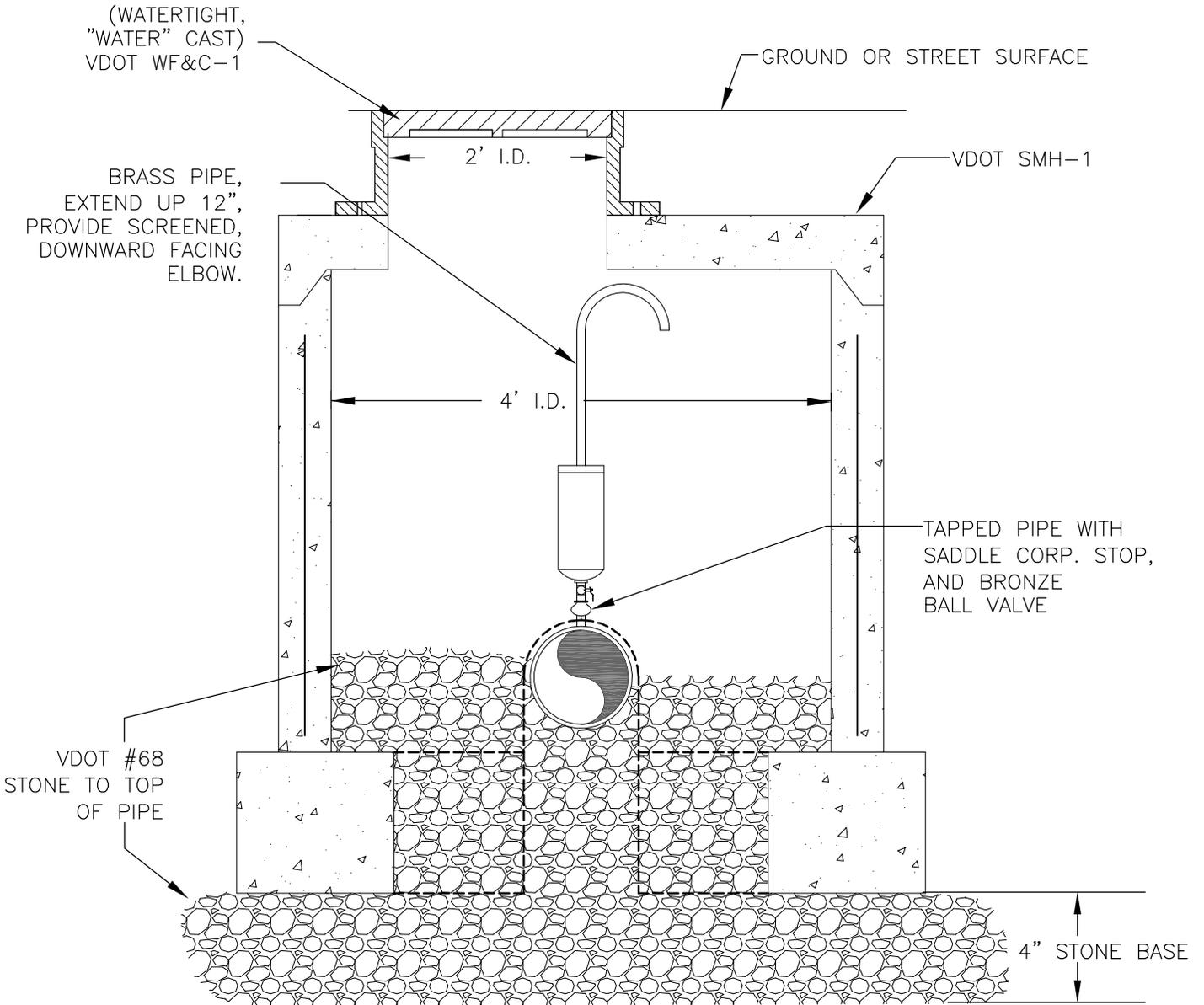


ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL

SCALE:
None
W 3.1

NOTES:

1. AIR RELEASE VALVE SHALL BE CRISPIN OR VAL-MATIC AND SHALL BE OF THE COMBINATION (AIR/VACUUM AND AIR RELEASE) TYPE. ORIFICE AND TAP DIAMETERS SHALL BE SIZED PER LOCATION-SPECIFIC WORKING PRESSURE.
2. THIS DETAIL SHALL NOT BE USED IN AREAS OF HIGH GROUNDWATER. SHOULD EVIDENCE OF HIGH GROUNDWATER BE FOUND DURING CONSTRUCTION, ENGINEER SHALL BE NOTIFIED FOR MODIFICATIONS.
3. PIPE AND ELBOW SHALL BE LOCATED CLEAR OF THE LID ARC AREA, AND SUCH THAT ACCESS FOR MAINTENANCE IS NOT INHIBITED.



REVISIONS			
DATE	BY		
DATE: 09/01/04 BY: P.H.S.			
APPR:	BY:		



