



Design Standards for the Town of Smithfield, Virginia

JANUARY 2008

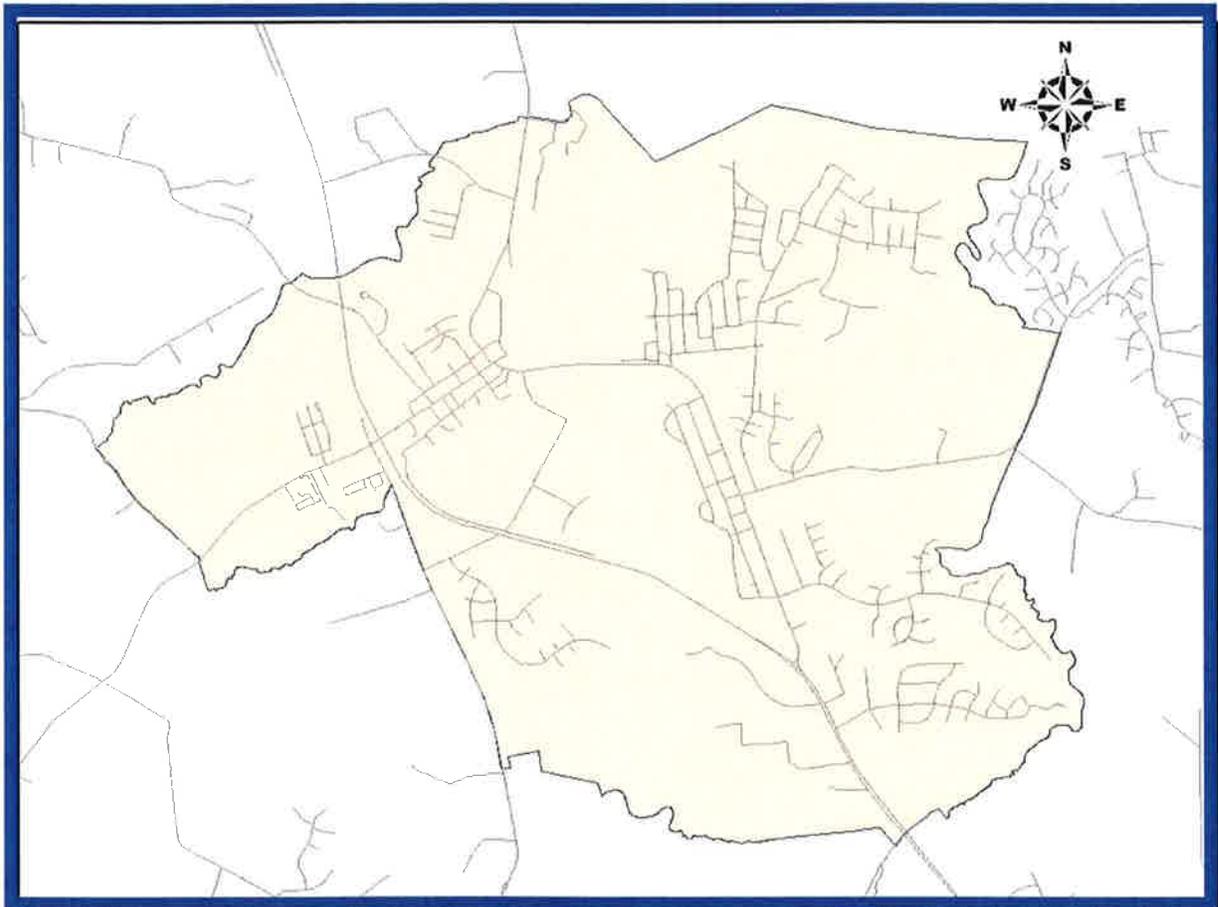


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Article VI. Standard Details

Reference Index

03/06/06

Through out this manual, references will be made to certain manuals and specification books and/or literature that will require your informational knowledge to insure your proper completion of the scope of work entitled.

Below are listed these reference materials:

1. Virginia Department of Transportation; Road and Bridge Specifications, January 2003 or most current issue. <http://virginiadot.org/business/manuals-default.org>
2. Virginia Department of Transportation; Road and Bridge Standards, Vol. I & II, 2001 or most current issue. <http://virginiadot.org/business/manuals-default.org>
3. Virginia Department of Transportation; Drainage Manual, May 2003 or most current issue. <http://virginiadot.org/business/manuals-default.org>
4. Virginia Department of Transportation; Urban Manual, 2001 or most current issue. www.virginiadot.org/projects/urban-manual.asp
5. Virginia Department of Transportation; Subdivision Street Requirements, 2005 or most current issue. <http://virginiadot.org/business/manuals-default.org>
6. Virginia Department of Transportation; Pavement Design Guide for Subdivision and Secondary Roads in Virginia, 2000 or most current issue. <http://virginiadot.org/business/manuals-default.org>
7. The current National Fire Code by NFPA.
8. The current American Water Works Association Manual
9. Virginia Department of Conservation and Recreation; Virginia Erosion and Sediment Control Handbook, 1992 or most current issue. www.dcr.state.va.us/sw/e&s-ftp.htm
10. Virginia Department of conservation and Recreation; Virginia Stormwater Management Handbook, 1999 or most current issue. <http://www.state.va.us/dcr/sw/stormwat.htm - handbook>
11. Virginia Dept. of Transportation; Virginia Work Area Protection Manual, 2003 or most current issue. <http://virginiadot.org/business/manuals-deault.asp>
12. Virginia Dept. of Transportation; Minimum Standards for Entrances to State Highways, 1998 or most current issue.
13. Hampton Roads Planning District (HRPDC) regional standards, January 2003 or most current issue, <http://www.hrpdc.org/RegionalStandards03/Rsoopeningpage.shtml>

Introduction

01/21/08

The purpose of this manual is to be used together with the latest edition of the Hampton Roads Planning District Commission (HRPDC) Regional Standards. All construction of water distribution and sanitary sewer systems shall adhere to the HRPDC Regional Standards unless otherwise listed within these standards. Design of all water distribution and sanitary sewer systems shall adhere to these standards. The Town Manager reserves the right to waive or modify any or all parts of this document, as he/she deems appropriate unless it is in strict violation of any approved Commonwealth of Virginia Regulation.

Approval of any plans for a project by the Town or its designated agent shall not relieve the Owner or its Engineer of the responsibility for errors and/or omissions contained in said plans. By its approval, the Town does not certify as to the correctness or completeness of plans. It shall be the sole responsibility of the developer to secure all regulatory agency approvals and permits required for the prosecution of work associated with a project.

The Developer agrees to indemnify and hold harmless the Town of Smithfield and its agent(s) from and against all claims, damages, losses and expenses arising out of or resulting from the performance of work included in any project pursuant to requirements in this manual.

The Town of Smithfield must be notified a minimum of 72 hours prior to the commencement of work, of any nature, on a project which requires inspection by the Town. Notification must be in the form of a formal letter to the Utilities Superintendent. Failure to provide proper notification may result in rejection of the work.

Design plans shall be sealed by a Professional Engineer or Land Surveyor licensed in the Commonwealth of Virginia in accordance with the Department of Professional and Occupational Regulations. Plans shall be accompanied by a Town of Smithfield Site Plan Checklist. Site Plan Checklist can be obtained by contacting (757) 365-4200 or by visiting <http://www.smithfieldva.gov>. As a minimum, plan cover sheet shall bear a suitable title showing the name of the project, scaled vicinity map, datum, legend, Miss Utilities information, responsible land disturber, and the name and contact information of the engineer, developer, and future owner of the utilities. Subsequent sheets shall bear an imprint or legible facsimile of Professional's seal along with title, graphic scale, and north arrow. Plans shall reference all applicable Town, HRPDC, and state details on all callouts to apertances on plan and profiles. The Town at their discretion may request additional information.

The design consultant required obtaining approval from Virginia Department of Environmental Quality (DEQ) and Virginia Department of Health (VDH) for the minimum of the following:

- All gravity sewers serving 40,000 gpd or greater Average Design or 100 or more connections
- All pumping stations with 20 gpm or more pumping rate
- All pump stations connecting to a common force main with one or more pump stations connected
- All water mains 16-inch or greater
- All transmission mains

- All water productions facilities

After completion of construction of facilities from approved plans and/or specifications the developer or owner responsible for the construction shall prepare record drawings, based on accurate, field-obtained information, to show actual conditions of the finished construction. The Developer shall furnish to the Town a complete set of reproducible drawings, one (1) set of electronic files in requested AutoCAD format, and two (2) sets of prints showing and as-built conditions. Receipt of the record drawings will be a prerequisite to acceptance of the project by the Town and release of bonds that may be required. The Town will not accept any portion of a project until all facets are complete.

