STANDARDS AND SPECIFICATIONS
WATER DISTRIBUTION SYSTEMS
KING GEORGE COUNTY SERVICE AUTHORITY

KING GEORGE COUNTY, VIRGINIA

KGCSA

March 2006

KING GEORGE COUNTY SERVICE AUTHORITY

WATER DISTRIBUTION SYSTEM STANDARDS AND SPECIFICATIONS

INDEX

APPENDIX

SECTION I
DESIGN PARAMETERS AND CRITERIA

A. General Requirements:

The following "Water Distribution System Standards and Specifications" shall be followed for the design, construction, inspection, testing and acceptance of all waterworks facilities installed in King George County, Virginia for operation and maintenance by the King George County Service Authority (KGCSA). The requirements specified hereinafter are considered to be minimal requirements. All public water extensions shall be in accordance with the King George County Public Service Authority Regulations (Regulations) and all requirements of the Virginia Department of Health (VDH), the Virginia Department of Highways (VDOT), and the Virginia Erosion and Sediment Control Manual.

The KGCSA may permit the extension of the public water system by a developer. All such extensions shall be at the request of the developer and shall be made pursuant to a Public Water Extension Agreement (PWEA) between the developer and the KGCSA approved by the Board of Directors and executed by the General Manager on behalf of the KGCSA, and approved as to form by the County Attorney. The PWEA shall include terms providing for the amount of all fees to be paid to the KGCSA and providing the time frames for payment of connection fees by the developer. The PWEA shall set forth any cost sharing and provide that, upon completion and approval of the construction of such facilities, including satisfactory completion of all warranty and guarantee periods, they shall become the property of the KGCSA. Such PWEA shall be executed by all parties prior to the issuance of a Certificate to Construct.

The applicant/developer shall accept responsibility for the costs of all KGCSA, VDOT, VDH, DEQ, and King George County Department of Community Development inspections and/or tests.

Design of all waterworks facilities that are to be dedicated to the KGCSA shall be performed by a design professional certified by the Commonwealth of Virginia.

Vertical and horizontal survey datum control shall be based upon, and referenced to, the Primary Geodetic Control Network of King George, Virginia. Ground measurements shall be furnished in U.S. Survey Feet and shall reference the **Virginia State Plane Coordinate System (North Zone), NAD 83 (HARN), NAVD 88**. A minimum of one permanent benchmark that meets the requirements of the Subdivision Ordinance of King George County, Virginia shall be established for each development project.

Provisions shall be made for logical future extensions at proposed or existing street connections, and at other locations as required by the KSCSA. Future extensions shall be provided for by an end line gate valve, twenty (20) foot section of pipe and end cap. This pipe shall be properly plugged, blocked, disinfected and pressure tested along with the rest of the water system.

The safety and protection of public and private water supplies is of paramount importance. There shall be no connection between any public or private potable water supply system and any sewer or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable water supply.

B. Definitions:

Unless the context specifically indicates otherwise, the meaning of terms used herein shall be as follows:

Abut: touching, adjoining, or bordering on.
Acceptance: means approval and subsequent ownership including satisfactory completion of all warranty and guarantee periods by the KSCSA.
ANSI: American National Standards Institute
Applicant: the owner or his duly authorized representative who applies to the KGCSA for either water service or wastewater service or both such services.
Approved: approved by the Board of Directors, DEQ, or where applicable the General Manager and County Engineer.
Appurtenance: any accessory object or component connected to a public water main or public sewer.
As-built Drawing: record drawings of the completed facilities showing actual constructed elevations, dimensions and locations.
ASTM: American Society for Testing and Materials.
Average Daily Flow - ADF: the average flow rate during a typical 24 hour period of normal usage measured over a 30 day period.
AWWA: American Water Works Association.
Backflow: the undesirable reversal of flow of water or mixtures of water and other liquids, gases or other substances into the distribution pipes of the potable supply of water from any source or sources.
Backflow Prevention Device: any approved device, method or type of construction designed to prevent backflow into a public water system.
Board of Directors: the Board of Directors of the KGCSA which serves as the governing body for the KGCSA.
Buffer: an area, structure or landscaping used to separate one use from another or to shield or block noise, light, glare, pollutants or other nuisances.
Building: any structure having a roof supported by columns or walls, including modular and pre-fabricated buildings, which is used for the shelter, housing, or enclosure of persons, animals, or tangible property and, unless specifically

exempted, constructed in accordance with all applicable provisions of the Virginia Uniform Statewide Building Code.

Building water piping: all water lines and facilities from the water service pipe to the point of ultimate use where water is exposed to the atmosphere.

Certificate of Occupancy: a document issued by the Department of Community Development allowing the occupancy or use of a building and certifying that the structure and/or site has been constructed in accordance with all applicable plans, codes and ordinances.

Chlorine Solution: a solution of chlorine in the water.

Code: The Virginia Uniform Statewide Building Code, National Fire Protection Association, Virginia Safety and Health Codes, Commonwealth of Virginia and the County of King George.

Coliform Bacteria: a group of bacteria predominantly inhabiting the intestines of man or animal but also occasionally found elsewhere. Coliform bacteria includes all aerobic and facultative-anaerobic, gram-negative, non-spore forming bacilli that ferment lactose with production of gas. Also included are all bacteria that produce a dark purplish-green colony with metallic sheen by the membrane filter technique used for coliform identification.

Construction: any placement or installation of water facilities or equipment including preparation and/or restoration work for such installation.

Contractor: any person performing work (other than the KSCSA) on facilities of the KSCSA or facilities proposed to be dedicated to the KSCSA.

County: King George County, Virginia.

County Administrator: shall mean the County Administrator of King George County, Virginia, as appointed by the King George County Board of Supervisors..

County Engineer: shall mean a professional engineer hired by the County Administrator whose duty is to ensure that work designed and constructed for the KGCSA complies with these Standards. The County Engineer shall review and approve all facilities prior to acceptance by the KGCSA.

County Inspector: shall mean the inspector(s) supervised by the County Engineer to inspect the construction of water distribution and well and pumping facilities that are to be dedicated to the KGCSA for future maintenance and operation.

Cross-connection: any connection or structural arrangement, direct or indirect, to the public water system whereby backflow can occur.

Dechlorination: the partial or complete reduction of residual chlorine in water by any chemical or physical process.

DEQ: the Commonwealth of Virginia, Department of Environmental Quality.

Developer: any person, firm, corporation, society, or association, or authorized agent thereof, having an interest, whether legal or equitable, sole or partial, in any premises which may in the future be served by the facilities of the KGCSA, and which may in the future be responsible for the design and construction of facilities which are to be under the jurisdiction of the KGCSA and are to become a part of the public utility system of the KGCSA.

Development: any building or subdivision activity which is required to have either site plan or subdivision approval of the County before it is commenced,

including the construction of any duplex, and requiring either new or expanded water supply or sewage disposal facilities.

Disinfection: a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

Distribution Main: a water main whose primary purpose is to provide potable water to service connections.

Domestic Usage: normal daily use, including drinking, laundering, bathing, cooking, heating, cleaning and flushing toilets.

Dwelling unit: one room or rooms connected together, constituting a separate, independent housekeeping establishment physically separated from any other dwelling units which may be in the same structure, and containing independent cooking, sleeping and bath facilities..

Easement: a grant by a property owner recorded with the Clerk of the Circuit Court of King George County for the use of his or her land by another party for a specific purpose.

Facilities of the KGCSA: any and all component and pertinent parts of the entire systems of the water and wastewater utilities under the jurisdiction of the KGCSA, such as water pipe lines and their appurtenances, water storage tanks, treatment facilities and pumping stations, water lines and their appurtenances, sewage pumping stations and treatment plants, including these items and others now constructed, installed, operated or maintained by the KGCSA, or any which may be approved and accepted in the future as additions to or extensions of the systems.

Fire Protection System: a separate system of water pipes or mains and their appurtenances installed solely to supply water to extinguish fires.

Fire Service Connection: a pipe extending from a public water system to supply a sprinkler, stand pipe, yard main, or other fire protection system.

Future use capacity: capacity for the future in system facilities; capacity not needed at time of design and construction to accommodate existing needs; capacity which provides for the security and development of property and for community growth.

General Manager: chief administrative officer appointed by the King George County Service Authority Board of Directors.

Groundwater: all water obtained from sources not classified as surface water (or surface water source).

Health Department: the local or regional offices of the Virginia Department of Health.

Internal Water Distribution System: the pipes, valves, fittings, fire hydrants, service connections, meter settings, and other appurtenances lying wholly within an industrial or commercial project, or similar use which system is privately owned and used to convey water from the public supply facility.

Lot: any tract of land described in a recorded deed or on a subdivision plat of record, and which possesses or is in the process of being assigned a number for tax assessment identification purposes. For purposes of development a lot may consist of an individual lot of record, or combinations of adjacent recorded lots and/or portions of lots of the same ownership.

Meters: an instrument for measuring the amount or rate of flow.
Minimum Daily Flow - MDF: the minimum flow rate determined by use of the appropriate factor times the average daily flow (generally MDF = 0.5ADF), or as measured directly over a 30 day period for existing developed areas.
Off-site extension: an extension of a water or sewer line from existing local or system facilities of the KGCSA to the property boundary of the developer or applicant in a manner and location approved by the KGCSA.
Owner: any person having an interest whether legal or equitable, sole or partial, in real property which is, or which may in the future be, served by the facilities of the KGCSA.
Peak Daily Flow - PDF: the maximum flow rate determined by use of the appropriate peaking factor times the average daily flow (generally 250% of ADF) or as measured directly over a 30 day period for existing developed areas.
Person: any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, county, city, town or any other political subdivision of the state, any interstate body or any other legal entity.
Potable Water: water fit for human consumption and domestic use which is sanitary and normally free of minerals, organic substances, and toxic agents.
Premises: any building, group of buildings, or land upon which buildings are to be constructed which is or may be served by the facilities of the KGCSA.
Primary service area: consists of areas presently provided with KGCSA owned water and/or sewer systems; and areas identified by the Board of Directors to receive such services.
Private water system: a water system owned by one or more persons as opposed to a facility of the KGCSA.
Public water: a water system in which all owners of abutting properties have equal rights and which is controlled by the KGCSA.
Public Water Extension Agreement (PWEA): a contract authorized by the Board of Directors between the KGCSA and a developer for the extension of the public water system by a developer.
Regulations: the King George County Public Service Authority Regulations.
Reliability: a measure of the ability of a component or system to perform its designed function without failure or interruption of service.
Sewage: that water carried waste which derives principally from dwellings, businesses, institutions, industry and the like exclusive of any storm, surface and/or ground water.
Site Plan: a required plan submission prepared and approved in accordance with the provisions of the King George County Zoning Ordinance, which depicts and provides design details on the proposed improvements on a site.
Standards: means the water and sewer standards and specifications of the KGCSA.
Subdivision: the division of a lot, tract or parcel of land into two or more lots, tracts or parcels for the purpose, whether immediate or future, of transfer of ownership or development.

Warranty/Guarantee Period: means the period of time stipulated in PWEA wherein the developer of the water facilities is responsible for the correction of any deficiencies in materials and/or workmanship discovered during that specified period of time.

Water conservation program: a program for conservation of water which may include (i) a prohibition on watering of lawns, gardens, shrubs, trees, or other plants (ii) a prohibition of washing cars, boats, houses, or other large objects usually washed outside and (iii) such other measures as may be determined by the Board of Directors.

Water service connection: the point at or near the applicant's property or easement line where the water service pipe connects to the water service line.

Water service line: That portion of pipe within the water system which extends from the public water main to the water service connection.

Water supply: water taken into the public water system from wells.

Water system: pipelines, treatment facilities, storage tanks and all other construction, facilities and appurtenances used for the treatment, storage and conveyance of water to a user.

Water Treatment Facility: any system used in the storage, treatment, and pumping of water, including but not limited to pumping, power, and other equipment, and their appurtenances, and any works, including land that will be (i) an integral part of the treatment process, or (ii) used for ultimate disposal of residues or effluent resulting from such treatment.

Virginia Pollution Discharge Elimination (VPDES) Permit: a document issued by DEQ authorizing, under prescribed conditions, the potential or actual discharge of pollutants from a point source to surface waters and the use or disposal of sewage sludge. Under the approved State program, a VPDES Permit is equivalent to a NPDES Permit.

C. Quantity of Water Demand:

The volume of water demand shall be determined by considering the future use capacity requirements of the water service area as determined by the KGCSA and County Engineer. The following parameters shall be used when determining the average daily flow of sewage:

1. Design Basis for New Developments: Table 1.1
2. Industrial and commercial areas: based on known building and staffing data or by the formula in Figure 1.1:

Figure 1.1

A = acres
FD = Flow Duration (hours) See Table 1.1
ADF = Average Daily Flow (gallons) =

$$\frac{0.25 \times A \times (43560\ sf/acre) \times (250gpd/1000sf)}{FD \times (1day/24hours)}$$

3. Special developments: detailed studies to determine the average daily demand of water will be required.

In addition to the above specified average daily water demand flows, consideration shall be given to the peak daily water demands. In general, distribution mains stations shall be capable of carrying, when flowing full, a minimum of 250% of the average daily flow plus the required fire flow. The design professional shall include a "Water System Data Sheet" with all plan submissions. An example is provided in the Appendix.

TABLE 1.1
DESIGN BASIS FOR NEW DEVELOPMENTS

TYPE OF DEVELOPMENT	DESIGN UNITS	FLOW (GPD/UNIT)	FLOW DURATION (HR)
Single Family Sub.	# Homes	300	24
Apartment Complex	# Units	250	24
Retirement Apartments	# Units	225	24
Condominium	# Units	250	24
Timeshare	# Units	225	24
Manufactured Homes	# Units	250	24
Office Building	Gross Sq. Ft.	0.10	12
Medical Offices	Gross Sq. Ft.	0.175	12
Clinic	Gross Sq. Ft.	0.40	12
Nursing Home	# Beds	200	24
Hospital	# Beds	300	24
Restaurant	# Seats	35	16
Carry-out (Chain)	# Seats	15	16
Motel	# Units	130	24
Laundromat	# Machines	500	16
Service Station	Gross Sq. Ft.	0.18	16
Convenience Store	Gross Sq. Ft.	0.15	24
Warehouse	Gross Sq. Ft.	0.02	24
Shopping Center	Gross Sq. Ft.	0.20	12
Grocery Store	Gross Sq. Ft.	0.20	12
Beauty Salon	Gross Sq. Ft.	0.35	12
Gift Shop	Gross Sq. Ft.	0.04	12
Hardware Store	Gross Sq. Ft.	0.04	12
Bar/Night Club	# Seats	10	8
Auto Dealership	Gross Sq. Ft.	0.08	12
Vet. Clinic	Gross Sq. Ft.	0.18	12
Bank	Gross Sq. Ft.	0.06	12
Drug Store	Gross Sq. Ft.	0.10	12

Theater	# Seats	1.5	12
Garage (Auto Repair)	Gross Sq. Ft.	0.02	12
Library	Gross Sq. Ft.	0.10	12
Bakery	Gross Sq. Ft.	0.15	12
Exercise Club	Gross Sq. Ft.	0.13	12
Racket/Tennis Club	# Courts	300	12
Pool	# Members	5	12
Elementary School	# Persons	10	8
High School	# Persons	16	8
School-Dormitory	# Persons	75	24
Nursery School	# Persons	4	8
Church	# Seats	4	6
Camping-Primitive	# Sites	30	24
Camping-Trailer	# Sites	75	24
Picnic Area	# Persons	5	24
Factory	Persons/8 hr. Shift	25	Operating Period

D. Design Considerations – Water Mains:

1. Water pipelines shall be sized to meet all hydraulic demands. Hydraulic demands include fire flow, domestic, current and future demands.

2. Master plans and models for proposed projects are essential for an efficient design of the water system. A master plan and water model shall be submitted for all projects. If the project is to be constructed in phases, then a phasing sequence for the master plan shall be submitted with the first phase.

3. The criteria for pipeline sizing is as follows:

   a. For design flow up to 400 gpm and when the head-loss allows, the pipeline shall be 4-inches in diameter. Fire hydrants shall not be installed on 4-inch lines.
   b. For design flow of 400 to 1,500 gpm and when the head-loss allows, the minimum pipeline size shall be 8-inches in diameter.
   c. Fore design flow of 1,500 to 3,500 gpm and when the head-loss allows, the minimum pipeline size shall be 12-inches in diameter. If there are two or more feeds to the proposed system, then the minimum size for the two fees shall be 8-inch diameter.
   d. For design flow greater than 3,500 gpm and when the head-loss allows, the minimum pipeline size shall be 16-inches diameter. If there are two or more feeds to the proposed system, then the minimum size pipeline for two of the feeds shall be an 8-inch and a 12-inch.
   e. If the required design flow cannot be obtained due to head-losses in the pipeline, than larger size pipelines shall be used.

f. Under maximum hour domestic demands (excluding fire flow demands), the water distribution system shall maintain pressures above 40-psi.
g. Under fire demands, the water distribution system shall at all times maintain pressures above 20-psi. Fire flow requirements are specified in Table 1.2.
h. Water pipeline layouts shall minimize dead ends and shall be looped where possible.
i. Water quality is an important consideration in water system design. Therefore, over-sizing of water pipelines shall be avoided.
j. The minimum size for water service lines shall be ¾-inch Type K copper.

4. Hydraulic Analysis:

a. A hydraulic analysis shall be performed on all water pipeline design. The analysis shall verify flow demands and pressure availability for the proposed project (average, peak, average plus fire flow, peak plus fire flow), and shall include the evaluation of the impact of the proposed project on the existing water system.
b. Velocities in the pipeline shall not exceed 10 feet per second under all flow conditions.
c. Head losses shall not exceed 20-psi per 1,000 feet of pipe under all flow conditions.
d. Water system pressures shall not be less than 40-psi under max hour domestic demands and shall not be less than 20-psi under any condition.

5. Depth of Water Mains:

The minimum cover depth of all water lines shall be 42-inches. Lines with less than 42-inches of cover shall be ductile iron pipe (any pipe with less than 42-inches of cover requires approval by the County Engineer and KGCSA).

6. Easements: a minimum 20-foot wide easement, centered over the water main, shall be conveyed to the KGCSA when facilities of the KGCSA are to be placed on private property (this width may be modified by the General Manager). No building or permanent structure shall be constructed within these easements. No trees, shrubs, structures, fences or obstacles shall be placed within an easement, which would render the easement inaccessible, by equipment. Temporary construction easements, of varying widths, shall be acquired when necessary to facilitate wastewater system construction.

7. Horizontal and Vertical Separation: sewers shall be laid at least 10-feet, horizontally, from existing or proposed water mains. Should local conditions prevent a horizontal separation of 10-feet, a sewer may be laid closer than 10-feet to a water main if it is laid in a separate trench and the elevation of the top (crown) of the sewer is at least 18-inches below the bottom (invert) of the water main.

   Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pressure type pipe having mechanical joints or approved slip type joints and shall be pressure tested in place to 50-psig in accordance with the most recent edition of the AWWA C600, Section 4 prior to backfilling. There shall be "zero" leakage in sewer mains and manholes when the required horizontal or vertical separation from water mains is not met.

   When sewers must cross under water mains, the sewer shall be laid such that the top of the sewer is at least 18-inches below the bottom of the water main. If local conditions prevent this vertical separation, the sewer line shall be constructed from a full length section of AWWA specified pressure type pipe having mechanical joints or approved slip type joints for a minimum distance of 10-feet on each side of the water main. This section of the sewer line shall be pressure tested to 50-psig in accordance with the most recent edition of the AWWA C600, Section 4 prior to backfilling. One full length of water main should be centered over the sewer so that the pipe joints of the water main will be as far as possible from the sewer. There shall be "zero" leakage in sewer mains and manholes when the required horizontal or vertical separation from water mains is not met.

   When sewer must cross over water mains, the sewer shall be laid such that the bottom of the sewer is a minimum of 18-inches above the top of the water main. The sewer line shall be constructed from a full length section of AWWA specified pressure type pipe for a minimum distance of ten (10) feet on each side of the water main. This section of the sewer line shall be pressure tested to 50-psig in accordance with the most recent edition of the AWWA C600, Section 4 prior to backfilling. The crossing shall have adequate structural support to prevent damage to the water main. There shall be "zero" leakage in sewer mains and manholes when the required horizontal or vertical separation from water mains is not met.

   In addition to the requirements specified above, a water main shall not be allowed to pass through or come into contact with a sewer manhole.

8. Polyethylene Encasement: an approved polyethylene encasement material shall be provided on all ductile iron pipes in areas where corrosive soils exist. It shall be the responsibility of the professional design engineer to

satisfy the County Engineer as to the extent and aggressiveness of corrosive soils.

9. Surface Water Crossings: Surface water crossings shall comply with all requirements of the VDH and shall at a minimum meet the following requirements:

   a. Above water crossings – the pipe above water crossings shall be:
      - adequately supported;
      - protected from freeze damage;
      - accessible for repair or replacement; and
      - above the 100-year flood level.

   b. Under water crossings:
      - the pipe shall be of special construction, having flexible watertight joints;
      - valves shall be provided on both ends of the water crossing so that the section can be isolated for tests or repair; the valves shall be easily accessible and not subject to flooding; and
      - permanent taps shall be made for testing and locating leaks.

E. Design Considerations – Blow - offs:

1. All dead end water pipelines shall be equipped with a permanent blow-off. A 2-inch blow-off shall be provided in accordance with the Standard Details.

F. Design Considerations – Restraint Systems:

1. All tees, bends, fittings, valves, end caps, blow-offs, etc. shall be restrained. The portions of the pipe to be restrained shall be clearly indicated on the drawings.

G. Design Considerations – Valves:

1. Valves shall be placed at intersections and between intersections at 1,000-foot spacing.

2. In areas where the water pipeline is located in an easement, the valve(s) shall be located on the main line at a maximum distance of 5-feet from a hydrant or tee.

H. Design Considerations – Fire Hydrants:

1. Fire hydrants shall be installed in non-traffic areas within the VDOT right-of-way or in easements. Fire hydrants located at intersections shall be installed at the curb's point of curvature.

2. Fire hydrants shall be located at 600-foot spacing in residential areas and at 400-foot spacing in commercial/industrial areas.

3. Fire flows shall be provided as specified in Table 1.2:

TABLE 1.2

FIRE FLOW REQUIREMENTS

Type of Use	Minimum Fire Flow
Residential (individual lots)	600 gpm
Apartments/Townhouses	1,500 gpm
Light Commercial/Industrial	2,000 gpm
Heavy Commercial/Industrial	2,500 gpm

4. The tops and nozzle caps of hydrants shall be painted with the following capacity-indicating color scheme:

   a. Capacity of less than 500 gpm: Red
   b. Capacity between 500 gpm and 999 gpm: Orange
   c. Capacity between 1,000 gpm and 1,499 gpm: Green
   d. Capacity greater than 1,500 gpm: Light Blue

5. All hydrants shall be painted silver (except for the color of the top and nozzles as specified above).

6. All buildings and structures on a site shall be readily accessible to emergency vehicles and apparatus. When two or more buildings are located on the same parcel, the distance between the structures shall be sufficient to ensure convenient emergency access and to comply with all applicable fire separation standards prescribed in the Uniform Statewide Building Code. Circulation routes, driveways, parking lot aisles and other vehicular circulation areas shall be designed and arranged so as to provide for convenient access and operation of emergency apparatus.

I. Design Considerations – Detector Checks:

1. Detector checks shall be installed in non-traffic areas within the VDOT right-of-way or in easements.

2. The Fire Department Connection shall be located within 10-feet of the post indicator valve, and within 100-feet of a fire hydrant.

3. Fire Department Connections shall be located and shall be visible on a street front or in a location approved by the Fire Chief and Building Official. Such connections shall be located so that immediate access can be made by the Fire Department. Fire Department Connections shall not be obstructed by fences, trees, walls or other obstacles.

4. The detector check shall be installed in accordance with the Standard Details.

J. Design Considerations – Water Meters:

1. Water meters shall be located in readily accessible, visible non-traffic location within the right-of-way or easement.

2. Water meters will be installed by the KGCSA. The meter box and meter setter shall be installed by the developer.

3. The design flow shall be provided by the design professional for each project. Meters shall be sized in accordance with AWWA Manual M-6. For design purposes, the KGCSA uses 50-percent flow capacity for the average continuous flow and the 100-percent capacity as the maximum intermittent flow to determine meter sizes.

4. All water meters shall conform to AWWA C700, latest edition.

5. Meter boxes and meter assemblies shall be in accordance with the Standard Details.

K. Design Considerations – Pump and Well Facilities:

All pump and well facilities constructed for dedication to the KGCSA shall be designed in accordance with the Commonwealth of Virginia Waterworks Regulations as promulgated by the Virginia Department of Health and the following requirements, and shall satisfy the requirements of the King George County Department of Community Development. All facilities shall be designed to minimize water quality problems.

All mechanical and electrical equipment which could be damaged or inactivated by contact with or submergence in water shall be physically located above the 100-year flood/wave action or otherwise protected against the 100-year flood/wave action.

1. Wells proposed to be dedicated to the KGCSA shall be Class I in accordance with the Waterworks Regulations. Water storage tanks, pumping facilities and treatment facilities shall also be in accordance with the Waterworks Regulations.

2. Provisions shall be made to discharge the "first flush" water from the well to a stormwater or approved drainage system.

3. Design Flow: consideration shall be given to the amount of present and future development and the impact to existing waterworks facilities. Therefore, the design professional engineer shall prepare flow projections with a tributary map and shall perform an evaluation of the adequacy of existing systems to serve the proposed project. **In addition, the design professional shall include an evaluation of the impact of the proposed groundwater withdrawal on the aquifer or aquifers**. The facility shall also be designed to accommodate peak flow rates and fire flows. Peak flow rates are generally 2.5 times the average design flow or as further required by the Waterworks Regulations. The design flows used for the design of well and pump facilities is provided in Section I.A. of these Standards.

4. Pump Room Requirements:

    a. The pump room must be sized for ease of maintenance. A minimum of three (3) feet shall be provided from major pieces of equipment to the next piece of equipment or wall.
    b. Access and handling facilities shall be designed to facilitate removal and reinstallation of pumps and other equipment.
    c. The pump room shall conform with the following:

        1) Pumps shall be installed on raised blocks.
        2) Electrical outlets are to be installed three (3) feet or higher above the slab elevation. Installation shall include NEMA Type "4 X" enclosures.
        3) All lights are to be accessible.
        4) The motor and pump controls are to be on or above existing ground elevation.
        5) All interior piping is to be supported by concrete pedestals and approved hangers and pipe supports and shall be blocked or braced.
        6) Ventilation: The building shall be mechanically ventilated.
        7) All ventilating equipment shall be corrosion resistant and explosion proof.
        8) Switches to de-energize each motor with a lockout button shall be provided in a NEMA Type "4 X" enclosure.

9) A low temperature dehumidifier shall be installed; the drain shall be piped to the sump with PVC pipe.

5. Motor Control Room Requirements:

a. The motor control room shall be located at or above ground elevation.

b. Motor control room structure:

1) Shall be constructed of brick or masonry block with brick veneer on concrete slab (or precast if approved by the KGCSA).
2) Shall not have windows.
3) Access to the control room must be of sufficient size to allow the removal of installed equipment.
4) A finished plywood ceiling with insulation is required.

c. Motors are to be mounted on concrete blocks secured with dowels to the floor slab.

d. Station electrical and control wiring must meet County and NEC codes and contain a main disconnect.

e. Motors shall be three (3) phase sixty (60) cycle (200, 240 or 480 voltage) unless specifically approved otherwise.

f. KGCSA water service supplied to the station must utilize an approved backflow preventer (RPZ type). Hose bibs or yard hydrants are to be conveniently located in or adjacent to the building.

6. Pump Selection Criteria:

a. Pumps shall be designed and constructed in accordance with Standards of the Hydraulic Institute. The efficiency of the pump when operating under conditions of the specified capacities and heads shall be as near its peak efficiency as practicable. All pump motors and controls shall be suitable for operation at 40-degrees C ambient temperature unless otherwise approved.

One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

Spare parts shall be provided and shall be properly packaged and labeled for easy identification without opening the packaging and suitably protected for long term storage under humid conditions. Spare parts and tools shall be delivered to the KGCSA at or prior to the time of facility start-up.

b. Each station shall contain a minimum of two (2) booster pumps, each capable of pumping the design peak flow. In addition, depending on fire flow requirements, a third fire flow pump may be required (booster pumps are not required when the well discharges directly into the hydropneumatic tank).

c. A water meter with strainer shall be installed on the well discharge piping.

d. An elapsed time meter is required for each pump motor. Meters shall be installed at "eye" height.

e. A 4-1/2 inch stainless steel cased, liquid filled pressure water gauge, with shut-off valve, measuring in increments of 2-psi with a range of 0 – 100 psi shall be provided for each pump. The gauge location shall be on the pump side of the discharge gate valve.

7. Station Piping Requirements:

a. Ductile iron pipe, installed inside buildings or underground vaults shall have flanged joints. Pipe shall be a minimum Class 53 ductile iron in accordance with AWWA C115/ANSI A21.15. Flanges shall conform to Class 125, ANSIB16.1.

b. Buried pump station piping shall be ductile iron with push-on mechanical (stuffing box type) joints at fittings and valves. Pipe shall be a pressure Class 250 for nominal diameters 12-inch and larger and Class 250 for diameters less than 12-inch. Joints shall be rubber gasket joints in accordance with AWWA C111/ANSI A21.11. Outside coating shall be asphaltic coating.

c. Allowable velocities:

1) Suction pipe velocities shall be in the range of two (2.0) to five (5.0) feet per second.

2) The water main discharge rate of flow shall be greater than two (2.0) feet per second but less than ten (10.0) feet per second.

d. A gate valve and a check valve shall be placed on the discharge side of each pump.

8. Control Panel and Motor Controllers:

a. Provide the following electrical system components:

1) Benshaw solid state "pump-type" (which includes a de-acceleration feature), combination soft-start type motor starters and motor rated circuit breakers for each pump rated for the pump horsepower. Provide with NEMA type 12 enclosure suitable for corrosive environments.

2) Provide complete on-site instructions for the operation, adjustment and programming of the starters.
3) Relays and switches for alternate operation of the pumps and hands-off-automatic operation of each pump.
4) Relays and timers as necessary for failure-to-pump sensing; one system for each pump. Each system shall be designed so that when a pump motor is signaled to start by the level sensing equipment, or by the hand-off-automatic switch, a timer with a 0 – 30 second adjustable setting shall be actuated.
5) Power line sensing equipment shall be provided to continuously monitor and to shut down pumps when incoming voltage drops below 75% of rated value or if there is a phase reversal on the incoming power system. The system shall automatic reset after the power system returns to normal.
6) Timers and relays as necessary to provide a time delay, adjustable form 0 – 30 seconds, for restarting a pump motor after a power interruption and to allow only one pump motor to be started an brought up to speed at a time, regardless of how many pumps may be called for by the level sensing and control equipment.
7) Fully labeled terminal strips for connection of all incoming and outgoing service, load, control and alarm wiring. All internal wiring and conductors shall be labeled on each end.
8) Provide circuit breakers for lights, vent fans and receptacles. A step down transformer may be required to control circuits and station auxiliaries.
9) A lightning arrestor shall be supplied in the control panel and connected to each line of the incoming side of the power input terminals.

b. Install the following indicating lights in the Control Panel Door, each wired and piped into the system for proper operation and each provided with an engraved, laminated, black-core white-background nameplate to indicate its function:

1) A green “pump running” light shall be provided for each pump. The light shall operate off of a motor starter auxiliary contact.
2) White “Control Power On” pilot light.
3) Red or amber “Failure –to-Pump” pilot light; one for each pump.
4) Pushbutton to "Reset Failure-To-Pump System"; one for each pump.

5) Hand-Off-Automatic selector switch; one for each pump motor.
6) Six (6) digit running time meter reading in hours and tenths of an hour; one for each pump motor (to be mounted at eye height).
7) Pump sequencing selector switch
8) Designation plate indicating name and address and phone number of manufacturer of the control panel.

c. Remote Telemetry Unit: where required by the KGCSA, the staring and stopping of well pumps is to be controlled by a storage tank level transducer and a treatment/pumping facility remote telemetry unity (RTU). The transducer shall transmit a 4-20mA signal to the RTU which is programmed to send start/stop signals to the well facility RTU (for remote wells, this shall be via a fixed frequency radio).

1) The starting and stopping of chemical feed pumps shall be controlled by the water meters and the RTU. The water meter shall transmit a 4-20mA signal to the RTU which starts/stops the chemical feed pumps based on a minimum set flow. The set flow shall be set below the normal pump rates to provide overfeed protection.
2) The starting and stopping of the air compressor shall be controlled with a level switch installed on the hydropneumatic tank. This switch shall be a Mercoid 123-153 switch or approved equal. A high pressure cut-off switch shall lock the air compressor off in the event high pressure should develop.
3) The treatment/pumping facility RTU shall communicate with the KGCSA master unit, relaying storage tank water level, system pressure, well pump rate, service pump operation status, and chlorine level information.
4) The treatment/pumping facility RTU shall be Environmation RUG9 mounted in a NEMA 12 enclosure. The RTU shall include all I/O cards as required, and shall include a transient voltage surge suppressor and a UPS.
5) The remote well RTU shall be an Environmation RUG5 mounted in a NEMA 4 enclosure. The RTU shall include all I/O cards as required, and shall include a transient voltage surge suppressor and a UPS.
6) #2 pump fail to start (check valve limit switch)

9. Standby Power System:

a. General: the KGCSA requires that all well and pump facilities be provided with a complete standby electric power system consisting of a Diesel engine driven generator set, an automatic load transfer switch, time switches, contactors, wiring, conduit, piping and accessories. The engine generator set and automatic load transfer switch shall be completely built, tested and shipped by a manufacturer who has been regularly engaged in the production of such equipment and who has parts and service facilities locally available so there is one source of supply and responsibility. The performance of the electric plan shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation. All equipment shall be guaranteed free from defects in workmanship and material for a period of 5 years or 1,500 running hours from date of acceptance. An Authorized Distributor of the manufacturer shall inspect the equipment installation after it is completed and perform initial start-up and test of the system and shall submit a certificate of this inspection and test. The date of acceptance as referred to hereinbefore is defined as the date on which this certificate of inspection and test is received by the KGCSA. All equipment shall be listed by UL and so labeled. Equipment shall be manufactured by Olympian/Caterpillar. Engine generator set shall be a diesel engine driven machine with a continuous standby rating of _____ KW, _____ KVA, 80% power factor, 208/120 volts, 3-phase, 4-wire, wye connected, 1,800 rpm, 60 Hertz. It shall be complete with welded steel mounting base, vibration isolators, battery, exhaust silencer, flexible exhaust hose and fuel oil piping and pumps from the fuel tank, air cleaners, and lubricating oil pump .

b. Engine: it shall be Diesel fueled, naturally aspirated or turbocharged, four cycle, water cooled with mounted radiator, fan and water pump. It shall have _____ cylinders with a minimum displacement of ____ cubic inches and a minimum rating of ____ bhp at its operating speed of 1,800 rpm. Free turn, overhead valves shall be hard chrome-cobalt alloy faced. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have replaceable, full-flow, oil filter. Engine speed shall be governed by a pressure lubricated mechanical governor to maintain alternator frequency within 5-percent from no-load to full-load alternator output. Provide complete fuel injection system with electric motor driven fuel transfer pump and air cleaner with replaceable dry element. The engine shall have a battery charging alternator with rectifiers and a transistorized voltage regulator. Starting shall be by a 12 or 24 volt electric starter with electric solenoid shift. Complete engine control shall be 2-wire which operates to start engine on closing contact and to stop engine on opening contact. A cranking limiter shall be provided to open the

starting circuit in approximately 45-seconds if the plant is not started within that time. The electric plant controls shall also include a 3 position selector switch with the following positions; RUN-STOP-REMOTE. High engine temperature, low oil pressure, and overspeed shutdown shall be provided. Selector switch shall be mounted on engine instrument panel as shall a common signal light which shall be illuminated when engine is shut down by cranking limiter, high engine temperature, low oil pressure or overspeed. In addition, provide a separate labeled signal lamp for each of the engine shut-down malfunctions. Shut-down for any of these causes shall require manual resetting before engine can be restarted. Provide a set of normally open contacts to which a remote alarm can be connected to warn of any engine malfunction.

c. Engine instrument panel: it shall contain an oil pressure gauge, water temperature gauge and battery charge rate ammeter in addition to selector switch and pilot lights as described above.

d. Alternator (generator): it shall be 4-pole, revolving field design with temperature compensated solid state voltage regulatory and brushless rotating rectifier exciter system. No brushes shall be allowed. The stator shall be directly connected to the engine flywheel housing and the rotor and shall be driven through a semiflush driving flange to insure permanent alignment. The insulation system shall be Class F as defined by NEMA MG1.1.65. Voltage regulation shall be within plus or minus 2 percent of rated voltage, from no load to full rated load. The instantaneous voltage dip shall be less than 13.0 percent of rated voltage when full load at rated power factor is applied to the alternator. Recovery to stable operation shall occur within 2.0 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1-percent of rated voltage. Rheostat shall provide a minimum of plus or minus 5-percent voltage adjustment from rated value. Temperature ruse shall be within NEMA MG1-22.40 definition.

e. Alternator instrument panel: it shall be provided adjacent to the engine instrument panel. The alternator instrument panel shall be wired, tested and shock mounted on the generating set by the manufacturer of the alternator. It shall contain panel lighting, manual reset main line generator output circuit breaker, frequency meter, running time meter, voltage adjusting rheostat, AC voltmeter (dual range, indicates all voltages), AC ammeter (dual range, indicates current each phase), and voltmeter ammeter phase selector switch with OFF position.

f. Mounting: the electric plant shall be rubber cushioned and mounted on a welded steel base, which shall provide suitable mounting on a 4" concrete slab.

g. Accessories: they shall be provided as follows:

1) Critical type exhaust silencer to reduce exhaust noise level to standards for critical areas;
2) One 12-volt, nickel-cadmium battery with hydrometer, battery cables, rack and an automatic float/equalizer charger. This shall be on a dedicated circuit.
3) Engine coolant heater thermostatically controlled to aid in cold weather starting (supply dedicated circuit from circuit breaker in station control panel);
4) Fuel oil filter, solenoid valve and shut-off valve for fuel lines;
5) Three sets of detailed operating, maintenance and service manuals complete with illustrated parts lists;
6) Anti-freeze coolant in radiator and engine.
7) The generator shall be enclosed in a NEMA-3R generator mounted unit interwired with automatic start. The enclosure shall have hinged lockable doors on each side, fixed intake louvers, and protective grill on the radiator end. The enclosure shall be a minimum of 14-gauge sheet metal, treated and painted to resist corrosion. Suitable muffler support brackets shall be bolted to the roof. The enclosure shall be bolted directly to the generator set base, and shall fully enclosure and protect the generator set, control panel, batteries, and battery charger.

h. Fuel piping: it shall be soft copper tubing, Type K. Flexible connections in fuel piping at engine shall be corrugated seamless bronze or stainless steel tubing with single wire braid. Valves shall be suitable for fuel oil service. Provide a shut-off valve in the fuel supply line at the engine. Strainers shall have steel housing with fiber treated cloth cone tube capable of removing particles 10 microns and larger. Provide a strainer in the fuel supply line at the engine.

i. Exhaust piping: it shall be extra strong black steel pipe with screwed or welded fittings. Pipe hangers and supports shall be provided for exhaust piping and shall be adjustable type. Isolation supports shall be provided for all piping connections to the generator set. The finish of pipe hangers and supports shall be zinc or cadmium plated. The interior pipe and silencer shall be covered with six inches of calcium silicate rigid insulation butted firmly together and wired in place using 16-gauge wires on a 9-inch center. Insulating cement and/or glass cloth shall be applied over the insulation to achieve a smooth finish.

j. Automatic load transfer switch: it shall be rated at ____ amperes, ____ volts, three-phase, 4-wire, 60 Hertz. The manufacturer shall furnish schematic and a wiring diagram for the particular

automatic transfer switch and a typical interconnection wiring diagram for the entire standby system. The automatic transfer switch shall be rated for continuous operation in ambient temperatures -25 degrees F to + 125 degrees F. The transfer switch shall be rated for all classes of load, both inductive and noninductive, at 600-volts, and shall be designed, built, and tested to close on an inrush current up to and including 20 times the continuous rating of the switch without welding or excessive burning of the contracts. The transfer switch shall be capable of enduring 6,000 cycles of operation, at rated current, at a rate of 6 cycles per minute, without failure. One cycle shall consist of complete opening and closing of both sets of contacts on an inrush current 10 times the continuous rating of switch. The automatic transfer switch, with terminal lugs for either copper or aluminum wire, shall have individual, heat resistant chambers enclosing solid silver cadmium oxide, doublebreak contacts. The transfer switch, with mechanical and electrical interlocks to prevent simultaneously energizing both normal and emergency service, shall be mechanically held on both sides, with manual operator and auxiliary contacts rated 6-amp, 120-volt AC; 3-amp, 240-volt AC on both sides. It shall be wall mounted in a NEMA 12 enclosure. Control accessories shall mount on a dead-front, swing-out control accessory panel to avoid shock hazard while adjusting control functions, but will swing out exposing the wiring to facilitate servicing. Indicating lamps and meters shall be set in the front door of cabinet. Transfer switch shall be of the programmed transition type which shall provide dead band time adjustable from 1 to 10 seconds when the load is not connected to the normal power source, nor to the engine generator. Control accessories shall be solid state type and shall provide the following functions:

1) Monitor each ungrounded line with calibrated dial, adjustable voltage, solid state UNDERVOLTAGE SENSORS to sense a decrease of voltage below a set point, or a loss of voltage on any phase or a reversal of phases on the normal power source. Voltage sensors shall be temperature compensated for 2-percent maximum deviation above the temperature range -25 degrees F to +175 degrees F (not applicable to open delta).
2) Signal the engine-generator set to start in the event of a power disturbance as sensed by the monitoring system. A solid state TIME DELAY START (adjustable from 0 to 60 seconds) shall delay this signal to avoid nuisance startups on momentary voltage dips or power disturbances.
3) Retransfer the load to the line after normal power restoration. A TIME DELAY RETRANSFER (adjustable

from 0 to 30-minutes) shall delay this transfer to avoid retransfer in case of short-term normal power restoration.