AIR RELEASE VALVE/VAULT

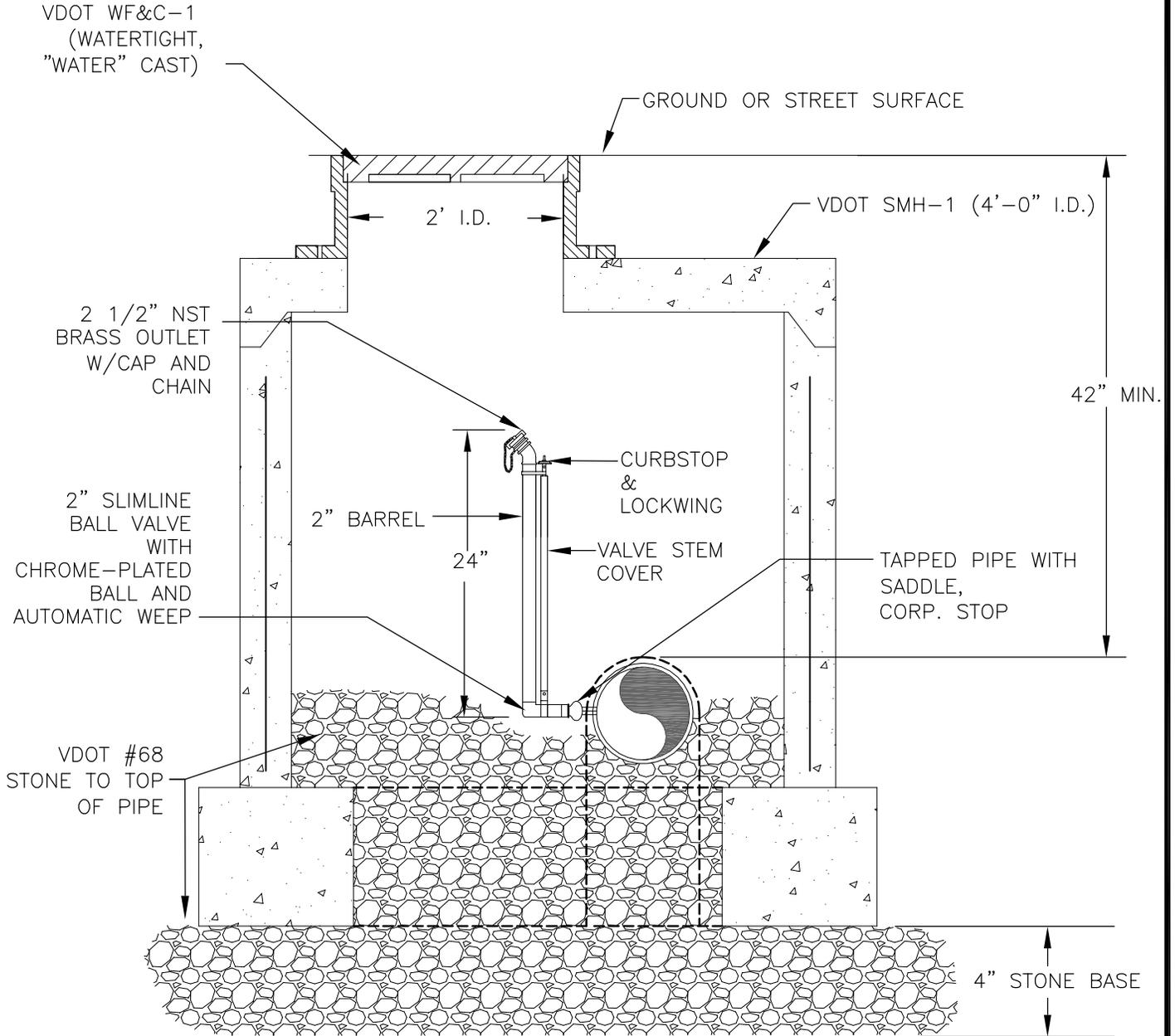
**ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL**

SCALE:
None

W 4.0

NOTES:

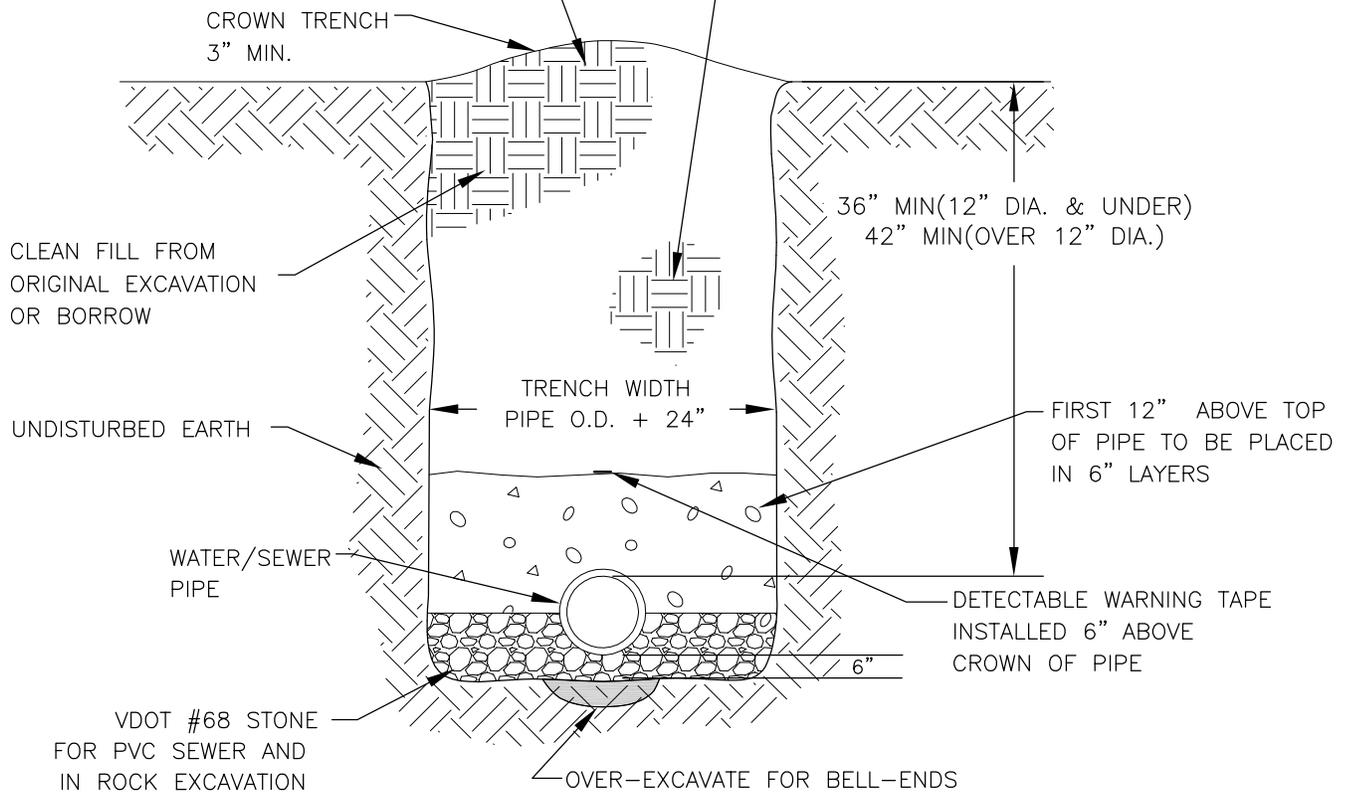
1. FLUSHING HYDRANT SHALL BE GIL AQUARIUS GH-20 OR APPROVED EQUAL.
2. THIS DETAIL SHALL NOT BE USED IN AREAS OF HIGH GROUNDWATER. SHOULD EVIDENCE OF HIGH GROUNDWATER BE FOUND DURING CONSTRUCTION, ENGINEER SHALL BE NOTIFIED FOR MODIFICATIONS.
3. HOSE FITTING SHALL BE LOCATED CLEAR OF THE LID ARC AREA, AND SUCH THAT ACCESS FOR MAINTENANCE IS NOT INHIBITED.