01/21/08

Average Day Demand for Proposed Water and Sewer Design			
Type of Development	Design Units	Flow (GPD/Unit)	Flow Duration (hr.)
Apartment Complex	# of Units	250	24
Auto Dealership	Gross Sq. Ft.	0.08	12
Bakery	Gross Sq. Ft.	0.15	12
Bank	Gross Sq. Ft.	0.06	12
Bar/Night Club	# of Seats	10	8
Beauty Salon	Gross Sq. Ft.	0.35	12
Camping (Average)	# of Sites	40	24
Camping (Primitive)	# of Sites	30	24
Camping (Trailer)	# of Sites	75	24
Car Wash (Automatic)	# of Cars	35	12
Carry-Out (Chain)	# of Seats	15	16
Church	# of Seats	4	6
Clinic	Gross Sq. Ft.	0.40	12
Convenience Store	Gross Sq. Ft.	0.15	24
Drug Store	Gross Sq. Ft.	0.10	12
Exercise Club	Gross Sq. Ft.	0.125	16
Factory	# of Persons per Shift	25	Operating Hours
Garage (Auto Repair)	Gross Sq. Ft.	0.015	16
Gift Shop	Gross Sq. Ft.	0.04	12
Golf Clubhouse	# of Persons	5	12
Grocery Store	Gross Sq. Ft.	0.20	12
Hardware Store	Gross Sq. Ft.	0.04	12
Hospital	# of Beds	350	24
Laundromat	# of Machines	500	16
Library	Gross Sq. Ft.	0.10	16
Manufactured Homes	# of Units	250	24
Medical Offices	Gross Sq. Ft.	0.175	12
Motel	# of Units	130	24
Nursery School	# of Persons	4	8
Nursing Home	# of Beds	130	24
Office Building	Gross Sq. Ft.	0.10	12
Picnic Area	# of Persons	5	24
Pool	# of Persons	5	16
Racket/Tennis Club	# of Courts	300	16
Restaurant	# of Seats	35	16
Retail	Gross Sq. Ft.	0.20	12
Retirement Apartments	# of Units	225	24
School (Dormitory)	# of Persons	40	8
School (Elementary)	# of Persons	6	8
School (High)	# of Persons	7.5	8
Services Station	Gross Sq. Ft.	0.18	16
Single-Family Sub.	# of Units	310	24
Theater	# of Seats	1.5	12
Timeshare Unit	# of Units	250	24
Veterinary Clinic	Gross Sq. Ft.	0.18	12
Warehouse	Gross Sq. Ft.	0.02	24

Article I
Waterworks
01/21/08

1. **General**

- a. All waterworks shall be in accordance with these guidelines and requirements of the Commonwealth of Virginia "Waterworks Regulations".
- b. The construction of any new private water system is prohibited unless otherwise approved by Town Council. The term "private water system" refers to any water line service to two (2) or more separately platted lots that are not directly owned and maintained by the Town.
- c. All water distribution facilities and operations shall comply with Part II Article 3: "Cross Connection Control and Backflow Prevention in Waterworks" of the Waterworks Regulations of the Virginia Department of Health. All water distribution facilities and operations shall also comply with the "Program for Cross Connection Control and Backflow Prevention" of the Town of Smithfield, Virginia.
- d. Water meters shall not be installed until all water lines have been installed, tested, and approved by the Town.

2. **Plans**

- a. Plans and specifications shall include provisions for excavation and backfill, dewatering, sheeting and bracing, maintenance of traffic and protection of the public, protection of existing utilities and structures, separation of water and sewer lines, trench widths and preparation, materials, material testing, details of pipe laying and construction of pipe lines and appurtenances and their pressure, leakage, disinfection and bacteriological testing in accordance with these referenced standards. Plans shall include profiles, details and topographic information such as existing and proposed zoning, lot numbers, street pavement, sidewalks, driveways, curb and gutter, storm drains, utilities, trees, shrubbery, property lines, street names and house numbers (where available) and appropriate elevations.
- b. Plans shall be clear and legible. They shall be drawn to a scale, which will permit all necessary information to be plainly shown. Plans shall not be larger than 24" by 36". Profile stations must be clearly shown on the appropriate plan drawings as well as the profile drawings. **Datum shall be Town of Smithfield, Virginia 2003 Geodetic Control Network, Horizontal NAD 83 (1996), Vertical NAVD 88,** and a referenced benchmark and project benchmark shall be shown.
- c. A comprehensive plan of the existing and proposed water lines shall be submitted for new water distribution systems or substantial additions to existing systems. This plan shall show existing or proposed streets and all streams or water surfaces. Spot elevations, with contour

lines at suitable locations, shall be included. A single cover sheet showing, in a general layout, all substantial project features, with a sheet index, vicinity map and legend, shall be provided. The title block shall appear in the lower right corner of each plan sheet.

- d. Detailed plans consisting of plan view, profiles, elevations, sections and supplementary views, and specifications shall be provided.
- e. Profiles shall have a horizontal scale of not more than 40 feet to the inch and vertical scale of not more than 4 feet to the inch where practical. Plan views shall be drawn to a corresponding horizontal scale. Plans and profiles shall show:
 - (1) Location of streets and water mains.
 - (2) Line of existing and proposed ground surface above the pipe, size, material and type of pipe, and the water main between each two adjacent valves or hydrants.
 - (3) Stationed location of all special features such as material, meters, valves, bends, fittings, hydrants, concrete encasements, steel casings, elevated mains, and crossings.
 - (4) All known existing structures and utilities both above and below ground which might interfere with the proposed construction, particularly sewer lines, gas mains, storm drains, underground conduits, etc. Whenever available, the size and type of material shall be indicated.
 - (5) Special detail drawings, made to a scale to clearly show the nature of the design, shall be furnished to show conflicts and/or other critical details.
- f. Revised sheets shall contain a revision with identifying notation, date and mark for the revision.
- g. Record drawings for the water lines shall be field surveyed and submitted to the Town 30 days after final field test. Each sheet shall be stamped "Record Drawing" and dated. These drawings shall indicate the location of all mains, lateral, hydrants, meter and valve boxes \pm 6-inch. Three full sets of "Record Drawings" plus electronic files will be required indicating only the waterlines and street ROW alignment.

3. **Design**

a. **Minimum Residual Pressure**

A minimum residual pressure of 20 psi shall be maintained throughout the water system under any condition. A minimum residual pressure of 40 psi shall be maintained during a peak hour event. Fire protection flows shall be in accordance with applicable requirements of the National Fire Protection Agency (NFPA), Insurance Services Office (ISO), State, and local agencies and

must be approved in writing by the Fire Chief of the Town of Smithfield. Verification of these pressures shall be supported by a hydraulic analysis provided to the Town during system design.

b. **Dead Ends and High Points**

Dead ends shall be minimized where possible by looping the water system. Where system is at a dead end, a hydrant shall be placed on 6-inch diameter piping or larger and a blow-off assembly on 6-inch diameter piping or smaller. All high points shall have an approved manual air release device. Device shall be inspected and approved by the Town prior to backfilling.

c. **Hydraulic Analysis**

A hydraulic analysis is required for all phases of design projects that require potable or fire supply water from the Town's water system unless otherwise directed by the Town Manager. This analysis will be used to show the available flow and pressure for the proposed project. The analysis will also be used to show the effects of the proposed demands on the existing water system. The hydraulic analysis shall include as a minimum the following:

- Average demands as per Virginia Department of Health Waterworks Regulations 12 VAC 5-590-690 along with these standards.
- Irrigation demand of 1.2 gpm per residential connection or 1 acre of commercial land (Minimum 15% total acreage of commercial land). Irrigation demand shall be modeled in all scenarios. Provide written proffers to the Town of Smithfield if irrigation will not be allowed for the development.
- Maximum day demands using a peak factor no less than 1.7.
- Maximum day plus fire demands approved by Town of Smithfield Fire Department. The proposed or existing water system shall not drop below 20 psi.
- Peak hour demands using a peak factor of 4.0 times average demand so the proposed or existing water system does not drop below 40 psi. Peak hour demand equivalent to fixture count for meter sizing.
- Water systems shall be designed to minimize dead ends and shall be looped whenever possible.
- Velocity in any pipe shall not exceed 8 fps.
- Pipe diameters and lengths as well as elevations.
- Head loss shall not exceed 20 psi per 1,000 feet of pipe.
- Sealed, signed, and dated as per Virginia Department of Professional and Occupational Regulations
- Node Map labeling pipes, junctions, reservoirs, pumps, tanks, contours
- The following scenario reports in order are required along with detailed reports for all pumps and tanks:
 - **Junction Reports:** Label, Elevation, Base Flow (gpm), Description, Demand (Calculated gpm), Pressure Head (ft), Pressure (psi), and Calculated Hydraulic Grade (ft)

- **Pipe Reports:** Label, From Node, To Node, Status, Diameter (in), C-Factor, Discharge (gpm), Velocity (ft/sec), Pressure Pipe Headloss (ft), Headloss Gradient (ft/1000ft)
- **Pump Reports:** Label, Control Status, Elevation, Notes, Intake Pump Grade (ft), Discharge Pump Grade (ft) Discharge (gpm) Pump Head (ft)
- **Reservoir Reports:** Label, Elevation, Calculated Hydraulic Grade (ft), Inflow (gpm) Outflow (gpm)
- **Tank Reports (If applicable):** Label, Inflow (gpm), Current Status, Calculated Hydraulic Grade (ft), Calculated Volume (gal), Calculated Percent Full (%), Calculated Level (ft), Outflow (gpm), Total Volume (gal)

4. When a water storage tank is proposed, the engineer shall provide an Extended Period Simulation (EPS) showing the proposed tank emptying and filling. The Town engineer on a case-by-case basis will evaluate any additional information required for EPS models.

- a. Water distribution systems shall be designed to provide adequate flow and pressure for both domestic supply and fire flow, based on sound hydraulic analysis. Design shall be based on a maximum flow velocity of 8 feet per second, a Hazen-Williams "C" factor no greater than 120, and a minimum system pressure of 20 psi.
- b. Fire flow requirements shall be in accordance with the latest editions from the National Fire Protection Agency, Insurance Services Office, and shall be approved in writing by Town of Smithfield Fire Department.
- c. Maximum obtainable design flow out of a single hydrant is 1,000 gpm.
- d. Services and meters shall be sized in accordance with the AWWA Manual M22 "Sizing Water Service Lines and Meters" using proposed Water Supply Fixture Units (WSFU) calculated from International Plumbing Code 2000. Calculations must be submitted for review. Minimum service size shall be 1-inch. Each service shall have an individual tap, except that for duplex and townhouse lots, one 1-inch tap may be used for two services if adequate.
- e. Design of wells and water storage facilities shall meet or exceed the latest VDH regulations.
- f. Minimum water main size feeding a hydrant assembly shall be 8-inch diameter. Smaller diameter pipes may be used where fire protection is not needed at the discretion of the Town engineer.