4) Provide an automatic RETRANSFER TIME DELAY BYPASS to retransfer the load from generating set to normal source if generating set output interrupts after normal sources restore voltage.

5) Signal the engine-generator to stop after load retransfer to normal source. A solid state TIME DELAY STOP (adjustable from 30-seconds to 5-minutes) shall permit engine to run unloaded to cool down before shutdown.

6) Provide a TEST SWITCH to simulate an interruption of power form the normal source.

7) Provide a constant-voltage automatic charging (1.40- 1.24 volts per cell) SCR, current limited, BATTERY FLOAT CHARGER to maintain fully charged cranking batteries.

8) Provide an EXERCISER CLOCK to automatically start the generating set at regular intervals and allow it to run for a preset time period, such as 30 minutes per week.

9) Provide WITH LOAD - WITHOUT LOAD SELECTOR SWITCH to select test or exercise as follows:
"without load", the generating set runs unloaded.
"With load", the automatic transfer switch transfers load to the generating set, after time delay, the same as it would for a normal source interruption.

10) Provide a CONTROL DISCONNECT PLUG to electrically disconnect the control section from the transfer switch for maintenance service during normal operation.

11) Provide two (2) auxiliary relays or auxiliary contacts on the main power contractors (normal and emergency) so that a remote alarm or light can be connected to indicate that normal power has been lost and that power is being supplied from the engine generator set.

12) The automatic load transfer switch and/or the generator control panel shall have relays and wiring which provide contacts for closure in the event of a generator-set failure after transfer to emergency power. The contacts shall be made available for connection to the existing alarm transmitter.

13) Provide two (2) sets of auxiliary contacts to be actuated when the transfer switch is in the normal position and two (2) sets of auxiliary contacts to be actuated when the transfer switch is in the emergency position.

14) Provide a "neutral" position timer (adjustable from 0-10 seconds) to allow loads, such as motors, to come to a complete stop before being transferred to another source.

k. Installation: the engine-generator set and automatic load transfer switch shall be installed in strict accordance with the recommendations of the manufacturer and with all applicable codes and regulations. Engine generator sets shall be mounted on a concrete foundation isolation pad. All connections to it shall be made with flexible pipe, conduit, etc., to minimize transfer of vibration.

l. Quality Assurance: prior to shipment, the following tests shall be conducted at the plant of the manufacturer, and certified results of these tests shall be delivered to the Engineer for transmittal to the Owner: Full load test of the generator set for one hour with fuel consumption, output voltage, engine speed, voltage, and speed-regulation and generator winding temperature measured and recorded at ten-minute intervals.

m. Start-up and Training: the services of a factory trained and factory authorized technician shall be available, and he shall perform complete start-up services on the engine-generator set after it has been set in place and connected. Upon successful start-up, the technician shall conduct one day (eight hours) of training in the operation and maintenance of the standby power system for KGCSA personnel.

n. Field Testing: provide the manufacturer's standard certified testing at the factory as specified below. If this certified information is not provided, prior to acceptance of the unit, it shall be field tested in the presence of the County Inspector as follows (the contractor shall provide a load bank for the test):

1) Start and operate at 25% rated load for a period not less than 1 hour, after which increase load to 50% of rated load and operate for the second 1 hour.
2) Then increase total to 100% and hold continuously for a period not less than 2-hours.
3) After this 3-hour period of operation, unload and allow to run under no-load conditions for at least 15-minutes. Then suddenly apply and hold a full 100% load for a period of not less than 15-minutes or more than 30-minutes.
4) Load and unload (at 100%) in this manner for a minimum of three (3) operations, during which observe and report the speed load recovery capabilities of the unit.
5) Submit a full written certified test report indication BHP developed, KW output, voltage, current and frequency variations to the professional design engineer for valuation.

12. Water Well Drilling:

a. Water well construction shall be in accordance with the Waterworks Regulations. Wells shall be Class I.
b. The Contractor shall collect drill cutting samples at not more than 10-foot intervals for submission with the "Water Well Completion Report".
c. Water for the drilling operation shall be only from a source approved by the KGCSA.
d. Casing and liner pipe shall be new black steel pipe meeting ASTM A53 with welded or threaded joints in accordance with the Waterworks Regulations.
e. Grout shall consist of neat Portland cement and water, with not more than 6-gallons of water per sack of cement. Addition of bentonite clay or other additives and use of high early strength cement will require approval of the design professional and the KGCSA.
f. Well pumps shall be Grundfos, Goulds or approved equal. The pump shall include a pump controller (Subtrol-Plus by Franklin Electric or approved equal).
g. Well piping shall be nickel-copper alloy, seamless, standard weight galvanized pipe and shall meet or exceed the requirements of ASTM A53. Jointing shall be threaded and galvanized. Fittings shall be malleable iron, 200-pound class, conforming to ANSI B16.3.
h. Check valves shall be threaded bronze type equipped with a spring-loaded rubber poppet (Simmons 509 SB Series or approved equal) rated for 250-psi.
i. If a pitless unit is required, it shall be Monitor PS or approved equal. The unit shall be frost-proof and have a watertight well cap. All water passages shall be of corrosive resistant material.

13. Water Storage Tanks:

a. The general design of water storage tanks shall be in accordance with AWWA D100, Section 3. The earthquake load shall be based on Section 13 (AWWA D100) for structures located in seismic zone 1 with site amplification factor equal to 1.2. Snow loads shall be 25 pounds per square foot and wind load shall be 100 miles per hour. The tank and foundation system shall be designed by a professional engineer registered in the state of Virginia.
b. Water tanks shall be sized in accordance with these Standards, the American Water Works Association standards, and the Virginia Waterworks Regulations.
c. All coatings shall be in compliance with the Virginia Waterworks Regulations and AWWA D102.
d. Ladders shall include a safety cage and safety climb devices in accordance with OSHA requirements.

SECTION II
SYSTEM COMPONENTS

A. General Requirements: the contractor shall use only new materials, parts, products and equipment in the work which conforms to the specified requirements. Standards and other publications referenced in these Standards shall be of the latest issue or revision in effect at the time of approval of the design documents, unless otherwise specified.

B. Approval of Equipment and Materials: at the request of the County Inspector, the contractor shall supply samples of materials to be used in the work for approval by the KGCSA. Unless waived by the County Engineer the contractor shall furnish a Certificate of Compliance from the manufacturer of materials and equipment used in the work stating that the material or equipment meets the requirements of these Standards. Manufacturer catalogs that provide required technical, installation and descriptive data and/or samples of the precise article proposed to be furnished shall be provided to the County Engineer for approval of the equipment to be supplied. Test data shall be furnished as requested by the County Engineer. Prior to making performance tests, the manufacturer shall notify the County Inspector sufficiently in advance so that the test can be witnessed. Approval of shop drawings does not relieve the contractor from the responsibility of furnishing materials and equipment of proper dimension, size, quality, quantity, and all performance characteristics to efficiently perform the requirements and intent of these Standards.

C. Materials:

1. Suitable Materials:

a. Aggregate granular material shall be washed or crushed material which conforms to VDOT specifications for #57 coarse aggregate and ASTM C 33, or as may be approved by the County Engineer.

b. Sand, when specified for backfill, shall be natural sand consisting of grains of hard, sound material free from injurious amounts of clay or other coatings and deleterious material (CBR-20 or greater unless otherwise approved).

c. Select backfill material shall conform to VDOT specifications for #25 or #26. Crusher run aggregate shall conform to VDOT specifications for #21B dense graded aggregate.

d. General fill material shall be deemed as material that classifies in the ASTM D2487 soil classification groups GW, GP, GM, SW and SP, or a combination of these group materials. The maximum particle size shall be two (2) inches in the largest dimension. Maximum sized particles shall not be in excess of 20-percent of

the volume of fill material, and such particles shall be well distributed throughout the mass.

Unsuitable material includes material not meeting the above requirements, and includes clay, frozen materials, saturated materials, cinders, ashes, refuse and vegetable or organic material. Unsatisfactory soils include ASTM D2487 soil classification groups MH, ML, CH, CL, OL, OH, GC, SM, SC, and PT or a combination of these group symbols. Unsatisfactory soils also include satisfactory soils not maintained within 3-percent of optimum moisture content at time of backfill and compaction.

2. Asphalt Concrete Pavement:

   a. The materials, design, mixing, placement, finishing and curing of asphalt and paving materials shall be in accordance with the standards, specifications and requirements of the VDOT.
   b. Tack coat shall be Grade RC-250 or CSS-1h.
   c. Prime coat shall be Grade RC-250 or CSS-1h.
   d. Seal coat shall be Grade CRS-2 or CMS-2 or CMS-2h.
   e. Asphalt concrete base material shall be Type BM-25.
   f. Asphalt concrete surface material shall be Type SM-9.5.
   g. Line markings shall conform to VDOT specifications.

3. Concrete:

   a. The materials, design, mixing, placement, finishing and curing of concrete shall be in accordance with the standards, specifications and requirements of the VDOT and American Concrete Institute (ACI).
   b. Complete certified test reports shall be furnished to the County Inspector in triplicate. The contractor shall furnish the necessary labor, material and facilities for the making, storing, curing and testing of test cylinders. The contractor shall notify the County Inspector 24-hours prior to placing concrete and all samples must be obtained in the presence of the County Inspector. The contractor shall be responsible for all elements of the testing.
   c. Foundations shall at a minimum have a 28-day compressive strength of 3,000 psi or as otherwise approved by the professional design engineer. The requirement for slabs on grade and sidewalks is 4,000 psi and the requirement for precast structures is 5,000 psi. Prior to the start of any concrete work, a statement of the proportions proposed for the concrete mixture shall be submitted to the County Engineer. This shall be accompanied by a certified test report from an approved testing laboratory.

d. A minimum of four (4) test cylinders shall be taken for each 50 cubic yards of concrete placed with no less than one set from each pour. The making, curing, storing and testing of the concrete cylinders shall be in accordance with ASTM C 31 and C 39. The testing of the cylinders is to be accomplished by an approved, competent, independent testing laboratory. One cylinder from each pour shall be tested at 7-days and two (2) cylinders from each pour shall be tested at 28-days. If either of the 28-day cylinders in a set falls below the required strength by more than ten (10) percent, or if the average of the two falls below the required strength by more than five (5) percent, then the forth cylinder is to be immediately tested. The strength level of the concrete from any pour will be considered satisfactory if the average of all cylinders tested at 28-days for that pour meet or exceed the required strength, and no single 28-day cylinder is below the required strength by more than 500 psi. Any concrete which does not meet these requirements shall be removed and replaced unless otherwise deemed acceptable by the County Engineer.

e. The concrete slump shall be from 2-inches to 4-inches unless approved otherwise by the professional design engineer and will be determined in accordance with ASTM C 143. Samples for slump determination will be taken from the concrete during placement in the forms. Each load of concrete shall be tested for slump.

f. Air content shall be between 5 percent and 8 percent unless approved otherwise by the professional design engineer and will be determined in conformity with the requirements of "Test for Air Content of Freshly Mixed Concrete by the Pressure Method," ASTM C 231. If tests do not show satisfactory results, the mix shall be adjusted as directed.

g. Miscellaneous concrete in water construction shall at a minimum have a 28-day compressive strength of 3,000 psi.

h. Steel reinforcement shall be Grade 60 and shall meet ASTM A 615. Steel reinforcement shall be free from excessive rust or mill scale, dirt, paint, oil or other foreign substances. Bends shall be made in accordance with the requirements of the Manual of Standard Practice for Detailing Reinforced Concrete Structures (ACI 315). Bars shall be tied at every intersection where spacing is greater than twelve-inches in each direction. Where the spacing is less than twelve-inches, ties shall be made at alternate intersections. The minimum concrete cover shall be provided in accordance with ACI 318. Reinforcing steel shall be epoxy coated where shown on the plans and/or required in the specifications. Welded wire reinforcement shall meet ASTM A185 requirements.

i. Grout: premixed, nonmetallic, noncrossive, nonstaining grout containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents,

complying with ASTM C1107, of consistency suitable for application, and a 30-minute working time.

4. Masonry Work:

   a. Concrete masonry units (CMU) shall be manufacturers' standard units with nominal face dimensions of 16-inches length by 8-inches height. The CMU shall be high load bearing that conforms to ASTM C 90, Grade N, Type 1.
   b. Brick shall be best quality, machine made of clay or shale, conforming to ASTM C 216, Grade MW, Type FBS. Color and texture is to be approved by the KGCSA.
   c. Mortar materials shall be made using potable water and masonry cement conforming to ASTM C 150, Type I. The sand shall conform to ASTM C 144.
   d. Hydrated lime shall comply with ASTM C 207, Type S.
   e. Reinforcement for composite masonry walls shall be truss design with spacing of side rods two inches less than the nominal thickness of the wall. Side rods shall be 3/16-inch diameter, cross rods shall be #9 wire. The reinforcement shall be galvanized after fabrication in accordance with ASTM A 153. Masonry reinforcement shall be installed in the first course of block and in every second block course thereafter. Reinforcement shall lap at least 6-inches at splices.
   f. Vapor barrier shall be 6-mil, clear polyethylene sheeting.
   g. Air-entraining agent shall conform to ASTM C260 and be of a type that is compatible with Portland Cement.
   h. Water reducing retarder shall be ASTM C494, Type D and shall comply with the water/cement ration standards of ACT 211.1.
   i. Expansion joint material shall be pre-molded filler strips and shall conform to ASTM D1752. Material shall be ½-inch thick and shall extend the full depth of the slab.
   j. Design and construction of concrete formwork shall be the responsibility of the contractor and shall be governed by the "Recommended Practice for Concrete Formwork", ACI 347.

5. Metals:

   a. Structural steel shall comply with the AISC "Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design" and the Research Council on Structural Connections (RCSC) "Specification for Structural Joints Using AASTM A325 or A 490 Bolts".
   b. Comply with applicable provisions of AWS D1.1 "Structural Welding Code – Steel".

c. Structural steel shapes, plates, anchor bolts and bars shall comply with ASTM A36.
d. High strength bolts, nuts and washers shall comply with ASTM A325, Type 1.
f. Gray iron castings shall comply with ASTM A48, Class 30.
g. Miscellaneous aluminum shall comply with ASTM B221, Alloy 6063.
h. Stainless steel shall be Type 316 unless otherwise specified.

6. Water Main Materials:

Water mains four (4) inches or larger may be either PVC, ductile iron or HDPE.

a. PVC pipe, 4-inches to 12-inches in diameter, shall be unplasticized poly-vinyl-chloride (PVC) plastic pressure pipe with integral wall bell and spigot joints and shall be in accordance with AWWA C900 Class 150 DR-18. Joints shall be locked-in factory assembled rubber ring type. Joint material including gaskets and lubricants shall conform to AWWA C900. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage. Molecular Oriented PVC may be used if approved by the County Engineer. This pipe shall be Class 150 PVCO 1135 pipe conforming to ASTM F1483-03 and AWWA C909. PVC pipe greater than 12-inches in diameter shall be AWWA C905 – Class 235 (DR18). Pipe smaller than 4-inch diameter shall be Schedule 80 PVC, in accordance with ASTM D-1784 and ASTM D-2241. Schedule 80 PVC fittings shall meet the requirements of ASTM D-2467, cell classification 12454B, ASTN D1784.
b. Fittings for PVC pipe shall be ductile iron ANSI/AWWA C153/A21.53, compact fittings with a minimum pressure class of 350-psi. Manufacturer's standard asphaltic coating (one-mil thickness) shall be provided on the exterior of all fittings. Fittings shall have a double thickness cement-mortar lining in accordance with ANSI A21.4 (AWWA C104). Joint restraint shall be used where specified.
c. Joint Restraint: retainer glands for PVC pipe in diameters up to 12-inch shall be EBAA Iron Series 2000PV or approved equal and Megalug Series 2800 for pipe diameters greater that 12-inch. Glands shall be manufactured of ductile iron conforming to ASTM A 536. The restraining glands shall have a pressure rating equal to or greater than the pipe on which it is used. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53.

Ductile iron pipe shall be restrained using Megalug Series 1100. All retainer glands shall conform to ASTM A536 and shall have twist-off nuts.

d. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51 and flanged ductile iron pipe shall comply with the requirements of ANSI/AWWA C115/A21.15. The pipe shall be minimum pressure class 350 for exposed pipe and for pipe diameters less than 12-inch and pressure class 250 for 12-inch diameter and larger. The pipe and fittings shall have a double thickness cement-mortar lining in accordance with ANSI/AWWA C104/A21.4. Joints shall be rubber-gasket joints of the mechanical, push-on or flanged type in accordance with ANSI/AWWA C111/A21.11 or ANSI/AWWA C115/21.15. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage. The minimum acceptable pressure rating for joints shall be 250-psi. The pipe shall have an asphaltic coating.

e. Ductile iron fittings shall conform to ANSI/AWWA C153/A21.53. Fittings shall be compact and have a minimum pressure class of 350. All fittings shall be cement mortar lined in accordance with AWWA C104/ANSI 21.4.

f. Restrained Ductile Iron Pipe and Fittings: Restrained joint systems for push-on joint type piping and fittings shall be Snap-Loc/Bolt-Loc (Griffin), Super Lock (CLOW), TR Flex (U.S. Pipe) or similar systems as specified by the professional design engineer and approved by the County Engineer.

g. Manufacturer's standard asphaltic coating (one-mil thickness) shall be provided on the exterior of all pipe and fittings. If, after installation, the exterior coating has been damaged, Contractor shall provide a two-mil coating of an approved bituminous coating product to those damaged areas.

h. Polyethylene encasement of the piping shall be provided in accordance with ANSI/AWWA C105/A21.5 were required due to soil corrosivity. Materials and methods of installation shall be in accordance with ANSI/AWWA C105; Method A, B, or C may be used unless otherwise specified. Polyethylene shall be a minimum of eight mils thick.

i. Buried copper pipe shall be seamless copper tubing conforming to ASTM B88, Type K, Temper 060. Fittings shall be wrought copper solder-joint pressure fittings conforming to ANSI B 16.22. Copper pipe and fittings shall be rated for a working pressure of 100-psi. Joints shall be compression style.

j. High Density Polyethylene pressure pipe and fittings (HDPE) shall meet AWWA Standard C600 for force main applications and AWWA Standard C906 for water main applications. The pressure rating shall be DR-9 for 4-inch through 8-inch diameters and DR-

11 for 10-inch through 24-inch diameters for water main applications and DR-13.5 for force main applications.

k. Gate valves three (3) inches and larger shall be resilient seat type, shall have a minimum working pressure of 150 psig conforming to AWWA Standard C509 and shall have an interior epoxy coating in accordance with AWWA C550 using a coating approved by the Virginia Department of Health for contact with potable water and shall not contain lead, coal tar resins, lampblack, carbon black or bituminous materials. The exterior surfaces shall receive a factory applied fusion bonded epoxy coating. The valves shall be of the non-rising bronze or stainless steel stem type with an iron body, mechanical joint or flanged ends, "O" ring stem seals, bronze mountings, and, suitable for buried service. The valves shall open left (counter-clockwise) by a 2-inch square operating nut. Gate valves shall be as manufactured by Darling, A.P. Smith, Mueller, Kennedy, Clow or approved equal. One valve wrench shall be provided for every three (3) valves installed in a project. Gate valves smaller than 3-inches in diameter shall be cast bronze, solid wedge disc, screwed bonnet, inside screw, non-rising stem valves with threaded connections. Valves shall conform to Standard SP80, Type 2, Class 150, Manufacturers Standardization Society of the Valve and Fitting Industry, Inc. and shall open counter-clockwise. Valves in vaults shall have a handwheel of cast iron conforming to ASTM A126, Class B.

l. Tapping valves shall meet the same specifications as gate valves, except they shall have a full, unobstructed opening to receive a full size shell cutter. It shall be a standard mechanical joint type on one end and a flanged joint on the other end. A Mueller H-667 or approved equal shall be used. The valves shall be subjected to a test pressure of 400-psi and be designed for a working pressure of 200-psi. All interior ferrous surfaces of all valves shall be coated in accordance with ANSI/AWWA C550 using a coating approved by the Virginia Department of Health for contact with potable water and shall not contain lead, coal tar resins, lampblack, carbon black, or bituminous materials. The exterior surfaces shall receive a factory applied and KGCSA approved coating.

m. Tapping sleeves shall be mechanical joint, cast iron, or stainless steel furnished complete with plain rubber gaskets, mechanical joint accessories, and duckback gaskets. The connecting flange between the sleeve and valve shall conform to ANSI/AWWA C110/A21.10. The outlet flange for ductile iron and C-900 pipe shall be 125 pound, drilling per ANSI B16.1, with standard tapping flange counterbore per MSS SP-60. Tapping sleeves for other than C-900 PVC shall be furnished with plain rubber gaskets and have a full circumference band made of 18-8 type 304 stainless

steel. The flange and all bolts shall conform to AWWA C207 Class D 150 pound drilling, made of 18-8 type 304 stainless steel.

n. Valve boxes shall be approved standard Buffalo-type, cast iron, slip-type adjustable shaft boxes, with a minimum shaft diameter of 5-1/4 inches. Valve box covers for water mains shall have the word "WATER" cast into them. Valve boxes shall be Tyler Series 6855, or equal, for valves up to 12-inches in diameter and Tyler Series 6865 for valves larger than 12-inches.Valve box tops shall be of cast iron construction in accordance with ASTM A48 Class 30. Valve box frame and cover shall be in accordance with the Standard Details and shall be designed for AASHTO Highway Loading Class H-20.

o. Tie rods shall be in accordance with ASTM A-307.

7. Fire hydrants:

a. Fire hydrants shall be of the dry barrel type and shall conform to AWWA C502. The flow rate shall be 1,000 gpm with not more than a 5-psi pressure drop through the steamer nozzle.

b. The hydrant base shall have a 6-inch mechanical joint bell, designed for connection to a horizontal 6-inch hydrant branch with retainer glands. The traffic coupling shall allow for 360-degree adjustment of the upper standpipe.

c. Hydrants shall include two 2-1/2 inch hose nozzles placed 180-degrees apart and one 4-1/2 inch steamer nozzle. All threads shall be National Standard (American) fire hose coupling screw threads. Nozzle caps shall be fitted with chains.

d. Hydrants shall be Mueller Centurion A-461, Kennedy Guardian K-81 or Clow Medallion.

e. Hydrants shall have a high-gloss, alkalyd industrial coating. The color shall be silver with the tops and nozzle caps painted as specified in Section I.

f. Acceptable drainage shall be provided per Virginia *Waterworks Regulations* Section 12 VAC 5-590-1160. Such provisions and facilities shall not be connected to a sewer.

8. Water Meters:

a. All water meters shall conform to AWWA C700, latest edition.

b. Meters, meter boxes and meter installations shall be as specified in the Standard Details.

c. Acceptable drainage shall be provided per Virginia *Waterworks Regulations* Section 12 VAC 5-590-1160. Such provisions and facilities shall not be connected to a sewer.

9. Casing Pipe:

a. The casing pipe shall be either nonspiral welded or seamless steel having a minimum yield strength of 35,000 pounds per square inch (psi) and shall meet the requirements of ASTM A 139, Grade B. All joints shall be butt welded, watertight in accordance with the American Welding Society's recommended procedures.

b. The carrier pipe shall be ductile iron unless otherwise approved by the County Engineer.

c. Casing spacers shall be Model No. C8G-2 or C12G-2 as manufactured by PSI, Inc. or approved equal. The spacers shall be sized to fasten securely onto the carrier pipe barrel O.D. and specified with a minimum runner height to keep the pipe from resting or sliding on its joint during installation. Casing spacers shall be bolt on style with a shell made in two sections of 14 gauge 0.074-inch mild steel or 304 stainless steel. Connecting flanges shall be ribbed for extra strength. They shall be lined with a PVC liner 0.090-inch thick with 85-90 Durometer or neoprene rubber. All nuts and bolts shall be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer and shall be supported by risers made of heavy 304 stainless steel.

d. If vent piping is required, it shall be galvanized piping. The threads shall be coated upon installation.

e. The casing pipe shall have the minimum wall thickness and diameters as listed in Table 2.1 (unless otherwise approved by the County Engineer):

TABLE 2.1

Carrier Pipe Size (inches)	Casing Sizes (inches)	Wall Thickness (inches)
4	16	.250
6	18	.312
8	20	.312
10	22	.312
12	24	.375
16	28	.375
18	30	.500
20	32	.500
22	34	.500

A pipe that is to be installed under a railroad or public roadway shall meet all requirements of the permitting agent. The contractor shall arrange for and pay for all flagmen, signs and other measures required by VDOT or the railroad company. Railroad crossings shall conform to Roadway and Ballast Section 5.2 – Specification

for Pipelines Conveying Non-Flammable Substances of the American Railway Engineering Association Manual for Railway Engineering.

10. Underground Warning Tape and Tracer Wire:

Underground warning tape shall be printed polyethylene tape, magnetic, 6-inches minimum width, color coded, one-inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types. Color coding shall be blue for water mains. Tracer wire shall be plastic coated 10-gauge copper wire. Wire coating shall be suitable for direct burial. Waterproof connectors shall be provided to join tracer wire.

11. Anchor Bolts:

All concrete anchor bolts not cast in place shall be stainless steel. Anchor bolts that are pre-set and cast in place may be either galvanized or stainless steel.

12. Air Release Valves:

Air release vents shall be installed where shown on the drawings and in accordance with the Standard Details. Brass pipe shall be red brass pipe meeting the requirements of ASATM B43. Brass pipe fittings shall be screwed end malleable iron pattern meeting the requirements of ANSI B16.15. Unions shall be all brass or bronze with ground joints. Fittings shall be rated for steam working pressures up to 125-psi. Joints shall be screw type with threads clean cut, tapered and smooth, meeting the requirements of ANSI B2.1. Acceptable drainage shall be provided per Virginia *Waterworks Regulations* Section 12 VAC 5-590-1160. Such provisions and facilities shall not be connected to a sewer.

13. Backflow Prevention Devices:

Backflow prevention devices and measures shall be on accordance with and in compliance with all requirements of the Virginia Department of Health Waterworks Regulations and the King George County Service Authority Cross-connection Control and Backflow Prevention Program approved by the Commonwealth of Virginia Department of Health on August 25, 1993.

14. Control Valves (2” in diameter and larger):

Control valves (2” and larger) shall be hydraulically operated, pilot-controlled diaphragm-type globe valve. All control valves shall be constructed in an aboveground structure. The main valve shall have a

single removable seat and a resilient disc. The stem shall be guided at both ends by a bearing in the valve core and an integral bearing in the valve seat. No external packing glands are permitted and there shall be no pistons operating the main valve or any pilot controls. The pilot control shall be a direct-acting, adjustable, spring loaded, normal open, diaphragm valve, designed to permit flow when controlled pressure is less than spring setting. The control valve shall be Class 125 bronze fittings manufactured in accordance with ANSI B16.1, ASTM A48, B61 and B62, adjustable from 30 to 300 psi. Valves shall have an internal and external coating in accordance with AWWA C550, latest edition. Valves shall be furnished with a Delrin stem in both normally open and normally closed configurations. Valves shall also include position indicator devices. Control valve functions include one or more of the following:

a. Check Valves: shall have no-slam operation, drip tight shut-off and shall have adjustable dual speed controls.
b. Pressure Reducing Valves: shall provide sensitive and accurate pressure control, shall provide easy adjustment and maintenance, shall be tamper resistant, and shall include a fully supported frictionless diaphragm.
c. Combination Pressure Reducing and Pressure Sustaining Valves: shall have accurate response to slight pressure changes, a check feature, shall be completely automatic operation, drip tight, positive seating; and, shall have fully hydraulic operation.
d. Solenoid Actuated Valves: shall have quick acting solenoid actuation, and shall provide for ease for installation and maintenance.
e. Rate of Flow Control Valves: shall accurately limit flow rate, shall have automatic operation, shall include orifice plate and holder, and shall have a check valve feature and allow for ease of adjustment.
f. Altitude Valves: shall include accurate repeatable level control, drip tight positive shut-off, reliable hydraulic operation, easy adjustable controls, complete automatic operation, and shall be either double acting or single flow as required by the KGCSA.

15. Flushing Hydrants:

Flushing hydrants shall be 2-inch Aquarius “One-O-One” HH or 2-inch Main Guard Model #78. Acceptable drainage shall be provided per Virginia *Waterworks Regulations* Section 12 VAC 5-590-1160. Such provisions and facilities shall not be connected to a sewer.

16. Couplings & Expansion Joints:

Standard couplings shall be Dresser Style 38 or approved equal. Transition couplings shall be Dresser Style 162 or approved equal. Flanged adapters shall be Dresser Style 127 or approved equal. Expansion joints shall be Red Valve J-1 or approved equal.

17. Flowable Fill:

Flowable fill shall have comply with the VDOT requirements for a 50 psi design mix.

18. Lumber, Fasteners and Joint Sealers:

a. Lumber shall be dressed, S4S.
b. Dry lumber shall be provided with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less.
c. Plywood shall be DOC PS 1 a in compliance with "Code Plus" provisions of APA Design/Construction Guide : Residential and Commercial". Exterior soffit and ceiling sheathing shall be Structural I 5/8-inch T&G A/C sheathing. Exterior roof sheathing shall be Structural I, ¾-inch T&G sheathing.
d. Treated lumber shall be AWPA C2 and treated plywood shall be AWPA C9.
e. Fasteners shall be hot-dip zinc complying with ASTM A153/A153M.
f. Stainless steel fasteners shall be Type 304.
g. Power driven fasteners shall be CABO NER-272.
h. Bolts shall be steel complying with ASTM A307, Grade A with ASTM A563 hex nuts.
i. Metal framing anchors shall be made from hot dip, zinc coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
j. Joint sealant for exterior work shall be single component polyurethane, ASTM C-920 type W, grade NS, class 25, use NT, M, A.
k. Joint backing shall be closed cell polyethylene rod, circular or rectangular dimension or bond-breaking type coated open cell polyurethane rod similar to "Polytite B" by Sandell Manufacturing.
l. Extruded-polystyrene board insulation shall be in accordance with ASTM C578. Faced glass fiber blanket insulation shall be in accordance with ASTM C665, Type III.
m. Fiberglass shingles shall be mineral-surfaced, self-sealing, 3-tab, fiberglass-based, strip asphalt shingles, complying with both ASTM D3018, ,Type I, and ASTM D3462. Shingle shall have a Class A fire-test-response classification that pass the wind-resistance test requirements of ASTM D3161. Shingles shall be fungus resistant and include a 30-year designation.

n. Felt underlayment shall be Type II, asphalt-saturated, organic felt, complying with ASTM D226 (No. 150 or ASTM D4869.
o. Asphalt plastic cement shall be nonasbestos fibrated asphalt cement, complying with ASTM D4586.
p. Sheet metal flashing and trim shall be stainless steel sheet, per ASTM A167, Type 304, soft annealed, with No. 2D finish.

19. Hinges and Hardware:

a. Door hinges and hardware shall be composed of non-corrosive materials in compliance with ANSI 156.1-1981.
b. Bored locksets shall be heavy duty in accordance with ANSI 156.2-1983.
c. Keying shall be as specified by the KGCSA.

20. Painting shall be in compliance with the most current, applicable regulations of the following agencies and organizations:

a. Steel Structures Painting Council
b. National Fire Protection Association
c. American National Standards Institute
d. Occupational Safety and Health Administration
f. American Water Works Association
g. American Society for Testing and Materials
h. National Association of Corrosion Engineers
i. National Paint and Coatings Association
j. Virginia Department of Health

22. Louvers and Vents:

a. Louvers shall be fixed-blade with extruded-aluminum frames and blades. Lover insect screens shall be aluminum 18-by-16 mesh, 0.012-inch wire and bird screens shall be aluminum ½-inch square mesh, 0.063-inch wire. Louvers and vents shall be complete with factory baked finishes.

22. Other Materials:

a. Drain piping shall be cast iron hubless CISPI 301) or PVC ASTM D 2665.
b. Cleanouts shall be threaded PVC per ANSI A112.36.2M.
c. Drains shall be ASME A112.21.1M cast iron or ductile iron with clamping rings for use with membrane waterproofing. Provide a P-trap for each floor drain.
d. Pipe hangers shall be MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods.

e. Emergency eyewash station shall be provided and shall include a pull rod and flag handle. The station shall have dual spray heads for eye/face wash.
f. Fire extinguishers shall be NFPA 10 portable fire extinguishers.
g. Hose bibs shall be bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets.

D. Well and Pumping Facilities:

Materials used in the construction of well pumping and treatment facilities shall meet all applicable requirements specified below and in Section I of these Standards and the Virginia Waterworks Regulations. Any materials or equipment proposed for facilities shall be as specified by the professional design engineer and approved for use by the County Engineer and KGCSA. The professional design engineer shall submit to the County Engineer and the KGCSA all documentation necessary for the evaluation of the non-specified materials or equipment.

1. Pump and well facility structures shall be of brick masonry construction and shall have similar architecture and colors as adjacent buildings and surroundings. Building components shall be as specified in Paragraph C above and as follows:

a. Shingles - fiberglass, fungus resistant, minimum 25-year warranty
b. Doors - Fiberglass reinforced plastic (or as otherwise approved by the KGCSA)
c. Ventilation fan with HOA switch in a NEMA 12 enclosure.
d. Electric unit heater sized to maintain a minimum temperature of 50 degrees F

2. The KGCSA may allow the developer to construct a precast concrete building. Such buildings are to be field assembled by the manufacturer on a poured in place foundation. Precast buildings shall be EASI-SPAN brand as manufactured by SMITH- MIDLAND Corporation or approved equal. Precast buildings shall be provided by the manufacturer with all necessary openings as specified by the design professional in conformance with the manufacturer's structural requirements. Precast buildings shall be as follows:

a. Seismic load performance category 'C'. Exposure Group III.
b. Standard Live Load: 60 PSF
c. Standard Floor Load: 250 PSF
d. Standard Wind Loading: 130 MPH
e. Roof shall slope ½-inch from front to back in 10-foot direction. The roof shall extend a minimum of 2-1/2 feet

beyond the wall panel on each side and have a turndown design which extends ½-inch below the top edge of the wall panels to prevent water migration into the building.

f. Concrete: Steel-reinforced, 5,000 psi minimum, 28-day compressive strength, air entrained (ASTM C260).

g. Post-tensioning Strand: 41K Polystrand CP50, .50, 270 KSI, 7-wire strand, enclosed within a greased sheath (ASTM A416), roof and floor (if precast floor panel is utilized) each to be post-tensioned by a single, continuous tendon.

h. All joints between panels shall be caulked on the exterior and interior surface of the joints.

i. Vents shall be cased in the wall.

j. All panels shall be securely fastened together with ¼-inch thick stainless steel brackets. All fasteners shall be ½-inch diameter stainless steel bolts. All inserts for corner connections shall be bolted directly to form before casting panels. Wall panels shall be connected to the floor slab with 4-inch expansion anchors.

k. The interior of the building shall be smooth steel form finish. The exterior shall be architectural precast concrete brick finish. Finish brick size shall be 2-3/8 inch x 7-5/8 inch with a 3/8-inch deep by 3/8-inch wide joint between each brick.

l. The building slab shall be minimum 4,000-psi, 8-inch thick reinforced concrete slab.

3. A paved entrance and a parking area are required and shall have a minimum twenty-five (25) foot turning radius. A six (6) foot or higher chain link fence, with green or black vinyl colored fence fabric, shall enclose the site, unless otherwise approved by the KGCSA. The interior of the fenced in area shall be graded and backfilled with No. 57 stone.

4. Provision shall be made to facilitate the removal of equipment, tanks, valves and piping. Adequate floor openings, doorways or roof hatches shall be provided. Eye-bolts, trolley beams, trolley and chain fall for hoisting equipment shall be installed. Sufficient clearance between equipment and storage walls shall be provided for ease of maintenance and to meet all applicable code requirements.

5. Where required, provide OSHA approved switchboard matting in front of electrical panels and transfer equipment are required.

6. Electrical equipment and wiring shall be insulated and properly grounded. Switches and control shall be of the non-sparking type.

7. Adequate lighting shall be provided in all locations including: outside, motor control panel, and wet well or as specified.

8. Electrical equipment in enclosed places where gas may accumulate shall comply with the NEMA Class I, Div. 1, Group D, specifications for hazardous conditions.

9. An adequate supply of potable water shall be provided for use in the facility.

10. The facility site shall include a buffer area as required by the King George County Zoning Ordinance and Waterworks Regulations. As a minimum, the well shall be located on a 100-foot by 100-foot dedicated well lot (and recorded well dedication document), a minimum of 50-feet from all property lines.