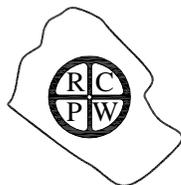
REVISIONS					FLUSHING HYDRANT/VAULT		SCALE: None W 5.0
DATE	BY				ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL		
DATE: 09/01/04		BY: P.H.S.					
APPR:		BY:					

FINAL BACKFILL (PROPOSED IMPROVED SURFACE) REFILLED AND COMPACTED IN 8" LOOSE LIFTS COMPACTED TO MIN. 95% STANDARD PROCTOR DENSITY AT ± 2% OPTIMUM MOISTURE

FINAL BACKFILL (PROPOSED UNIMPROVED SURFACE) REFILLED AND COMPACTED IN 12" LOOSE LIFTS COMPACTED TO MIN. 92% STANDARD PROCTOR DENSITY AT ± 2% OPTIMUM MOISTURE



REVISIONS			
DATE	BY		
08/31/09	RNJ		
DATE: 09/01/04		BY: P.H.S.	
APPR:		BY:	

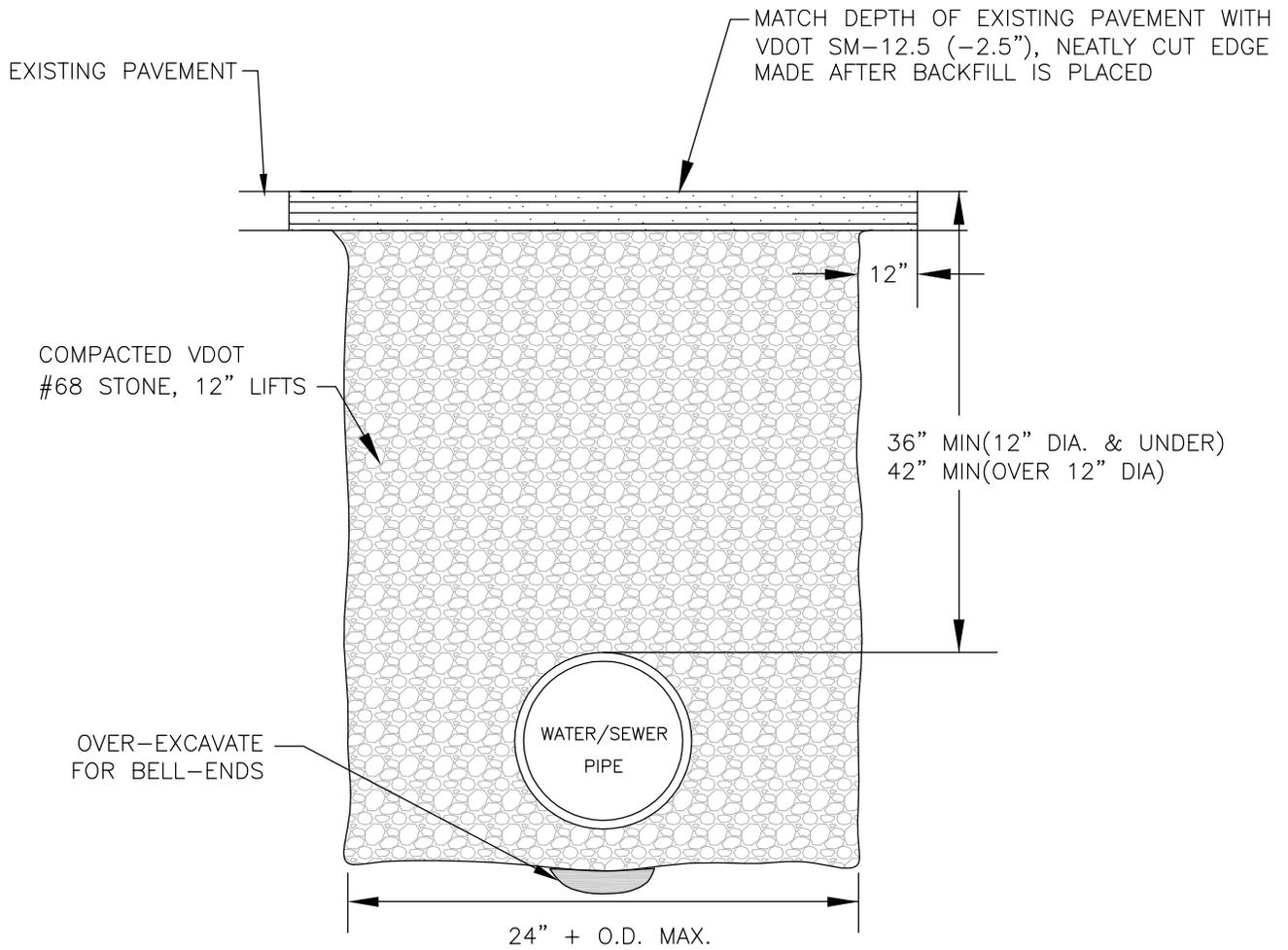


TRENCH BACKFILL/BEDDING

**ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL**

SCALE:
None

W 6.0



REFER TO DETAIL W6.0 FOR PIPE BEDDING

NOTE: IF NO PAVEMENT IS PROVIDED ON A DRIVEWAY OR ROAD, PLACE 6" MIN VDOT #21A STONE AS A TOP COURSE.

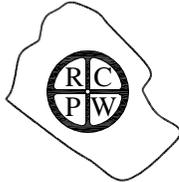
REVISIONS				DRIVEWAY/ROAD REPAIR		SCALE: None
DATE	BY					
				 <p>ROCKINGHAM COUNTY DEPARTMENT OF PUBLIC WORKS STANDARD DETAIL</p>		W 7.0
DATE: 09/01/04 BY: P.H.S.						
APPR: BY:						

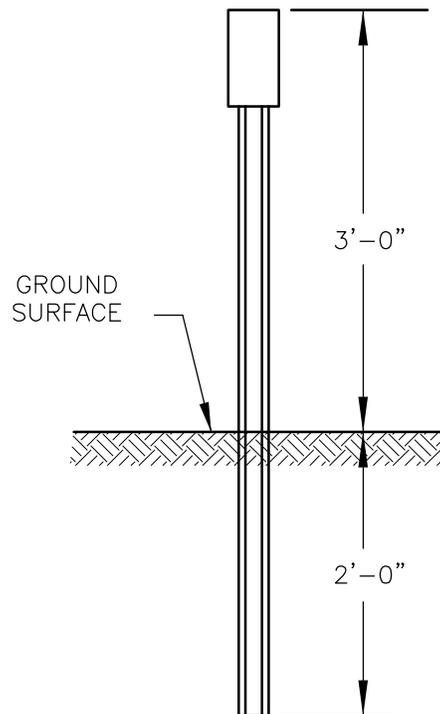
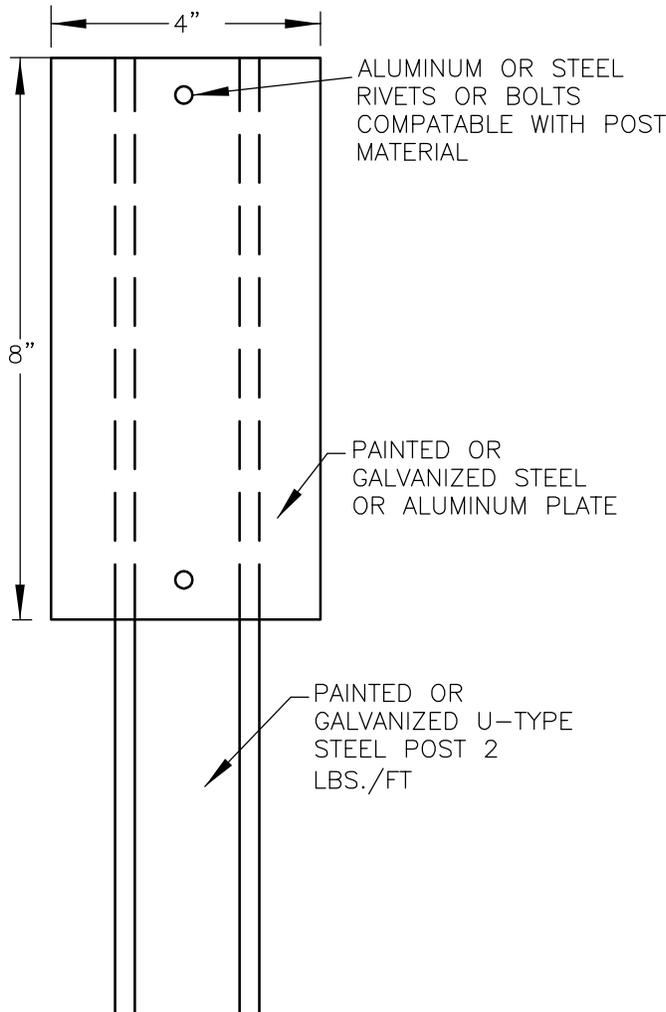
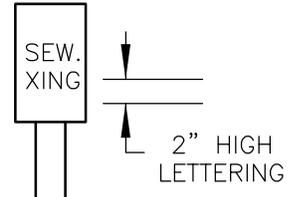
PLATE MATERIAL
 1/32" MIN. GALVANIZED STEEL
 OR
 5/64" MIN. ALUMINUM

BLACK EPOXY
 PAINT LETTERING

1. WATER



2. SEWER



INSTALLATION LOCATION PER
 OWNER'S INSTRUCTIONS

REVISIONS			
DATE	BY		
DATE: 09/01/04 BY: P.H.S.			
APPR:	BY:		