5. **Location**

- a. Water mains shall generally be located on the northern and eastern side of public rights-of-way and no further than five (5) feet from the right-of-way boundary line. Except for sanitary sewers, all other utilities shall be a minimum of five (5) feet horizontally/vertically

from the water main or as per direction of the Town of Smithfield's Superintendent of Public Utilities. Separation from sanitary sewer shall be in accordance with state regulations. Water mains will be permitted in easements only when approved by the Town. Easements shall provide sufficient space for both installation and maintenance with a minimum width of twenty (20) feet. Water main shall not be located under sidewalk.

b. Existing and proposed sanitary sewers and storm drainage systems and all other underground utilities and structures shall be considered in the design and selection of pipe depths and alignments to avoid conflicts and facilitate maintenance.

c. Recommended minimum hydrant spacing:

Residential	600' intervals (400' radius)
Commercial/Industrial	400' intervals (250' radius)

Hydrants in residential areas shall be located at intersections and in the middle of long blocks whenever practicable. On cul-de-sacs or dead-end streets that cannot be extended, hydrants shall be placed approximately 400 feet from the end of the cul-de-sac or dead end.

d. Valves shall be located at not over 1,000 foot intervals and at all changes in pipe diameter. Valves shall also be required on all sides at all pipeline intersections so as to provide shut-off for repairs of limited sections without interruptions of service to large areas and to facilitate testing.

e. Water mains shall be provided with air release valves and blow-offs at suitable locations to allow testing, chlorination and draining of the line. Where air reliefs are subject to flooding the open end shall be extended to at least 1-foot above grade and be provided with a screened downward facing elbow.

f. Where dead ends occur, there shall be provided with a fire hydrant, flushing hydrant, or blow-off for flushing purposes.

g. Meter boxes shall be located at property lines. All water meter lids shall be of the "touch-read" type specified within these standards.

6. **Conflicts and Clearances**

a. **Parallel Installation**

(1) Normal Conditions - Water mains shall be laid at least ten (10) feet horizontally from any sanitary sewer or sewer manhole whenever possible. The distance shall be measured edge to edge.

- (2) Unusual Conditions - When local conditions prevent a horizontal separation of ten (10) feet, a water main may be closer to a sanitary sewer or sewer manhole provided that:
 - (a) The bottom of the water main is at least 18 inches above the top of the sewer.
 - (b) Where this vertical separation cannot be obtained the sewer shall be of AWWA approved water pipe and shall be pressure tested to assure water tightness prior to backfilling and after backfilling.
 - (c) The sewer manhole is constructed watertight and tested in place.

b. **Crossings**

- (1) Normal Conditions - Water mains crossing sanitary sewers shall be laid to provide separation of at least eighteen (18) inches between the bottom of the water main and the top of the sewer, wherever possible.
- (2) Unusual Conditions - When local conditions prevent a vertical separation of eighteen (18) inches, the following shall be used:
 - (a) Sewers passing over or under water mains shall be in accordance with Article II, Section 6.a.2.
 - (b) Water mains passing under sewers shall, in addition, be protected by providing:
 - (i) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main.
 - (ii) Adequate structural support for the sewer to prevent excessive deflection of joints and settling on and breaking of the water main.
 - (iii) That the length of water pipe be centered at the point of crossing so that the joints will be equal-distant and as far as possible from the sewer.
- (3) Surface water crossing - Where a water main crosses above surface water, the pipe shall be adequately supported, completely insulated to protect it against damage from freezing, accessible for repair or replacement, and above the level of a 100-year flood and any floating debris it may carry. The tops of all buried sewers entering or crossing streams shall be at a minimum of 10-foot depth below the natural bottom of the streambed to protect the sewer line. Less cover will be considered if the proposed sewer crossing is encased in concrete and will not interfere with future improvements to the stream channel.

c. **Sewer Manholes**

No water pipe shall pass through or come into contact with any part of a sewer manhole.

7. **Water Main Materials**

- a. Unless otherwise specified by the Town of Smithfield and HRPDC Regional Standards water mains shall be ductile iron pipe conforming to the following:

Pipe - ANSI/AWWA C151/A21.51, Class 52 minimum.

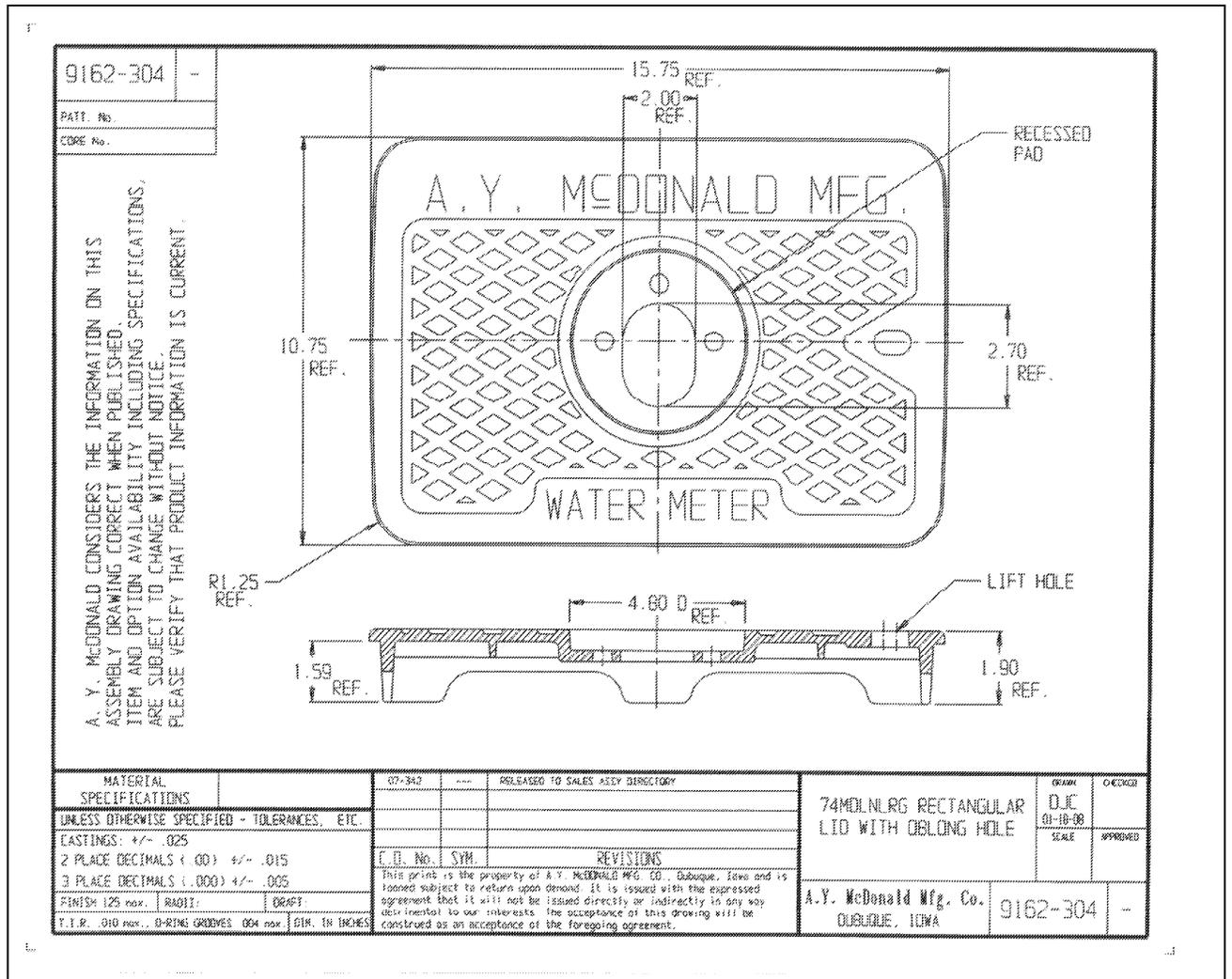
Fittings - ANSI/AWWA C110/A21.10.

Joints - ANSI/AWWA C111/A21.11 (Mechanical or slip-on).

Cement Lining - ANSI/AWWA C104/A21.4.