11. Facility sites shall be landscaped as required by the King George County Zoning Ordinance.

12. The access frame and cover for access vaults shall have a ¼-inch thick one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor. The door panels shall be ¼-inch aluminum diamond plate, reinforced to withstand a live load of 300 psf. The doors shall open to 90 degrees and automatically lock with stainless steel hold open arms with aluminum release handles. Doors shall close flush with the frame. Lifting handles, hinges, and all fastening hardware shall be stainless steel. The unit shall lock with non-corrosive locking bars. Units for well and pump facilities shall be Haliday Model No. T1R3648 or Haliday Model No. R1R72.

13. Penetration sleeves shall be Link-Seal as manufactured by Thunderline Corporation, or equal, and shall include the Link-Seal wall sleeve.

14. Well Pumps:

    a. Pumps shall be of the submersible turbine type with integral submersible motor as manufactured by Grundfos, Goulds or approved equal Motors shall be manufactured by Franklin Electric.
    b. Pumps shall be factory-tested, hydraulically and dynamically balanced, and shipped completely assembled. Pumps shall be tested by the pump manufacturer at its factory with the actual driver to be furnished. The following data shall be provided:

        i. TDH vs. capacity
        ii. Pump efficiency vs. capacity

iii. Horsepower vs. capacity
iv. Maximum and minimum vibrations

c. During factory testing, the amplitude of vibration of any pumping unit, when operating at any point on its characteristic curve, shall not exceed, in any plane, the balance quality grade G6.3 of ANSI S2.19-1975 (ISO 1970-1973). Measurements shall be taken at the locations prescribed by the Hydraulic Institute, at each bearing housing, and at the pump discharge.

d. Each pump shall be provided with stainless steel data plates attached to the pump. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, frame and bearing numbers, and other pertinent data.

15. Booster Pumps:

a. Pumps shall be double suction, split-case mechanical seal pumps. The pumps shall be of the bronze fitted type. The casing shall be of the axially-split design, with suction and discharge flanges and mounting feet cast integrally with the lower half of the casing and shall be of cast iron complying with ASTM A48, Class 40. Tapped and plugged holes shall be provided for seal water, vent, and drain connections. The upper half of the casing shall be removable without disturbing the suction piping. The pump shaft shall be of AISI 1141 and of such dimensions that the maximum combined stress due to bending and torsion shall not exceed 8,000-psi under the most severe conditions of operation. The pump suction and discharge shall be provided with ANSI B16.2 flanges with Class 125 drilling pattern. At the running joint between the suction and discharge chambers, wear rings shall be provided on both the casing and impeller.

b. Seals shall be of the split mechanical design. All components of the seal shall be split in half, including the elastomers, gland, rotary and stationary seal faces and rotary holder. The non-shaft elastomers shall incorporate a ball and socket to provide ease of installation. The seal shall be a rotation, hydraulically balanced, O-ring design. The stationary seal face shall be mechanically loaded with multiple springs to ensure no leakage when the pump is shut off.

c. Bearings shall be of the anti-friction type grease lubricated ball. Bearings shall have a minimum rated service life of 40,000 hours in accordance with the standards of the Bearings Manufacturers Association throughout the specified operation range.

d. The pump and drive motor shall be horizontally mounted on a common baseplate of fabricated ASTM A36 steel. The pump and

motor shall be aligned on the baseplate before leaving the factory. The base plate shall be provided with a ½-inch drain piped to a floor drain for removing leakage and condensation that may collect in the base. The pump shall be directly connected to its drive with a flexible coupling. After pump assembly installation, the contractor shall demonstrate that the pump and motor shafts are within plus or minus .002-inches on axial alignment and that there is no misalignment from center of shaft to center of shaft.

e. Spare parts to be provided shall include one set of mechanical couplings, bearings and seals for each size pump.

f. Motors shall be adequate to operate the pump at every point on the performance curve without exceeding the motor rating. The motor shall be provided with lifting lugs. Motors shall be of the constant speed, horizontal, squirrel cage, induction type with non-overloading characteristics throughout the entire pump operating range. Motors shall be NEMA design B, in dripproof enclosures with 1.15 service factor.

g. Flexible shaft couplings shall be resilient grid coupling sized to a 1.5 service factor. The coupling guard shall be all metal ANSI type, constructed of expanded metal fabric.

16. Hydropneumatic Tank:

a. Provide carbon steel tanks designed and constructed in accordance with ASME codes for unfired pressure vessels. Lap welds shall be continuous on both sides. Provide an ASME stamp for a minimum working pressure of 150-psi and a test pressure of 225-psi. Inlet and outlet flanged connectors shall be manufactured plumb for connection to the proposed piping system. All tank cradle joints and the wall entry shall have ½-inch thick neoprene padding.

b. Furnish connectors and manholes to include the following:

i. ½-inch NPT sample tap
ii. ½-inch NPT plugged tap
iii. ½-inch NPT sight glass (2 each)
iv. ½-inch NPT gauge assembly
v. ½-inch NPT air supply
vi. 1-inch NPT pressure relief
vii. 2-inch NPT plug drain
viii. 3-inch flanged drain
ix. flanged inlet (sized for flow conditions)
x. flanged outlet (sized for flow conditions)
xi. 18-inch x 24-inch elliptical manways (2 each)

c. Provide a ½-inch sight glass with shut off and drain valves and bushings for ½-inch tank connection. Provide full length metal guards (Type 316 stainless steel).
d. Pressure relief valves shall be direct-acting, adjustable, spring-loaded valves and shall be designed to permit flow when pressure exceeds the spring setting. The valve shall be adjustable over a 1-psi to 250-psi range.
e. Vacuum relief valves shall be designed to open when tank pressure is below atmospheric pressure. At pressures above atmospheric pressure, the valve shall be tightly closed. Valve body and cover shall be bronze or cast iron, and the valve shall be suitable for tank pressures up to 150-psi.
f. The check valve on the air supply line shall be bronze swing check valves rated for 150-psi with screwed NPT fittings.
g. Union type connections shall be provided.

17. Air Compressor:

a. The air compressor shall be oil-less piston type, and shall include combination starter, control circuit, overload, and disconnect switch in a NEMA 3R enclosure. An HOA selector switch, a level switch and a pressure switch shall be provided to control the air compressor in conjunction with the factor preset pressure switches on the tank for on-off control.
b. Provide an automatic air relief valve for high pressure protection, dry-type air filter silencer, automatic condensate drain, bossed tapped connection for the ½-inch pipe connection with check valve and gate valve.
c. The air compressor shall be mounted on rubber vibration isolators.
d. An insulated aluminum cover shall be provided over the air compressor.
e. A flexible connector shall be provided on the air line adjacent to the compressor.

18. Water Storage Tanks:

a. The following standards apply to water storage tanks:

i. AWWA D100
ii. AWWA D101
iii. AWWA D102
iv. AWWA D105
v. Virginia Waterworks Regulations
vi. Steel Plate Fabricators Association, Welded Steel Water Storage Tank Manual

b. Water storage tanks shall include ladders with safety cages, vandal proof access, vents, watertight access manholes, water level indicator, lights, safety climb devices, overflows, and controls; all in compliance with the requirements of the Virginia Waterworks Regulations.

c. Level controls shall be provided for the following control functions:

   i. Activate well pump for tank system fill.
   ii. Deactivate well pump to cease tank system fill.
   iii. Disable booster pumps at selected pressure.
   iv. Enable booster pumps at selected pressure.

d. Water storage tanks shall be in complete compliance with the requirements of the Virginia Waterworks Regulations and applicable American Water Works Association standards.

19. Chlorine Analyzer:

a. Chlorine analyzers shall be ATI Series A15 or approved equal.
b. The analyzer shall monitor free chlorine and be mounted in a NEMA 4X enclosure.
c. A ¾-inch Watts Model 25 AVB pressure regulator shall be provided on the supply line.

20. Chemical Solution Feed Systems:

a. Sodium hydrochloride, potassium permanganate and corrosion inhibitor feed pumps shall be Pulsafeeder Pulsotron MP series or approved equal sized for the chemical feed requirements. Pumps shall be capable of manual control with independent adjustments of stroke and speed control for 100:1 combined turndown, and shall be equipped with backlit LCD display and controls to program the integrated microprocessor. The pump shall be controlled manually and/or by use of 4 to 20 mA signal. Pumps shall be provided with back pressure/anti siphon valves and shall have alarm signals for signal loss, full count, pulse overflow, pulse high rate and circuit failure. A spare un-mounted feed pump of each shall be provided for each facility.
b. Solution tanks (sized for the chemical treatment requirements) shall be a translucent UV-stabilized polyethylene tank with gallon scales and hard covers with hinged doors, in accordance with NSF 61. The tanks shall have two ½-inch PVC tank outlets with ball valves. Tanks shall be supplies with Pulsafeeder mixers with speed controlled by motor mounted controller; mixer stands shall be provided.

c. Solution and discharge piping and fittings shall be braided, translucent PVC tubing with PVC fittings, NSF approved for potable water.

d. Calibration column shall be a 100 ml clear PVC calibration column with a ½-inch threaded base and removable base. The scale shall be in mg/l and GPH.

e. Backpressure/anti-siphon valves shall be made of PVDF with a pressure rating of 145 psi.

f. Injection lances shall be PVC body with Viton seals.

g. All chemical solution tubing conduit shall be supported with Aikenstrut PVC pipe supports. Supports shall be provided every 24-inches and at each change in direction.

21. Treatment facilities shall be designed for each specific facility based on the water quality of the supply source. Treatment facilities shall be designed and constructed in accordance with these Standards and the Virginia Waterworks Regulations

SECTION III
CONSTRUCTION METHODS AND TESTING

A. General Requirements:

1. Erosion and sediment control/land disturbing activity permit:

   a. No person shall engage in any regulated land disturbing activity until after submitting an erosion and sediment control plan for approval and has received a permit certifying such approval has been issued in accordance with the requirements of the King George County Department of Community Development.

   b. No agency, department or officer authorized under any other ordinance or law to issue grading, building or other required permits for projects involving land disturbing activities shall issue such permits until the following requirements are met:

      1) The Erosion and Sediment Control/Land Disturbing Activity Permit has been issued.
      2) An initial inspection of the erosion and sediment control measures for the project has been conducted.
      3) Notification has been issued that the project is in compliance with the erosion and sediment control plan.

2. Certificate to Construct:

   Before a contractor begins work, an application for a Certificate to Construct shall be submitted to the KGCSA and where applicable, the VDH. A sample copy of the certificate is located in Appendix. Work shall not commence until the KGCSA or VDH has issued the Certificate to Construct, and the developer/contractor has acquired a Land Disturbing Permit from the Department of Community Development for the project.

3. Clearing:

   Clearing shall be confined to within the limits identified on the approved erosion and sediment control plan. Any damage outside of these limits that result from the contractor's operations shall be the contractor's responsibility.

4. Grubbing:

   Areas to be grubbed shall have roots or other objectionable materials and debris removed to a minimum depth of 12-inches below ground surface. All stumps shall be removed regardless of their depth from ground

surface. Where grubbing is not required stumps shall be ground up or cut flush with the ground.

5. Disposal:

All unsuitable materials and debris resulting from the contractor's operation shall be disposed of legally by the contractor.

6. Restoration/Replacement:

Trees and shrubs damaged, but remaining, shall be repaired in accordance with the guidelines established by the Virginia Cooperative Extension Agency and the "Virginia Erosion and Sediment Control Manual", latest edition. Trees and shrubs intended to remain but which have been damaged beyond repair, or which have been removed, shall be replaced by the contractor. The contractor shall protect existing trees and shrubs to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within the drip line.

a. Trees to remain shall be identified by flagging, a 48-inch high snow fence or comparable barrier.
b. Roots of trees to remain shall be protected from damage.
c. Where possible, roots in the trench line over 1-1/2 inch in diameter shall be tunneled by hand with the pipe laid below the roots.
d. Exposed roots are to be temporarily covered with exposed wet burlap to prevent roots from drying out; these roots are to be covered with earth as soon as possible. Roots, which can not be avoided, shall be cleanly cut with a root pruner.
f. The faces of roots over 1-1/2” inches in diameter cut during construction operations shall be coated with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues.
g. Trenches within the root area of trees to remain shall be backfilled to finished grade with one part peat moss and three parts topsoil. The area shall be watered at the time of backfill. The trenches shall be fertilized with 30-10-7 slow-release organic nitrogen fertilizer to stimulate root growth.

7. Topsoil Removal and Restoration:

The following procedure shall be followed for topsoil removal and replacement:

a. Strip topsoil;
b. Stock topsoil in location shown on plans;

c. Perform the work;
d. Scarify subsoil at least four inches in depth;
e. Spread topsoil to preconstruction grades;
f. Remove all objects over two inches in diameter; and
g. Landscape per approved plan.

8. VDOT Tree Trimming Permit:

Before the contractor trims or clears any trees on a VDOT right-of-way, the contractor shall obtain a Tree Trimming Permit from VDOT. One copy shall be provided to the County Inspector.

9. Burning Permits:

Prior to burning construction debris the contractor shall obtain required burning permits from local and state jurisdictions. The contractor shall provide one copy to the County Inspector and post and maintain one copy on-site.

10. Property Corners:

Property corners and survey monuments shall be preserved during construction activities. If a property corner or survey monument is disturbed or destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, said property corner or survey monument shall be replaced by a land surveyor registered in the State of Virginia. All costs to be paid by the contractor.

11. Stabilization and Maintenance:

Areas utilized by the contractor during the construction activities shall be cleaned to the satisfaction of the County Inspector and KGCSA. All lumber, earth clods and rocks larger than two inches in diameter, or other undesirable materials shall be reduced in size or removed from the site and legally disposed of by the contractor. The contractor shall return all areas disturbed during the course of construction to a condition equal to or better than those existing prior to the commencement of construction.

All disturbed areas not designed for pavement and sidewalk replacement or structural use shall be stabilized. Stabilization shall include topsoil, seed, fertilizer, lime, and mulch applied in accordance with the latest edition of the "Virginia Erosion and Sediment Control Manual."

Disposal of excess materials, cleanup activities, site restoration and stabilization shall be accomplished within seven days of the trench excavation.

Trees, shrubs and ground cover shall be maintained by the contractor until final acceptance but in no case less than 60-days after planting. All plantings shall be guaranteed for a period of one year pending final acceptance. From time to time as work progresses the contractor shall clean up and dispose of off-site, all refuse and unused materials of any kind resulting from the work. Upon failure by the contractor to do so within 24-hours after directed, the work may be performed by the KGCSA and the cost of the clean-up charged to the contractor.

B. Excavation, Backfill, Bedding and Compaction:

1. Dewatering:

Excavations shall be kept free from standing water during pipe installation, and to such extent as may be necessary during backfilling. This includes lowering the water table below trench bottom by well points and/or pumping with pumps of sufficient capacity to dewater the excavations. Disposal of excess water shall not affect public health or cause injury or damage to public or private property, the work of other contractors, or to any portion of the work completed, or in progress, or cause impediment to the use of highways or streets by the public. Dewatering flows shall be controlled in accordance with the erosion and sediment control regulations. Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device or both and discharged in a manner that does not adversely affect flowing streams or offsite property. Upon completion of dewatering, the removal of sediment from storm sewers and drainage ditches and restoration of the impoundment area is required. Gutters, storm sewers, drains and ditches shall be kept open at all times. No damming or ponding of water in gutters or other waterways will be permitted.

2. Excavation:

All work shall be performed to dimensions and depths shown on the approved plans. Material suitable for backfill shall be stockpiled near the site. Materials undesirable for backfill shall be legally disposed of off-site. Existing utilities, structures and fencing shall be protected during the construction period, and if damaged or removed during operations, shall be repaired or replaced in as good or better condition. Where an excavation is deeper than necessary a layer of consolidated gravel (No. 57 course aggregate or equal) shall be placed in sufficient quantity to allow the pipe to be placed at the proper elevation. Excavated material shall be

stockpiled so as not to interfere with public travel. Bridging shall be provided as necessary to provide access to public or private property.

During the progress of the work, sidewalks, crossings and driveways shall be kept open for the passage of pedestrians and vehicles. Permission and authorization shall be obtained for partial or complete closing of a street, driveway or crossing. The contractor shall perform all work impacting traffic flow or public rights-of-way in accordance with VDOT standards and requirements.

3. Trenching:

Pipe installation operations shall be kept as close to the excavation as possible. As a general rule no more than 200-feet of trench is to be opened at any time. The County Inspector reserves the right to stop the excavation at any time if and when, in his opinion, the trench is opened too far in advance of pipe installation. Trench excavations shall conform with all Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees. Unless otherwise shown on the plans pipe trenches shall be excavated to a depth that will insure a minimum of 42-inches of cover for water lines. Lines with less than 42-inches of cover shall be ductile iron. Pipe for water lines shall be laid to the alignment, grades and limits shown on the drawings. The minimum clear width of the trench, sheeting or unsheeted, measured at the springline of the pipe shall be 12-inches greater than the outside diameter of the pipe. The maximum clear width of the trench at the top of the pipe shall not exceed a width equal to the pipe outside diameter plus 24-inches. The excavation shall take into account the pipe bells and shall be of sufficient depth to permit access to the joint for construction and inspection.

4. Bedding:

Type III Bedding, installed to a depth of 1/2 of the outside diameter of the pipe, shall be provided under all flexible piping (HDPE and other forms of non-rigid piping). Aggregate bedding shall not be required when ductile iron pipe is installed unless specified by the design engineer or necessitated by poor bearing conditions of the native soils. Bedding material shall be used for laying ductile iron pipe when needed to provide a suitable foundation. Additional bedding, such as Type II bedding installed to a depth of 0.10 of the outside diameter of the pipe, shall be used when local conditions require additional pipe support. Unstable foundations may be improved with geotextile materials in lieu of extra cut and fill and the use of select material. The use of geotextile materials and the location of their use shall be shown on a plan and approved by the County Engineer on a case by case basis. Installation if approved shall be in accordance with manufacturer's requirements.

5. Backfill and Compaction:

a. All pipe shall have proper bedding and each joint properly made before backfill is placed. All trenches shall be backfilled with approved material immediately after the pipes are laid, unless other protection of the pipe line is provided and approved by the County Engineer. Where trench excavation material is deemed suitable and the use of select material has not been required, the trench excavation material shall be used for backfill. Where trench excavation material is deemed unsuitable for backfilling (unsuitable as described in Section II of these Standards), the contractor shall provide select backfill consisting of clean earth, sand, gravel, or other approved material (as described in Section II of these Standards). The determination of suitability of all backfill shall be made by the professional design engineer or approved soils engineer. The quantity and source documentation shall be provided upon request. Backfill material shall be carefully tamped around and over the pipes in six (6) inch layers up to a level at least one foot above the top of the pipe. The maximum size stone in the first twelve (12) inches of backfill shall not exceed one-inch in diameter. Simultaneous backfilling on both sides of the pipe is required. The remainder of the backfill shall be deposited and compacted by mechanical equipment in thoroughly tamped layers not exceeding one-foot lifts. The maximum size stone permitted in this portion of backfill shall not exceed two (2) inches diameter. In areas where paving is to be placed over the backfilled trench, the entire depth of backfill shall be deposited in six (6) inch layers and compacted by hand or mechanical tampers. Flooding with water to achieve compaction is not permitted.

b. Backfill compaction requirements shall be in accordance with AASHTO Method T-99, modified. Each layer of material is to be compacted to a minimum of 95 percent of the maximum density at optimum moisture content as described by ASTM D 698, (85 percent is acceptable in yard and non-paved areas).

c. Compaction Testing:

1) Conduct compaction testing at locations approved by the professional design engineer during backfilling operations.
2) Determine compaction by the testing procedure contained in ASTM D 698.

d. It is the intent of these Standards to secure a condition where no further settlement of trenches will occur so that when backfilling is completed the roadway or base or final ground cover may be placed immediately. Additionally, settlement is not to occur around

manhole structures. When using mechanical tampers the contractor shall exercise care to insure that pipe joints will not be broken, damaged or disturbed.

e. The trench shall be maintained in a dewatered state during placing of backfill and while compacting. Sufficient water shall be added to fill material, as required, to obtain a moisture content that falls within three-percent of the optimum moisture for the specific backfill material. All saturated backfill material is unacceptable.

6. Testing:

Compaction tests of in-place trench material shall be performed to assure attainment of required density. These tests shall be made at the contractor's expense and shall be performed by a Soils Laboratory approved by the County Engineer and KGCSA. Generally, one test is to be performed per 1,000 linear feet of pipeline for every 24-inches of lift required starting from one-foot above the pipe. The contractor shall give copies of all test results in a report form to the County Inspector to demonstrate compliance with compaction requirements. The number of required tests shall not be construed as to be limited to one test per 1,000 linear feet. If additional testing or alternative test methods are required by other agencies involved in the project, such as VDOT, it shall be the contractor’s responsibility to satisfy all additional requirements. The contractor shall repair any settlement within the one-year guarantee period. The contractor shall make all necessary repairs and replacements within 30-days after notice from the KGCSA.

7. Sheeting, Shoring and Trench Boxes:

All excavations and other work requiring sheeting, shoring or trench boxes shall be performed in accordance with all Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees. The contractor is solely responsible for the safety and condition of all work. The contractor shall not proceed until the necessary trench boxes, sheeting, shoring and bracing have been properly installed. Shoring shall not be removed before a minimum of two-feet of backfill has been placed over the crown of the pipe and compacted to the required density. The contractor shall, at his own expense, protect from direct or indirect injury all personnel, pipes, tracks, walls, buildings, and other structures of property in the vicinity of his work, whether above or below the ground. All sheeting, shoring and bracing shall be removed by the contractor during backfilling operations unless otherwise approved by the design professional.

8. Unstable Subgrade:

In the event that unsuitable material is encountered at or below the level of the pipe bed, such material shall be removed and replaced, or removed, stabilized and replaced. Material used for replacement must be No. 57 course aggregate or other material specifically designated in writing by the design professional and approved by the County Engineer.

9. Overhead High Voltage Lines Safety Act:

The contractor shall comply with the provisions and requirements of the Overhead High Voltage Lines Safety Act (Title 59.1, Chapter 30 of the Code of Virginia) in performing work.

C. Pipe Installation - Water Mains:

1. Each joint of pipe shall be inspected for defects prior to being lowered into the trench. The pipe shall be swabbed or brushed out to insure that dirt or foreign materials do not get into the finished line. Trench water shall be kept out of the pipe and the pipe kept closed by means of a plug whenever work is not in progress. The pipe shall be handled carefully and in accordance with the manufacturer's instructions and recommendations.

2. Bell and spigot pipe shall be laid with spigot ends pointing in direction of flow.

3. Pipe installation shall commence immediately after the excavation is started, and every means must be used to keep pipe laying closely behind the trenching. Type III bedding, as a minimum, is required for flexible pipe. Additional bedding may be required, such as Type II for ductile iron and PVC C-900 pipe or Type IV for flexible pipe, depending upon soil conditions. Bedding requirements shall be specified on the drawings by the design professional.

4. Proper and suitable equipment and tools shall be used for the safe and convenient handling of pipe during installation. Special care shall be taken to insure that each length abuts the next in a manner that precludes shoulder unevenness of any kind.

5. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded the full length of its barrel. A pipe joint shall not be brought into position until the preceding length has been secured in place with sufficient backfill material to prevent movement of the pipeline.

6. Whenever a pipe requires cutting for the insertion of valves, fittings, closure pieces, or to bring it to the required location, the work shall be performed so as to leave the end smooth in accordance with the manufacturer's instructions or recommendations. A pipe damaged by the contractor in cutting shall be replaced at his expense.

7. All pipe laying and joining shall be performed in strict accordance with manufacturer's installation instructions.

8. Magnetic Detection: all pressurized underground utility lines shall have installed a continuous strip of identification tape within 18-inches of the ground surface; located over the centerline of the pipeline. PVC pipe shall have in addition to the tape a plastic coated ten (10) gauge solid copper clad wire attached to the pipe with plastic strapping. The wire shall terminate above ground at every valve box and air release valve. The wire shall be of sufficient length to allow the wire to be uncoiled and extended one (1) foot above the finished grade.

9. Thrust Restraint: all pipe fittings, bends, tees, and valves shall be properly restrained to resist thrust. Thrust restraint shall be designed utilizing standard engineering practice to meet the requirements of each installation considering parameters such as the pipe size, pressure, and soil conditions. The location and design of the pipe restraint shall be included on the plan and profile sheets; restrained sections of pipe shall be clearly identified by shading or other means on the drawings. All exposed piping, flanges, couplings, tie rods, nuts and bolts shall be given two coats of Koppers Bitumastic 50, or approved equal protective coating.

D. Pipe Testing -Water Mains:

1. All completed pressure lines and appurtenances shall be disinfected and pressure tested by the contractor in the presence of the County Inspector in accordance with the following procedure:

   a. The contractor shall provide the water, pressure gauges (measuring in maximum five pound per square inch (psi) increments), pumps and apparatus for testing. Gauges are subject to inspection and verification of accuracy on a dead weight tester. The contractor shall present documentation that the pressure gauges used for the test have been calibrated within six months prior to the test by an authorized testing facility. Prior to pressure testing, all joint restraint shall be installed and all air shall be expelled completely from the pipe, valves and hydrants.
   b. The newly laid pipe, or any valved section thereof, shall be slowly filled with water from an approved source. The pressure test shall be of two-hour minimum duration at a hydrostatic test pressure of

150 psi or 1.5 times the design operating pressure, whichever is greatest, measured at the highest point along the test section. The contractor shall ensure that all intermediate valves remain open during the test. Hydrostatic testing shall be performed in accordance with AWWA C600, Section 4.

c. The piping section shall be deemed as passing the test if there is no more than 5-psi change in the test pressure and does not exceed the allowable leakage.

d. A leakage test shall be conducted concurrently with the pressure test. The leakage allowance is the quantity of makeup water that must be supplied to maintain the test pressure. The allowable leakage shall be determined using the equation below:

$$\frac{L = SD(P)\ ½}{133{,}200}$$

Where:
L = allowable leakage, in gallons/hr.
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
(P) ½ = square root of average test pressure during leakage test, in psig

e. At the completion of the test, the pressure shall be bled to zero and test gauge verified as registering zero. Any cracked or defective pipe, fitting or valve discovered in consequence of testing shall be removed and replaced by the contractor with sound material in the manner specified. The test shall be repeated until a satisfactory rating is obtained.

f. Water for the pressure test shall be obtained through a fully valved manifold with an approved backflow perventer. If available, water for the first pressure test will be furnished by the KGCSA without charge to the contractor; the contractor will be charged for water for subsequent tests.

2. Flushing: all water mains shall be thoroughly flushed, using potable water prior to the introduction of disinfecting agents. The water mains shall be flushed at a velocity of 2-1/2 feet per second for a period sufficient to remove sediment and discolored water from the main. All valves and hydrants shall be operated and flushed.

3. Disinfection:

a. Disinfection of the main and appurtenances, and acceptable bacteriological tests received from a State certified laboratory, shall be completed before the pipeline is connected to the potable water distribution system.

b. All disinfection work shall be in accordance with AWWA C651, and as specified herein.

c. Chlorine shall be added to the water main at a constant rate, proportional to the water flow, so that the chlorine concentration in the water main is at least 50 mg/l (milligrams per liter). Chlorine may be liquid chlorine, sodium hypochlorite, or calcium hypochlorite.

d. The chlorinated water shall remain in the pipeline for at least 24 hours, after which time the residual chlorine content shall be at least 10 mg/l. All valves and appurtenances shall be operated while the heavily chlorinated water remains in the pipeline.

e. After the required retention time the heavily chlorinated water shall be flushed from the main using potable water. Flushing shall continue until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system.

f. Disposal of the heavily chlorinated water is the responsibility of the contractor and shall be performed in such a manner as to cause no damage to the environment. A reducing agent shall be applied to the disposed water to neutralize thoroughly the chlorine residual remaining in the water. Where necessary, federal, state, and local regulatory agencies shall be contacted to determine special provisions for the disposal of heavily chlorinated water.

g. Water samples shall be collected at a maximum of 2,000-foot intervals along the pipeline, and along each branch main. Two samples, collected 24-hours apart, shall be collected at each sampling point. Fire hydrants are not acceptable sampling points.

h. Chlorine residual measurements shall be taken and recorded at the time each sample is collected.

i. All samples shall be analyzed for the presence of coliform contamination by a State Certified Laboratory. The contractor is responsible for the cost of the tests.

j. If contamination is indicated the main shall be re-disinfected. This process shall continue until the results of the samples indicate no coliform contamination.

E. Valve - Installation:

1. Valves shall be set with the operating stem plumb in accordance with the Standard Details.

2. The top of the operating nut shall be not more than 48-inches below the top rim of the valve box frame (frame set to final grade). An approved valve stem extension shall be provided if required to comply with the 49-inch requirement.

3. Acceptable drainage shall be provided per Virginia *Waterworks Regulations* Section 12 VAC 5-590-1160. Such provisions and facilities shall not be connected to a sewer.

F. Hydrant - Installation:

1. Hydrants and hydrant branch valves shall be set plumb in accordance with the Standard Details.

2. Newly installed hydrants shall be covered with a bag, securely tied in place indicating that the hydrant is not usable.

3. Acceptable drainage shall be provided per Virginia *Waterworks Regulations* Section 12 VAC 5-590-1160. Such provisions and facilities shall not be connected to a sewer.

G. Pipe Installation - Casing Pipe:

1. The minimum cover for a bore and jack casing shall be 42-inches. The depth of cover must conform to that stated in Highway or Railway permits.

2. The casing excavation should not be more than one-inch greater than the casing's outside diameter. Should the casing excavation be more than one-inch larger than the outside diameter of the casing pipe, the void area shall be pressure grouted at the contractor's expense.

3. The contractor shall maintain the boring auger just far enough ahead of the casing being jacked to provide clearance for proper installation. The contractor shall provide a continuous operation until the casing is installed. The bore equipment shall be of adequate size and capacity to perform the work.

4. The elevation of the finished casing shall conform to the approved plans.

5. Welding shall be a full penetration circumferential weld performed by a qualified welder.

6. The jack pit and receiving pit shall be excavated in the location shown on the approved plans and be performed with a minimum of interference with or damage to the adjacent areas.

7. The jack pit shall be kept in a dewatered state throughout the duration of construction. When the work is completed the pits shall be closed by proper backfilling and compaction, and the disturbed areas shall be restored to original or better condition.

8. The contractor shall install sheeting, shoring and bracing as required to insure work area safety at all times.

9. Casing pipe size shall be as specified in Section II and shall be in accordance with the Standard Details.

H. Tapping Existing Mains Under Pressure:

1. The centerline of a tapping sleeve and valve shall be located a minimum of 3-1/2 feet from an existing pipe joint for 4 -inch through 8-inch diameter pipe and a minimum of 5-1/2 feet for 10-inch and larger diameter pipe.

2. In addition to pressure testing of newly installed pipelines, each tapping sleeve and valve assembly shall be tested prior to making the body of the sleeve, to a pressure of 150-psi, through the test plugs. If test plugs are not provided in the sleeve, a tapped mechanical joint plug shall be assembled to the valve for testing purposes. Pressure shall be maintained for a one-hour period without evidence of leakage. This test shall be witnessed by the County Inspector. A satisfactory test shall be completed before beginning the tapping operation.

I. Procedures for Cutting into or Repairing Water Mains:

1. When an existing main is opened, either by accident or repair, the excavation will be wet and may be contaminated. Liberal quantities of hypochlorite shall be applied to the open trench areas.

2. Once the trench has been dewatered and repairs begin, all pipe, couplings, sleeves, and associated appurtenances shall be swabbed or sprayed with a 5-percent hypochlorite solution before they are installed. No. 57 stone shall be applied to the bottom of the trench to provide footing for repair crews. Upon completion of repairs, flushing from hydrants or other means shall take place toward the work location from both directions if possible. Flushing shall take place immediately after repairs are completed and shall continue until all discolored water and air is eliminated.

3. Where practical, in addition to the procedures above, a section of main in which the break can be isolated without interrupting service to customers, the section shall be flushed with a 300 mg/l chlorine solution with a contact time of 15-minutes. This shall be accomplished by placing hypochlorite granules into the upstream end of where the repair is taking place.

After the repair is completed, the upstream valve shall be opened only long enough to fill the main. Once the 15-minute contact time has taken place, the main shall be thoroughly flushed until all discolored water and air is removed and the chlorine residual is less than 2 mg/l. Flushing shall take place in such a way as to prevent discolored and heavily chlorinated water from being pushed out into the system.

J. Pump and Well Facilities:

1. Detailed plans and specifications of pump and well facilities shall be reviewed and approved in writing by the County Engineer, KGCSA and VDH prior to the start of construction. Prior to the contractor commencing construction, the professional design engineer shall provide the KGCSA with a copy of the Certificate to Construct issued by the VDH. In addition, changes to any previously approved plans and specifications shall be approved in writing by the County Engineer prior to initiating the work.

2. Pump and well facilities shall be constructed under the supervision of the professional design engineer who prepared the plans and specifications. All structural, electrical, mechanical and other work shall be conducted in strict accordance with all applicable codes, laws and regulations.

3. A minimum of two-weeks prior to final inspection of the pump and well facility, two-copies of the Operation and Maintenance manual shall be submitted to the KGCSA and two-copies shall be submitted to VDH. The format and content shall be as required in Section IV of this document.

4. Upon completion of construction, the KGCSA and VDH will inspect the facility. A test run shall demonstrate that the performance requirements of all components have been met by the equipment as installed and shall include, but not be limited to, the following tests:

    a. That all units have been properly installed.
    b. That the units operate without overheating or overloading any parts and without objectionable vibration.
    c. That there are no mechanical defects in any of the parts.
    d. That the pumps can deliver the specified pressure and quantity.
    e. That the level controls work as designed.
    f. That the pump controls perform satisfactorily.
    g. That the generator and transfer switch operate automatically in a satisfactory manner.
    h. That the alarm system operates satisfactorily.

5. The professional design engineer shall certify to the KGCSA and VDH that the project has been completed in accordance with approved plans and

specifications and in accordance with these Standards and the Waterworks Regulations. Prior to the KGCSA accepting the facility, the professional design engineer shall obtain a Certificate to Operate from the approving agency.

6. As more fully specified in Section IV of these Standards, the professional design engineer shall develop and certify a set of as-built drawings for the station and the associated piping. These drawings shall be submitted to and approved by the KGCSA as part of the acceptance process for the facility. The KGCSA reserves the right to reject any facility in the event that construction was not in accordance with the approved plans and specifications.

7. As more fully specified in Section IV of these Standards, a guarantee of materials, equipment and workmanship for a period of one-year from the date of acceptance by the General Manager will be required from the contractor and/or developer for stations to be owned by, or dedicated to, the KGCSA.

9. Well Drilling:

   a. Well drilling shall be in accordance with the Waterworks Regulations for Class I wells.
   b. The contractor shall drill until a desirable yield is achieved. The well shall be plumb and in alignment. The contractor shall test the plumbness by lowering a section of pipe 40-feet long to the lowest anticipated pump setting. The outer diameter of the plumb shall not be more than ½-inch smaller than the part of the casing or hole being tested.
   c. Wells shall be drilled and cased to a depth sufficient to exclude undesirable ground water and in no case shall the casing be less than 100-feet in length. The diameter of the borehole to the depth required above shall be at least 3-inches greater than the outside diameter of the couplings of the casing to be used. Casing shall be fitted with guides to ensure a minimum thickness of grout of 1.5-inches over the casing and fittings.
   d. Formation samples shall be taken at a maximum interval of 10-feet and at each change in formation. Samples shall be dried and preserved in separate containers of at least one-pound capacity. Containers shall be plainly marked with well designation, purchaser, location, depth interval, sampling method, and date and time the samples was taken.
   e. A stratigraphic log shall be prepared to accompany the set of drilling samples, noting (1) depth; (2) strata thickness; (3) lithology, including size, range, and shape of constituent particles, as well as smoothness, and rate of penetration.

f. The contractor shall maintain a complete drilling log to include: reference point of all depth measurements, depth at which each change in information occurs, depth at which the first water was encountered, location and thickness of each aquifer, identification of the stratigraphy and lithology encountered in the borehole, depth interval from which each water and formation sample was taken, depth for each borehole diameter, depth to static water level and observable changes in static water level with well depth, total depth of completed well, location limits of lost circulation zones, depth of surface seal, nominal borehole diameter of well, quantity and type of grout installed, information on well casing material, information of well screen material, location of seals, and time log showing rate of penetration.

g. An electric lot shall be collected from the open boreholes to determine the most productive water bearing zones. The electric log, at a minimum, should determine and illustrate the following: Spontaneous Potential (SP), Resistivity (Normal) and Resistivity (Lateral).

h. Wells shall be gravel-packed. Gravel pack materials and methods of placement will be determined on a site specific basis. The gravel-pack materials and the thickness of the gravel pack shall be based on the available information (usually between 3-inches and 12-inches thickness). Gravel-pack shall consist of clean, washed, graded material. The gravel-pack shall be chlorinated to 400 mg/l residual. Gravel-pack shall be placed in the annular space adjacent to the well screens and shall extend above the screen at least 20-feet.

i. Grout shall be installed by pressure pipe through a tremie pipe, from the bottom of the annular opening upward in one continuous operation until the annular opening if filled. The minimum depth of grouting is 100-feet. The minimum thickness shall not be less than 3-inches in radial thickness.

j. Well screens (and fittings) shall be stainless steel. The well screen opening size shall be determined based upon graduation (sieve) analysis on at least three cutting samples from the formation intervals to be screened. The diameter of the selected well screen shall be the minimum size permitted that will maintain a vertical velocity within the screen barrel of not greater than 4 feet per second, based on the maximum well flow in gallons per minute. The total aperture size shall be that which will result in entrance velocities equal to or less than 1.5 feet per second. The bottom of the deepest screen shall be sealed by a threaded or welded stainless steel plate or a self-closing valve covered by a cement plug at least 1-foot in depth.

10. Well Development:

a. Well development consists of the application of appropriate techniques designed to bring the well to its maximum discharge capacity with

attendant optimization of well efficiency, specific capacity, stabilization of aquifer material, and control of sand and suspended solids. Development will likely be by jet washing and air lifting.

b. Water developed from the completed wells shall be sand free.

c. The well shall be pump tested following development. The test pump shall have sufficient capacity and be set at the maximum depth feasible to obtain the highest yield from the well, but with throttling arrangement so that discharge can be throttled to 25-percent of the maximum. The pumping unit shall be complete with prime mover of being operated without interruption for a period of 72-hours. All water being discharged during development and testing shall be dechlorinated and shall pass through an appropriate filtering sediment system prior to discharge into open waterways.

d. Adequate and accurate records shall be kept during the test to establish the stabilized water level at various pumping rates and at the termination of the test, the rate and amount of recovery.

e. The test shall be conducted for a minimum of 48-hours and the recovery period shall last for a period of time dictated by the well. Testing shall be extended as required to obtain reliable data as directed by the design professional. A step test shall be performed to allow the evaluation of drawdown at different pumping rates.

f. Separate water samples shall be collected near the completion of the drawdown test. The number and frequency of samples collected shall be in accordance with the Waterworks Regulations. The samples shall be collected in containers provided by the Virginia Department of Health and submitted to them or a State approved laboratory for chemical, radiological, metals, VOC, and bacteriological analysis in accordance with the Waterworks Regulations.

g. After the well has been tested, it shall be thoroughly cleaned of all foreign substances, including tools, timbers, rope, debris of any kind, cement, oil, grease, joint dope, and scum.

h. Following cleaning, the well shall be disinfected. The chlorine solution shall be of such volume and strength and shall be so applied that a concentration of at least 50 mg/l of chlorine shall be obtained in all parts of the well. The chlorine solution shall remain in the well for a minimum of 2-hours. After the chlorine solution is discharged from the well, samples shall be collected for bacteriological analysis. A series of nine (9) consecutive negative samples is required.

i. The contractor shall protect the well at all times in such a manner as to prevent either tampering with the well or entrance of foreign matter into it. Upon completion of the well, the contractor shall provide and set a threaded, flanged or welded cap or sanitary seal.

j. The top of the casing and cap shall extend a minimum of 24-inches above grade and a minimum of 24-inches above the 100-year flood level. A properly screened vent with the end elbowed downward shall be provided for the well casing.

k. The well casing shall be equipped with a drawdown gauge, airline, and appurtenances for measuring the change in the elevation of the water level in the well.