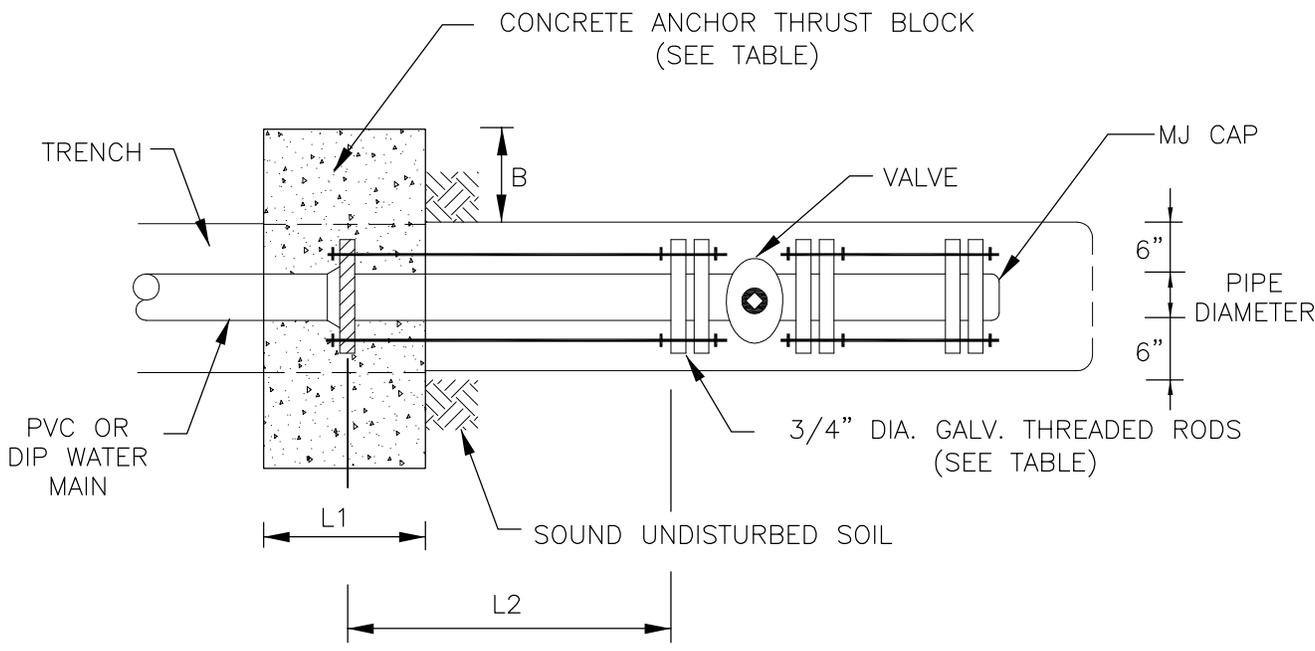


PIPELINE CROSSING MARKER

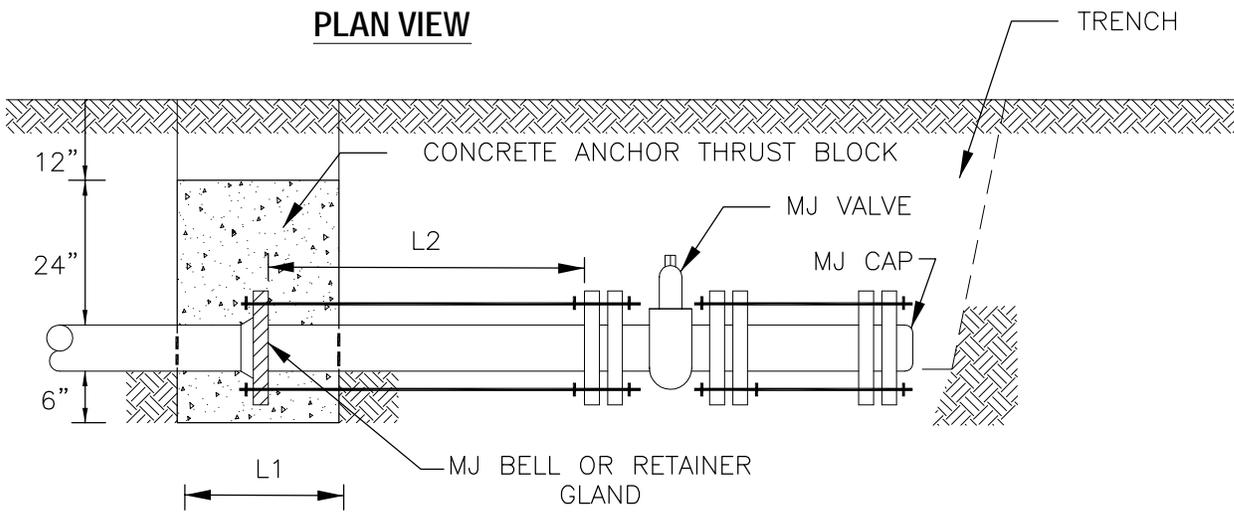
**ROCKINGHAM COUNTY
 DEPARTMENT OF PUBLIC WORKS
 STANDARD DETAIL**

SCALE:
 None

W 8.0



PLAN VIEW



SECTION VIEW

RETAINER GLAND FOR PVC PIPE SHALL BEE SERIES 2000 PV, AND FOR DIP PIPE SERIES 100, BY EBAA IRON SALES, INC. "MEGA-LUG" OR APPROVED EQUAL

PIPE DIAMETER (in.)	B min (in.)	L1 min (in.)	NUMBER OF RODS PER RETAINER	L2 min (in.)
4-8	12	18	4	27
10-12	33	L2	6	50
14-16	50	L2	8	75

NOTE: FOR USE WITH TEST OR WORKING PRESSURES LESS THAN 200 PSI.