- b. Gate valves may be iron body, bronze mounted, double disc, and non-rising conforming to ANSI/AWWA C500 or resilient seat, non-rising conforming to ANSI/AWWA C509. Valve boxes and covers as approved by the Town shall be adjustable cast iron or 14" truss pipe with full cast iron lid with the word "WATER" cast in the top. Gate valves shall be manufactured by AVK or approved equal. Provide valve extension rod if valve nut is greater than 30-inches below grade.
- c. Hydrants shall be Mueller "Centurion" or Kennedy "K-81D"; with 4-1/2-inch pumper nozzle and two 2-1/2-inch hose nozzles and shall open left. Minimum hydrant size is 6-inch.
- d. Side outlet fittings for valves or future extensions shall be flanged and provided with valve and blind flange.
- e. Restraint for piping shall be Romac Industries Grip Ring Pipe Restrainer of approved equal.
- f. Water taps shall be made with corporation stop and gooseneck. Corporation stops shall be provided with compression fittings and stainless steel inserts. Water taps for service lines 2-inch diameter and larger shall be rigid connection with gate valve and shall be brass or copper unless otherwise specified by the Town. Taps under 2-inch shall be CTS (copper tube size) plastic rated at 200 psi.
- g. Coppersetter shall be Ford VHH71-7W-41-43 with padlock wings on key valve, angle double check valve at meter outlet, 1-inch C.T.S. compression fitting at inlet, 1-inch iron pipe fitting at outlet. An 18-inch Schedule 80 PVC pigtail, threaded at both ends, shall be provided on the outlet side of the Coppersetter or as otherwise approved by the Town.
- h. Meter boxes shall be 18-inch plastic with full cast iron lid. Meter boxes shall be located at property lines. Line setters shall be 18-inches below the finished grade of the lot. The type of meter shall be "Schlumberger" or as otherwise specified by the Town. All water meter

lids shall be of the “touch-read” type as specified by the Town – A.Y. McDonald MFG. Model # 74MBLNLRG.



- i. Warning tape shall be bright BLUE plastic with detectable foil and "CAUTION-WATER LINE BELOW" printed on it. Tape shall include a minimum 10 gauge copper wire for enhanced detectability and shall be installed 18"-24" above waterline. If CTS material is used, then tracer wire shall be provided.
- j. Water mains constructed in fill areas shall be restrained joint ductile iron pipe extending to nearest manhole or native ground.

8. **Installation**

- a. All water mains shall have a minimum of thirty-six (36) inches and a maximum of forty-two (42) inches of cover from finished grade, unless otherwise approved by the Town. Water service lines shall have a minimum of eighteen (18) inches of cover (includes bottoms of ditches). See “Design Basis For New Sewage Works” (page 63) for additional cover requirements for pipes and valves.

- b. Thrust protection shall be specified on Plans and shall consist of concrete thrust blocks against undisturbed earth, or approved tie rods, or lock type feature joints. Retainer rings may be permitted. Hydrants shall be protected from thrust by means of tie rods or retainer glands. Thrust blocks will not be permitted behind temporary plugs.
- c. Where valves are placed at the ends of lines for future extension sufficient length, but not less than one pipe length, of kicker joint shall be installed to hold the valve in place with retainer clamps on the valve. Dead-end lines shall be provided with an air release or blow-off corporation valve.
- d. Pipe shall be supported over its entire length by a continuous and uniform bedding. Where unsuitable material is encountered provide select bedding as shown on Plate S-8. Stones and rock encountered during trench excavation shall be removed to a depth of at least six inches below the bottom of the pipe and select fill bedding provided.
- e. Backfill over pipe shall be compacted in 6-inch layers. Select backfill material may be required if the native material is deemed by the Town to be unsuitable for backfill. Under areas to be paved 90% of maximum density as determined by ASTM D698 shall be achieved. It shall be the responsibility of the Contractor to engage a certified laboratory, approved by the Town, to make compaction tests to verify that adequate compaction has been attained.
- f. Any plastic or other nonmetallic pressurized conduit installed underground shall have installed with it a warning tape of electrically conductive material. Such shall be installed directly over the pipe at a depth of twelve inches. In addition a continuous 10 gauge copper wire shall be taped directly on the top of the pipe.
- g. Installation of new water mains and connection to existing water mains shall be subject to the requirements of the "Cross Connection Control and Backflow Prevention Program" of the Town of Smithfield".
- h. No flushing devices, chambers, or pits containing valves, blowoffs, meters or other such accessories, shall be directly connected to any sewer.

9. **Water Main Testing**

- a. A hydrostatic pressure test shall be made for all water mains that include the Coppersetter. Procedure shall conform to ANSI/AWWA C600. Test pressure shall be 150 psi for 2 hours with no pressure drop.
- b. Tapping sleeve valve, when installed, will be required to be pressure tested for 10 minutes at 150 psi with no pressure drop.
- c. All other testing including flushing, disinfection, and coliform shall be in accordance with HRPDC Reginald Standards, these Special Provisions, and VDH Regulations.

ARTICLE II
Sanitary Sewers
01/21/08

1. **General**

- a. Sanitary sewers and building sewers shall be in accordance with these guidelines, the Uniform Statewide Building Code, ordinances of the Town of Smithfield, and requirements of the Commonwealth of Virginia Department of Environmental Quality's "Sewage Collection and Treatment (SCAT) Regulations". The Town prior to commencement of construction shall approve all Plans and Specifications in writing.
- b. The construction of any new private sewer is prohibited. The term "private sewer" refers to any sewer serving two (2) or more separately platted lots that is not directly owned and maintained by the Town.
- c. Combined sewers are prohibited unless approved by the Town of Smithfield.

2. **Plans**

- a. Plans and specifications shall include provisions for excavation and backfill, dewatering, sheeting and bracing, maintenance of traffic, protection of the public, protection of existing utilities and structures, separation of water and sewer lines, trench widths and preparation, materials, material testing, details of pipe laying and construction of pipe lines and appurtenances and other items as may be applicable to the project, all in accordance with good engineering practice. Plans shall include profiles, details and topographic information such as existing and proposed zoning, lot numbers, street pavement, sidewalks, driveways, curb and gutter, storm drains, utilities, trees, shrubbery, property lines, house numbers (where available) and appropriate elevations. Methods of abandonment of existing sewers and laterals shall be shown.
- b. The plans shall be clear and legible. They shall be drawn to a scale that will permit all necessary information to be plainly shown. Plans shall not be larger than 24 inches x 36 inches. Profile stations must be shown on the appropriate plan drawings as well as the profile drawings. **Datum shall be Town of Smithfield, Virginia 2003 Geodetic Control Network, Horizontal NAD 83 (1996), Vertical NAVD 88**, and a referenced benchmark and project benchmark shall be shown.
- c. A comprehensive plan of the existing and proposed sewers shall be submitted for new sewer systems or substantial additions to existing systems. This plan shall show existing or proposed streets and all streams or water surfaces. Spot elevations with contour lines at suitable locations shall be included. The plan shall show the location, size and direction of flow of all existing and proposed sanitary sewers and pumping stations. A single cover sheet showing, in a general layout, all substantial project features, with a sheet index, vicinity map and legend shall be submitted. The title block shall appear in the lower right corner.

- d. Detailed documents consisting of plans, profiles, elevations, sections and supplementary views, and specifications shall be provided.
- e. Profiles shall generally have a horizontal scale of not more than 40 feet to the inch and a vertical scale of not more than 4 feet to the inch. Plan views shall be drawn to a corresponding horizontal scale. Plans and profiles shall show:
 - (1) Location of streets and sewers.
 - (2) Ground surface above the pipe, size, material and type of pipe, invert and surface elevation at each manhole, and grade of sewer between each two adjacent manholes. Manholes shall be numbered. Lateral and cleanout locations, and cleanout inverts shall be shown where necessary. Where there is any question of the sewer being sufficiently deep to serve any structure, the ground and finish floor elevations shall be plotted on the profile.
 - (3) Locations of all special features such as concrete encasements, sewers above ground, etc.
 - (4) All known existing structures and utilities both above and below ground which might interfere with the proposed construction, particularly water mains, gas mains, storm drains, underground conduits, etc. Wherever available the size and type of material shall be indicated.
 - (5) Special detail drawings, made to a scale to clearly show the nature of the design, shall be furnished to show conflicts and/or other critical details.
- f. Revised sheets shall contain a revision with identifying notation, date and mark for the revision.
- g. Record drawings for the sewer lines shall be field surveyed and submitted to the Town 30 days after final field test. Each sheet shall be stamped "Record Drawing" and dated. These drawings shall indicate the location of all mains, lateral, cleanouts, fittings, and valve boxes \pm 6-inch. Three full sets of "Record Drawings" plus electronic files will be required indicating only the sewer lines and street ROW alignment.

3. **Design**

- a. A minimum peak factor of 2.5 shall be applied to all flows for the purpose of determining peak flows. In small areas, and where justified, a 4.0 peak factor shall be utilized.
- b. Sewers shall be designed for the ultimate population.

- c. No gravity sewer, including laterals to cleanout, shall be less than 6-inch diameter or as approved by the Town.
- d. Gravity sewer diameter and pipe material shall remain constant between manholes.

4. **Location**

- a. Sewers generally shall be in center of street in public rights-of-way.
- b. Sewers will be permitted in easements only when there is no feasible alternative, and if the Town grants approval. Easements shall provide adequate working space for installation and maintenance with a minimum of twenty (20) foot width for force main and twenty (20) foot for gravity sewer. No sanitary sewer over twelve (12) feet in depth shall be placed in an easement unless otherwise approved by the Town. If approved, sewers over twelve (12) feet deep shall have a thirty (30) foot easement width. Easements for sewer over twenty (20) feet shall be reviewed on a case by case basis.
- c. Existing and proposed sanitary sewers, storm drainage systems and other underground utilities and structures shall be considered in the design and selection of pipe depths and alignments in order to avoid conflicts and facilitate maintenance.
- d. No sewer line shall pass within 50 feet of a drinking water supply well, source, or structure unless special construction and pipe materials are used to obtain adequate protection. The proposed design shall identify and adequately address the protection of all drinking water supply wells, sources and structures within 100 feet of the proposed project.
- e. Sewers shall be designed to prevent damage from superimposed loads. Loads due to the width and depth of trench shall be considered. Minimum cover shall be 24-inch for ductile iron pipe and 36-inch for other pipe materials.
- f. All sewers over ten (10) feet in depth shall be ductile iron pipe.
- g. Manholes over (12) feet in depth shall be 60-inch diameter.
- h. Sewers crossing streams, or above ground, shall be ductile iron with watertight joints.
- i. Air vents shall be self-bleeding and located at all high points in force mains.
- j. All other utilities shall be a minimum of 5' horizontally/vertically from the water main or as per direction of the Town of Smithfield's Superintendent of Public Utilities.