SECTION IV
SUBMITTALS

A. General Requirements:

1. Detailed utility design calculations, flow projections, impact analysis, and plans and specifications are to be submitted to County Engineer and the KGCSA through the Department of Community Development. The costs for review of designs, calculations, plans and specifications shall be as stipulated in the King George County Code and/or the KGCSA Regulations. All drawings, specifications, engineer's reports and other documents shall be prepared by or under the supervision of appropriately licensed professionals, legally qualified to practice in Virginia. The design professional shall also submit documents to the Virginia Department of Health when required in accordance with the Waterworks Regulations. The Water Distribution System Data Sheet (Appendix 2) and Project Approval Report (Appendix 3) shall be included in the submittal. The General Manager will review and forward the completed Project Approval Report to VDH upon approval of the project by the KGCSA.

2. Changes to any previously approved plan or specification shall require prior approval by the County Engineer, KGCSA and state agencies affected by those changes. Adequate copies of the plans showing proposed changes shall be submitted.

3. Utility plans shall contain a title sheet showing a vicinity map and an index of the construction sheets. An overview map (scale 1 inch = 200 feet) shall be provided that includes the system being constructed, street layout and names, pipe size, valve and hydrant locations, flow direction, drainage facilities, water mains and manholes. Plan sheets shall be twenty-four inches high by thirty-six inches long. Margins shall be one-half (1/2) inch top and bottom, three-quarter (3/4) inch on the right side and one and three-quarter (1-3/4) inch on the left side. A standard title block shall be located in the lower right hand corner of each sheet and shall bear the same general title identifying the overall project, and shall be numbered. All other requirements of the Virginia Department of Health and the King George County Zoning Ordinance for preparation and submission of development plans shall be satisfied.

4. The General Manager will authorize formal acceptance of the water system for operation and maintenance after all requirements of these Standards and the Regulations have been met and a Certificate to Operate has been issued by the KGCSA and/or the Virginia Department of Health.

B. Water Systems:

1. The minimum horizontal scale for water line plans shall be no less than one inch equals fifty feet (1 inch = 50 feet). Scale factors less than the minimum may be approved by the County Engineer for projects that require greater detail. The vertical scale shall be proportional to the horizontal scale. Single or double cycle plan profile sheets may be used. The location of the water main shall be shown on the upper half of the drawing with the water profile and ground elevation shown on the lower half of the plan.

2. For public water systems, all pipes, types of material, horizontal bends, vertical offsets, valves, hydrants, ends of line, meter boxes and other fittings shall be shown in plan and profile views. Water service lines and meter boxes shall be provided to all lots.

3. The plans shall show the location of all road rights-of-way, KGCSA easements (existing and proposed), property boundaries, houses or other structures. New developments shall show all proposed utility placement so as to show the effect, if any, upon utilities and easements that are to be dedicated to the KGCSA. Designs shall endeavor to keep other public utilities out of KGCSA easements.

C. Pump and Well Facilities:

1. Pump and well facilities that are constructed within King George County for dedication to the KGCSA shall be reviewed and approved prior to construction. Two (2) complete sets of plans and specifications shall be submitted to the KGCSA for review. These documents shall also be submitted to the VDH by the design professional engineer for compliance with State regulations and shall be approved by VDH prior to commencement of construction and prior to formal acceptance by the KGCSA. The design professional engineer's submittal shall include an evaluation of the adequacy of existing water system and shall also include a map showing the extent of the proposed service area. In addition, the submittal shall describe the proposed water supply source and shall include an evaluation of impact of the water withdrawal on the water supply source, including impacts to other users of the water supply source.

2. Plans: Pump and well facility plan sets shall contain the following:

   a. Title sheet: All well and pump facility plan sets shall contain a title sheet with the following:

      ( ) Project name or designation
      ( ) Sheet index
      ( ) Project vicinity map
      ( ) Project service area

( ) Project owner
( ) Professional engineer seal

b. Site plan: All pump and well facility plan sets shall contain a site plan with the following:

( ) North arrow
( ) Bench mark
( ) Locations of existing utilities
( ) Locations of all easements
( ) Scale identified
( ) Erosion control measures
( ) Existing and final topography
( ) Well and pump facility landscaping
( ) Well and pump facility fence location
( ) Site drainage and topography
( ) 100-year flood elevation, if applicable
( ) Other requirements of the County Zoning Ordinance
( ) Stream crossings
( ) Schematic drawing of well construction, showing diameter and depth of drillhole, casing diameter and depth, grouting depths, elevations and designation of geological formations, water levels and other details to describe the proposed well completely.
( ) Location of sources of pollution within 250-feet of drilled wells and within 100-feet of treated water storage facilities.
( ) Dedicated well lot (with recorded dedication document)

c. Construction plans and details shall be clearly and neatly drawn with proper identification, dimensions, material and other information necessary to insure the desired construction, to include:

( ) Proposed equipment layout
( ) Elevation of operating levels and alarms
( ) soil boring information
( ) plan and elevation views of the station and piping showing all valves and appurtenances.
( ) Schematic flow diagrams
( ) Location of chemical feed equipment and points of chemical application
( ) Location, dimensions and elevations of all proposed equipment.
( ) HVAC and ventilation.
( ) Chemical storage and chemical feed.

2. Specifications shall typically be of the Construction Specification Institute (CSI) format and contain technical data on the following:

   a. Projected flow rate/existing and future head conditions.
   b. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on eight and one-half (8½) inch by eleven (11) inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves will not be acceptable.
   c. Other pertinent engineering data.
   d. All construction information not shown on the drawings which is necessary to inform the contractor in detail of the requirements as to quality of materials and workmanship and fabrication of the project; the type, size, strength, operating characteristics and rating of equipment including machinery, pumps, tanks, filters, valves, piping and joining of pipe; electrical apparatus, wiring, operating tools, construction materials, miscellaneous appurtenances, and operating, testing and maintenance instructions.

3. Operation and Maintenance Manuals for Well and Pump Facilities:

   a. The contractor shall furnish four (4) copies of a loose-leaf type manual that contains complete operation and maintenance instructions for the following equipment (2 copies to VDH and 2 copies to the KGCSA):

      1) Control System
      2) Air Compressor
      3) Booster and Well Pumps, Including Pump Curves
      4) Electric Motors
      5). Generator Set, Including Transfer Switch Wiring Diagrams
      6) Alarm Systems
      7). Check Valves
      8) Gate Valves
      9) Unit Heaters
      10) Lights
      11) Water Treatment Equipment
      12) Metering equipment
      13) Water Storage Tanks
      14) Level Controls
      15) RTU

b. The manual shall include model numbers, a complete parts list and the names and addresses of applicable subcontractors, suppliers, and manufacturers.
c. A Schedule of Values of major well and pump facility items shall be included in the submittal.
d. The manual shall be in conformance with the Waterworks Regulations.

D. Water Treatment Facilities:

The design and construction of water treatment facilities shall be in compliance with the Waterworks Regulations and these Standards.

E. As-Built Drawings:

1. **PRIOR TO THE INSPECTION** of sewer, water, or drainage improvements by the County Inspector, the professional design engineer or surveyor shall submit two (2) preliminary paper copies of as-builts for the project to the County Inspector. The County Inspector will distribute the as-builts to the KGCSA and coordinate the review and approval of the as-builts. Copies should be submitted as soon as possible to facilitate a prompt acceptance process. The developer will be allowed no more than five (5) connections to the newly installed utility prior to the submittal of final as-built drawings and acceptance by the KGCSA. The remaining connections will be allowed only after the developer has completed item E.2 below. If there are ten (10) or less connections resulting from the new development, the developer shall complete item E.2 below before any connection will be permitted.

2. Upon approval of the preliminary as-builts, the developer shall:

a. Submit a letter requesting the General Manager to accept the project. The letter shall include the costs associated with installing the water system, both on-site and off-site if necessary. A one (1) year letter of warranty shall accompany the letter.
b. Through the design professional, submit one (1) reproducible mylar drawing and two (2) complete sets of prints for the entire project.

3. The following are minimum requirements for water system as-builts:

a. The name of the development.
b. The size of the as-built sheet shall be 24 inch x 36 inch and shall have a thickness of 0.003 mil (final reproducible). The original construction plan drawings may be modified in that design parameters can be erased and "as-built" information incorporated.

c. A certification statement prepared by the design professional shall be included on the as-built as follows:

"The sanitary sewer, water, and drainage structure locations and grades shown on these drawings, are accurate and complete to the best of my knowledge and belief and I certify that I, or my agent, have made sufficient inspections to ensure the accuracy of this statement."

d. The name of the professional engineer or surveyor along with his or her seal (King George County will only accept flow calculations from surveyors with parts A & B licenses).
e. Show lot numbers and property lines (and addresses if available).
f. Show drainage and utility easements with the deed book and page of recordation. (on-site and off-site if necessary).
g. Indicate bench mark(s) used and the description.

4. In addition to the requirements outlined above, the following information shall be included on water main as-builts:

a. The length, type and size of water lines are required. Note: If the water flows differ from the requirements of these Standards or the Virginia Department of Health, then a flow certification by the professional engineer or surveyor will be required and drafted on the as-builts.
b. Valves and hydrants shall be numbered and measurements given between valves and hydrants using continuous stationing running from downstream to upstream. All measurements shall be taken from the center of the valve cover or hydrant.
c. Except in a cul-de-sac, water meter box locations shall be measured using continuous stations and off-set from the center line of the water main. Water meters in cul-de-sacs shall use continuous stationing along the end main line alignment providing an offset distance from this stationing and the actual water service line length. The following information shall be provided for each water service line:

1) Run Up (RU) = The horizontal measurement of the actual meter box (right or left).
2) Height (Ht) = The distance measurement at 90 degrees offset from the main line to the end of the actual meter box.
3) Depth (D) = The depth of the water service line at the property line (minimum shall be 42-inches).
4) Corp. = The station location of the corporation stop (for water mains).

5) All horizontal bends, vertical offsets, valves, hydrants, ends of all lines, and other fittings shall be accurately located on the as-built by triangulation from two permanent structures, which will be visible on the ground surface.

d. Show significant physical conflicts with the mainline, in relation to other utilities.
e. Identify and label all existing utilities affecting respective project.

5. In addition to the requirements outlined above, the following information shall be included on Well and Pump Facility as-builts:

a. Number of homes to be served and total number of homes capable of being served.
b. Internal piping and electrical and mechanical layout with sizes, material, concealed utilities, and measurements from the structure.
c. Architectural drawing of the structure showing dimensional changes to sizes and materials.
d. Dimensioned site plan showing easements, deed/plat book and page number of recordation, station external piping, driveway, landscaping and drainage as situated on the plans.
e. All pump criteria as to present an ultimate capacity, head conditions, RPM's, impeller size, pump type and motor size.
f. Well and storage tanks.

6. An "as-built" checklist is provided in Appendix D.
7. Construction record information shall conform to the tolerances listed in the table below:

INFORMATION ACCURACY

	SURVEY	CONSTRUCTION	CONSTRUCTION TOLLERANCE
Manhole Rim & Invert	X		± .05 ft.
Manhole Location	X		± 1.0 ft.
Fire Hydrant Location	X		± 1.0 ft.
Valve Location	X		± 1.0 ft.
Fitting Location		X	± 1.0 ft.
Offset Location		X	± 3.0 ft.
Lateral Location		X	± 1.0 ft.
Corp. Stop Location		X	± 1.0 ft.
Meter Location	X		± 1.0 ft.
Blowoff, Air Vent Location	X		± 1.0 ft.
Pressure Pipe Location		X	± 1.0 ft.
Pressure Pipe Depth		X	± 6.0 in.

Pump Station Elevations	X		± .05 ft.
Pump Station Other		X	± 1.0 in.

F. Guarantee and Warranty:

1. The developer shall submit a letter requesting the General Manager to accept the public facilities for use by the KGCSA. Accompanying this letter shall be a final quantity take-off and a one-year letter of warranty containing the following verbiage:

> "On _____, 20___, we submitted to you the manufacturer's warranties relative to _____ (project). This firm hereby agrees to be responsible for performance in connection with all of the guarantees provided under these warranties. Additionally, this firm hereby warrants, for the period of one (1) year after acceptance of the project, all materials, equipment, and workmanship associated with the project. Additionally, this firm does hereby agree to conform in all respects to the requirements of KGCSA Regulations."

2. Water systems to be owned by, or which will be dedicated to, the KGCSA shall be guaranteed by the developer or contractor for a period of one (1) year after the date of formal acceptance by the General Manager. The guarantee shall cover all materials, equipment and workmanship and shall commence on the date that the facilities are accepted by the General Manager.

3. Should any item of equipment malfunction within the year of guarantee, the developer or contractor shall, at its own expense, renew or replace it, or do whatever is necessary to remedy the fault. The developer or contractor shall, during the same one-year period, repair promptly at its own expense all breaks or failures due to faulty material or workmanship.

4. In addition to the above stated one (1) year guarantee, the developer or contractor shall, for all equipment installed for which the manufacturer thereof has a standard guarantee in excess of one-year, furnish to the KGCSA all the necessary warranties to properly guarantee such equipment by the manufacturer for the standard term of the manufacturer's guarantee. The warranty period will not commence until the facility is formally accepted by the General Manager.

5. The above warranty shall be secured by a Virginia surety bond or letter of credit as specified in the Regulations.

APPENDIX 1

KING GEORGE COUNTY SERVICE AUTHORITY
CERTIFICATE TO CONSTRUCT WATER FACILITIES

_____is hereby granted a Certificate to Construct Water Facilities in accordance with the King George County Service Authority (KGCSA) Regulations, as amended by the KGCSA Board of Directors. Water system construction is to be in accordance with the provisions of the KGCSA Water Distribution System Standards and Specifications, the Commonwealth of Virginia Waterworks Regulations, the Occupational Safety and Health Standards, and the KGCSA Regulations.

This certificate is valid from the date of issue for a period not to exceed one (1) year and is subject to revocation for non-compliance with the above requirements. Any changes in these approved plans require notification to, and approval by, the General Manager and the County Engineer.

A pre-construction meeting is required before any water system work is started. The required pre-construction meeting must be conducted at least two (2) weeks (14 days) lead time prior to the ordering of materials. Additionally, the contractor shall notify the County Inspector a minimum of 48 hours prior to beginning any water facilities construction or testing to ensure that an inspector will be available.

LOCATION AND DESCRIPTION

Plan approved on: _____ Name of Project: _____

Plan dated: _____ Location: _____

Design Engineer: _____ Contractor: _____

APPROVED: _____ APPROVED: _____
County Engineer General Manager

Certificate Number: _____

Date: _____

APPENDIX 2

WATER DISTRIBUTION SYSTEM DATA SHEET

Date: _____

1. Project Name: _____
2. Project Location: _____
3. Water Service Area: _____
4. Design Engineer: _____
5. Number of Connections: _____
6. Projected Max. Hour Domestic Demand: _____
7. Projected Design Flow (fire + peak. day domestic): _____
8. Projected Peak Daily Flow: _____
9. Source of Water: _____
10. Water System Piping:

Diameter (inches)	Pipe System	Length (Feet)	Material (PVC,DI, etc)

11. Number of Hydrants: _____
12. Number of Valves: _____
13. Number of Water Service Connections: _____
14. Size of Water Meter Required (other than residential): _____

APPENDIX 3

PROJECT APPROVAL REPORT

Date: _____

Memorandum to: Hugh J. Eggborn, P.E., Field Director
Culpepper Field Office Director
Office of Drinking Water

From: _____
General Manager – King George County Service Authority

Subject: Waterline Project Report

Reference: Memorandum of Understanding, Local Review Program

Project Name: _____
Project Location: _____
Plans Prepared by: _____
Projected Construction Date: _____
Pipe: Size _____ Length_____ Material _____

Water Source: _____

Average Production for Last Three Months: _____

Maximum Daily Demand: _____

Water Storage: Existing Capacity - _____MG
Tank to Serve this Area - _____Ft
Tank to Overflow Elevation - _____ Ft
Tank Bottom Elevation - _____ Ft

Existing Service Area Evaluation After New Project Added:
Minimum Pressure - _____ psi
Maximum Pressure - _____ psi
Minimum Fire Flow Provided - _____ gpm

Hydraulic Capacity and Design: Pressures – Minimum _____ psi
Maximum _____ psi
Using Tank at _____
Fire Flow Provided _____

Number of Connections:		Average Daily Usage:	
Domestic	_____	Usage _____	gpd
Commercial	_____	Usage _____	gpd
Industrial	_____	Usage _____	gpd
Other (Identify)	_____	Usage _____	gpd
Total	_____	Total _____	gpd

APPENDIX 4

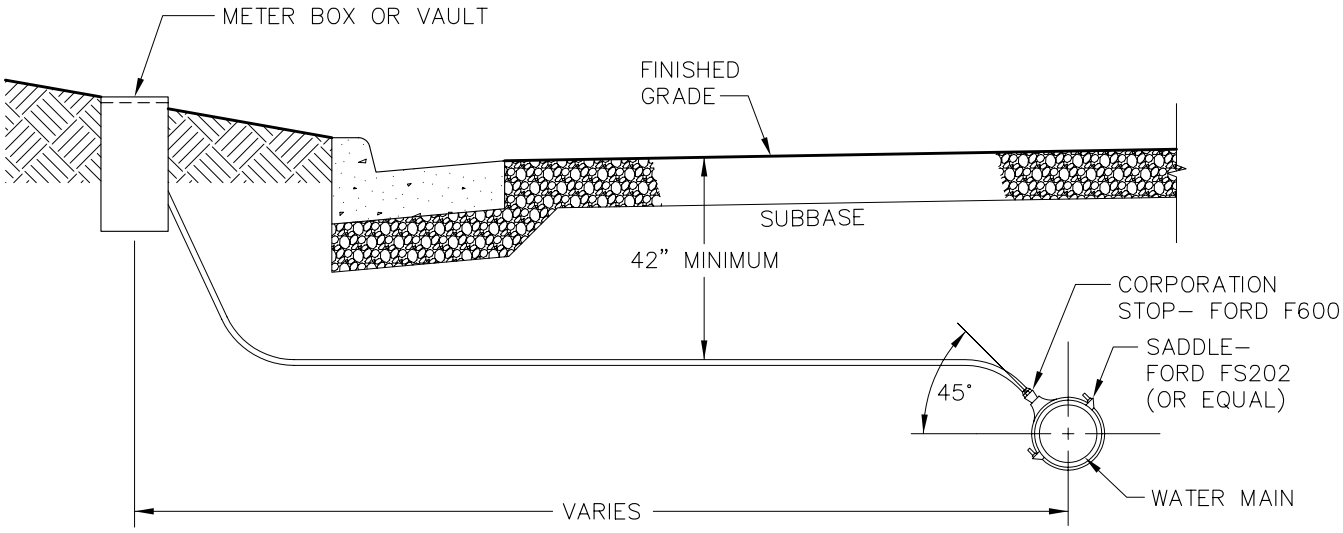
KING GEORGE COUNTY SERVICE AUTHORITY

GENERAL NOTES – WATER SYSTEMS
(to be placed on construction drawings)

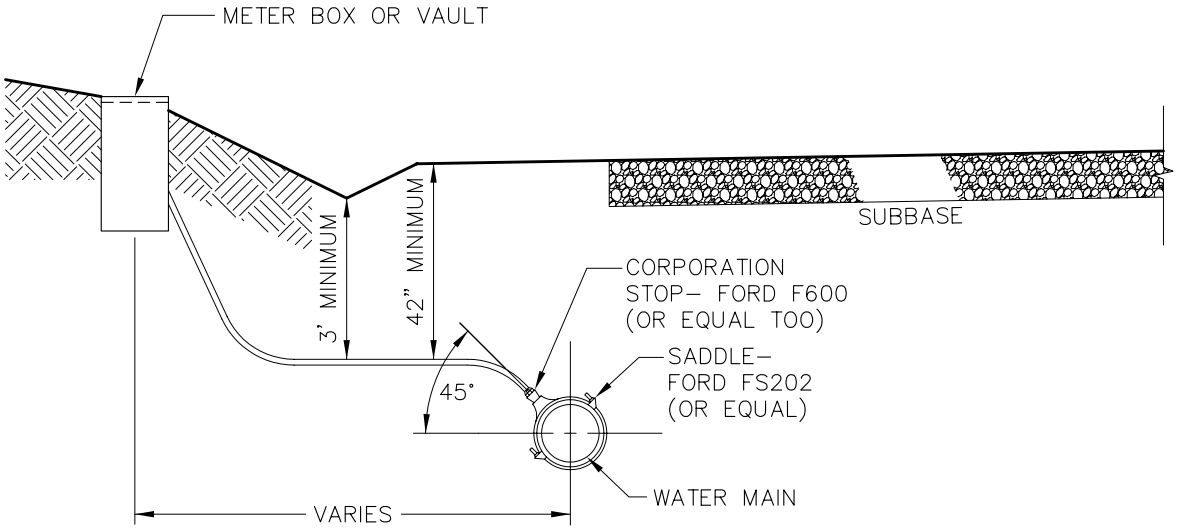
1. All components of water system shall be installed and tested in accordance with the latest edition of the King George County Service Authority (KGCSA) Standards and Specifications for Water Distribution Systems, the Virginia Department of Health Waterworks Regulations, the Virginia Erosion and Sediment Control Manual and the VDOT Road and Bridge Specifications. The contractor shall contact all agencies prior to commencement of construction.
2. The contractor shall submit a list of materials for approval to the County Inspector prior to commencement of construction.
3. The contractor shall contact the County Inspector a minimum of 2 days prior to commencement of construction to schedule a pre-construction meeting.
4. The contractor shall notify Miss Utility (800-552-7001) a minimum of 72 hours prior to commencement of construction.
5. The contractor shall obtain all permits required for construction, including a business license to perform work in King George County.
6. All erosion and sediment control requirements shall be installed and maintained during water system construction.
7. Prior to the inspection of the water improvements, the developer's representative shall submit as-built drawings to the County Inspector. Occupancy Permits will not be issued by the County Department of Community Development until all inspections and tests have been satisfactorily completed, and as-built drawings have been approved by the KGCSA.
8. Routine periodic inspections will be made by the County and KGCSA during construction. These inspections do not relieve the developer from its obligation and responsibility for constructing a water system in strict accordance with the standards and specifications of the KGCSA and the Virginia Department of Health.
9. Any changes to the final plans and specifications shall be approved by the County and KGCSA and shall be accurately indicated on the as-built drawings.
10. All lots shall be provided with water service connections. The connections shall be installed in accordance with the KGCSA Standard Details.
11. The developer shall submit water data sheets and shall obtain a Certificate to Construct prior to commencement of construction.
12. The contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. The contractor shall erect, and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection. The contractor is solely responsible for all job site safety.
13. The contractor shall comply with all provisions and requirements of the Overhead High Voltage Line Safety Act of the Code of Virginia.
14. For construction activities in existing developed areas, the contractor shall maintain access for mail and paper delivery vehicles, school buses, emergency vehicles, trash collection, and homeowners through construction. Disturbed mail and paper boxes and driveways shall be repaired and/or restored the same day.

APPENDIX 5

King George County Service Authority
Detail Sheet Index



CURB AND GUTTER



DITCH

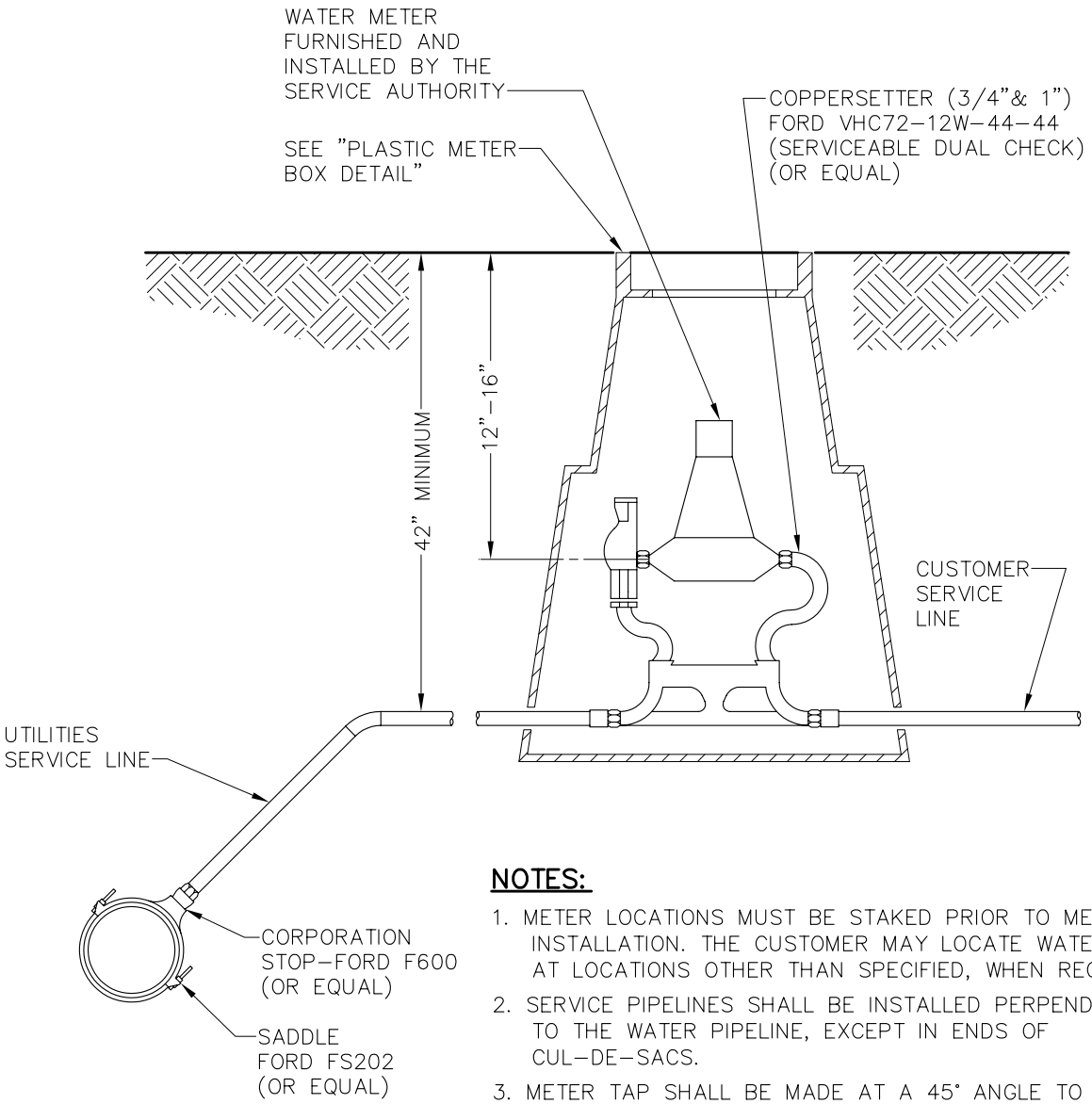
NOTES:

1. 3/4" SERVICE LINE IS MINIMUM. 3/4" AND 1" SERVICE LINES SHALL BE TYPE K SOFT COPPER, 1 1/2" AND 2" SERVICE LINES SHALL BE TYPE K HARD COPPER.
2. METER BOXES SHALL BE LOCATED BEYOND THE RIGHT–OF–WAY WHEN REQUIRED TO PLACE BOXES ON RELATIVELY FLAT SLOPES.
3. SADDLES SHALL BE USED ON PVC PIPE.
4. ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

TYPICAL WATER SERVICE CONNECTIONS

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02–27–06
DETAIL NO: W–1



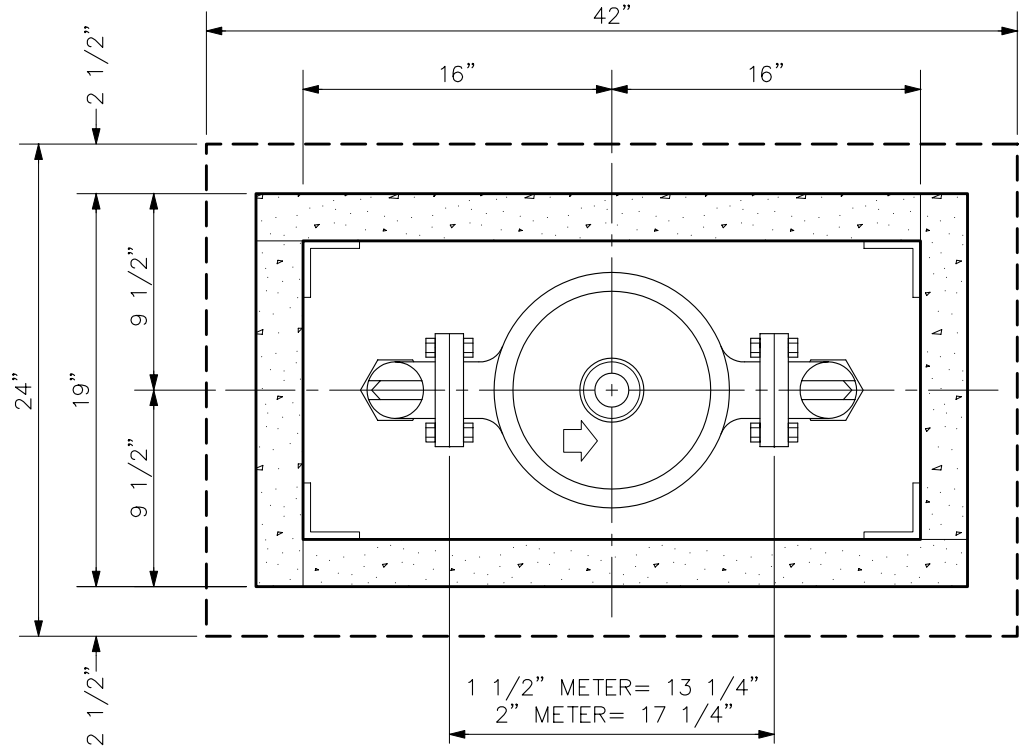
NOTES:

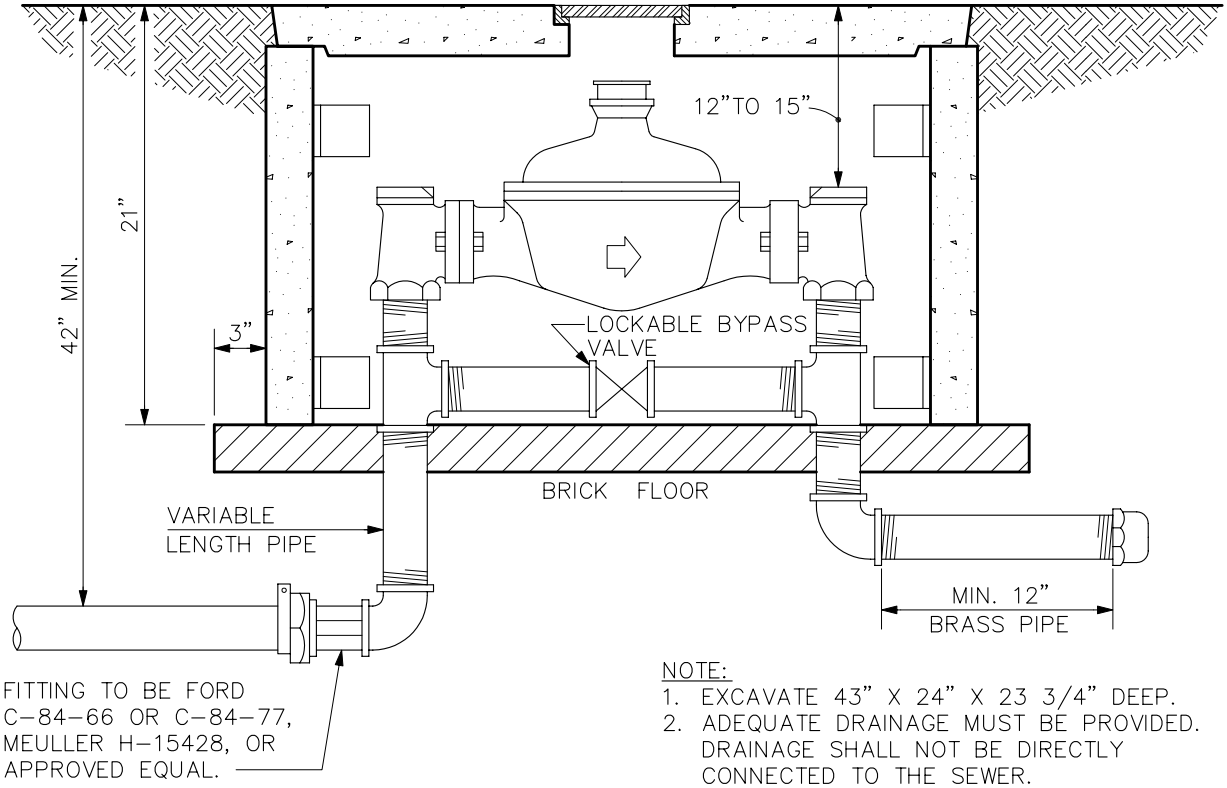
1. METER LOCATIONS MUST BE STAKED PRIOR TO METER INSTALLATION. THE CUSTOMER MAY LOCATE WATER METERS AT LOCATIONS OTHER THAN SPECIFIED, WHEN REQUESTED.
2. SERVICE PIPELINES SHALL BE INSTALLED PERPENDICULAR TO THE WATER PIPELINE, EXCEPT IN ENDS OF CUL-DE-SACS.
3. METER TAP SHALL BE MADE AT A 45° ANGLE TO THE WATER PIPELINE.
4. METERS SHALL BE LOCATED IN NON-TRAFFIC AREAS. METER RELOCATIONS FROM TRAFFIC AREAS SHALL BE AT CUSTOMER COST.
5. TAPS SHALL BE A MINIMUM OF 18" FROM PIPE JOINTS AND FROM THE NEAREST TAP.
6. WATER METERS SHALL BE LOCATED AT A MINIMUM DISTANCE OF 18" FROM THE EDGE OF DRIVEWAYS.
7. WATER METER BOXES SHALL BE NNWW NO. 1 OR NO. 2 OR APPROVED EQUAL.
8. ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

5/8" TO 1"
METER SETTING

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-27-06
DETAIL NO: W-2



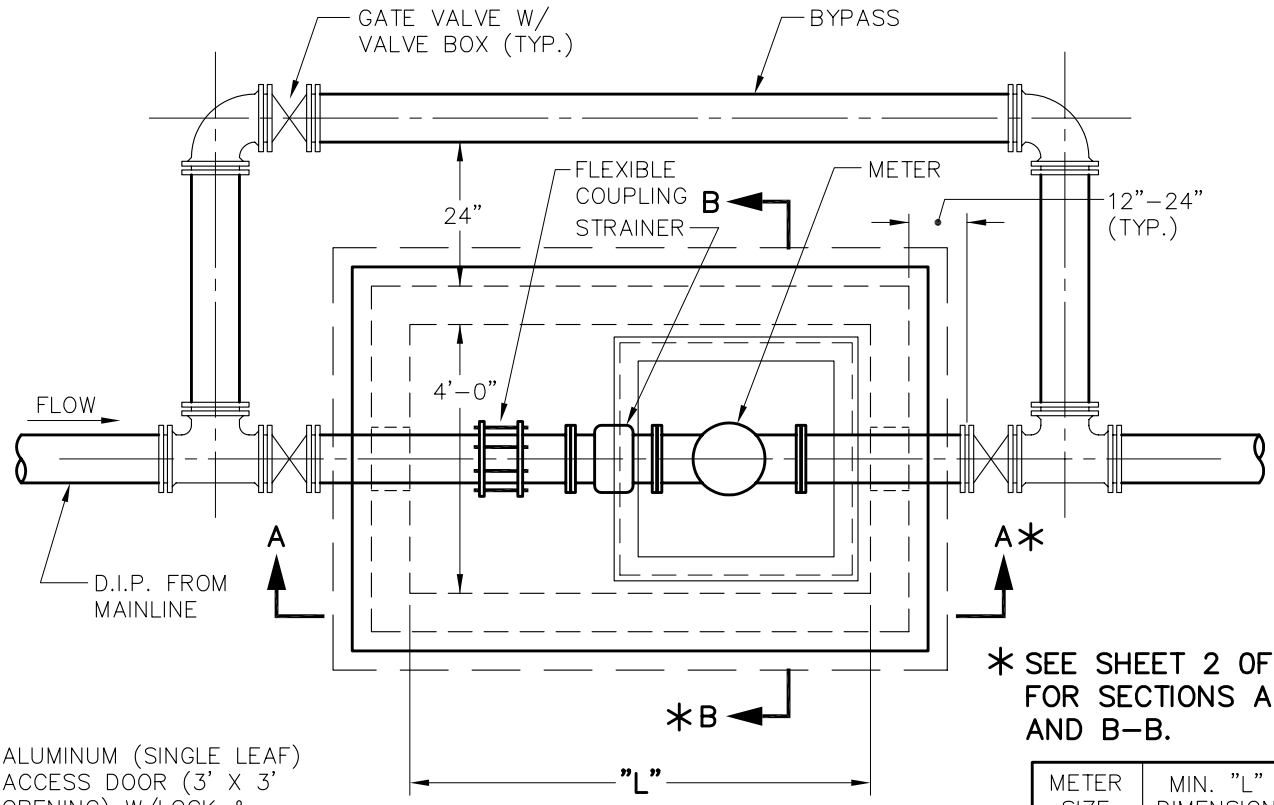


NOTE:
1. EXCAVATE 43" X 24" X 23 3/4" DEEP.
2. ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

1 1/2" OR 2" DISC METER SETTINGS

KING GEORGE COUNTY SERVICE AUTHORITY

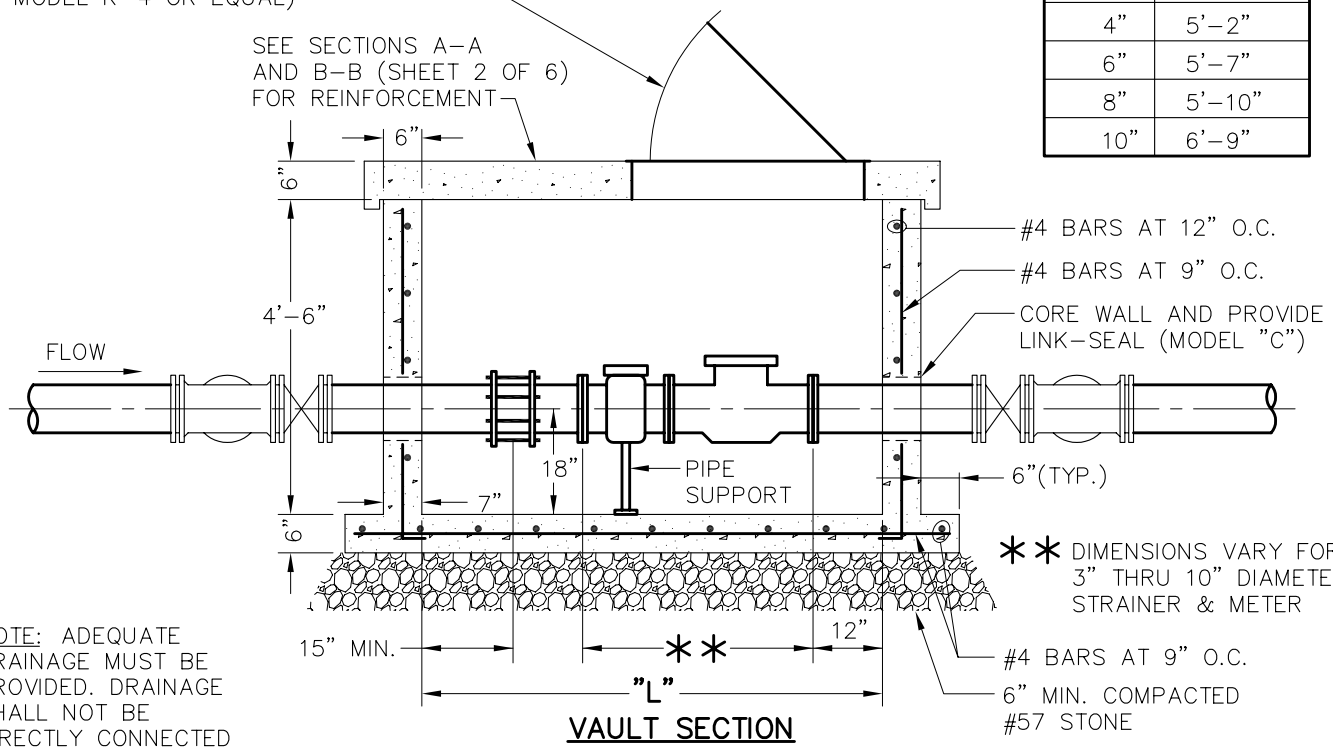
SCALE: NOT TO SCALE
DATE: 02-27-06
DETAIL NO: W-3



VAULT PLAN

* SEE SHEET 2 OF 6 FOR SECTIONS A–A AND B–B.