REVISIONS			
DATE	BY		
DATE: 09/01/04 BY: P.H.S.			
APPR:	BY:		

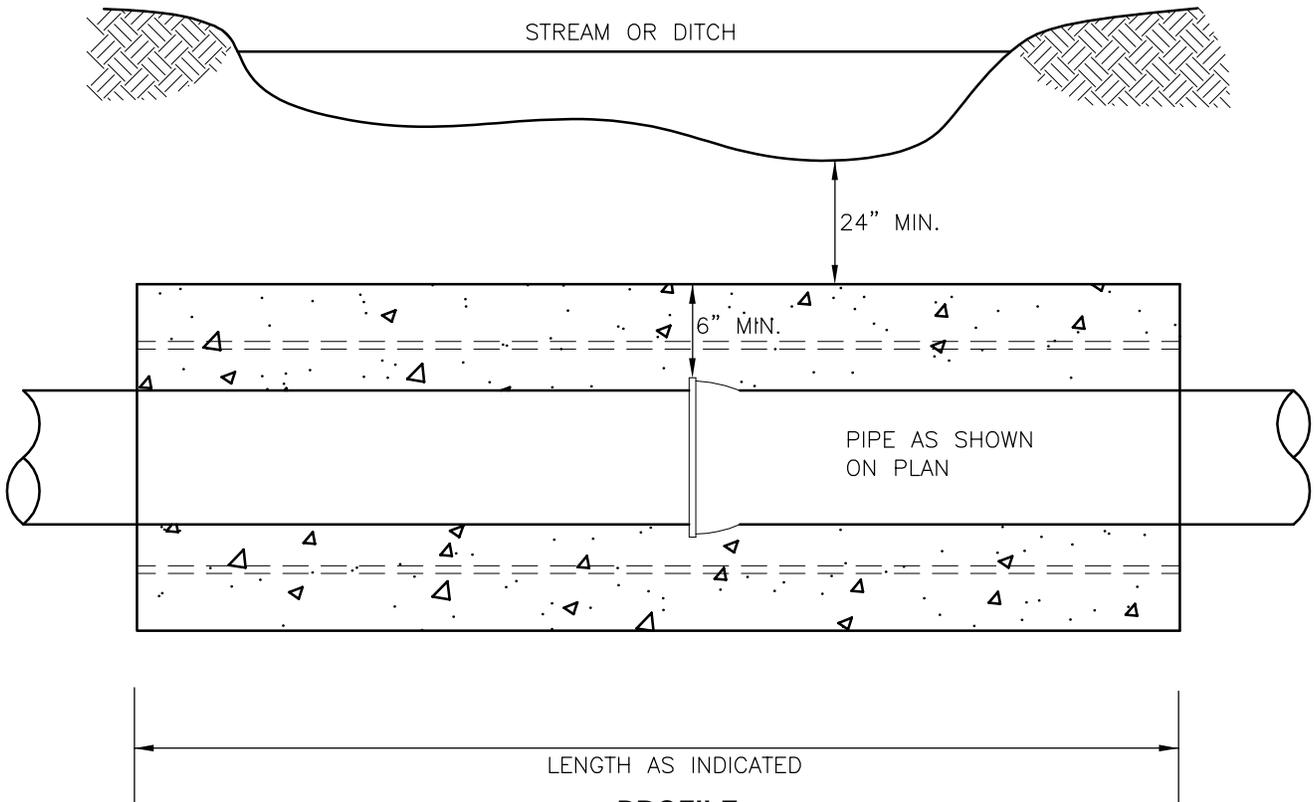


DEAD END ANCHOR DETAIL

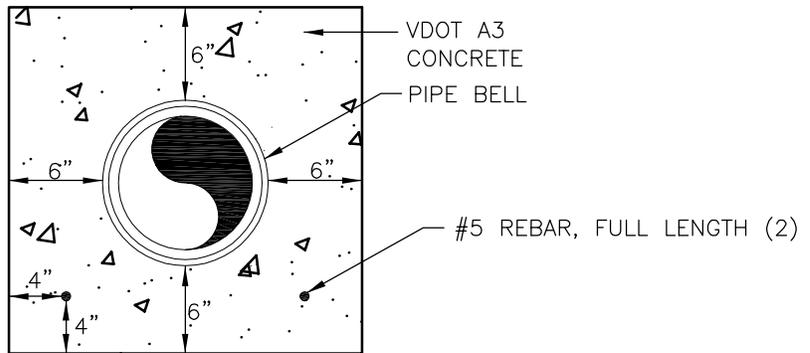
ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL

SCALE:
None

W 9.0



PROFILE



SECTION

REVISIONS			
DATE	BY		
DATE: 09/01/04 BY: P.H.S.			
APPR:	BY:		