5. **Velocity and Grade**

- a. Gravity sewers shall be designed for a minimum velocity, when flowing full, of 2.0 ft./sec. using a Manning's coefficient of 0.013. Maximum flow velocity shall not exceed 8.0 ft./sec. Grades shall be uniform between manholes and cleanouts. Short changes in grade shall be avoided.
- b. Minimum grades shall be as follows: (Maximum grade shall be less than 20%.)

Pipe Diameter (in)	Slope (%)
4	1.00
6	0.63
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

- c. Force mains shall be designed with a minimum velocity of 2.0 ft./sec., a maximum flow velocity of 8.0 ft./sec., and a Hazen-Williams C value of 120. Minimum size shall be 4-inch except that consideration will be given to smaller sizes where grinder pumps are used. Constant grades shall be used where feasible. Force main discharges require special consideration of materials, construction techniques and existing and future conditions.
- d. At all connections to gravity sewer manholes the difference between entrance and exit pipe invert elevations shall be at least 0.1 foot where possible.
- e. Six (6) inch sewers shall not exceed 150 feet in length and shall be used only at dead ends that are not extendable.

6. **Conflicts and Clearances**

a. **Parallel Installation**

- (1) Normal Conditions - Sanitary sewers or sewer manholes shall be at least ten (10) feet horizontally from any water main whenever possible. The distance shall be measured edge to edge.

- (2) Unusual Conditions - When local conditions prevent a horizontal separation of ten (10) feet, a sanitary sewer may be closer to a water main provided that:
 - (a) The bottom of the water main is at least 18 inches above the top of the sewer.
 - (b) Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints and construction that are equivalent to water mains, and shall be pressure tested to assure water tightness prior to backfilling.
 - (c) Where the bottom of the water main cannot be laid higher than the top of the sewer, eighteen (18) inches separation and materials equivalent to water main standards shall be required.

b. **Crossings**

- (1) Normal Conditions - Sanitary sewer crossing water mains shall be laid to provide a separation of at least eighteen (18) inches between the bottom of the water main and the top of the sewer, whenever possible.
- (2) Unusual Conditions - When local conditions prevent a vertical separation of eighteen (18) inches, then following shall be used:
 - (a) Sewers passing over or under water mains shall be in accordance with Article 2, Section 6.a, and subsection 2.b.
 - (b) Water mains passing under sewers shall, in addition, be protected by providing:
 - (i) A vertical separation of at least eighteen (18) inches between the bottom of the sewer and the top of the water main.
 - (ii) Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking of the water mains. That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

- c. All sewer line crossings of highways or other major structures shall be steel encased with adequate venting, protection, etc., as may be required.
- d. No water pipe shall pass through or come into contact with any part of a sewer or sewer manhole.

- e. Ductile iron pipe shall be used when crossing storm sewer and other underground conduits when the vertical separation is 18 inches or less. Full lengths of pipe shall be used with a minimum eight feet (8') feet of pipe on either side of the crossing.
- f. Sewers entering or crossing streams or estuaries shall be constructed of watertight pipe. The pipe and joints shall be tested in place and shall exhibit zero infiltration. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no other practical alternative exists. Such sewers on piers shall be constructed in accordance with the requirements for sewers entering or crossing under streams. Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade due to anticipated hydraulic and physical loads, erosion, and impact. The tops of all buried sewers entering or crossing streams shall be at a minimum of 10-foot depth below the natural bottom of the streambed to protect the sewer line. Less cover will be considered if the proposed sewer crossing is encased in concrete and will not interfere with future improvements to the stream channel. In paved channels, the top of the sewer lines should be placed below channel pavement. Sewers shall remain fully operational during the 25-year flood/wave action. Sewers and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, including the 100-year flood/wave action. Sewers located along streams shall be located outside of the streambed wherever possible.

7. **Manholes and Laterals**

- a. Manholes shall be located at the end of each line, at changes in pipe size, alignment or grade and at sewer junctions. Where future extension is possible, maximum 2 ft stubs must be provided.
- b. For sewer pipe on straight runs, maximum spacing between manholes shall not exceed 400 linear feet.
- c. Manholes below 100-year flood elevation shall be easily accessible and have watertight manhole covers.
- d. Drop manholes should be avoided where feasible. Where the invert elevation of the incoming sewer exceeds the invert elevation of the outgoing sewer by two (2) feet or more at the manhole, a drop manhole connection shall be required. Drop manhole diameter shall be a minimum of 60-inch.
- e. Manholes for sewers up to 24 inches in diameter shall not be less than 48 inch inside diameter. Manholes for sewers over 24 inches in diameter shall not be less than 60 inch inside diameter.
- f. No cleanout shall have an invert elevation greater than 4.5 feet below the ground elevation.

- g. Drop connections to manholes are required to be installed inside the manhole unless otherwise approved by the Town and must be shown where required.
- h. Sewer laterals shall have a minimum of fifteen (15) inch vertical clearance between curbs, gutters, sidewalks, driveways and ramps and shall not be in excess of 75 feet in length unless otherwise approved by the Town. Minimum cover at ditches shall be 18 inches.
- i. The maximum number of laterals entering an inline manhole shall be two (2) unless otherwise approved by the Town. Where a manhole is located at a cul-de-sac or dead-end, the maximum number of laterals entering shall be three (3).
- j. Minimum drop within a manhole is 0.10 feet.
- k. Manholes greater than 25 feet shall have design calculations sealed by Professional Engineer in Commonwealth of Virginia as well as certification from manhole and pipe manufacturer to be adequate.

8. **Sewer Materials**

- a. Unless otherwise specified by the Town of Smithfield and HRPDC Regional Standards sewers shall be P.V.C. or Ductile Iron except that sewer over ten (10) feet deep shall be ductile iron. This will be based on the invert grade of the pipe.
- b. P.V.C. pipe shall conform to the following:

Pipe - ASTM Specification D-3034 with minimum SDR of 35.
Joints - ASTM Specification D-3212.
- c. Ductile iron pipe shall conform to the following:

Pipe - ANSI/AWWA C151/A21.51, Class 52 minimum.
Joints - ANSI/AWWA C111/A21.11.
- d. Pipe used for force mains shall be ductile iron conforming to the following:

Pipe - ANSI/AWWA C151/A21.51, Class 52 minimum.
Fittings - ANSI/AWWA C110/A21.10, or ANSI/AWWA C153/A21.52, bituminous lined and coated.
Joints - ANSI/AWWA C111/A21.11, push-on or mechanical.
- e. Manholes shall be pre-cast with leveling rings, cast iron manhole frame and cover, and flexible pipe connection similar to "KOR-N-SEAL". Interior surface shall be painted with two coats of approved Tnemec coating. Manhole steps shall be PVC or Rubber encapsulated steel. When a watertight seal is not required, then dust covers shall be installed.

- f. Warning tape shall be bright GREEN plastic with detectable foil and "CAUTION-SEWER LINE BELOW" printed on it. Tape shall include a minimum 10 gauge copper wire for enhanced detectability and shall be installed 18"-24" above sewer line. Any plastic or other nonmetallic pressurized conduit installed underground shall have warning tape.
- g. Sewers and force mains constructed in fill areas shall be restrained joint ductile iron pipe extending to nearest manhole or native ground.

9. **Infiltration Testing**

An acceptance test shall be specified for all gravity sewer lines. The test may be either a hydrostatic test or an air test.

- a. Hydrostatic Testing - Where hydrostatic testing is specified (infiltration or exfiltration), the leakage outward or inward shall not exceed 100 gallons per inch of nominal pipe diameter per mile per day (2400 gpd/mi. maximum) for any section of the system including manholes. Where the exfiltration test is employed, the line shall be subjected to a minimum of 4 feet of head, or head to the top of the manhole, whichever is the lesser, above the crown of the pipe at the upstream manhole of the section being tested. The infiltration test shall be allowed only when it can be shown that the hydrostatic head outside the pipe is a minimum of 4 feet above the crown of the pipe for the entire length of the pipe being tested.
- b. Air Testing - Where air testing is specified, test methods and acceptability criteria shall be in accordance with ASTM specification F1417-92. Air testing shall generally be acceptable for all types of pipe and materials. If air testing is employed, the manholes shall be tested by exfiltration. Lines to be tested will be designated by the Town's representative, these lines will be tested at 4 psi at 20 minute increments.
- c. All sewer mains, gravity or force, PVC and / or ductile iron, will be required to have a pull through device, "pig", pulled through all lines to determine if any obstructions and/or pipe deflections have occurred.

10. **Force Main Tap**

- a. All taps to be approved and witnessed by the Town.
- b. Minimum tapping sleeve size for 4-inch or larger piping is 4-inch. Piping shall reduce to smaller size after valve.

11. **Force Main Pressure Testing**

All force mains shall be subjected to a hydrostatic pressure test of 150 pounds per square inch. The duration of each pressure test shall be at least two (2) hours. Each valved section of pipe shall be

slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe. Before applying the specified test pressure, all air shall be expelled from the pipe. Any cracked or defective pipes, fittings, or valves discovered shall be removed and replaced with sound material and the test shall be repeated until satisfactory. Tests should be completed with no leakage.