METER SIZE	MIN. "L" DIMENSION
3"	4'–10"
4"	5'–2"
6"	5'–7"
8"	5'–10"
10"	6'–9"



VAULT SECTION

NOTE: ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

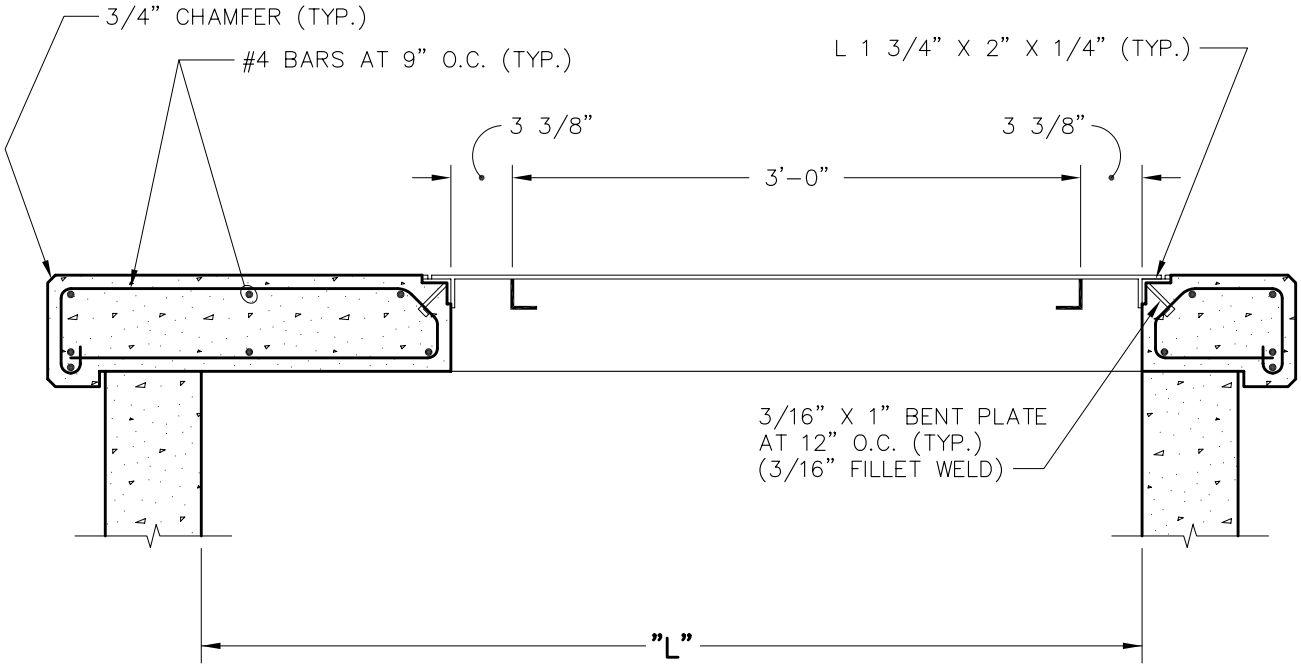
PRECAST CONCRETE VAULT– NON–LOAD BEARING
(3" THRU 10" WATER METER ASSEMBLIES)

SHEET 1 OF 6

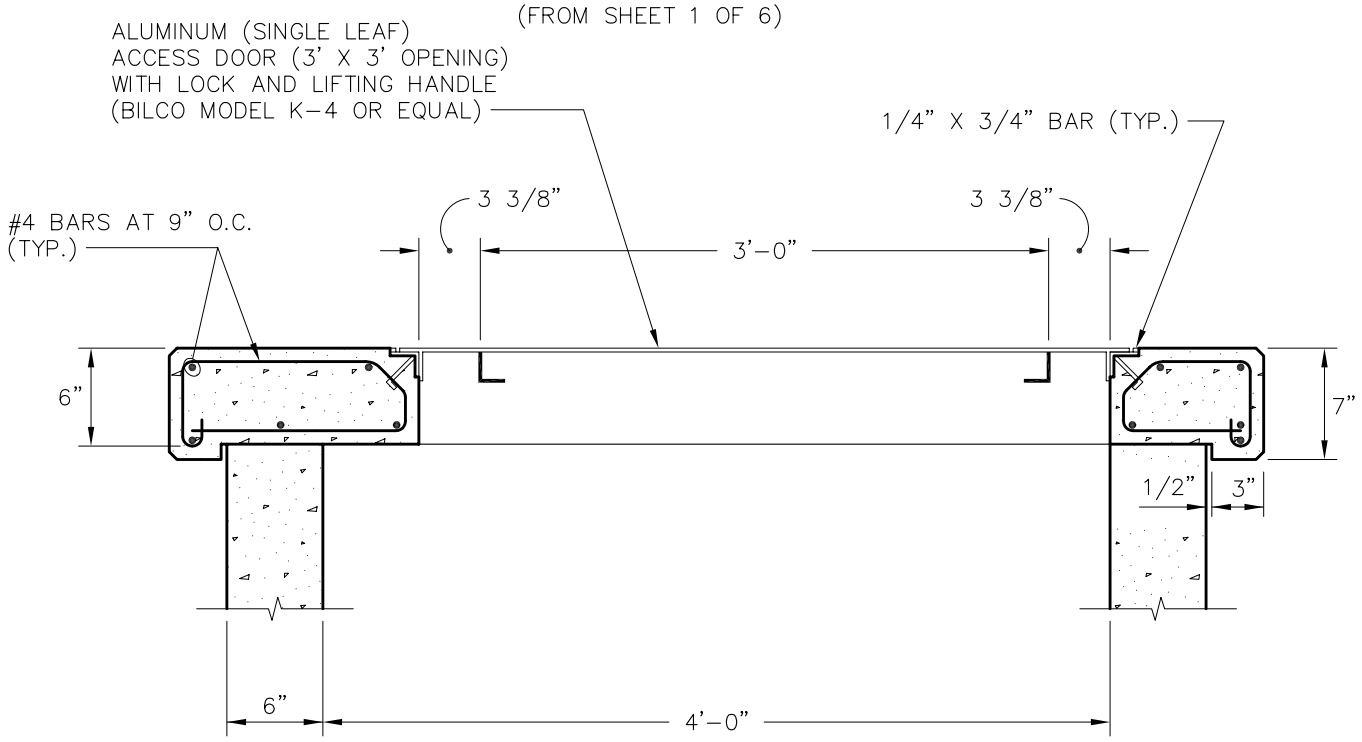
3" AND LARGER METER SETTING & VAULT

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02–27–06
DETAIL NO: W–4



SECTION A–A
(FROM SHEET 1 OF 6)



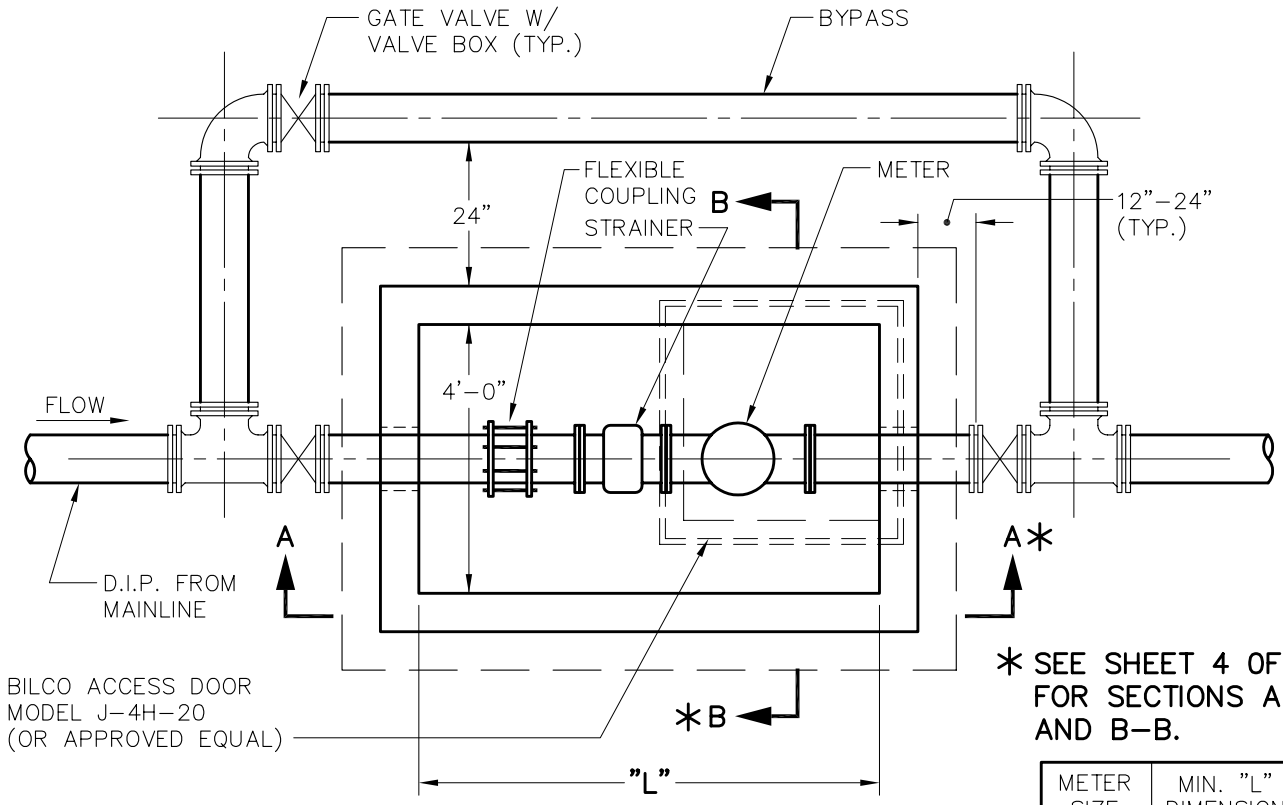
SECTION B–B
(FROM SHEET 1 OF 6)

PRECAST CONCRETE VAULT– NON–LOAD BEARING
(3" THRU 10" WATER METER ASSEMBLIES)

3" AND LARGER METER SETTING & VAULT

KING GEORGE COUNTY SERVICE AUTHORITY

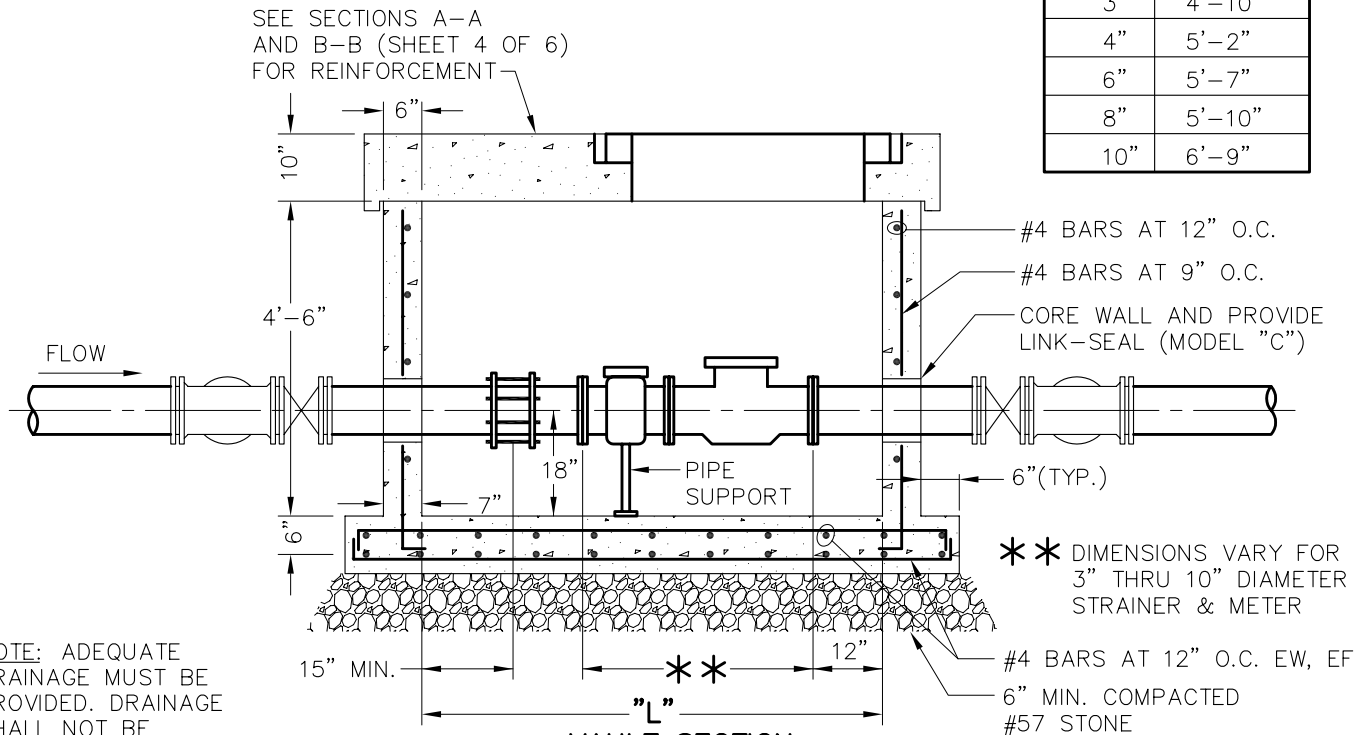
SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: W–4



VAULT PLAN

* SEE SHEET 4 OF 6 FOR SECTIONS A–A AND B–B.

METER SIZE	MIN. "L" DIMENSION
3"	4'–10"
4"	5'–2"
6"	5'–7"
8"	5'–10"
10"	6'–9"



VAULT SECTION

NOTE: ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

PRECAST CONCRETE VAULT– H20 LOADING
(3" THRU 10" WATER METER ASSEMBLIES)

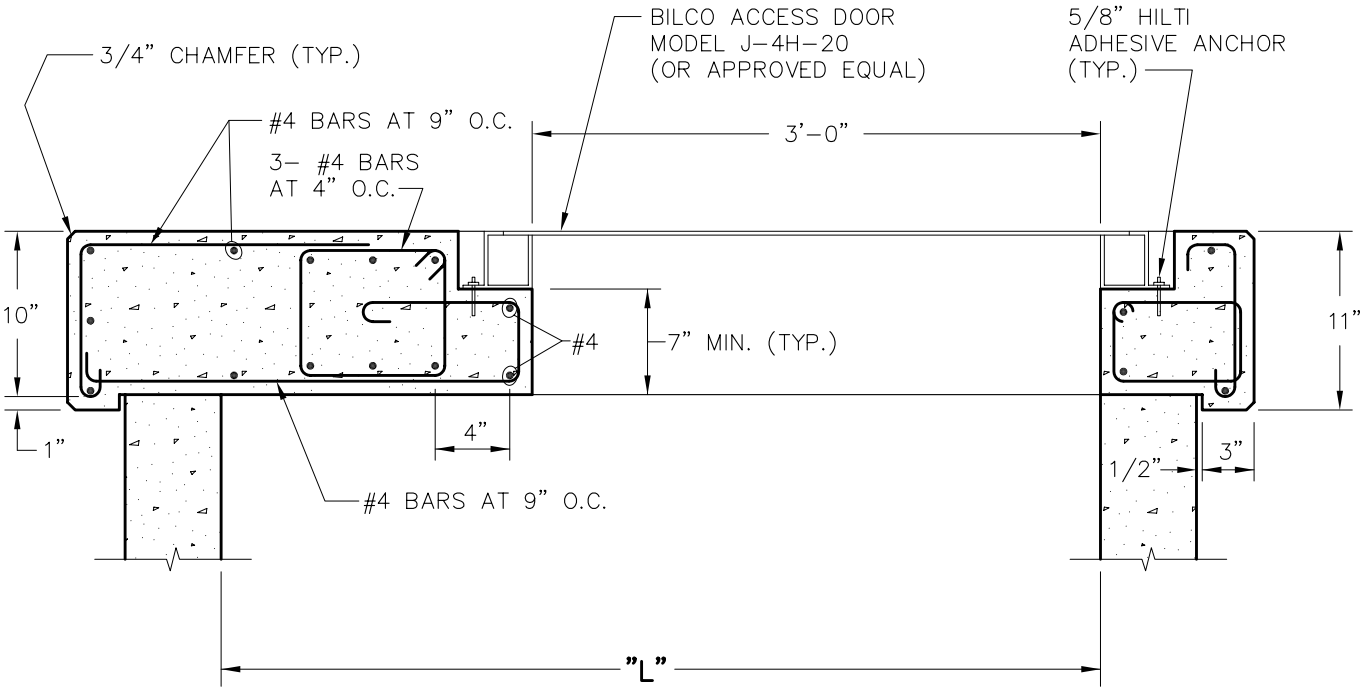
3" AND LARGER METER SETTING & VAULT

KING GEORGE COUNTY SERVICE AUTHORITY

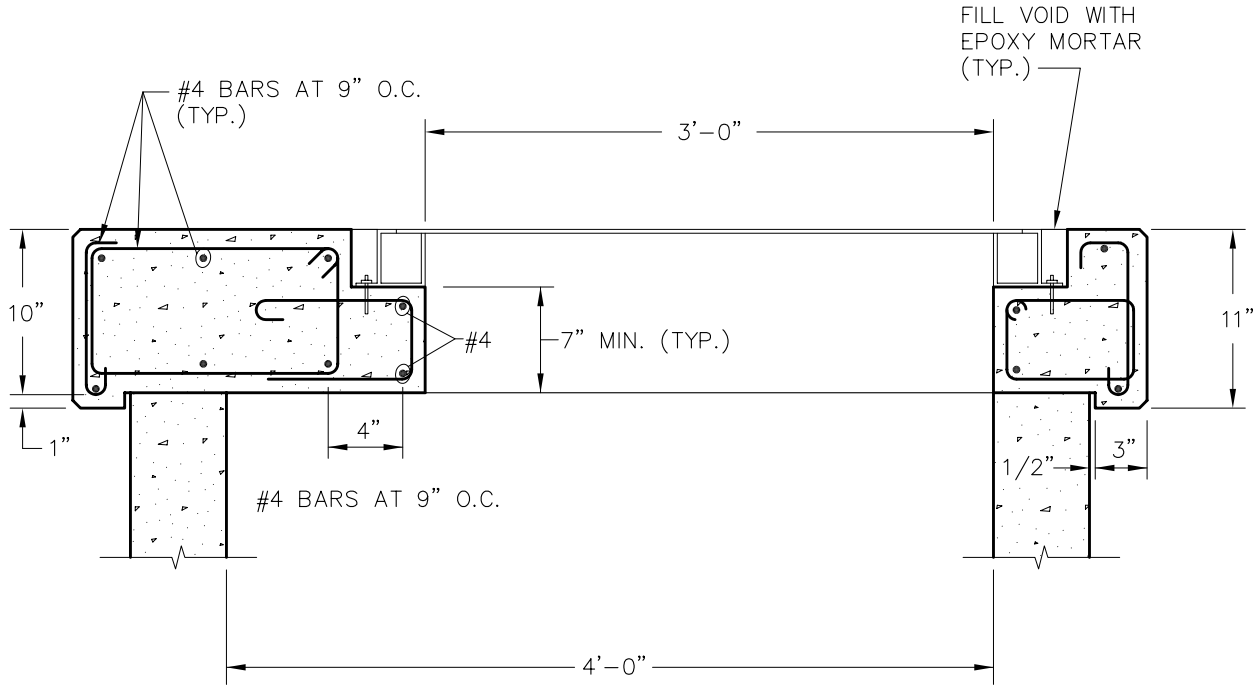
SCALE: NOT TO SCALE

DATE: 02–27–06

DETAIL NO: W–4



SECTION A-A
(FROM SHEET 3 OF 6)



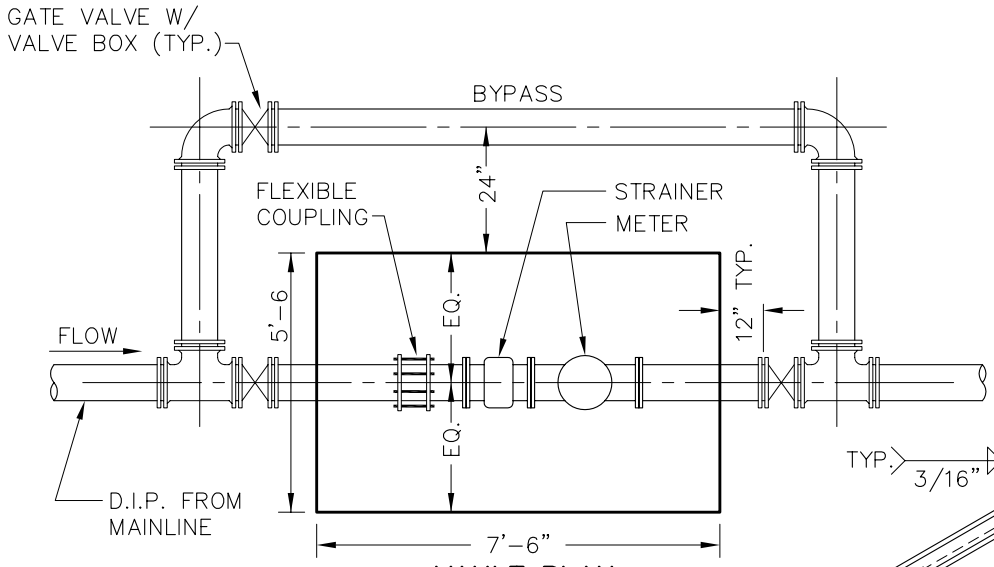
SECTION B-B
(FROM SHEET 3 OF 6)

PRECAST CONCRETE VAULT- H20 LOADING
(3" THRU 10" WATER METER ASSEMBLIES)

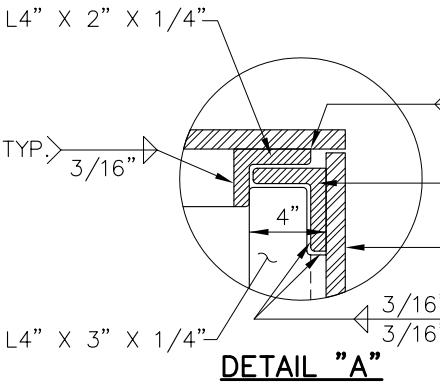
3" AND LARGER METER SETTING & VAULT

KING GEORGE COUNTY SERVICE AUTHORITY

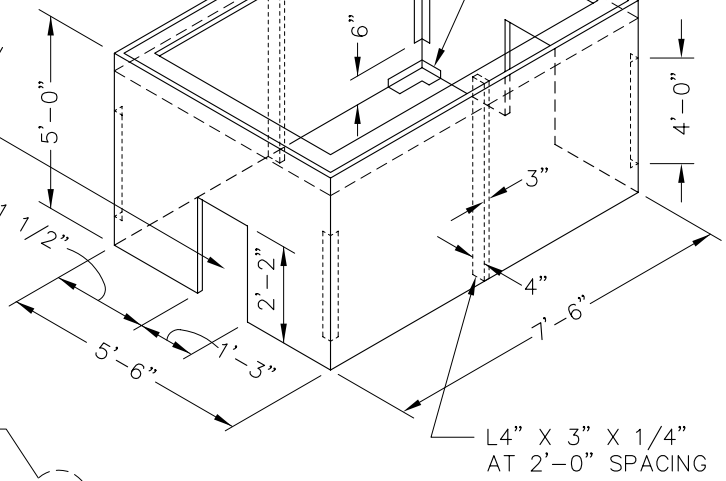
SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: W-4



VAULT PLAN

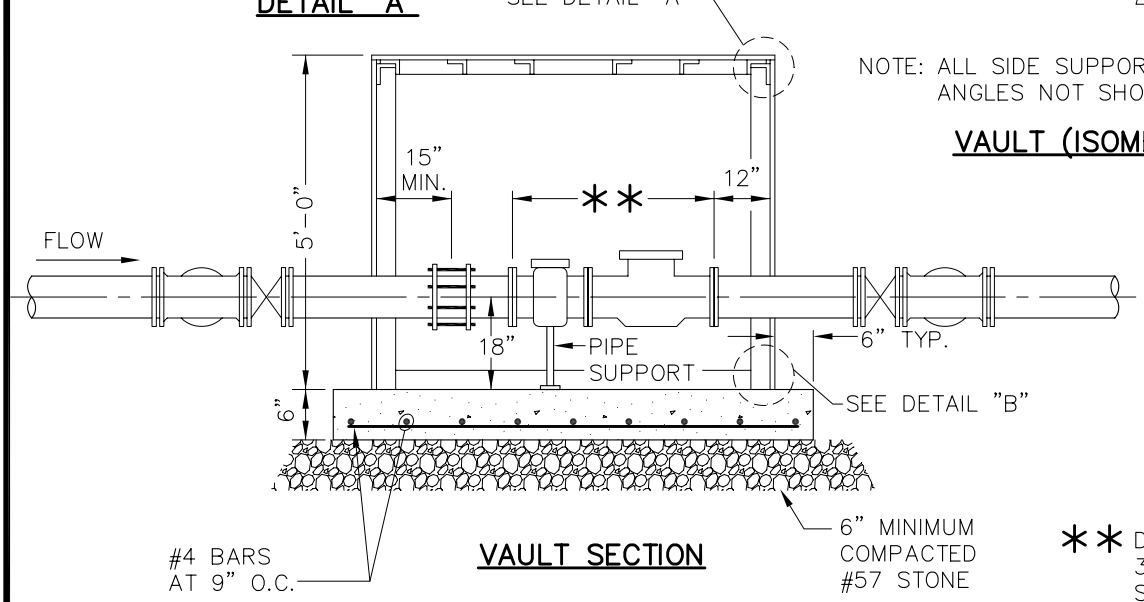


DETAIL "A"



NOTE: ALL SIDE SUPPORT AND BOTTOM ANGLES NOT SHOWN FOR CLARITY

VAULT (ISOMETRIC VIEW)



VAULT SECTION

NOTE: ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

** DIMENSIONS VARY FOR 3" THRU 8" DIAMETER STRAINER & METER

METAL METER VAULT
(3" THRU 8" WATER METER ASSEMBLIES)

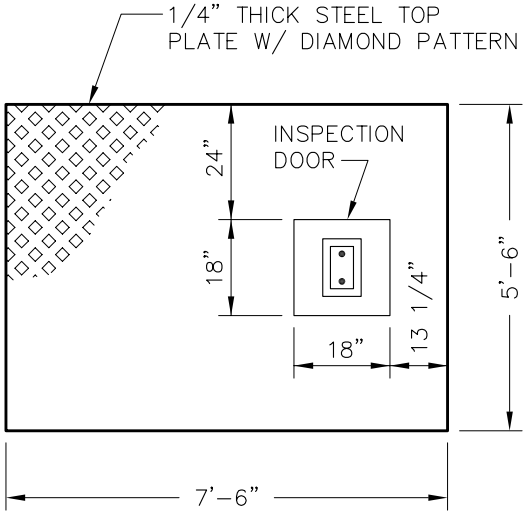
3" AND LARGER METER SETTING & VAULT

KING GEORGE COUNTY SERVICE AUTHORITY

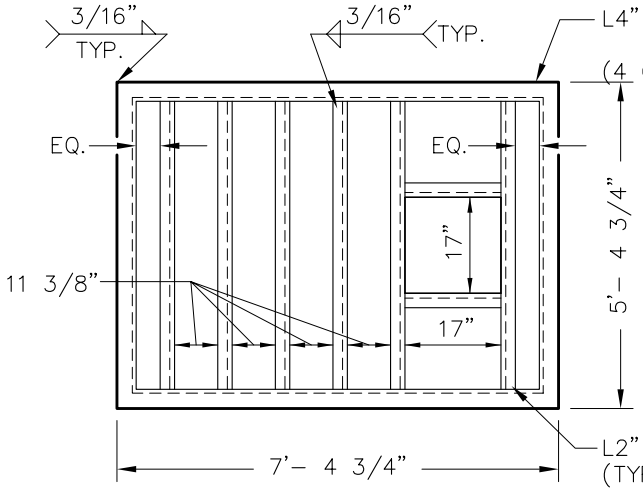
SCALE: NOT TO SCALE
DATE: 02-27-06
DETAIL NO: W-4

NOTES:

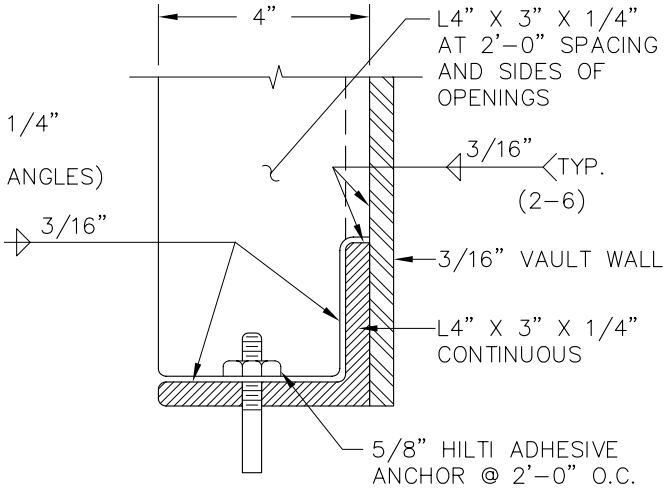
1. THIS BOX IS NOT TO BE USED IN STREETS, ALLEYS, OR ANY AREA EXPOSED TO VEHICULAR TRAFFIC.
2. THIS BOX CAN ONLY BE USED IN WELL-DRAINED SAND OR GRAVEL BACKFILL.
3. GRADE OF STEEL SHALL BE A36.
4. ALL EDGES TO BE GROUND SMOOTH.
5. BEDDING MATERIAL AROUND BOX TO BE SELECT MATERIAL.
6. STITCH WELD TOP TO FRAME WITH 3" BEAD ON 6" C-C.
7. ENTIRE ASSEMBLY TO BE HOT DIPPED GALVANIZED AFTER FABRICATION, THEN COATED WITH COAL TAR EPOXY. (EXCLUDING TOP PLATE)



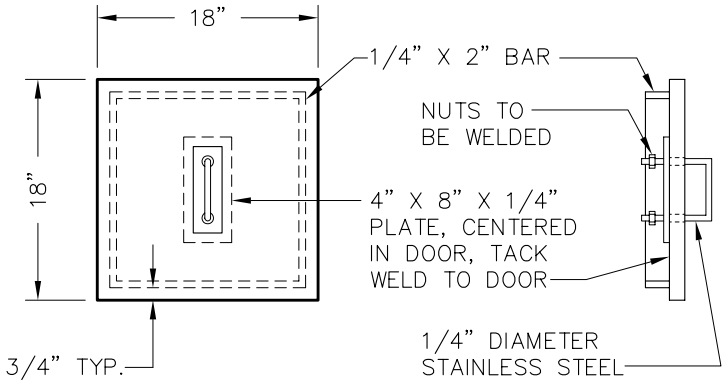
VAULT COVER (PLATE)



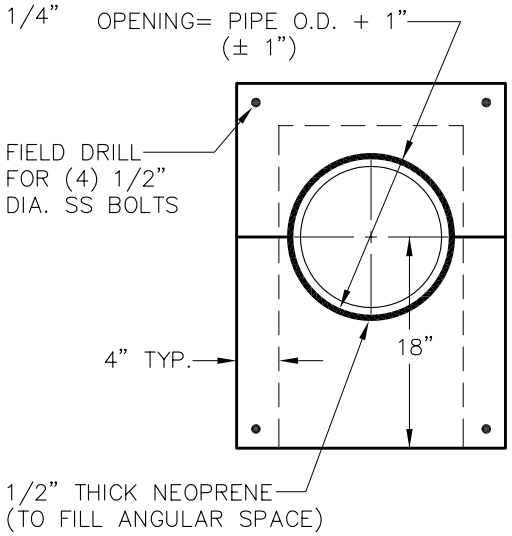
VAULT COVER (FRAME)



DETAIL "B"



INSPECTION DOOR



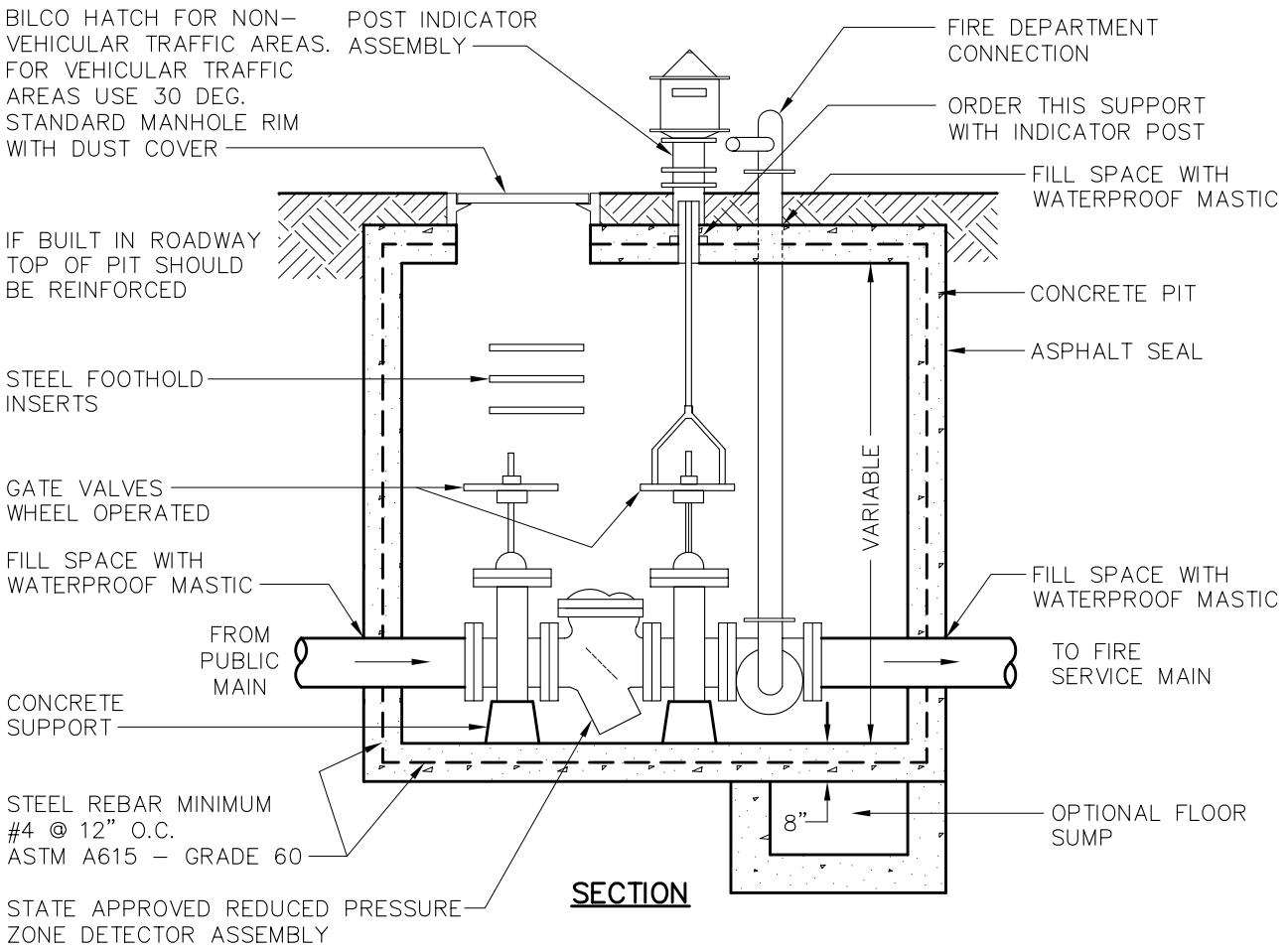
DETAIL "C"

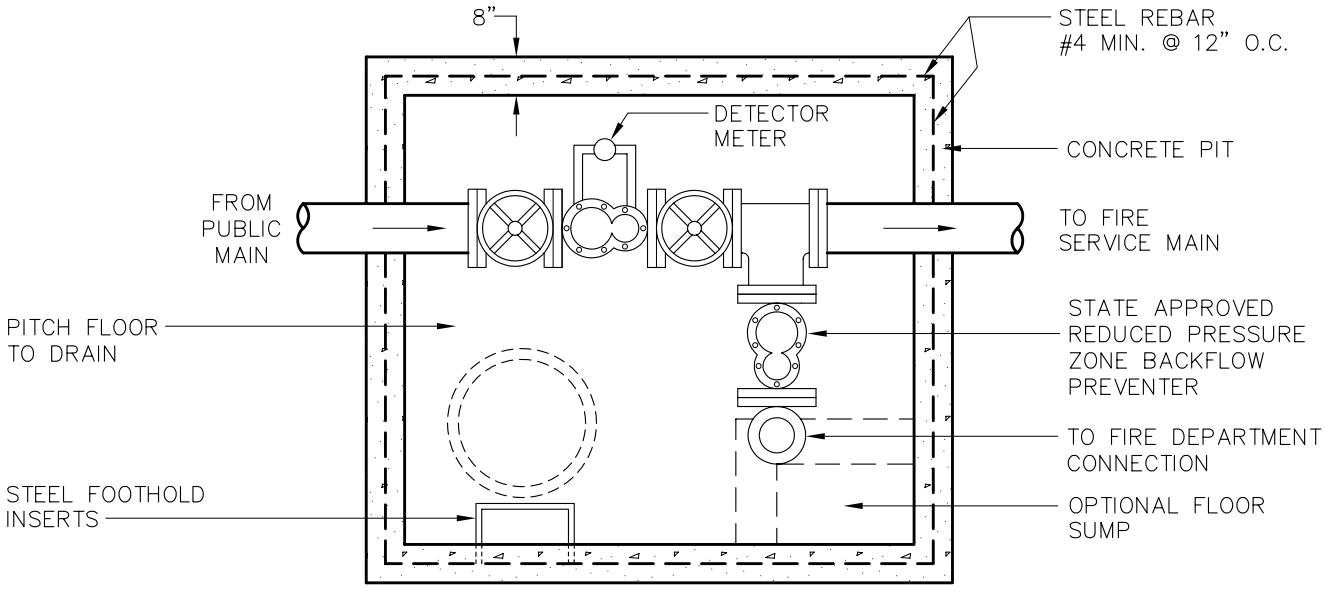
METAL METER VAULT
(3" THRU 8" WATER METER ASSEMBLIES)

3" AND LARGER METER SETTING & VAULT

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: W-4





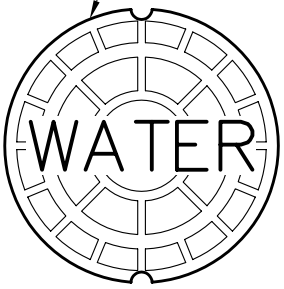
NOTES:

1. ALL NEW PIPE TO BE DUCTILE IRON, MECHANICAL JOINT, WITH RESTRAINED JOINTS (FLANGED PIPING INSIDE BOX)
2. ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

DETECTOR CHECK ASSEMBLY

KING GEORGE COUNTY SERVICE AUTHORITY

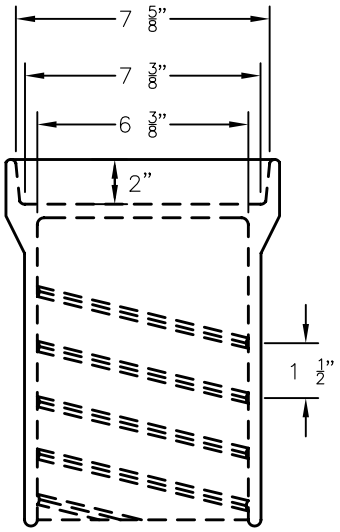
SCALE: NOT TO SCALE
DATE: 03–22–06
DETAIL NO: W–5



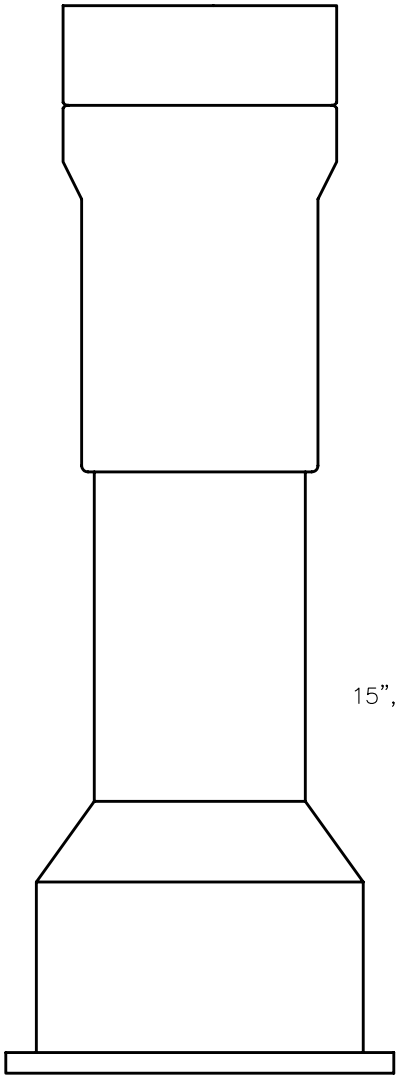
MARK WITH A WATER FOR WATER DISTRIBUTION SYSTEMS OR SEWER FOR SANITARY SYSTEMS. TOP AND BOTTOM OF LETTER DESIGNATION TO BE IN LINE WITH NOTCHES.