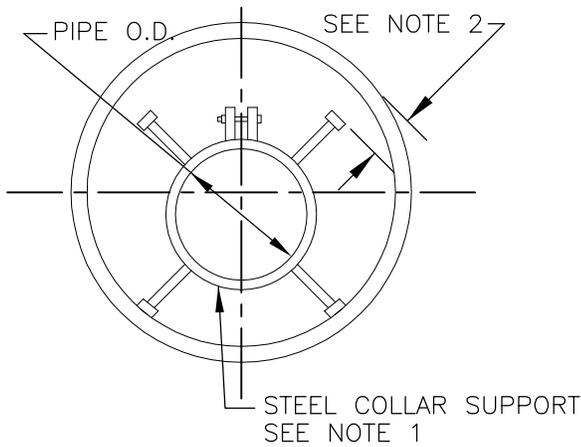


CONCRETE ENCASEMENT

**ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL**

SCALE:
None

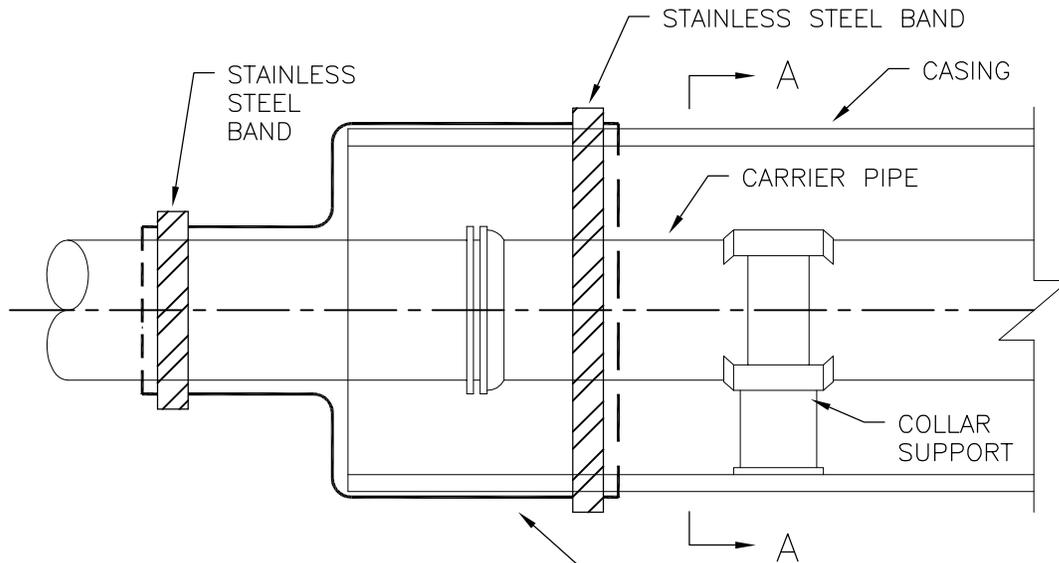
W10.0



SECTION A-A

NOTES:

1. SINGLE PIECE COLLAR IS SHOWN. CARRIER PIPES 18" OR LARGER REQUIRE 2-PIECE COLLARS. COLLARS SHALL BE NON-CONDUCTIVE POLYETHYLENE, OR APPROVED EQUAL.
2. DIMENSION AS NECESSARY TO PROVIDE MINIMUM CLEARANCE NEEDED TO SLIDE PIPE THROUGH CASING
3. CASING PIPE SHALL BE PER ASTM A139 GRADE B WITH BITUMINOUS COATING. LENGTH SHALL EXTEND 5' PAST EDGE PAVEMENT ON PRIMARY HIGHWAYS AND 3' ON SECONDARY.
4. CARRIER PIPE SHALL BE DUCTILE IRON WITH RESTRAINED JOINT LOCKING GASKETS
5. PROVIDE MINIMUM 1 COLLAR SUPPORT FOR EACH CARRIER PIPE JOINT WITHIN CASING.
6. INSTALLATION SHALL ALSO COMPLY WITH VDOT STANDARDS.



CASING PIPE SIZE		
CARRIER PIPE SIZE INCHES	MIN. CASING PIPE SIZE * INCHES	MIN. CASING PIPE THICK. INCHES
4 - 8	16	0.250
10 - 12	20	0.375
16	24	0.375

MIN. 1/8" RUBBER SLIP-ON ENDSEAL (ALTERNATES MAY BE COORDINATED WITH RCPW)

* SEWER LINES MAY REQUIRE LARGER CASING SIZES IN ORDER TO FACILITATE PROPER GRADE OF CARRIER PIPE.

REVISIONS	
DATE	BY
2/2/10	RNJ
DATE: 09/01/04	BY: P.H.S.
APPR:	BY:



HIGHWAY CROSSING

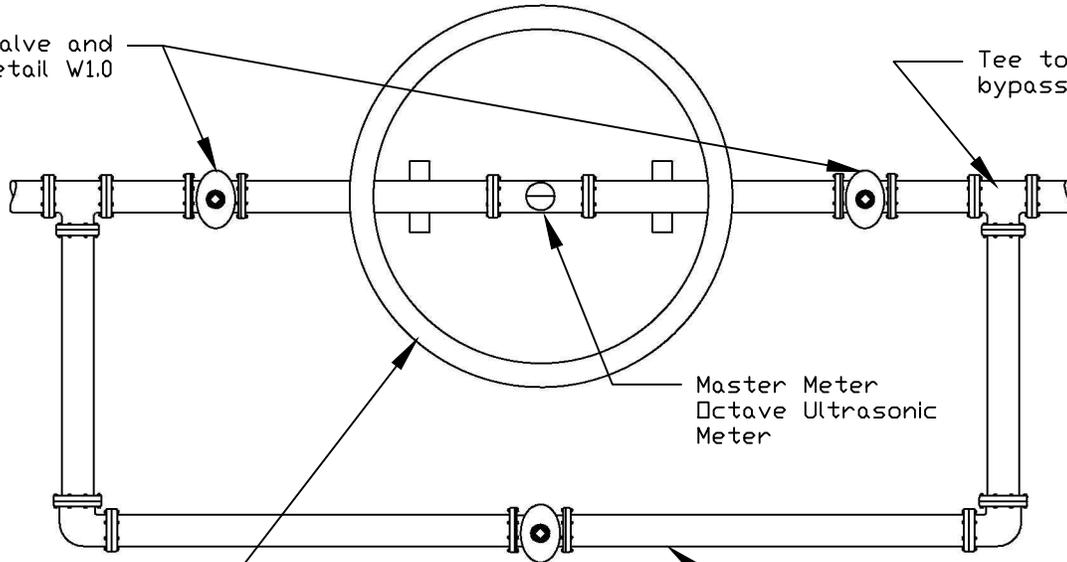
**ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL**