ARTICLE III
Sewage Pumping Stations

01/21/08

1. **General**

- a. Sewage pump stations shall be in accordance with these guidelines, ordinances of the Town of Smithfield, and requirements of the Commonwealth of Virginia “Sewage Collection and Treatment (SCAT) Regulations”. The Town prior to commencement of construction shall approve all Plans and Specifications in writing.

2. **Plans**

- a. Plans and specifications shall include provisions for excavation, foundation, and backfill, dewatering, sheeting and bracing, protection of the public, materials, material testing, details of construction of pump station and appurtenances and other items as may be applicable to the project, all in accordance with good engineering practice. Plans shall include elevations showing site appearance of the station, sections, details, electrical details and a site plan showing existing topographic information such as pavement, storm drains, utilities, trees, shrubbery, property lines, and appropriate elevations as well as new construction including layout dimensions and final elevations. Details provided by Town of Smithfield, VDOT, and HRPDC must be referenced where applicable.
- b. The plans shall be clear and legible. They shall be drawn to a scale that will permit all necessary information to be clearly shown. Plans shall not be larger than 24 inches x 36 inches. **Datum shall be Town of Smithfield, Virginia 2003 Geodetic Control Network, Horizontal NAD 83 (1996), Vertical NAVD 88**, and a referenced benchmark and project benchmark shall be shown.
- c. Dimensions and relative elevation of structures, finished floor elevations, the location and size of piping, surface water levels, 100-year flood level, and ground elevations shall be shown.
- d. Plans submitted for approval shall be accompanied by technical specifications, hydraulic calculations, pump curves, and pump cycle calculations.

3. **Design**

- a. Pump station will have two pump setup as lead / lag. Each pump shall be capable of handling peak flows at required force main pressures. All stations shall be provided with an equivalent spare pump for Town use. Pumps shall be capable of passing 3-inch diameter solids.
- b. Pump stations designed for greater than 250 gpm shall be wet well / dry well type with Fairbanks Morse pumps or approved equal unless otherwise specified by Town engineer.

Pumps shall turn to clockwise. Pump stations up to 250 gpm shall be Hydromatic or approved by the Town of Smithfield. All pumps and controls shall be explosion proof. All stations shall have 3-phase power where available.

- c. Capacity of the wet well shall be such that the pump runs continuously for five (5) minutes with a fill time of no more than 15 minutes at the average flow.
- d. When discharging into Hampton Roads Sanitation District (HRSD) force main system, both minimum and maximum pressures shall be considered in pump selection. Variable Frequency Drives (VFD) is required for connection to HRSD unless authorized by Town engineer. A pressure gauge and flow meter wired to control shall be installed on proposed discharge piping. Engineer shall notify Southside HRSD Interceptor Engineer 30 days prior to design of connection to HRSD force main for pressure letter. Engineer shall obtain HRSD flow certification letter for all connections to HRSD.
- e. As a minimum, provide design calculations to include service area map with flow rates, project description, vicinity map, piping schematic, pump design curves with operating points, structural calculations, and HRSD pressure letter if applicable, and the following minimum design calculations:
 - Sanitary Flows (Minimum, Average, and Peak)
 - Size Wet Well
 - Well Elevations
 - Well Flotation
 - Structural
 - Force Main Sizing
 - Pipe Headloss and Velocity
 - Equivalent Length of Force Main
 - System Head
 - Pump Selection
 - System Head Curve vs. Pump Curve
 - Pump Cycle Times (HRSD Minimum and Maximum Head if applicable)
 - Sewage overflow
 - Ventilation
- f. Force main velocities shall remain between 2-8 ft/sec.
- g. Wet well bottom shall have fillet of 1:1 occupying approximately 25% of wet well bottom.
- h. All pump stations shall have a manhole on site with minimum slope pipe entering wet well.
- i. All pump stations must meet DEQ SCAT Regulations method of continuous operation. Method of continuous operation must be provided in writing by the developer and approved by the Town and DEQ. Pump stations discharging to pressure pipe shall obtain DEQ approval prior to construction.

4. **Construction**

- a. Construction shall be of reinforced concrete with all wall penetrations sleeved. Superstructure walls shall be masonry or approved pre-cast concrete panels with hipped frame roof.
- b. All hatches and aluminum fabrications shall be 6061-T6.
- c. All fasteners (nuts, bolts, etc.) shall be stainless steel grade 316. All other metals in pump station shall be non-corrosive aluminum 6061-T6 or stainless steel grade 304.
- d. Wet well shall contain aluminum bar screen with maximum 3/4-inch openings, aluminum stairs, emergency suction, intermediate floor, and be provided with adequate lighting and ventilation.
- e. Dry well shall contain pumps, header piping and valves, sump pump, air relief piping, stairway, adequate lighting, pressure gauge, dehumidifier, and ventilation.
- f. Control Room shall contain pump control panel, remote alarm terminal, adequate lighting and ventilation, and generator / pump and controls if applicable.
- g. Pump suction velocity shall be 2-6 fps and discharge velocity shall be 2-8 fps.
- h. Wet well interior shall be coated with Tnemec coating or approved equal. Structure exterior must be coated with approved bituminous coating. Consult manufacturer for recommended mil thickness and obtain approval from Town.
- i. Electrical service shall be underground. An exterior plug-in connector approved by the Town shall be provided for connection of a 3 phase portable electric generator if permanent generator is not provided. Control panel shall include phase monitors, running time meters, convenience outlet, and lightning suppression. Electrical conduits shall be PVC.
- j. Remote alarm terminal will be furnished by the Town, but paid for and installed by the Contractor. Contractor shall provide duplex outlet for service to alarm transmitter. Connections to alarm transmitter shall be by 18 gage stranded telemetry wire. If exterior control box is provided for pump controls, it shall be NEMA 4 and have sufficient space for the alarm transmitter. Separate dry well high-level float shall be wired directly to the alarm transmitter.

- k. The developer / engineer shall contact the Town of Smithfield Public Utilities Department for current information and specifications involving the Town's SCADA Alarm System.
- l. Emergency pump connection shall be furnished on the discharge force main with 6-inch quick disconnects compatible with the Town system.
- m. Emergency suction pipe shall be furnished in the wet well with 6-inch quick disconnects compatible with the Town system.
- n. Portable pump and hoses or generator may be required to be furnished and turned over to the Town if needed to supplement the Town's continuous operability program and satisfy DEQ.
- o. Pump stations shall have 8' high chain link fence with a double gate around the site as approved by Town.
- p. All stations shall have paved surface entrance drive a minimum of 12 feet wide with turnaround. Provide on site parking for minimum of two (2) service vehicles.
- q. Submersible stations shall have separate check valves and gate valves located outside the wet well in an approved vault with aluminum weather tight top and access hatch. The vault shall also contain an approved pressure gauge and flow meter capable of communicating with the control panel through a PLC. Check valves shall be ball check for under 4-inch by Danfoss Flowmatic or approved equal and swing check with weighted arm for 4-inch and above by Kennedy.
- r. Submersible stations shall have a sealed stainless steel electrical junction box, location and materials to be approved by Town. See detail S-5.
- s. There shall be a mounted outside light with a switch and an exterior duplex receptacle.
- t. All stations shall be provided with water service equipped with a hose bib and a backflow preventer approved by the State Department of Health. If termination is outside, hydrant shall be freeze proof type, Simmon #802 yard hydrant with minimum two (2) feet of soil cover. Provide hose bib inside and outside station where building is specified.
- u. Control panels shall be equipped with alternate switch installed to Pump 1 or Pump 2.
- v. Level controls shall be purged bubbler for wet well / dry well type and sealed mercury float for submersible type.
- w. All pump stations turned over to the Town of Smithfield shall have a minimum of one (1) spare pump provided at the expense of the developer.

ARTICLE IV
Site Work, Drainage and Streets
01/21/08

1. **General**

- a. Design shall be by a professional engineer licensed in accordance with the requirements of the Code of Virginia. The Town prior to commencement of construction shall approve all plans, plats and specifications in writing.
- b. The Contractor shall be responsible for traffic control during the course of the work and shall provide certified flagmen, signs, etc., as necessary to meet requirements of VDOT and/or the Town of Smithfield. At least one (1) lane of traffic shall be maintained on existing residential streets at all times.
- c. Tree trunks, branches, and exposed roots damaged during equipment operation or construction shall be pruned as directed by a certified arborist or the Town of Smithfield.
- d. The Contractor shall construct and maintain all necessary silt devices sufficient to prevent soil from being eroded from the site into any adjacent system, ditch or watercourses. Any material that is eroded shall be promptly removed. The Contractor shall comply with the current requirements of the "Virginia Erosion and Sediment Control Handbook".
- e. All excavated materials shall be stockpiled so as not to interfere with existing drainage. Stockpiles shall have as a minimum silt fence installed around its perimeter.
- f. The Contractor shall be responsible for removing and replacing with matching materials any pavement, driveways, walks, curbs, etc., that must be cut or that are damaged during construction. Cuts in pavements shall be straight-line saw cut. Cuts in curbs and walks shall be saw cut at an existing joint. Repair as per Article 4, Section 3.c.7.