COVER: TOP

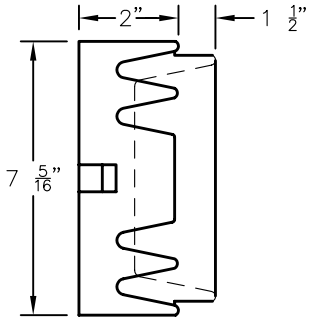
BOTTOM SUPPORT RING TO BE NOTCHED DIRECTLY UNDER PICK HOLE ON BOTH SIDES. NOTCHES TO BE CENTERED BETWEEN SUPPORT RINGS.



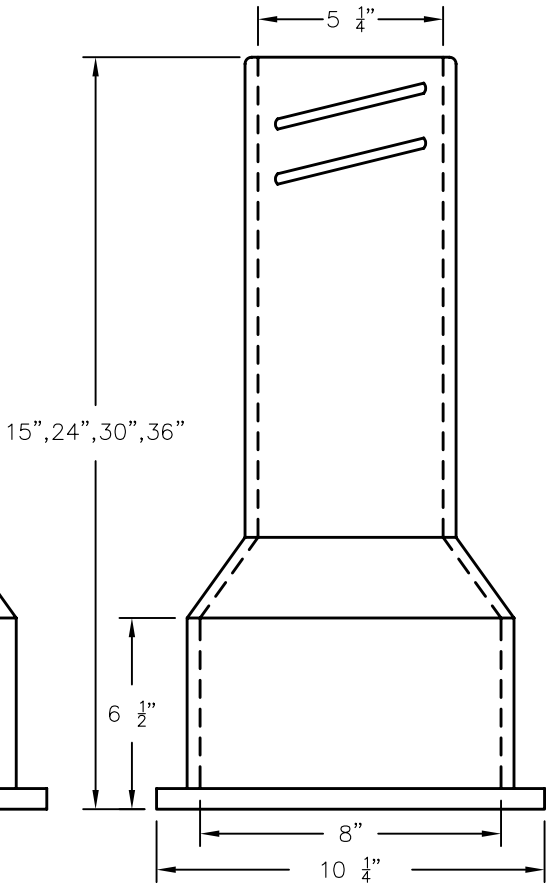
TOP SECTION



COMPLETE



COVER: TOP



BOTTOM SECTION

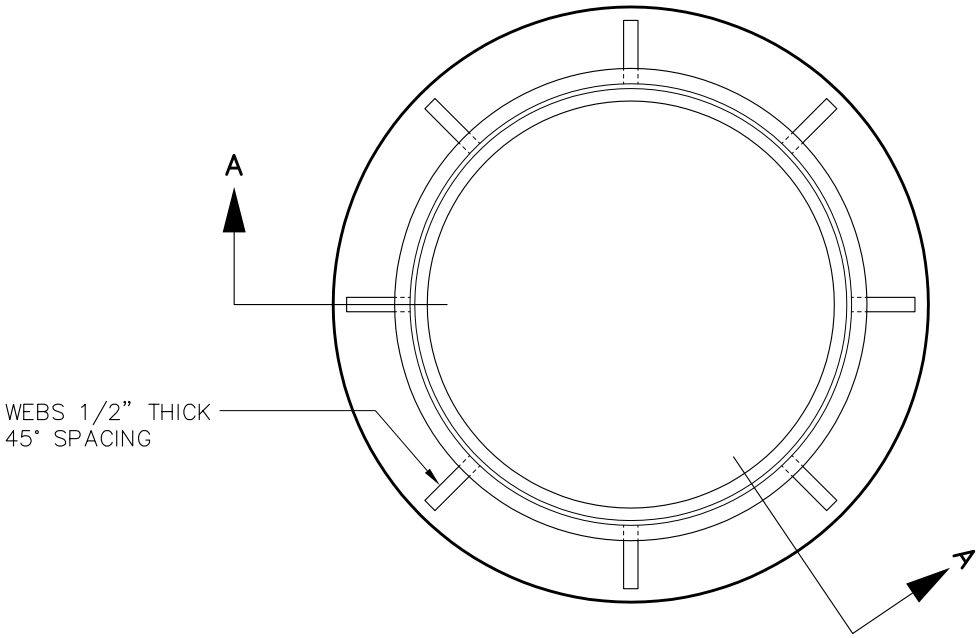
NOTES:

1. VALVE BOX FRAME AND COVER TO BE SUPPLIED BY CAPITAL FOUNDRY OF VIRGINIA, INC., MODEL AASHTO M105, OR APPROVED EQUAL.
2. ALL GRAY IRON CASTINGS SHALL CONFORM TO LATEST EDITION OF ASTM A-48, CLASS 30 AND SHALL BE OF UNIFORM QUALITY.
3. ALL CASTING DIMENSIONS SHALL HAVE A TOLERANCE OF 1/8" ±.
4. ALL CASTINGS SHALL BE CLEANED BY SHOT BLASTING AND HAND CHIPPING UTILIZING STANDARD INDUSTRY PRACTICES PRIOR TO SHOP APPLICATION OF ASPHALTIC COATING, BY DIPPING.

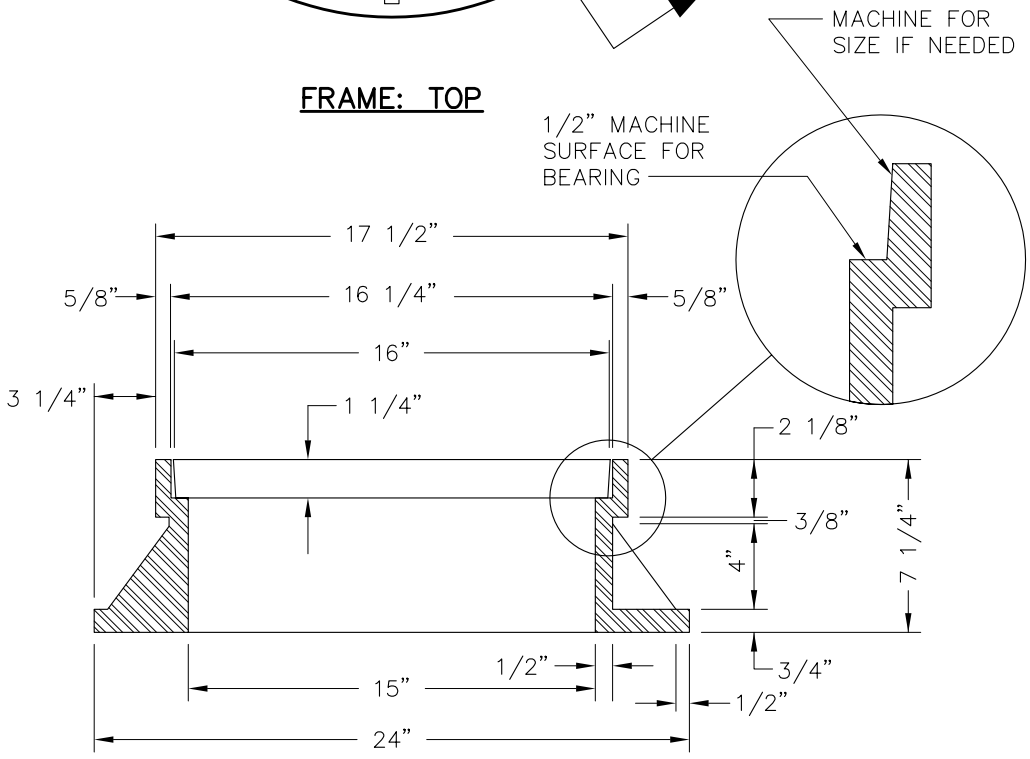
STANDARD VALVE BOX FRAME AND COVER

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: W-6



FRAME: TOP



SECTION A–A

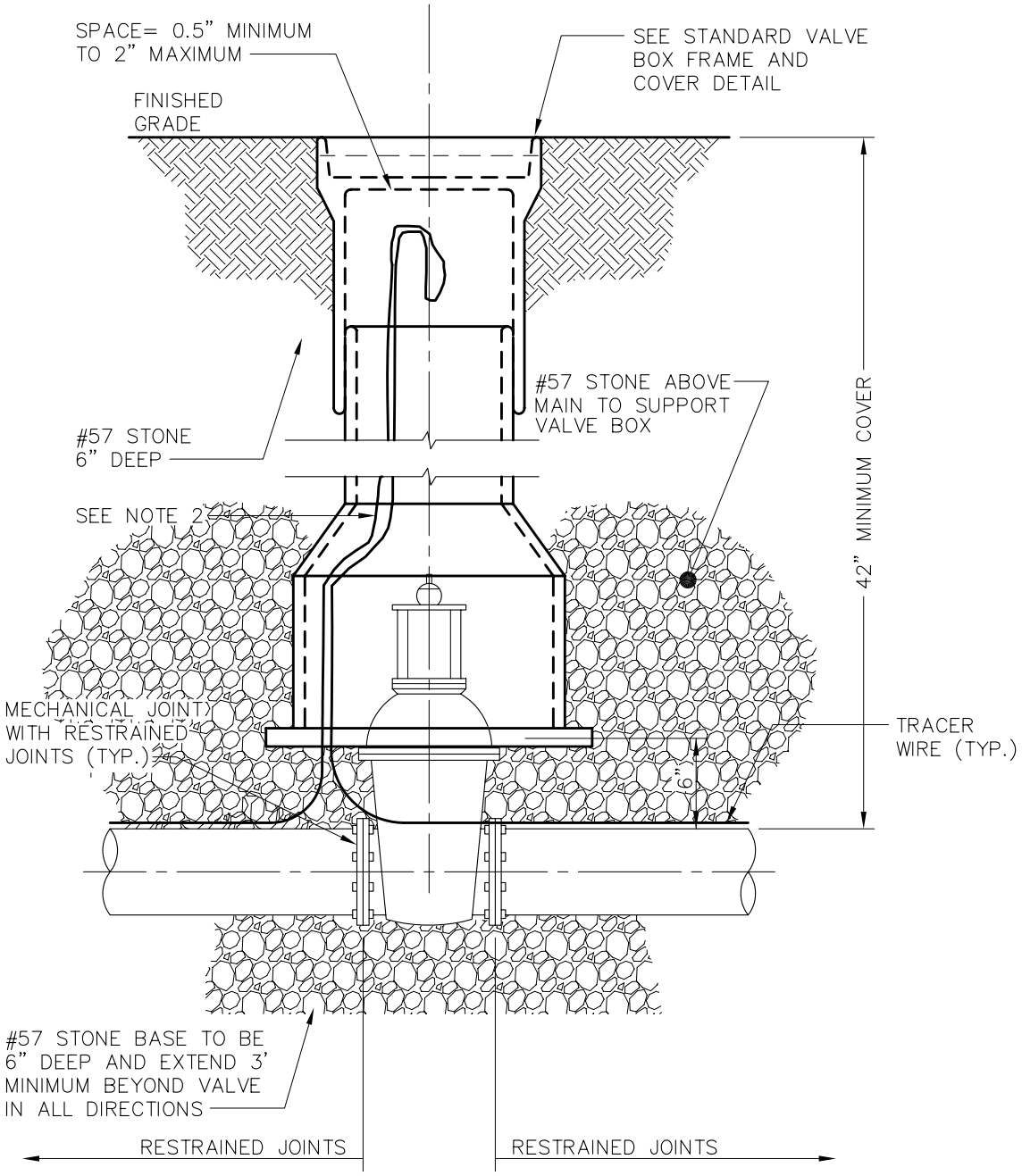
NOTES:

1. VALVE BOX FRAME AND COVER TO BE SUPPLIED BY CAPITAL FOUNDRY OF VIRGINIA, INC., MODEL B1200, 160 LBS., OR APPROVED EQUAL.
2. ALL GRAY IRON CASTINGS SHALL CONFORM TO LATEST EDITION OF ASTM A–48, CLASS 30 AND SHALL BE OF UNIFORM QUALITY.
3. ALL CASTING DIMENSIONS SHALL HAVE A TOLERANCE OF 1/8" ±.
4. ALL CASTINGS SHALL BE CLEANED BY SHOT BLASTING AND HAND CHIPPING UTILIZING STANDARD INDUSTRY PRACTICES PRIOR TO SHOP APPLICATION OF ASPHALTIC COATING, BY DIPPING.

STANDARD AIR RELEASE VALVE BOX FRAME AND COVER

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: W–6



NOTES:

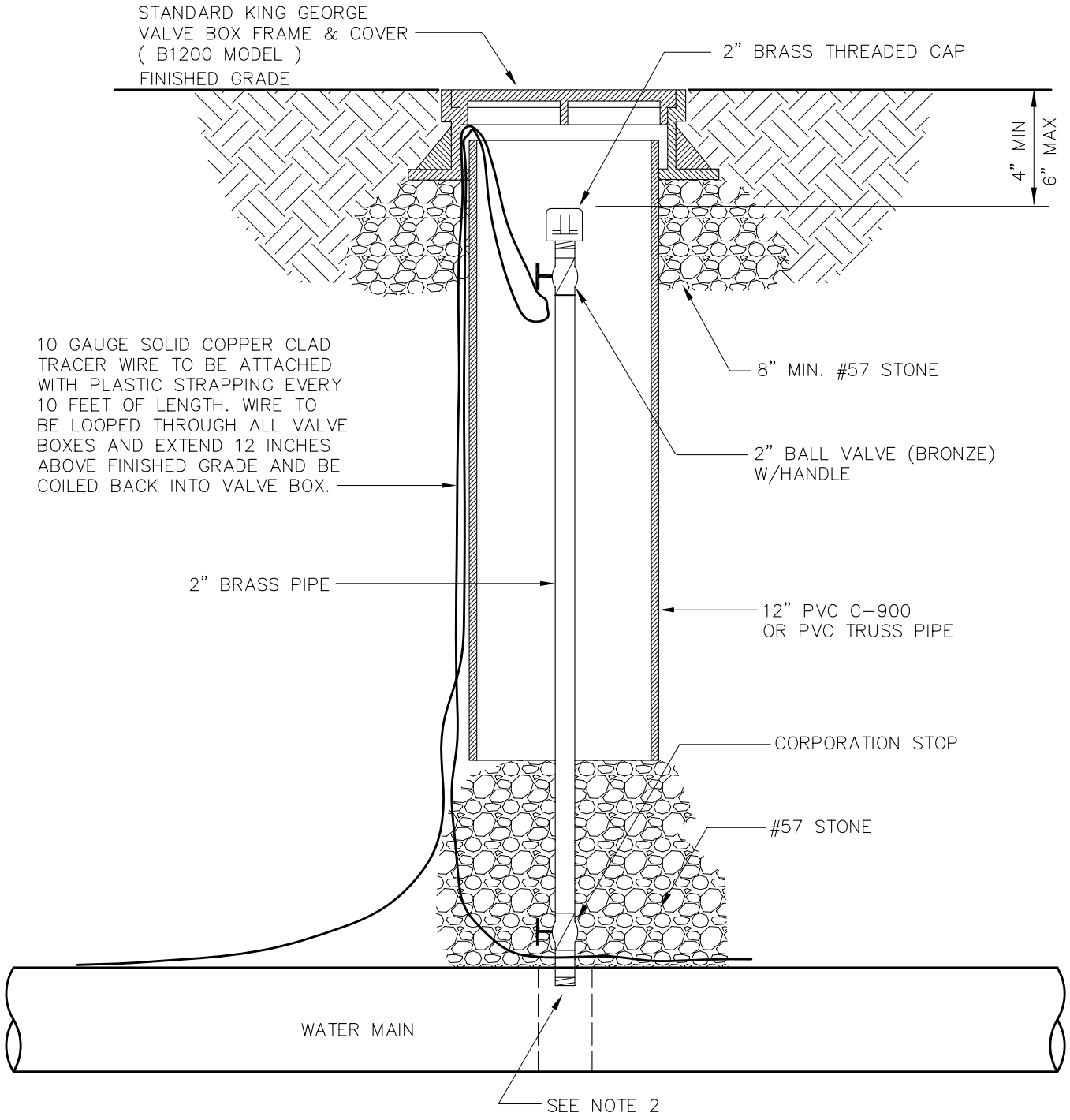
1. IF OPERATING NUT IS GREATER THAN 48" BELOW TOP OF VALVE BOX FRAME, A VALVE STEM EXTENSION MAY BE INSTALLED. THE EXTENSION SHALL REPLACE OR BE SECURELY ATTACHED TO THE NORMAL 2" SQUARE OPERATING NUT, SHALL BE AT LEAST AS STRONG AS THE VALVE STEM, AND SHALL BE COATED IN ACCORDANCE WITH AWWA C550. VALVE STEM EXTENSIONS MUST BE APPROVED BY THE LOCALITY.

2. PLASTIC COATED 10 GAUGE SOLID COPPER TRACER WIRE TO BE ATTACHED WITH PLASTIC STRAPPING EVERY 10 FEET OF LENGTH. WIRE TO BE LOOPED THROUGH VALVE BOX AND EXTEND 12" ABOVE FINISHED GRADE AND COILED BACK INTO THE VALVE BOX.

VALVE SETTING DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-04-05
DETAIL NO: W-7



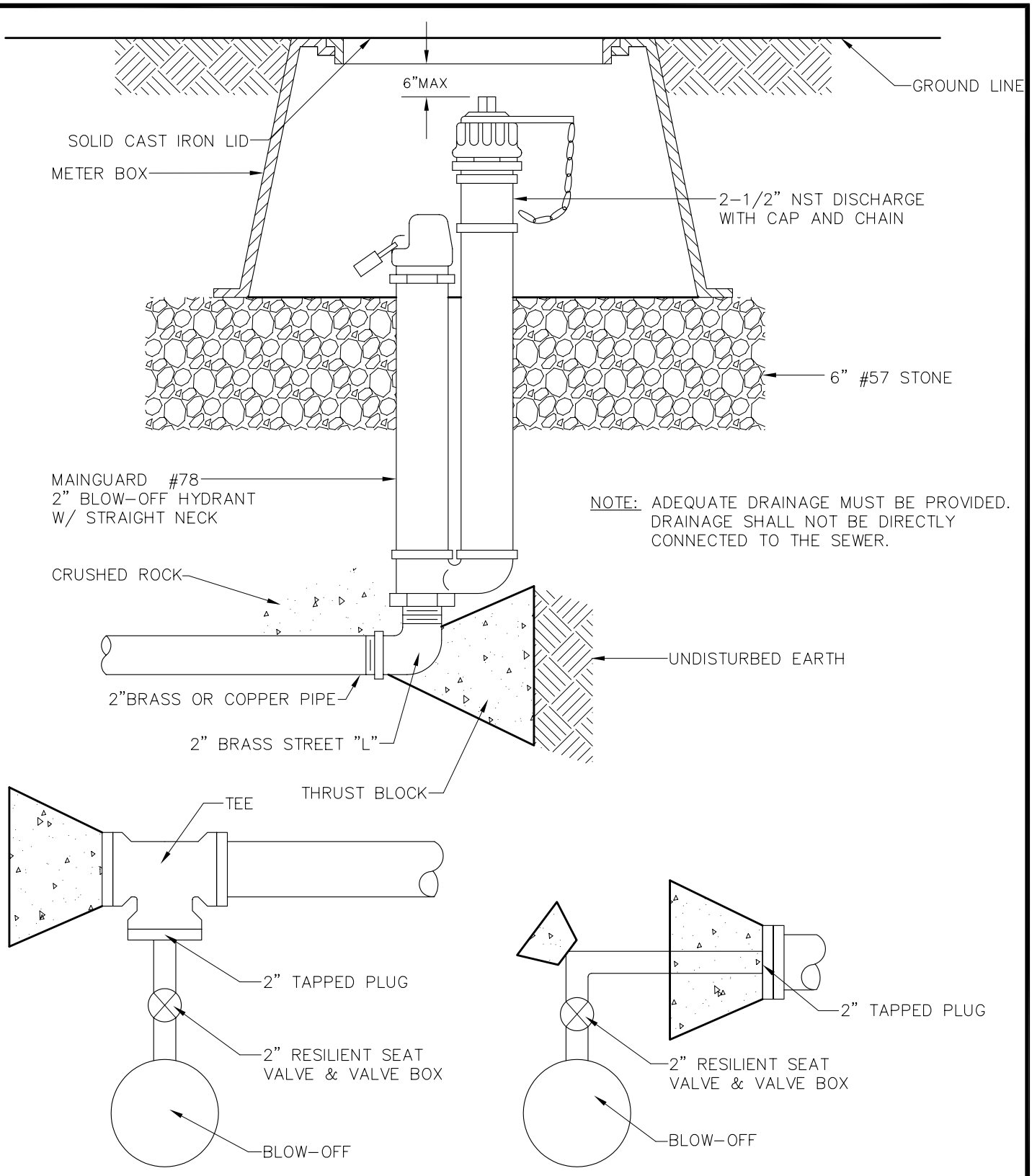
NOTES:

1. 2" BRASS PIPE AND FITTINGS SHALL BE USED FOR AIR RELEASE VALVE.
2. ALL DUCTILE IRON MAINS, SIX INCHES IN DIAMETER AND LARGER, MAY BE TAPPED WITHOUT SADDLES.
3. FOR PVC AND HDPE MAINS, A TAPPING SADDLE IS REQUIRED FOR ALL CONNECTIONS TO PVC PIPE.
4. ALL SADDLES TO BE STAINLESS STEEL OR EPOXY COATED.
5. ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

MANUAL AIR RELEASE VALVE

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-27-06
DETAIL NO: W-8

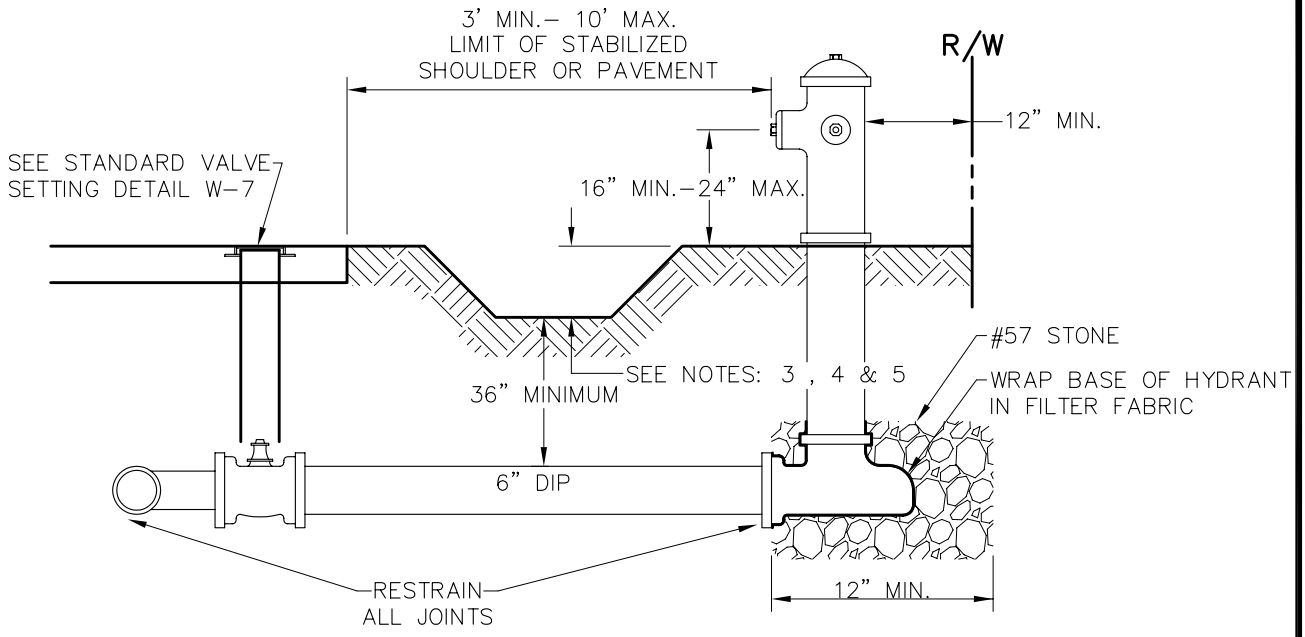


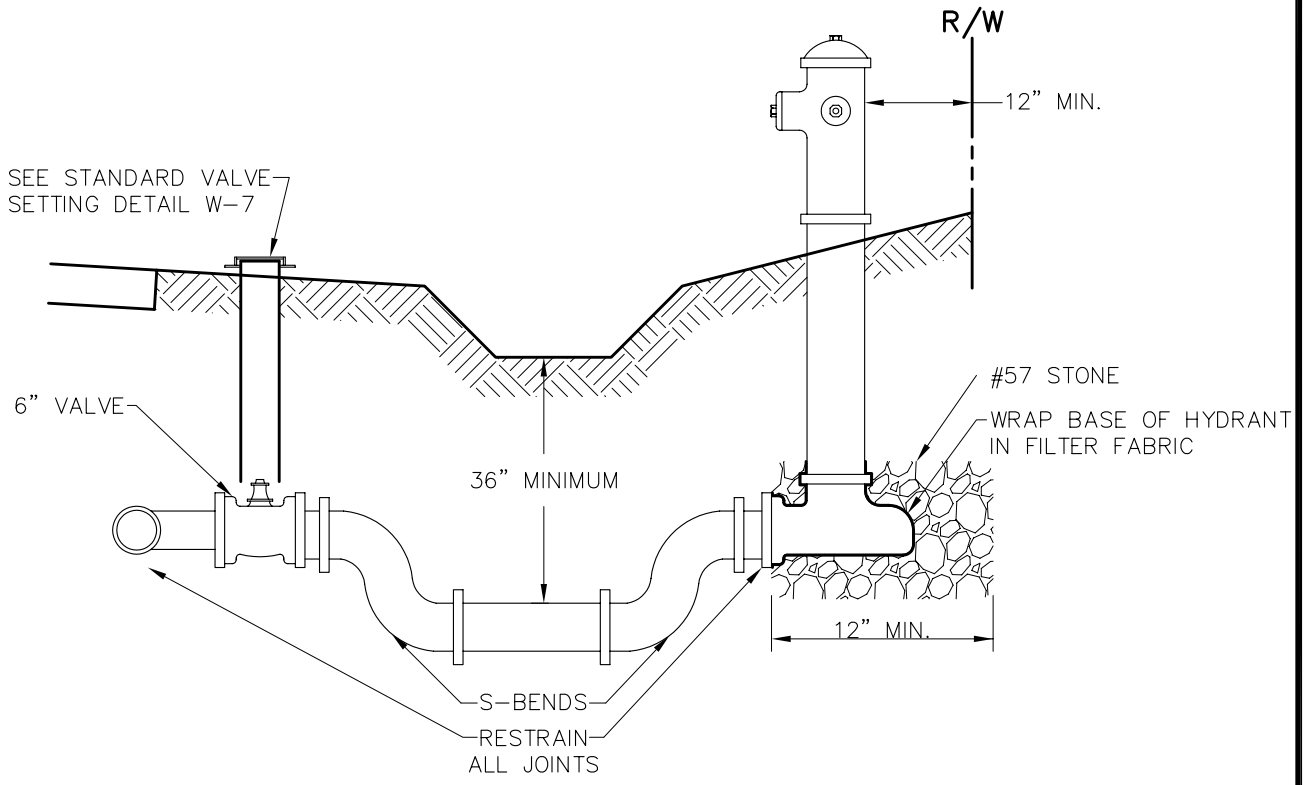
TYPICAL PLAN VIEW OF INSTALLATION (CONTRACTORS OPTION)

DEAD END
BLOW-OFF ASSEMBLY

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE:	NOT TO SCALE
DATE:	02–27–06
DETAIL NO:	W–9





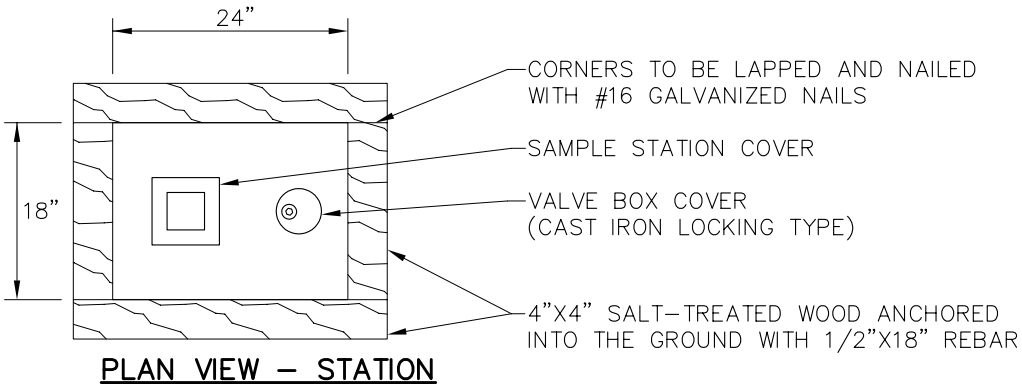
NOTES:

1. HYDRANT TO BE SET WITH BREAKABLE COUPLING APPROXIMATELY 3" ABOVE FINISHED GRADE.
2. STEAMER NOZZLE IS TO FACE ROADWAY UNLESS OTHERWISE NOTED.
3. TRACER WIRE AS REQUIRED.
4. ALL VALVES TO BE MJ.
5. THE INSTALLATION/TESTING OF FIRE HYDRANTS WILL REQUIRE FIELD VERIFICATION OF THE GROUNDWATER ELEVATION AND SURFACE WATER DRAINAGE BY THE ENGINEER PRIOR TO PLACEMENT OF THE FIRE HYDRANT.
6. ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

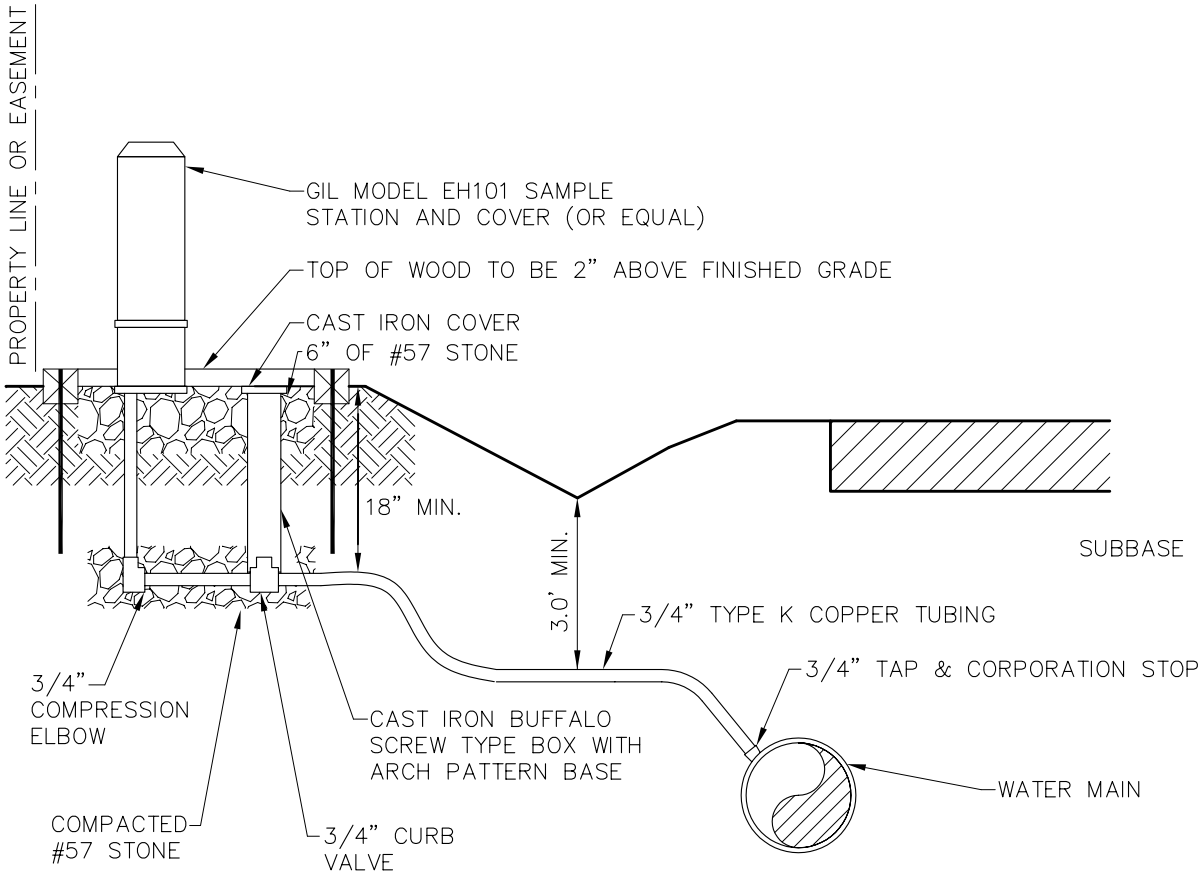
FIRE HYDRANT SETTINGS

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02–27–06
DETAIL NO: W–10



PLAN VIEW – STATION



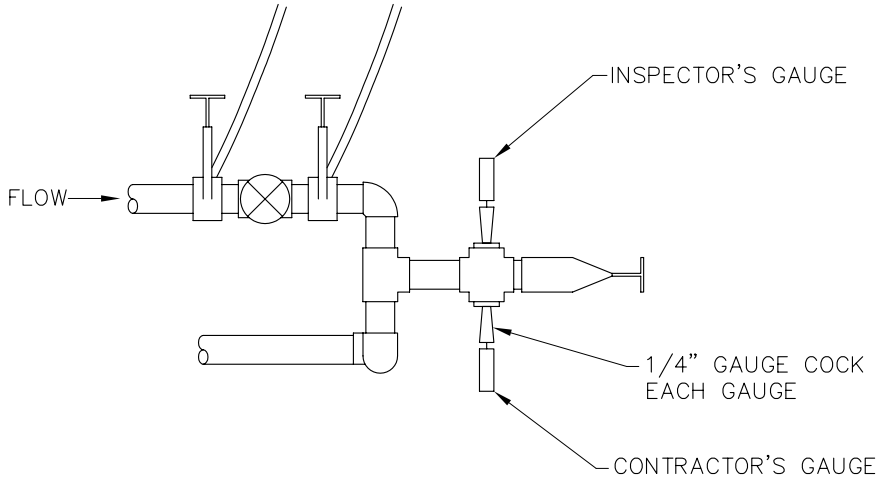
NOTES:

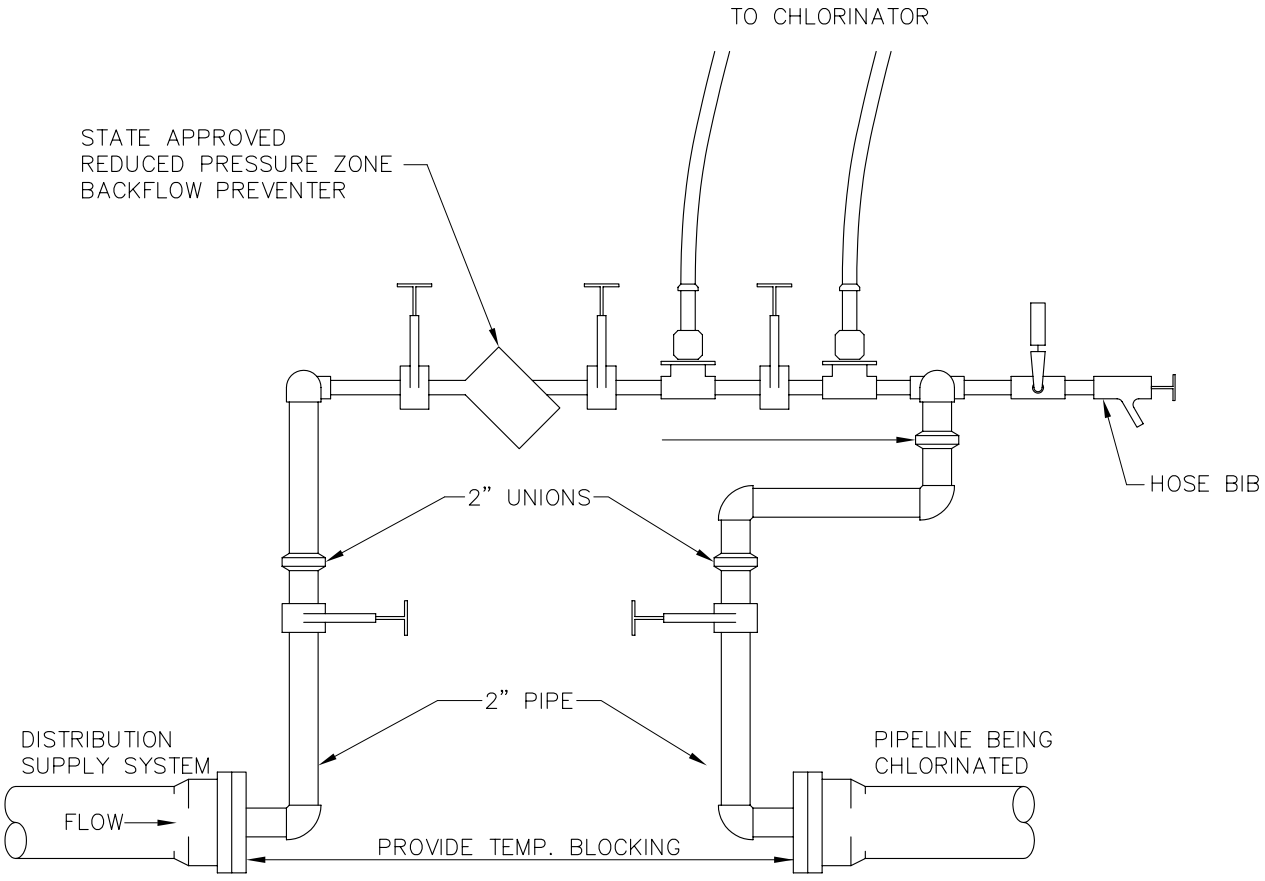
1. SADDLE MUST BE USED IF TAP IS MADE IN PVC OR A/C PIPE.
2. ALL FITTINGS SHALL BE AWWA APPROVED BRASS
3. ALL WATER IN SAMPLE PIPE SHALL BE REMOVED AFTER THE USE OF THE SAMPLING STATION.
4. CONTRACTOR TO COORDINATE WITH KING GEORGE SERVICE AUTHORITY ON LOCATION OF THE SAMPLING STATION.
5. ADEQUATE DRAINAGE MUST BE PROVIDED. DRAINAGE SHALL NOT BE DIRECTLY CONNECTED TO THE SEWER.