SCALE:
None

W 11.0

Gate valve and box per Detail W1.0

Tee to bypass and bypass valve



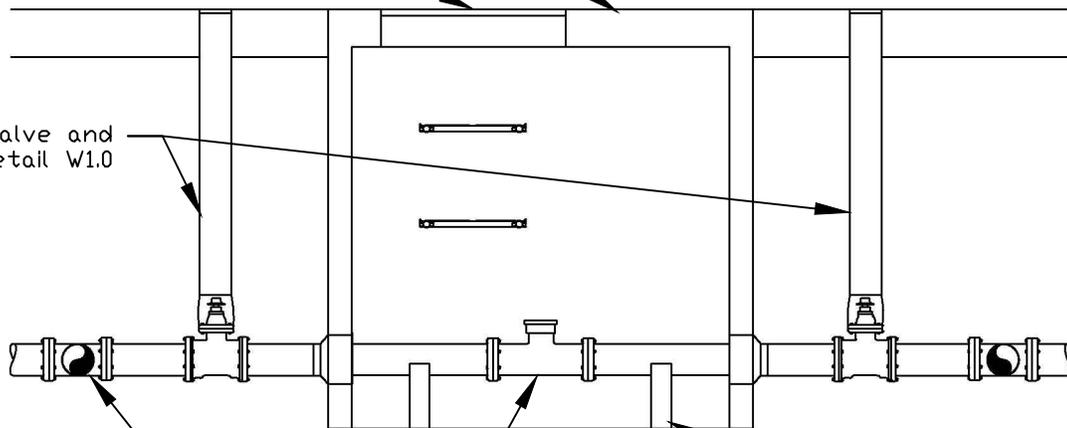
Master Meter
Octave Ultrasonic
Meter

PLAN

Bypass and bypass valve

4' doghouse manhole (VDDT MH-1 with no bottom)

VDDT rated F&C marked "Water"



Gate valve and box per Detail W1.0

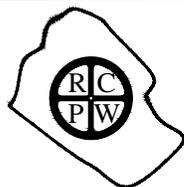
Tee to bypass and bypass valve (see plan view)

Master Meter
Octave
Ultrasonic
Meter

ELEVATION

Concrete block or poured concrete support on flanged connection

REVISIONS			
DATE	BY		
DATE: 8/19/16		BY: ELS	
APPR:		BY:	



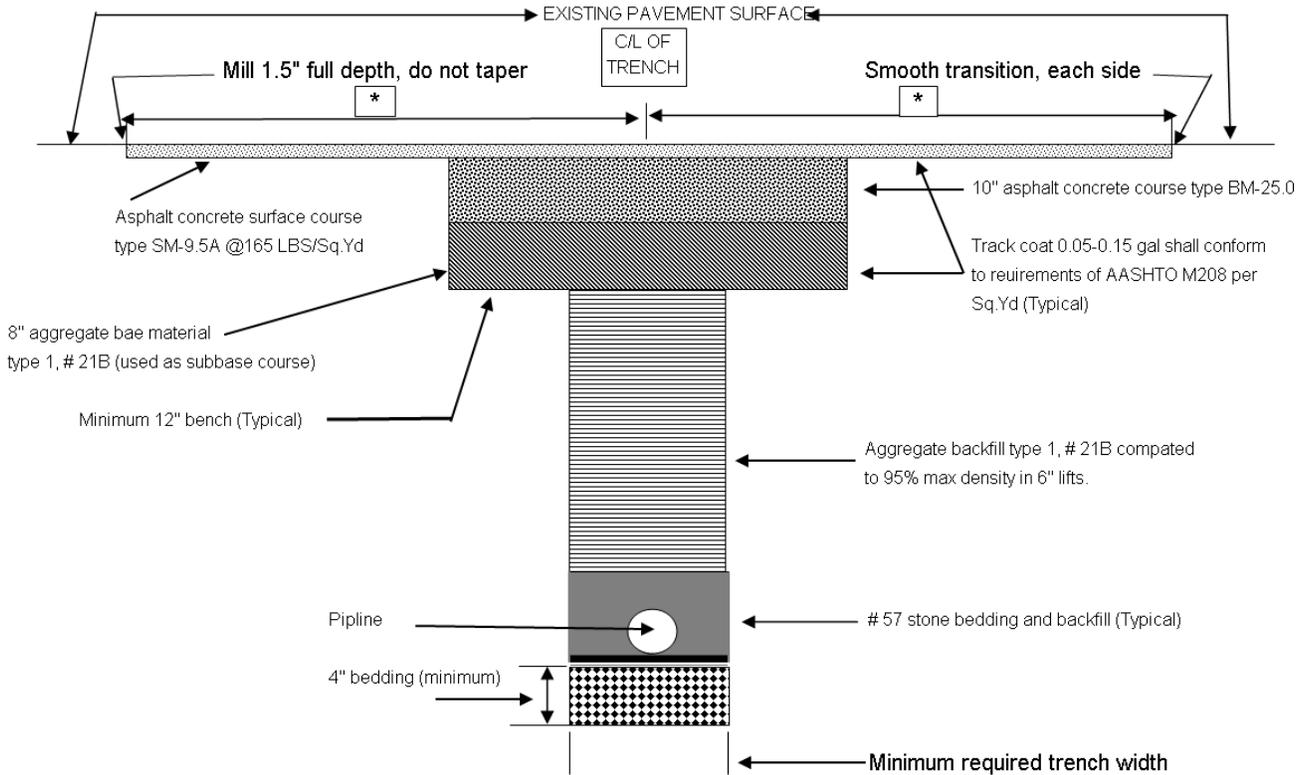
Ultrasonic Meter Set

**ROCKINGHAM COUNTY
DEPARTMENT OF PUBLIC WORKS
STANDARD DETAIL**

SCALE:

None

W 12.0



Notes: All pavement markings damaged or destroyed by trench excavation activity shall be replaced by the permittee per VDOT specifications.
 This detail for highways with existing asphalt concrete pavement sections.
 The extent of pavement restoration for all other pavement cuts shall be determined by the District Administrator's designee.
 * Width of travel lane minimum full pavement width for open cut trenching along road centerline or 25' (minimum) for perpendicular crossings

Not to Scale