2. **Plans**

- a. Plans, profiles and specifications shall include provisions for excavation and backfill, dewatering, sheeting and bracing, maintenance of traffic and protection of the public, protection of existing utilities and structures, trench widths and preparation, materials, material testing, details of pipe laying and construction of pipe lines and appurtenances and other items as may be applicable to the project and all in accordance with good engineering practice. Plans (Scale 1"=30' or larger) shall include profiles, details and topographic information such as existing and proposed zoning, lot numbers, street pavement, sidewalks, driveways, curb and gutter, storm drains, utilities, trees, shrubbery, property lines, street names and house numbers (where available) and appropriate elevations. Plans shall also include a vicinity map, map and deed book references for adjacent property and existing

easements, and typical sections of streets, roads and ditches. Plans shall not be larger than 24"x36". Plans shall include typical sections for streets and ditches.

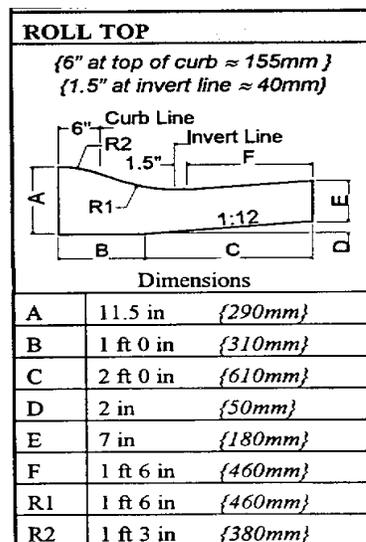
- b. **Datum shall be Town of Smithfield, Virginia 2003 Geodetic Control Network, Horizontal NAD 83 (1996), and Vertical NAVD 88.** Plans shall show referenced benchmark and a minimum of two (2) benchmarks established for the project. The developer shall establish permanent benchmarks in subdivisions. The number and locations are to be determined by the Town's representative and developer. The benchmark elevation is to be certified by a licensed land surveyor or a professional engineer.

3. **Drainage**

- a. **General** - Drainage shall be designed in general by the criteria established in the current VDOT Drainage Manual. Design and construction shall also meet the applicable requirements of the Town of Smithfield "Chesapeake Bay Preservation Area Ordinance"; and stormwater management and erosion and sediment control requirements of the Commonwealth of Virginia Soil and Water Conservation Board. Refer to the current "Virginia Erosion and Sediment Control Handbook" and "Virginia Stormwater Management Handbook". No "wet" drainage systems are to be allowed in the Town of Smithfield.
- b. **Design** - Drainage shall be designed by the criteria established in the Virginia Department of Highways Drainage Manual and in coordination with the following guidelines:
 - (1) Peak runoff shall be computed by the rational method with the intensity taken from the intensity-duration curve for Norfolk, Virginia.
 - (2) Where the drainage basin exceeds 200 acres or when a retention design is involved, hydrographic or other approved methods are to be used for design purposes.
 - (3) Runoff coefficients shall be based on a weighted coefficient for the composite area.
 - (4) Inlet capacities and pavement spread calculations shall be designed in accordance with the current VDOT Drainage Manual. These capacities shall be designed for a storm having a minimum 10-year recurrence frequency. Inlets shall be spaced to eliminate pavement spreads in excess of ten feet (10') on the typical street section calculated on a 10-year recurrence frequency.
 - (5) Pipe Capacities:
 - (a) Hydraulic grade line calculations are required which take into account structure and bend losses, etc. Pipe joints must be designed to withstand pressures proposed. System must be designed to prevent flooding during the design event.

- (b) Hydraulic grade line calculations must reflect the same design event in the downstream or receiving facility.
 - (6) Off-site drainage improvements will be required to prevent the proposed development from having any significant detrimental effect on the downstream facilities or natural channels.
- c. **Materials and Standards** - Materials and standards shall be in accordance with the current Virginia Department of Transportation (VDOT) "Road and Bridge Specifications" and "Road and Bridge Standards", unless otherwise stated.
- (1) Temporary drainage during construction shall be provided by the Contractor to relieve areas that may cause damage to roadways, etc. or as directed by the Town.
 - (2) Concrete shall be Class "A3" Air Entrained (3,000-psi. minimum) for general concrete and Class "A4" Air Entrained (4,000 psi minimum for pre-cast units).
 - (3) All storm sewer pipes in Town Right-of-Way shall be concrete tongue and groove. Pipes not subject to traffic loading may be non-reinforced pipe. Pipes subject to traffic loading shall be reinforced concrete pipe, Class III minimum. H.D.P.E. (High Density Polyethylene Pipe Smooth Bore) may be substituted in lieu of concrete pipe in all locations in which this pipe will meet or exceed the current VDOT Standards and Specifications, and the approval of the Town. Corrugated metal pipe will not be permitted. Any concrete pipe which its end section is either broken, chipped, or has been saw cut during installation will be required to be epoxy grouted as per approval of the Town engineer and / or their representative.
 - (4) Pre-cast structures are acceptable. These drainage structures shall meet all current VDOT Standards and Specifications. Drop Inlet T-DI-1 shall be furnished with square "Alternate Top" where wheel loading is not a factor.
 - (5) Riprap shall be provided at endwalls and flared end sections or as otherwise specified by the Town.
 - (6) All new and, where required, existing downstream, storm sewer pipes and structures shall be cleaned of debris and eroded material upon completion of construction.
 - (7) No open cut of a public roadway shall be allowed except with written permission from the Town, accompanied with all necessary sureties. This repair shall be equal to or greater than VDOT MP-70 Figure 1(pages 34-35) or as approved by the Town.
 - (8) Relocation of any utilities shall be at the Contractor's expense and completed with site work.

- (9) Before digging the Contractor shall call "MISS UTILITY" of Tidewater at 1-800-552-7001 for location of existing utilities. Prior to construction or excavation, the Contractor shall assume the responsibility of locating any underground utilities (public or private) that may exist and cross through the area of construction. Utility companies shall be notified 72 hours in advance of any excavation in the proximity of their utilities. The Contractor shall be responsible for repairing, at his expense, any existing utilities damaged during construction. The above referenced statement shall be noted on all construction plans. At their expense, the contractor shall be responsible for repairing any existing utilities or infrastructure within the right of way of the Town during construction. This repair shall meet the approval of the Town.
- (10) In lieu of CG-6 curb, roll-top curb is to be utilized where applicable by Virginia Department of Transportation's (VDOT) current standards and specifications or as directed by the Town's representative.



4. Streets

- a. **Pavement Design Criteria** - Pavement design shall be performed by a Professional Engineer/Land Surveyor licensed to perform this type of work. Soil sampling shall be performed as per the current VDOT Pavement Design Guide. Samples should be taken a minimum of 10' below the finish grade of the proposed street. The Engineer shall submit to the Town for review test logs, pavement design and bore location map. The following information shall be submitted to the Town with the pavement design:
- (1) **Soil Analysis** - Ten-foot (10') deep boring logs of sufficient quantity to determine the soil profile, related to elevations. The borings shall reflect ground water elevations; description of materials and blow counts on the samplers. Borings shall indicate normal water table elevation, and projected seasonable high water table elevation. Maximum spacing of test shall be 500 foot (250' radius of coverage per test) and as per the current VDOT Pavement Design Guide. No less than 2 tests are to be

provided. All soil tests are to be performed by a certified Testing Laboratory licensed to perform this type of work. Soil Analysis of subgrade material shall include:

- (a) Gradation (Sieve and Hydrometer Analysis)
- (b) Atterberg Limits.
- (c) Moisture density relationships and curves.
- (d) Maximum dry weight.
- (e) Optimum moisture content.
- (f) Specific gravity.
- (g) Swell.
- (h) California Bearing Ratio in accordance with Virginia Test Method (VTM-8), with soaked and unsoaked test results required. Samples shall be taken at the proposed street subgrade elevation.

(2) **Traffic Volumes** - On proposed new streets the following minimum 24-hour trip generation information shall be used or the current "I.T.E. Trip Generation Manual", whichever is greater:

<u>Development</u>	<u>Trip Generation Rate</u>	<u>%Heavy Trucks</u>	<u>7th Edition ITE Rate</u>
Single Family Residential	10/ dwelling unit	5	9.57
Townhouse Residential	6/ dwelling unit	5	5.86
Apartment Residential	6/ dwelling unit	5	6.72
Schools			
Elementary and Intermediate	0.8/Student	5	1.29/student elem. 1.62/student int.
High School	1.4/Students	5	HS 1.71/student
Industrial	52/AC	12	6.97/ KSF
Shopping Centers	600/AC	5	42.94/ KGLSF

Where proposed streets intersect the boundary of the subdivision providing access to adjoining undeveloped property, the design traffic shall be based on the number of acres and the total number of units expected to contribute traffic to the street.

(3) **Pavement Design** - The pavement shall be designed per the current "VDOT Pavement Design Guide for Subdivision and Secondary Roads in Virginia".

(a) Flexible Pavement. Flexible pavement design shall be in accordance with Section 315 of the current "VDOT Road and Bridge Specification Manual" and the current "VDOT Pavement Design Guide for Subdivision and Secondary Roads in Virginia".

Off site or private property:

- Minimum subgrade CBR of 15. If native soil has CBR < 15, install minimum 6-inch select borrow base.
- 6-inch minimum compacted subgrade.
- Minimum flexible pavement section:
 - Asphalt Surface Course: 2-inch.
 - Aggregate Base: 6-inch.
 - Compacted Subgrade: 6-inch.

(b) Full Depth Asphalt. Full depth asphalt pavement design criteria shall conform to the provisions of the Asphalt Institute Manual and/or any applicable sections of the current "VDOT Pavement Design Guide for Subdivision and Secondary Roads in Virginia". Minimum section shall be:

- 1-1/2-inch surface.
- 10-1/2-inch base.
- 6-inch compacted subgrade.