WATER SAMPLING STATION DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-27-06
DETAIL NO: W-11

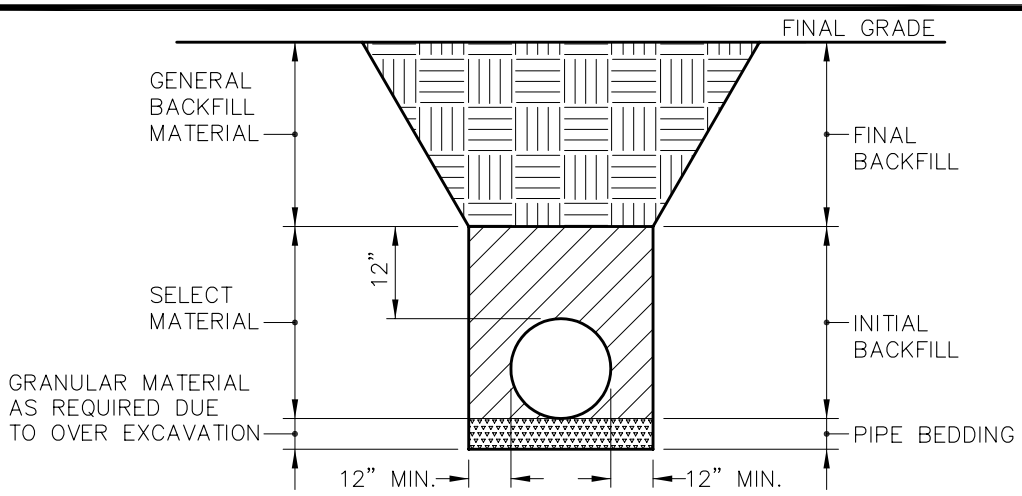




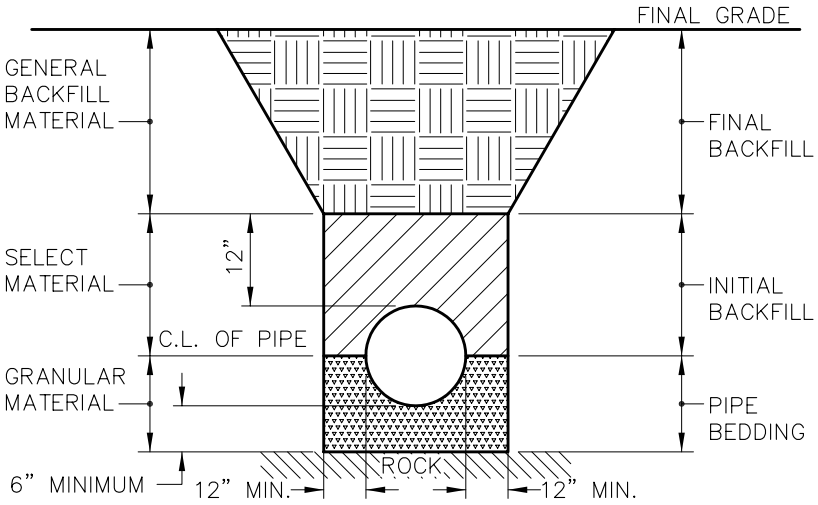
TESTING AND CHLORINATION MANIFOLD

KING GEORGE COUNTY SERVICE AUTHORITY

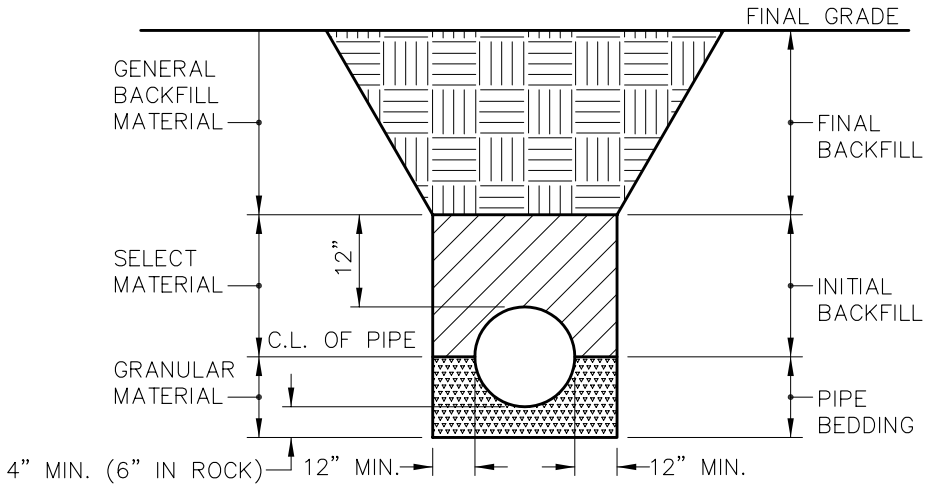
SCALE: NOT TO SCALE
DATE: 02–27–06
DETAIL NO: W–12



DUCTILE IRON PRESSURE PIPE
BEDDING AND BACKFILL DETAIL



DUCTILE IRON PRESSURE PIPE BEDDING
AND BACKFILL DETAIL (IN ROCK)

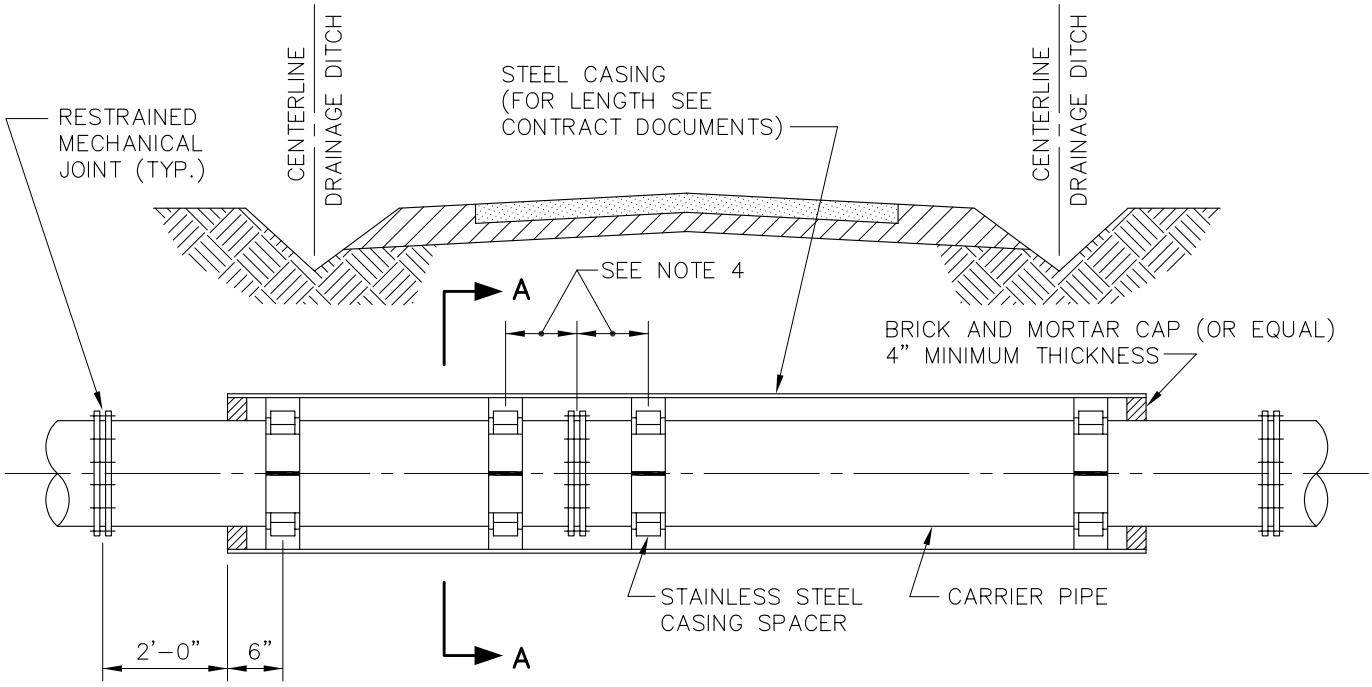


PVC OR HDPE PRESSURE PIPE
BEDDING AND BACKFILL DETAIL

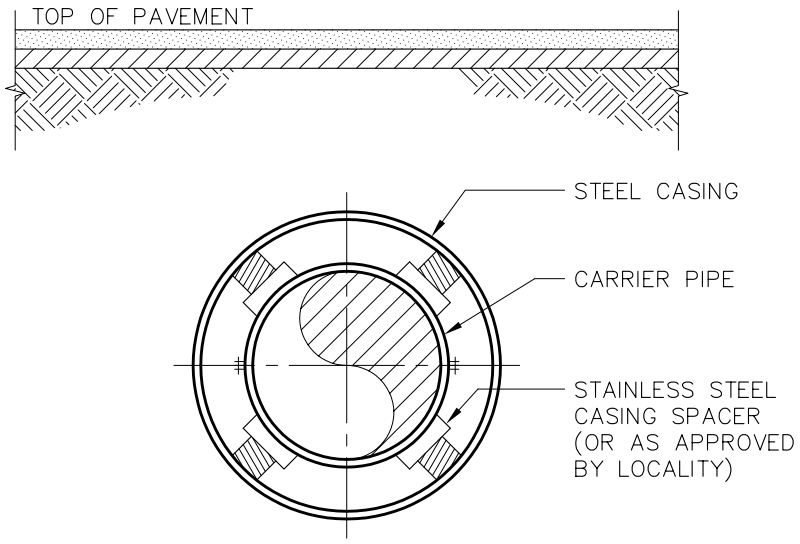
WATERLINE
TRENCH INSTALLATION

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-04-05
DETAIL NO: W-14



PROFILE



SECTION A–A

HIGHWAY CROSSING

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: G–1

STEEL CASING PIPE SELECTION CHART					
DUCTILE IRON PIPE SIZE	4"	6"	8"	12"	16"
STEEL CASING PIPE SIZE (O.D.)	12"	16"	20"	24"	30"

NOTES:

1. CARRIER PIPE MAY BE DUCTILE IRON (C1.350), HDPE (DR-17), OR PVC (C-900).

2. ALL JOINTS INSIDE OF CASING PIPE AND ONE JOINT BEYOND SHALL BE RESTRAINED MECHANICAL JOINTS OR AS APPROVED BY LOCALITY.

3. INSTALL CASING PIPE AS SHOWN ON DRAWINGS OR MINIMUM 5 FT. BEYOND EDGE OF PAVEMENT.

4. STAINLESS STEEL SPACERS
SPACERS SHALL BE BOLT-ON STYLE WITH A TWO PIECE SHELL MADE FROM T-304 STAINLESS STEEL OF A MINIMUM 14 GUAGE THICKNESS. THE SHELL SHALL BE LINED WITH A RIBBED PVC SHEET OF A 0.090" THICKNESS THAT OVERLAPS THE EDGES. RUNNERS MADE FROM UHMW POLYMER, SHALL BE ATTACHED TO RISERS AT APPROPRIATE POSITIONS TO PROPERLY LOCATE THE CARRIER WITHIN THE CASING AND TO EASE INSTALLATION. RISERS TO BE MADE FRON T-304 STAINLESS STEEL OF A MINIMUM 14 GUAGE THICKNESS AND SHALL BE ATTACHED TO THE SHELL BY MIG WELDING. ALL WELDS SHALL BE FULLY PASSIVATED. ALL FASTENERS SHALL BE MADE FROM T-304 STAINLESS STEEL. CASING SPACERS SHALL BE MODEL CCS AS MANUFACTURED BY CASCADE WATERWORKS MANUFACTURING COMPANY OF YORKVILLE, IL., MODEL SSI AS MANUFACTURED BY ADVANCE PRODUCTS AND SYSTEMS, INC. OF LAFAYETTE, LA., OR APPROVED EQUAL.

5. SPACER WIDTH AND PLACEMENT INTERVALS
IN ALL INSTANCES SPACER SHOULD BE PLACED TO SUPPORT THE CARRIER WITHIN TWO FEET OF THE END OF EACH PIPE JOINT. CONSULT SPACER MANUFACTURER FOR RECOMMENDATIONS OF SPACER WIDTH AND ADDITIONAL PLACEMENT INTERVALS.

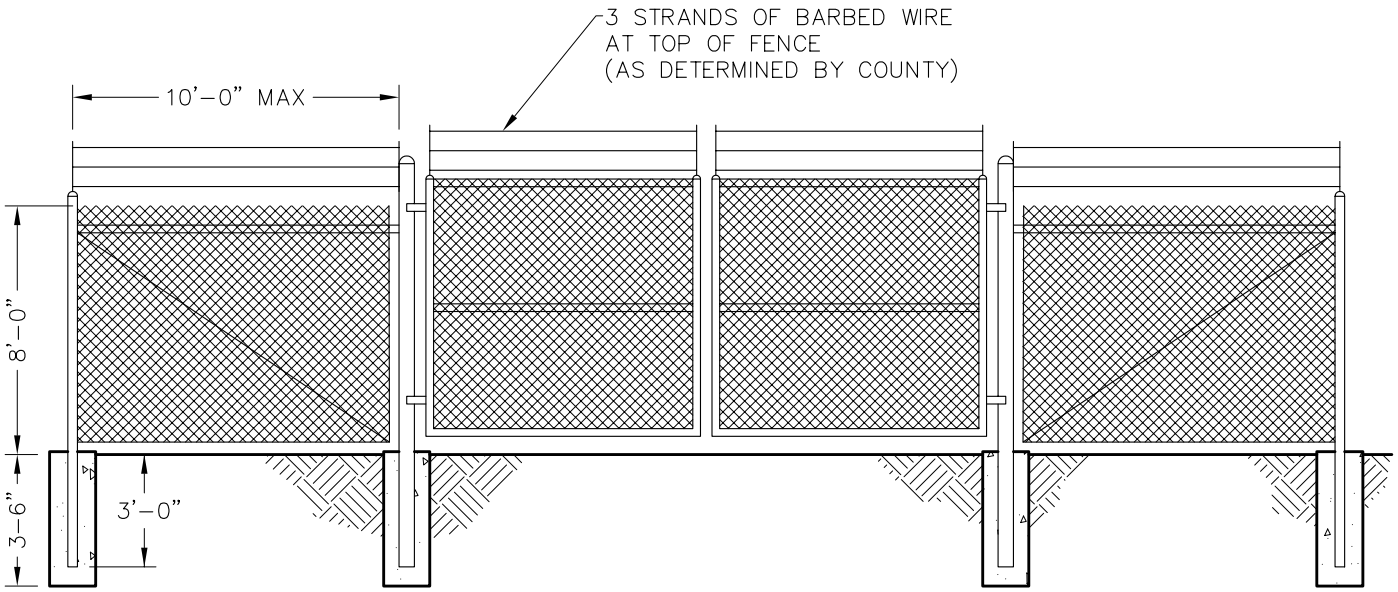
HIGHWAY CROSSING

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE

DATE: 09-01-04

DETAIL NO: G-1



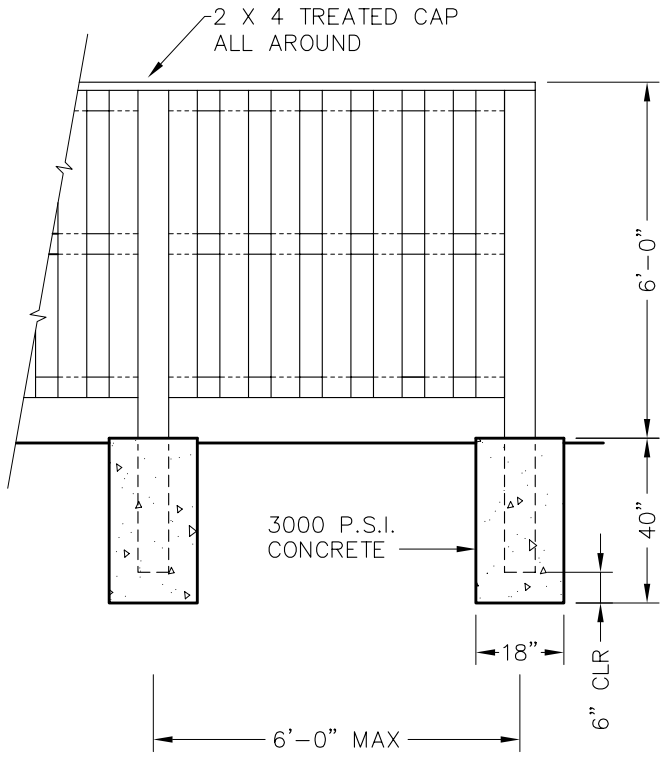
NOTES:

1. SINGLE STRAND, No. 9 GAUGE WIRE TO BE USED TO SUPPORT MESH WHEN NO FRAME IS AVAILABLE.
2. No. 6 GAUGE WIRE CLAMPS TO BE USED TO ATTACH FABRIC TO COLUMNS AND POSTS.
3. CONTRACTOR SHALL PROVIDE ALL NECESSARY HARDWARE, POSTS, TRACKING, AND LOCKS.
4. ALL GATE OR CORNER POSTS SHALL HAVE A CONCRETE FOOTER 14" IN DIAMETER. ALL LINE POSTS SHALL HAVE A FOOTER 10" IN DIAMETER.
5. BOTTOM OF FENCE SHALL BE AT FINISHED GRADE.

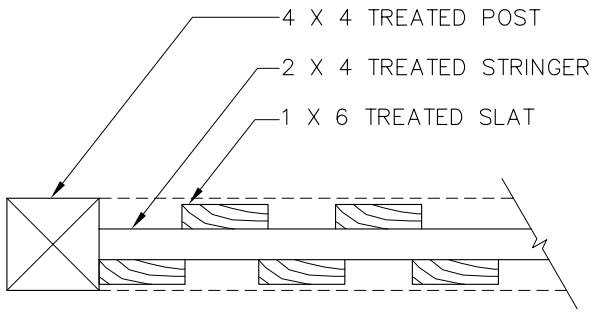
CHAINLINK FENCE AND GATE DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

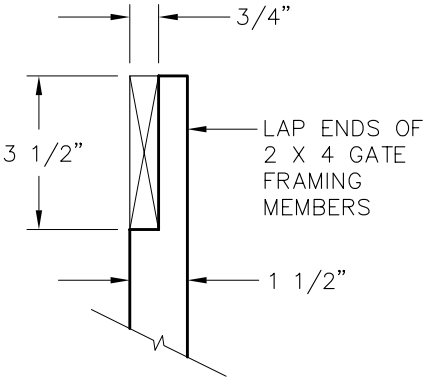
SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-2



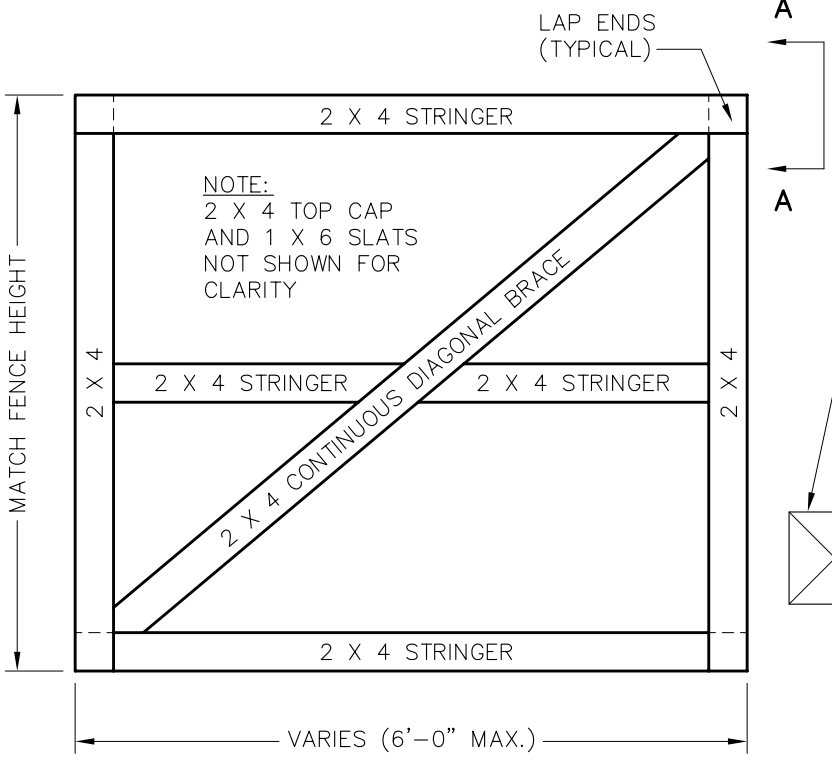
FENCE ELEVATION



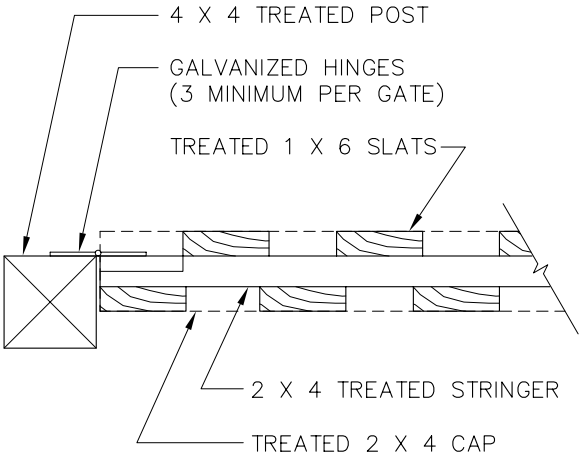
FENCE PLAN



DETAIL A–A



GATE FRAME ELEVATION

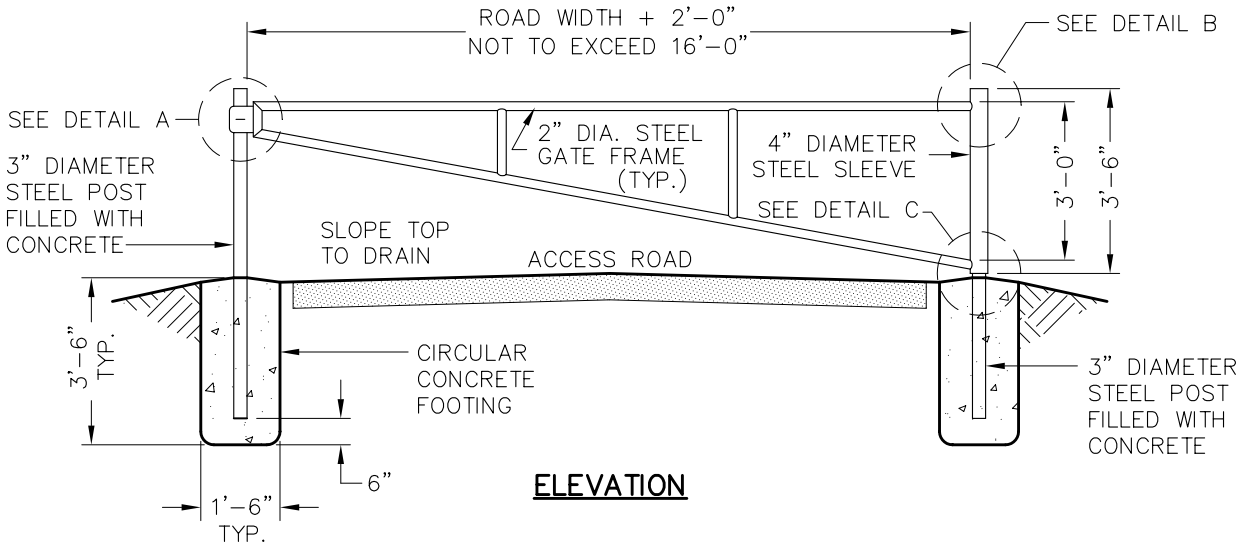


GATE PLAN

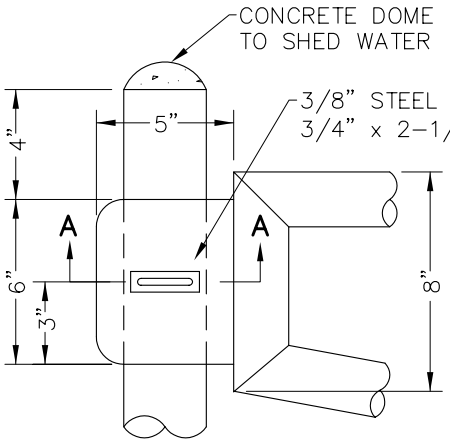
WOOD FENCE AND GATE DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

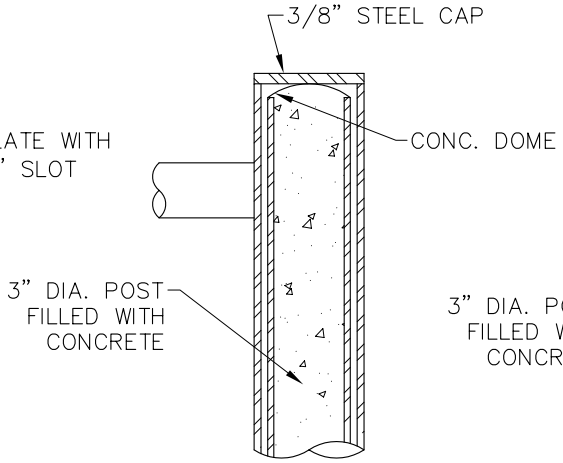
SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: G–2



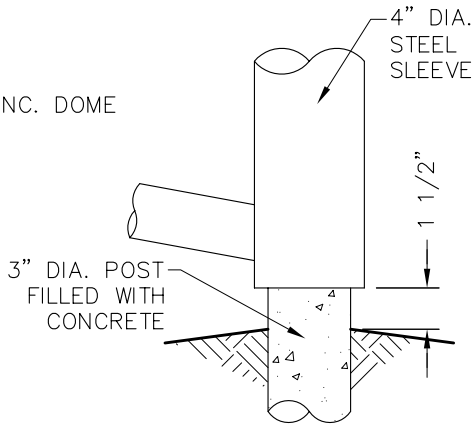
ELEVATION



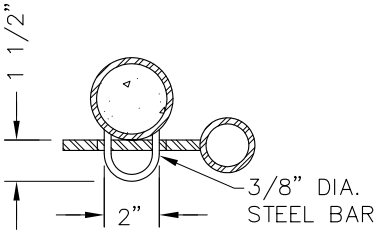
DETAIL A



DETAIL B



DETAIL C



SECTION A-A

NOTES:

1. STEEL USED IN THE MANUFACTURE OF THE GATE SHALL BE HOT DIPPED GALVANIZED.
2. ALL PIPE AND WELDS SHALL BE PAINTED ACCORDING TO MANUFACTURERS RECOMMENDATIONS.
3. ALL WELDS SHALL BE 3/16" FILLETS ALL AROUND.
4. PIPE MATERIAL SHALL BE SCHEDULE 40 STEEL. DIAMETERS ARE NOMINAL PIPE SIZE.
5. CONTRACTOR SHALL INSTALL AN ADDITIONAL 3" DIA. POST WITH 3/8" DIA. STEEL BAR, LOCATED TO SECURE THE GATE IN AN OPEN POSITION 90 DEGREES FROM THAT SHOWN ABOVE. GATE SHALL SWING TOWARDS THE COUNTY'S PROPERTY.

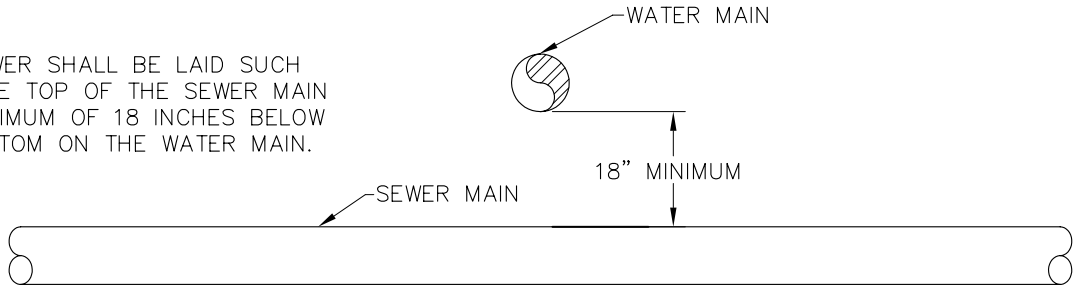
ACCESS ROAD GATE

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-3

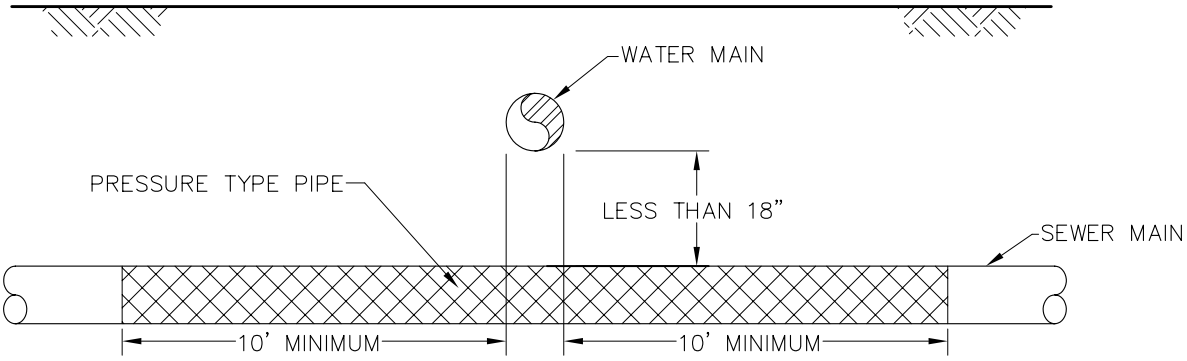
NOTES:

1. THE SEWER SHALL BE LAID SUCH THAT THE TOP OF THE SEWER MAIN IS A MINIMUM OF 18 INCHES BELOW THE BOTTOM ON THE WATER MAIN.



TYPICAL INSTALLATION

(SEWER MAIN CROSSING UNDER WATER MAIN)

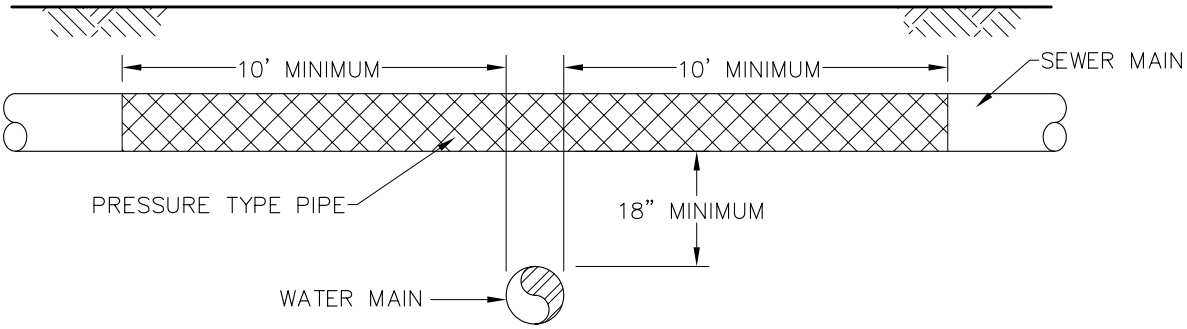


INSTALLATION WHERE VERTICAL SEPARATION IS LESS THAN 18"

(USED ONLY WHEN LOCAL CONDITIONS PREVENT TYPICAL INSTALLATION)

NOTES:

1. THE SEWER MAIN SHALL BE CONSTRUCTED FROM A FULL LENGTH SECTION OF AWWA SPECIFIED PRESSURE TYPE PIPE HAVING MECHANICAL OR APPROVED SLIP TYPE JOINTS FOR A MINIMUM OF 10 FEET ON EACH SIDE OF THE WATER MAIN.
2. ONE FULL LENGTH OF WATER MAIN SHOULD BE CENTERED AT THE SEWER MAIN SO THAT THE JOINTS IN THE WATER MAIN WILL BE AS FAR AS POSSIBLE FROM THE SEWER MAIN.
3. ZERO LEAKAGE OF SEWER LINES AND MANHOLES IS ALLOWED WHEN THE REQUIRED HORIZONTAL OR VERTICAL SEPARATION FROM WATER LINES IS NOT MET.



SEWER MAIN CROSSING ABOVE WATER MAIN

(USED ONLY WHEN LOCAL CONDITIONS PREVENT TYPICAL INSTALLATION)

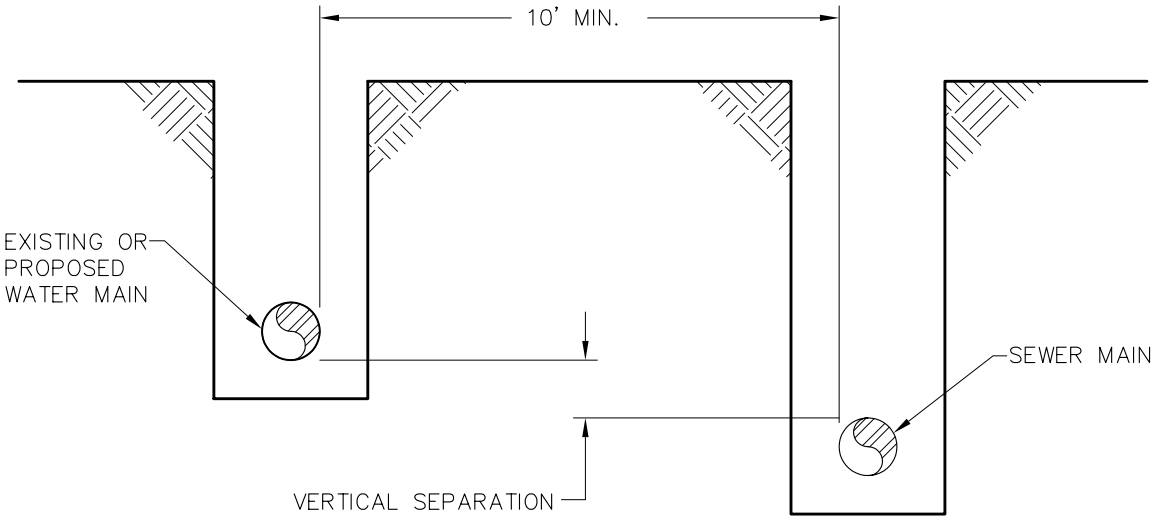
NOTES:

1. & 2. SAME AS ABOVE.
3. THE CROSSING SHALL HAVE ADEQUATE STRUCTURAL SUPPORT TO PREVENT DAMAGE TO WATER MAIN.

SEPARATION OF WATER AND SEWER MAINS

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE:	DATE:	DETAIL NO:
NOT TO SCALE	02-27-06	G-4

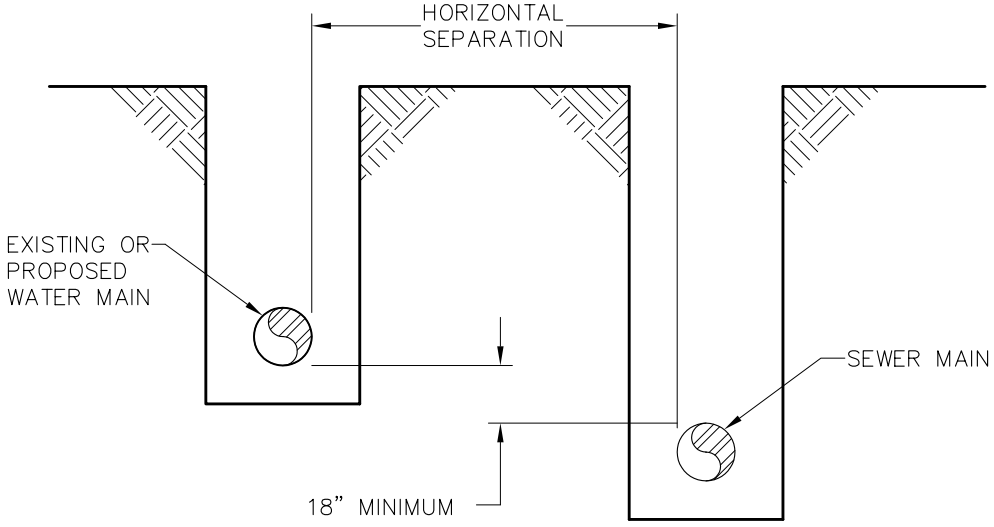


TYPICAL INSTALLATION

(MINIMUM 10' HORIZONTAL SEPARATION)

NOTES:

1. THERE ARE NO VERTICAL SEPARATION REQUIREMENTS WHEN HORIZONTAL SEPARATION IS 10' OR GREATER.



INSTALLATION WHERE HORIZONTAL SEPARATION IS LESS THAN 10'

(USED ONLY WHEN LOCAL CONDITIONS PREVENT TYPICAL INSTALLATION)

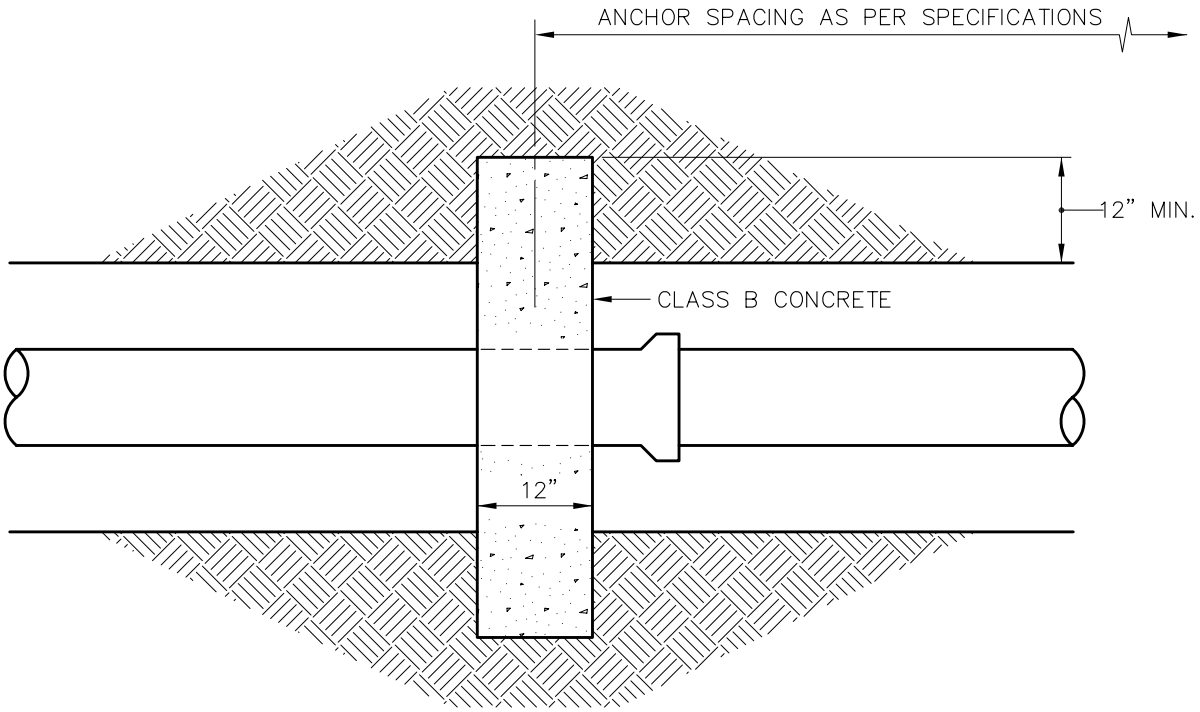
NOTES:

1. THE SEWER MUST BE LAID IN A SEPARATE TRENCH FROM THE WATER.
2. THE TOP OF THE SEWER MAIN MUST BE A MINIMUM OF 18" BELOW THE BOTTOM OF THE WATER MAIN.
3. WHERE THE MINIMUM 18" SEPARATION CANNOT BE OBTAINED. THE SEWER SHALL BE CONSTRUCTED OF PRESSURE TYPE PIPE.
4. ZERO LEAKAGE OF SEWER LINES AND MANHOLES IS ALLOWED WHEN THE REQUIRED HORIZONTAL OR VERTICAL SEPARATION FROM WATER LINES IS NOT MET.

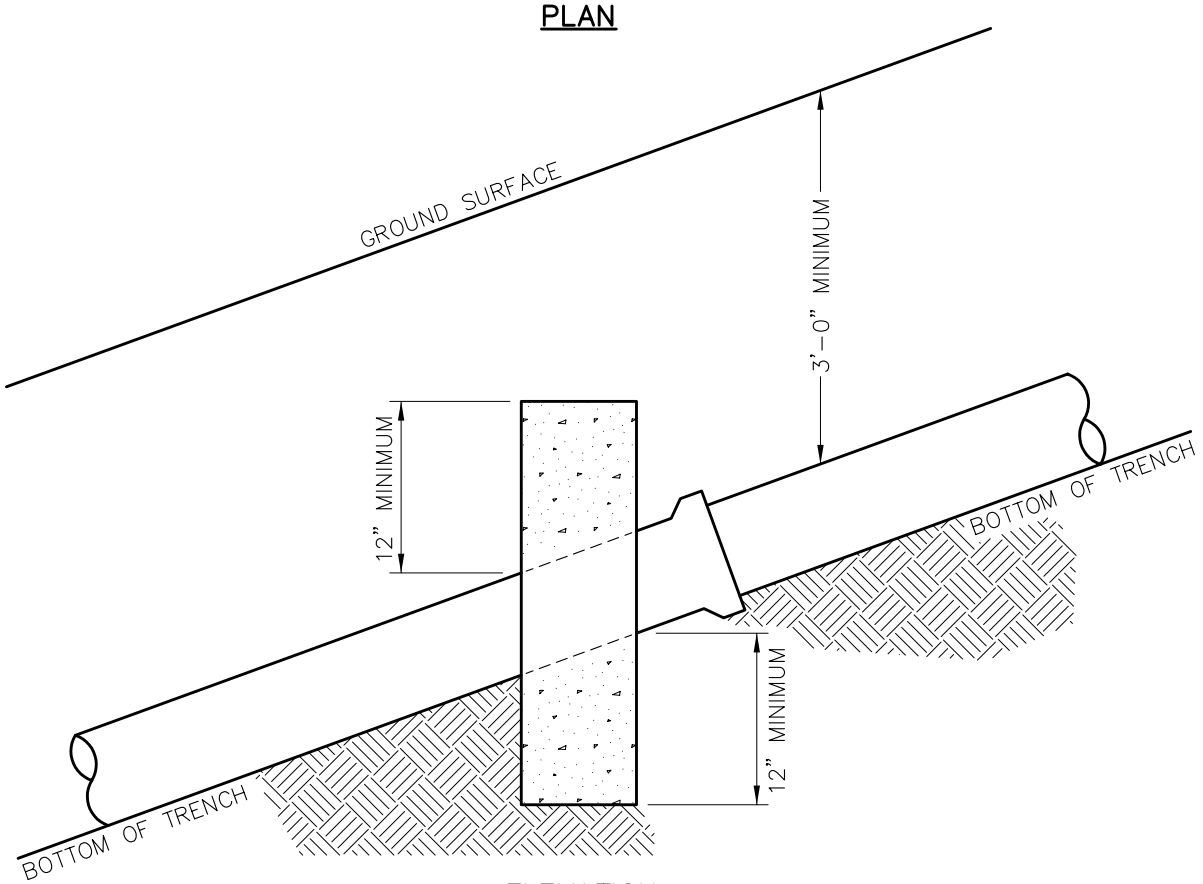
SEPARATION OF WATER AND SEWER MAINS

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-27-06
DETAIL NO: G-4



PLAN



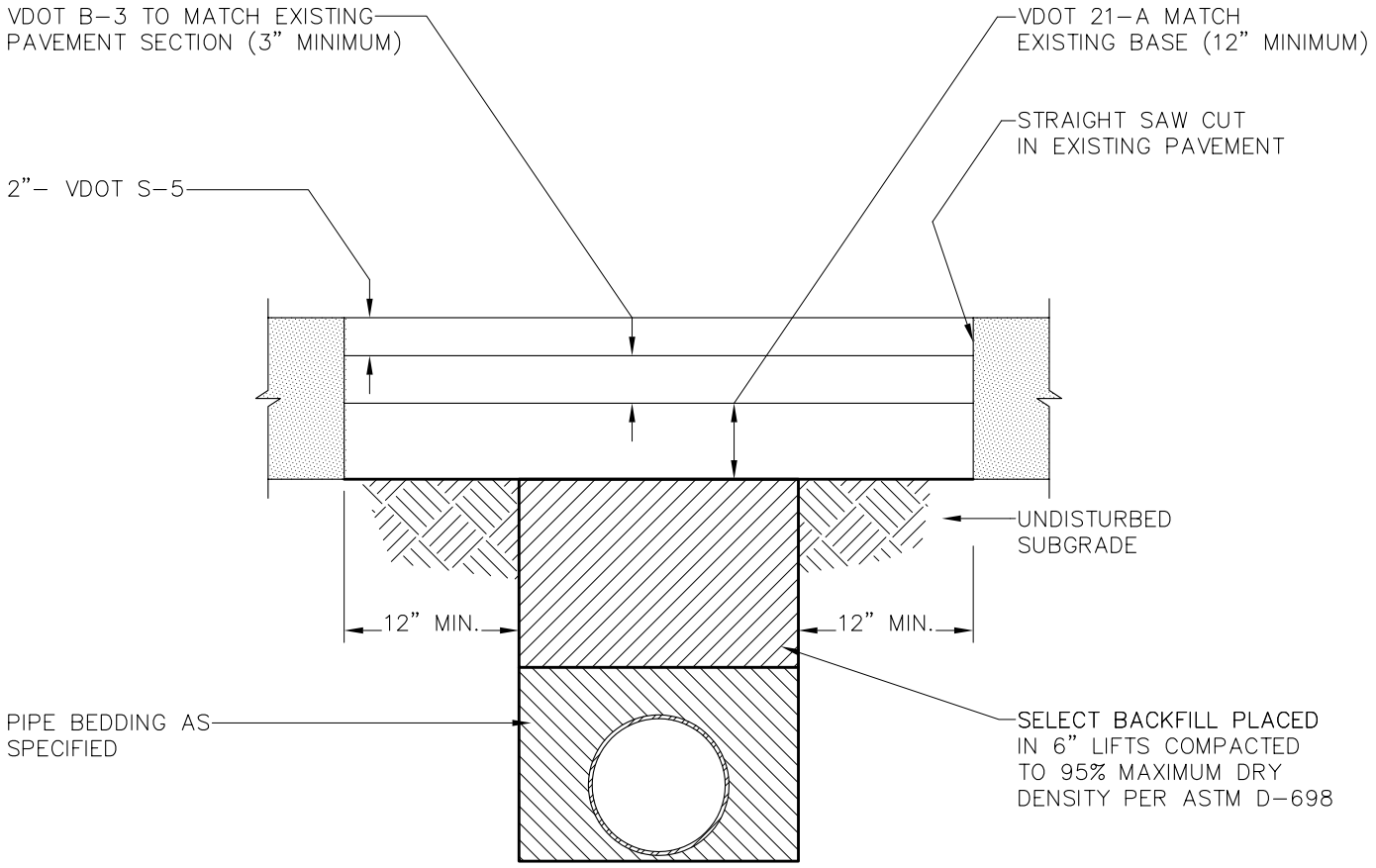
ELEVATION

NOTE: CONCRETE TO BE POURED AGAINST UNDISTURBED EARTH.

CONCRETE ANCHORS

KING GEORGE COUNTY SERVICE AUTHORITY

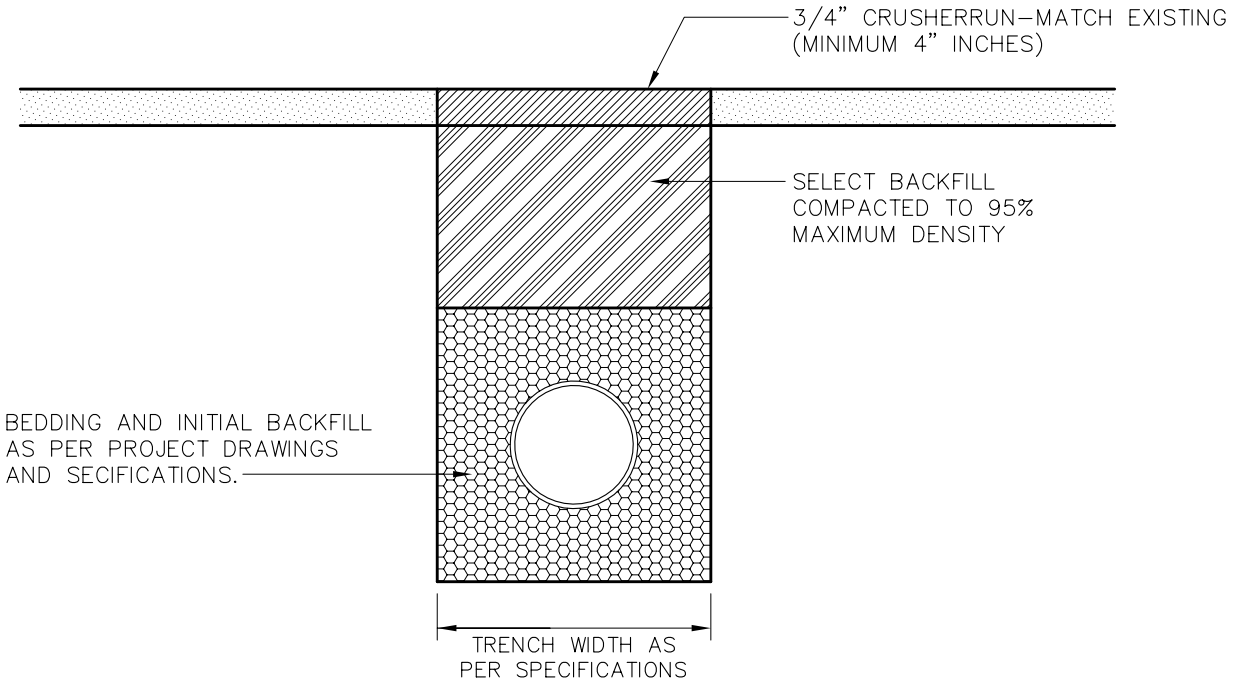
SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-5



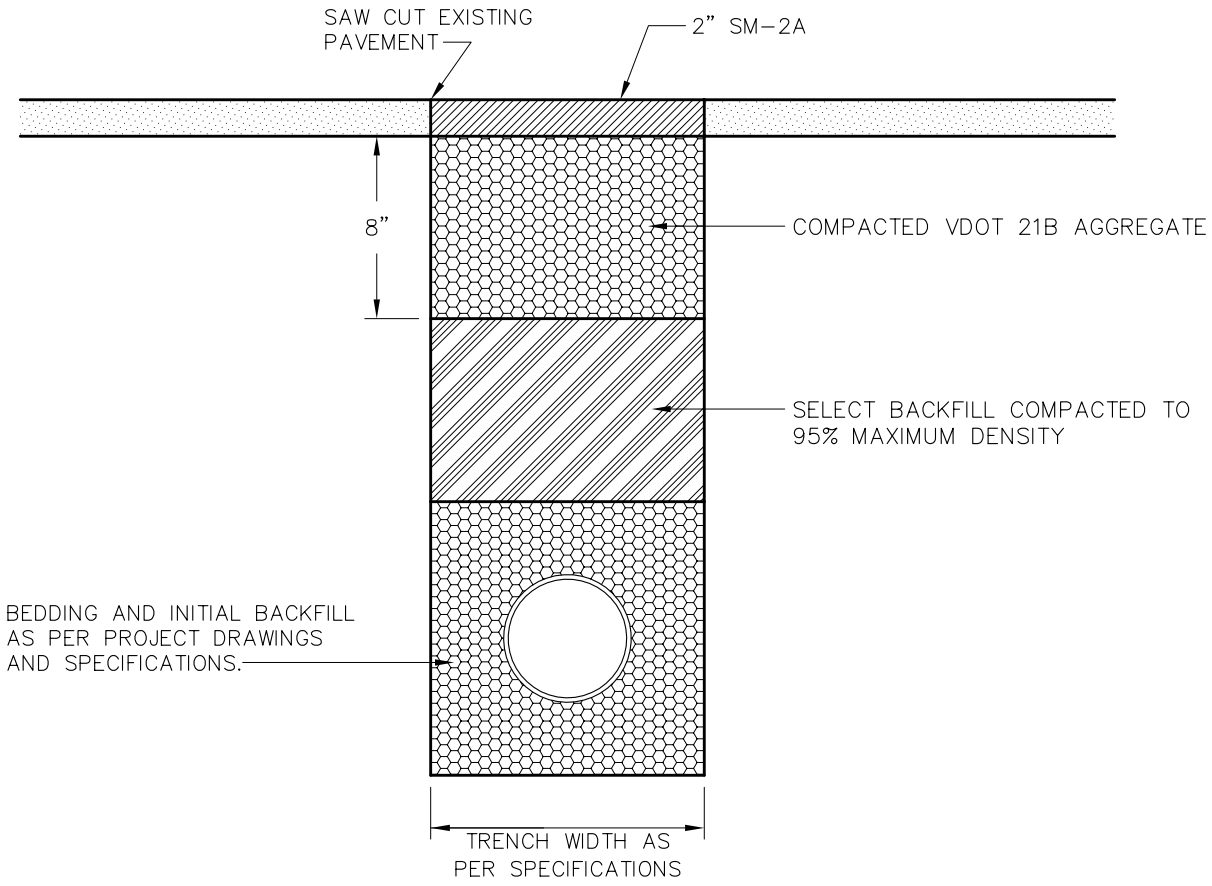
PAVEMENT REPAIR DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE:	NOT TO SCALE
DATE:	09-01-04
DETAIL NO:	G-6



GRAVEL DRIVEWAY/PRIVATE ROAD REPAIR

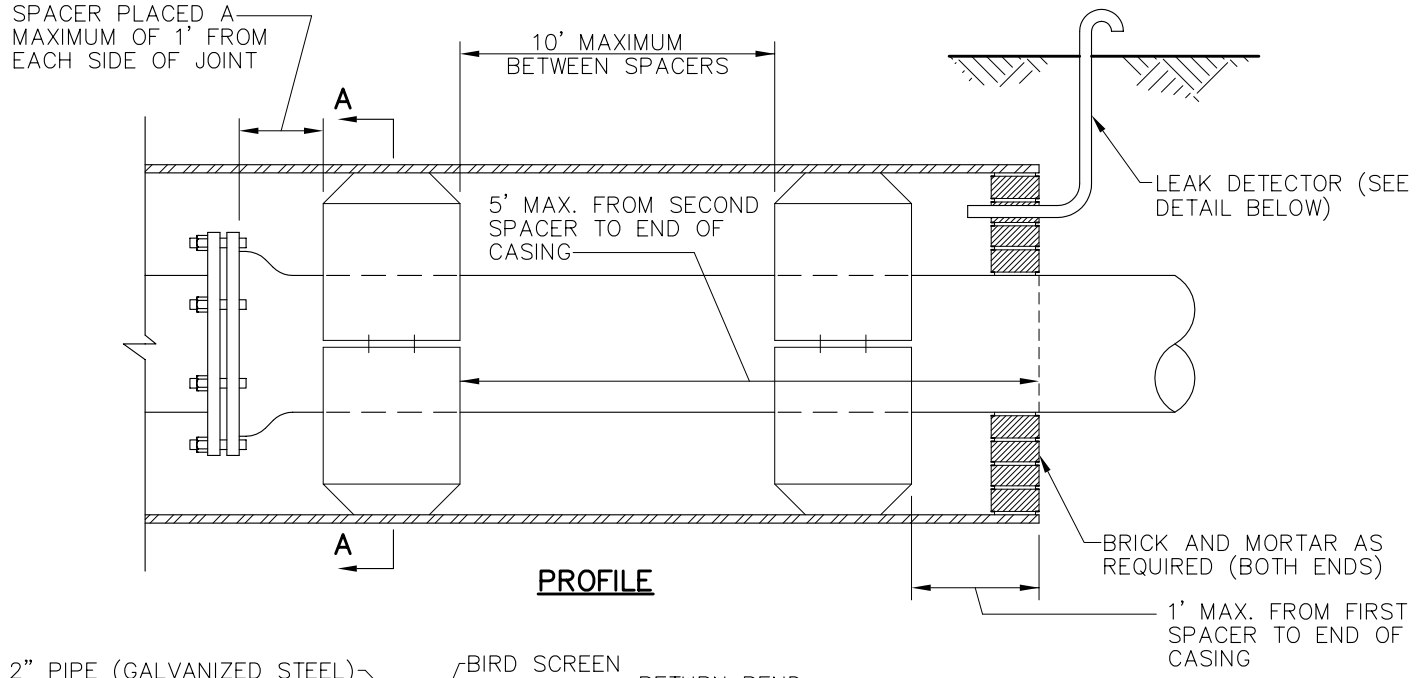


PAVED DRIVEWAY/PRIVATE ROAD REPAIR

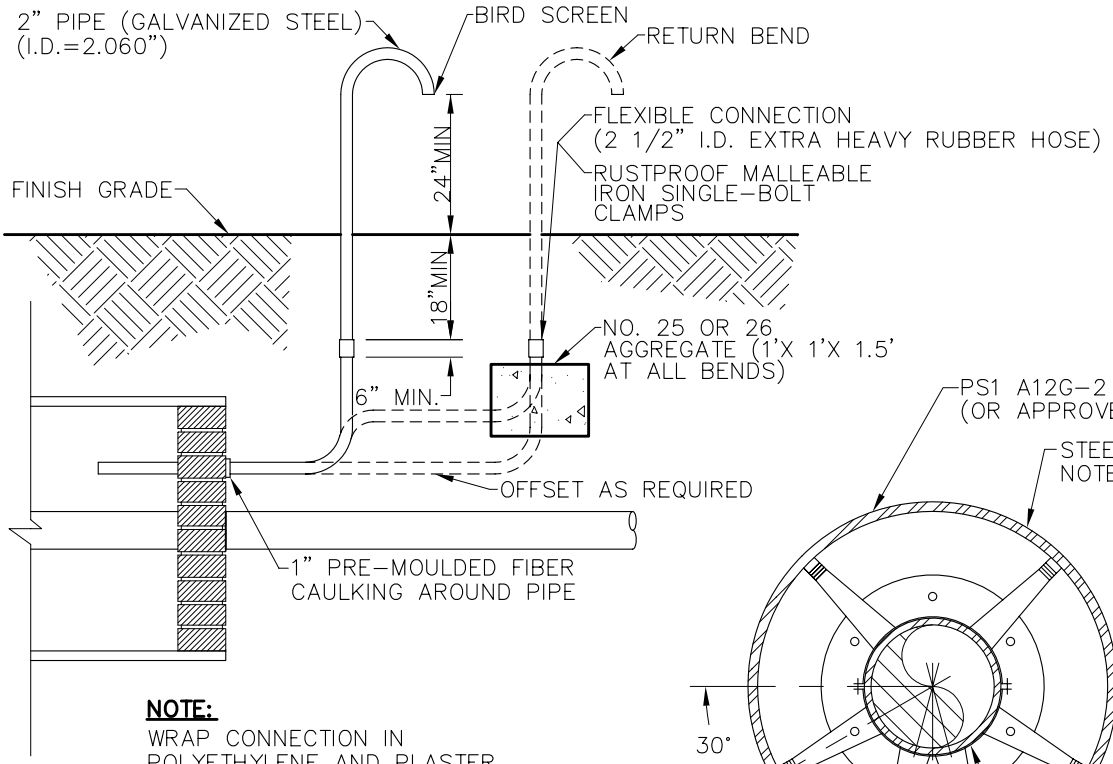
GRAVEL AND PAVED DRIVEWAY REPAIR

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: G–8

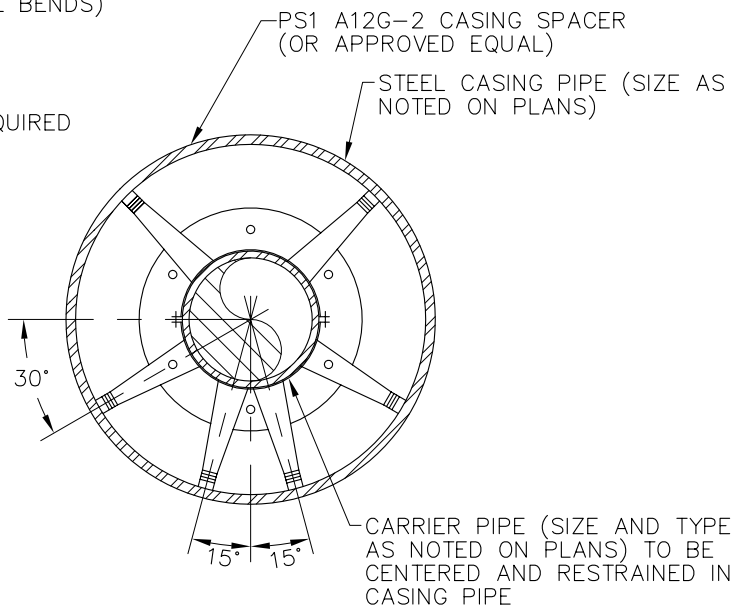


PROFILE



NOTE:
WRAP CONNECTION IN POLYETHYLENE AND PLASTER WITH ROOFING CEMENT OR ASPHALTIC MATERIAL.

STANDARD LEAK DETECTOR

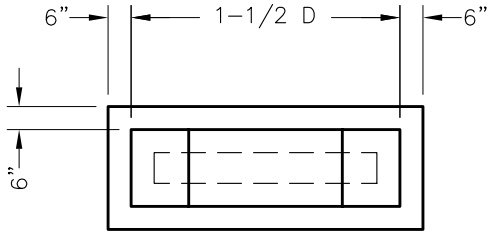


SECTION A-A

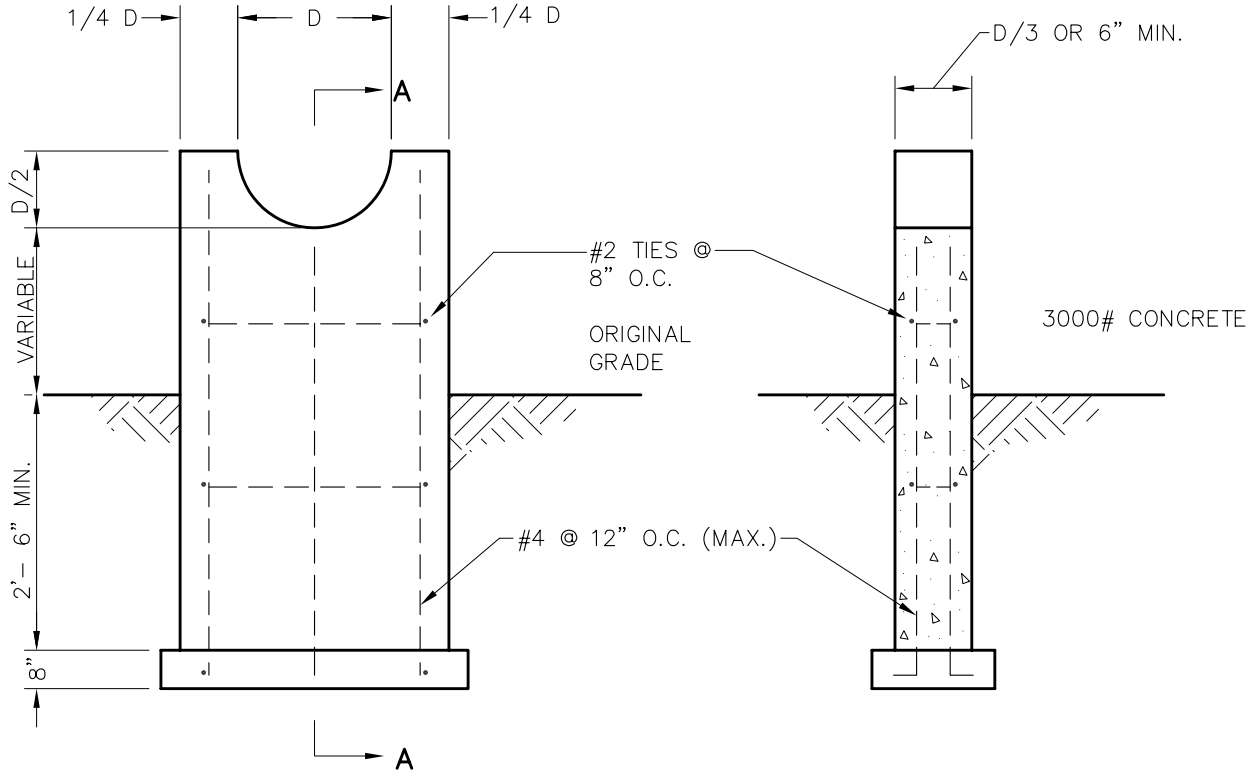
PIPE ENCASEMENT DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-9



PLAN



ELEVATION

SECTION A-A

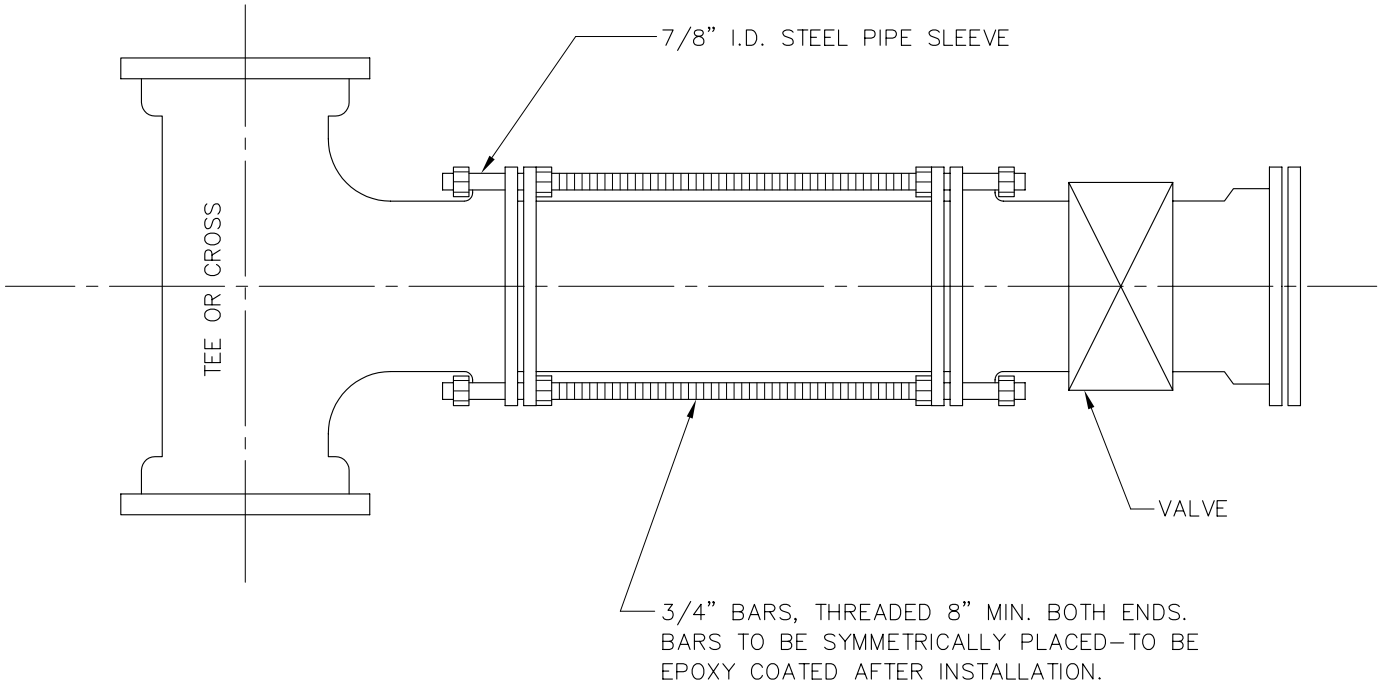
NOTE:

1. STRAP PIPE TO CONCRETE ANCHORS WITH 12 GA. 316 STAINLESS STEEL STRAPS AND BOLTS.

PIPE BRIDGE DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-10



VALVE SIZE	NUMBER OF 3/4" BARS REQUIRED	MAX. LENGTH OF SPIGOT PIPE
3"	2	24"
4"	2	24"
6"	2	27"
8"	2	27"
10"	4	27"
12"	6	27"
16"	8	36"
20"	12	36"
24"	16	36"
30"	20	42"

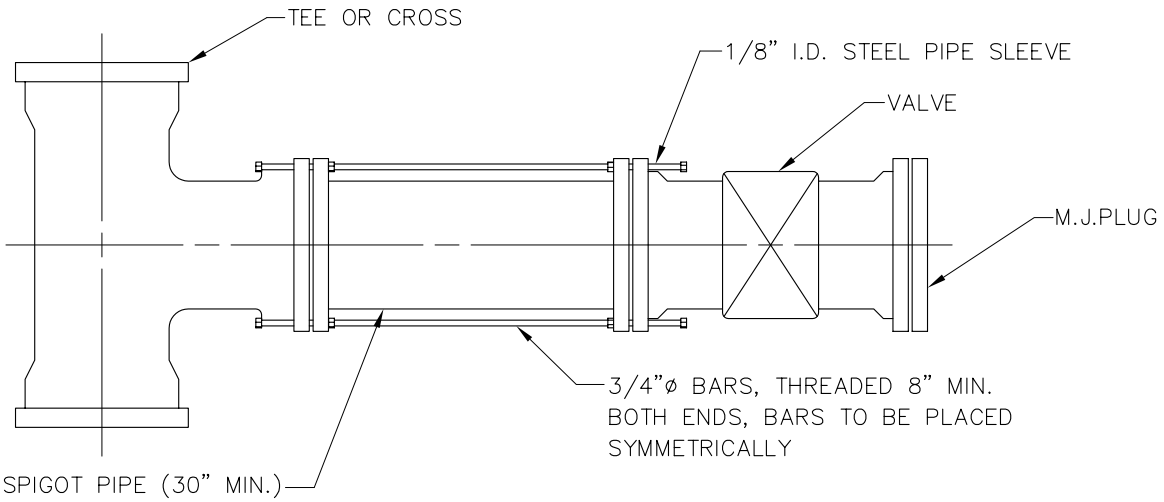
PIPE RESTRAINTS

KING GEORGE COUNTY SERVICE AUTHORITY

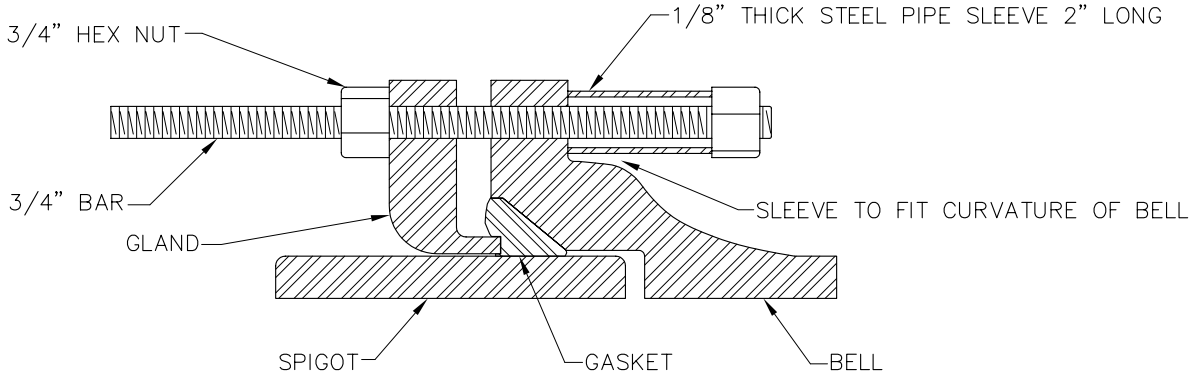
SCALE: NOT TO SCALE

DATE: 09–01–04

DETAIL NO: G–11



PLAN



CROSS SECTION
SLEEVE AND BAR ASSEMBLY

VALVE SIZE	No. OF 3/4"ø BARS REQUIRED	MAXIMUM LENGTH OF SPIGOT PIPE
6"	2	30"
8"	2	30"
10"	2	30"
12"	6	30"
14"	8	36"
16"	8	36"
18"	10	36"
20"	12	36"
24"	16	36"

NOTES:

1. PAINT ALL STEEL W/ TWO COATS OF VALDURO ASPHALT PAINT OR APPROVED EQUAL.
2. EYE BOLTS WILL BE ACCEPTED AS AN ALTERNATE TO THIS DETAIL.

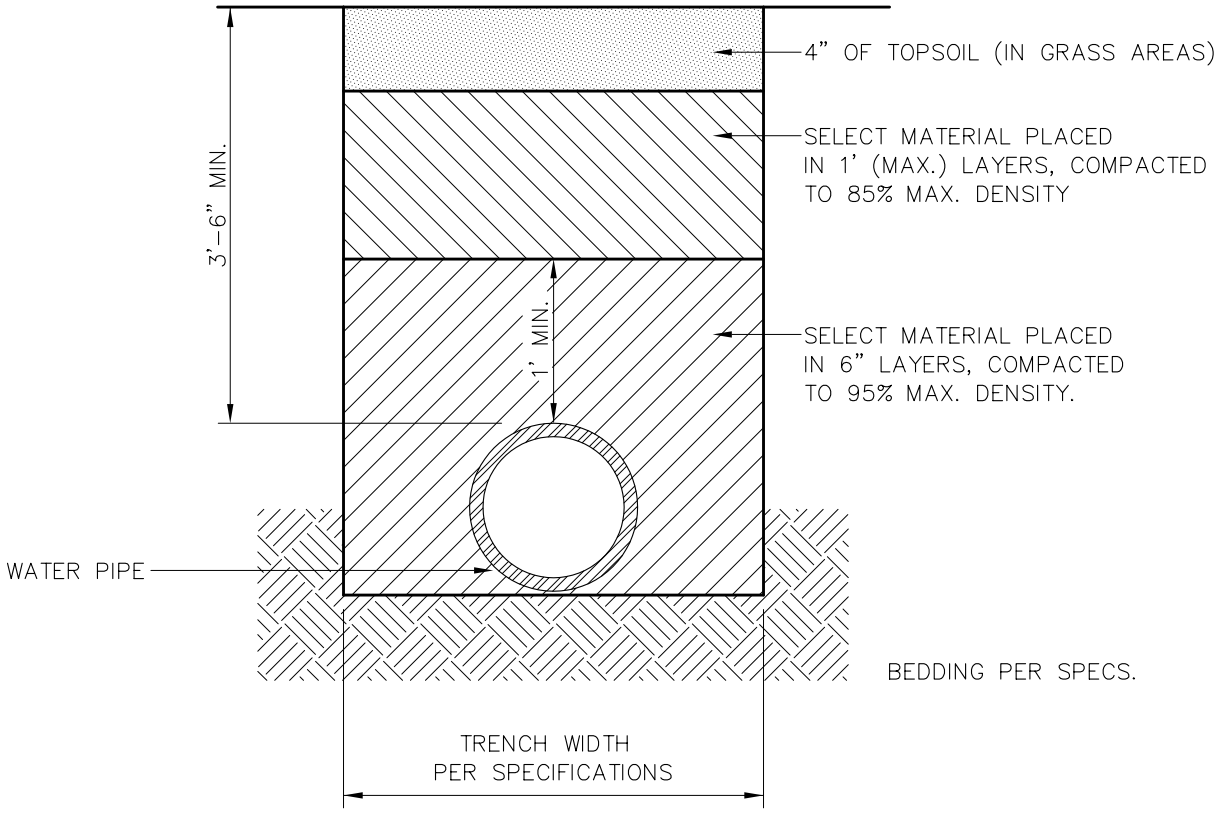
RESTRAINING ROD DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE

DATE: 09-01-04

DETAIL NO: G-12



PAYMENT LIMITS
TRENCH EXCAVATION & BACKFILL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-13