(c) Soil Cement Base. The use of a design that utilizes soil cement shall meet Section 307 of the current "VDOT Road and Bridge Specifications Manual".

(d) Lime Stabilized Base. The use of a design that utilizes lime-stabilized base shall meet Section 306 of the current "VDOT Road and Bridge Specifications Manual".

(e) Aggregate Base. The use of a design that utilizes aggregate base shall meet Section 309 of the current "VDOT Road and Bridge Specifications Manual".

b. **Materials and Standards** - Materials and standards shall be in accordance with the most recently adopted Virginia Department of Transportation (VDOT) "Road and Bridge Specifications" and "Road and Bridge Standards", unless otherwise stated.

(1) Asphalt shall be in accordance with the Section entitled "Asphalt Concrete" Table II-14, "Mixture Design Criteria". Surface mixture type shall include P670-22 viscosity grade. Placement and testing shall be in accordance with Section 315 of the VDOT Road and Bridge Specifications.

- (2) Aggregate shall be in accordance with Section entitled "Sub-base and Aggregate Base Material", Type I or II, Sizes 21-A or 21-B. Placement and testing shall be in accordance with Sections 308 and 309 of the VDOT Road and Bridge Specifications.
- (3) When materials that are unsuitable for foundations, subgrades or other roadway purpose occur within the limits of street construction, the Contractor shall be required to excavate such material below the grade shown on Plans, and the areas so excavated shall be backfilled with approved suitable materials. The extent of undercutting and backfilling is to be determined by the Town and performed at the developers/contractors expense.
- (4) All roadway improvements shall be equal to or greater than the current "VDOT Road and Bridge Standards".
- (5) For concrete color control, concrete mixture for all exposed concrete surfaces of walks, curbs, gutters and pour-in-place structures shall be from the same supplier and cement manufacturer.
- (6) A proof roll of the subgrade and sub-base areas of the roadway section will be required prior to the installation of any succeeding layers of roadway materials. The Town Engineer and / or his representative, along with the developer and / or their representative and the developers Geo-Tec., will be present for the test. Any areas deemed to be "pumping" and / or containing "unsuitable material" by the Town would be corrected in a manner agreed to by the Town. When the corrections have been completed another proof roll of the effected areas, with all those representatives noted above present, will be required and approved by the Town. As a minimum a tandem dump truck loaded with a material approved by the Town will be the normal test vehicle utilized unless otherwise approved by the Town.
- (7) All developers / contractors are required, for their respective projects, to provide a geotechnical service on site which shall complete any an all tests required by Town of Smithfield inspector. All tests shall meet Town of Smithfield, VDOT, or HRPDC requirements. Test reports shall be provided to the Town prior to acceptance of work completed.

Article V
**Town of Smithfield Special Provisions to the
HRPDC Regional Construction Standards (3rd Edition)**

03/06/06

Section 200 - Products and Materials

V – 5.10A

1. Delete 18 foot laying lengths.

V – 5.10D

- 1a. Gate valves shall be manufactured by AVK or approved equal.

V – 5.10G

6. Tapping sleeves shall be stainless steel conforming to the latest revisions of AWWA, ASTM, and ANSI.

V – 5.10H

- 3d. Add Ford Meter Box Company and Mueller as acceptable manufacturers.

V – 5.11A

1. Delete 18 foot laying lengths.

V – 5.19A

1. Delete 18 foot laying lengths.

V – 5.19B

9. HDPE pipe shall only be used for potable water applications when a carrier pipe is required for boring and shall comply with Section 5.10C of the Regional Standards.

V – 5.19B

- 1a. Gate valves shall be manufactured by AVK or approved equal.

V-5.19J

3. Tapping sleeves shall be stainless steel conforming to the latest revisions of AWWA, ASTM, and ANSI.

V – 5.20A-B

Delete A-B and refer to Town of Smithfield Design Standards

C. Service saddles shall be stainless steel conforming to the latest revisions of AWWA, ASTM, and ANSI.

Section 500 – Incidental Construction

II – 2.1D

3. All services lines to be abandoned shall be disconnected from the waterline by removing the service saddle and installing a full circle repair band.

Section 801 – Water Distribution Systems

II – 2.4B

B. Add sentence: Hydrants shall have a minimum of 18”-24” from back of curb with a maximum distance of 8 feet.

II – 2.7

- A. All existing valves located in the public ROW or public easement shall be operated only by Town of Smithfield personnel.
- B. The allowable duration of interruption to water service shall be approved by the Town in writing prior to execution of work.

II – 2.7C

5. Revise to 150 psig.

II – 2.8A

6. Contractor required to soak mains for 24 hours prior to testing. Contractor required to notify Town 48 hours prior to testing. NOTE: During periods of Town and State water restrictions, it will be at the discretion of the Town whether to allow required water for testing.

II – 2.8BC

Delete Sections and refer to Town of Smithfield Design Standards.

Section 802 – Sanitary Gravity Sewer Systems

II – 2.4B

c. Delete videotape and add CD. Add following sentence: Manhole labels provided in video inspection must correspond to the manhole labels shown on the construction documents and record drawings.

Section 803 – Sanitary Force Main Systems

II – 2.2E

Delete section and refer to Town of Smithfield Design Standards.

II – 2.6

A. All existing valves located in the public ROW or public easement shall be operated only by Town of Smithfield personnel.

B. The allowable duration of interruption to water service shall be approved by the Town in writing prior to execution of work.

II – 2.7B

8. Delete sentence.

II – 2.7C

Delete section

Section 811 – Television Inspection

Delete references to videotape and replace with CD.

HRPDC Standard Details

03/06/06

Roadway Construction (RC)

Delete RC_01 and refer to Town of Smithfield Figure 1, Pavement Cut/ Repair Details Special Provisions.

Delete RC_02 and refer to VDOT Road and Bridge Specifications

Drainage Structures (DS)

Delete details and refer to VDOT Road and Bridge Specifications

Earthwork (EW)

Delete details and refer to VDOT Road and Bridge Specifications

Concrete Items (CI)

Delete details and refer to VDOT Road and Bridge Specifications and VDOT Minimum Standards of Entrances to State Highways

Water Distribution (WD)

WD_01 Revise service line to 1-inch

WD_03 Delete Note 1 and reference A.Y. McDonald MFG. Model # 74MBLNLRG

WD_04 Delete

WD_12 Delete

Sanitary Systems (SS)

SS_01 Omit Sikagard 62 reference, add Tnemec

SS_02 Omit Sikagard 62 reference, add Tnemec

SS_03 Omit Sikagard 62 reference, add Tnemec

SS_04 Omit Sikagard 62 reference, add Tnemec

SS_05 Delete

SS_06 Add note: Adjustable manhole section to be coated with Tnemec coating or approved equal.

SS_13 Delete

SS_14 Delete, use Town of Smithfield Details S-1, S-2, S-3

SS_15 Revise to show 6"x6"x6" Wye with 6-inch piping throughout, delete Note 4

SS_16 Delete, use Town of Smithfield Details S-1, S-2, S-3

Water and Sanitary Systems (WS)

WS_03 Revise to show ball valve handle facing cover

Paved Private Entrance

10/01/2000

1. Applicants to whom permits are issued shall at all times indemnify and save harmless the Town of Smithfield, Virginia from responsibility for, damage to, or liability arising from the exercise of the privileges granted in such permit either during construction or at any time in the future.
2. A permit may be denied any applicant, and all permits issued by the Town of Smithfield may be revoked, whenever in the opinion of the Town Manager, the safety, use of maintenance of the highway, so requires.
3. The permittee agrees that if the work authorized by this permit, including any work necessary to restore shoulders, ditches and drainage structures to their original condition, is not completed by the applicant to the satisfaction of the Town, the Town of Smithfield will do whatever is necessary to restore the area within the right of way to its original condition, and the permittee will pay to the Town the actual cost of completing the work.
4. The absence of a Town representative does not in any way relieve the permittee of responsibility to perform the work in accordance with the provisions of this permit.
5. No trees are to be cut or trimmed within the right of way.
6. The entrance is to be constructed so as not to impair drainage within the right of way, with any and all drainpipe being supplied by the permittee.
7. All precautions will be taken for the protection of traffic, such as flagmen, signs, barricades, lights, etc. as necessary.
8. **Note:** The paved area (the area between the edge of the pavement/back of curb and the right of way line) shall consist of one of the following treatments in accordance with the current Virginia Department of Transportation specifications and/or approval by the Towns' Engineer:
 - a. Asphalt Entrance: The base course shall be crushed stone, Type I, No. 21A, 21B or 22, minimum 8" in depth compacted to 95% density at optimum moisture. The surface course shall consist of a prime with RC-250 at the rate of 0.3 gal. per sq. yd. and an application of bituminous concrete Type SM-2A at a rate of 220 lbs./sq. yd. geometrical design of the entrance, if piped, should be the same as the attached PE-1. If it is a curb and gutter roadway section, minimum 2 – foot flares should be installed at the curb line.
 - b. Concrete Entrance: The paved area shall consist of Class A3 concrete 7" thick (minimum), current Virginia Department of Transportation Road and Bridge standards, Sections 201 and 203. Geometrical design of the entrance, if piped, should be the same as attached PE-1. Allowance will be given on 20 – foot radial section of PE-1 with minimum 3 – foot flares. If it is a curb and gutter roadway section; minimum 2 – foot flares should be installed at the curb line.

Please contact Mr. Wayne Griffin, Town of Smithfield Engineer, at 365-4200 prior at any installations of entrances. Effective 07/10/00

Pavement Cut/ Repair Details Special Provisions

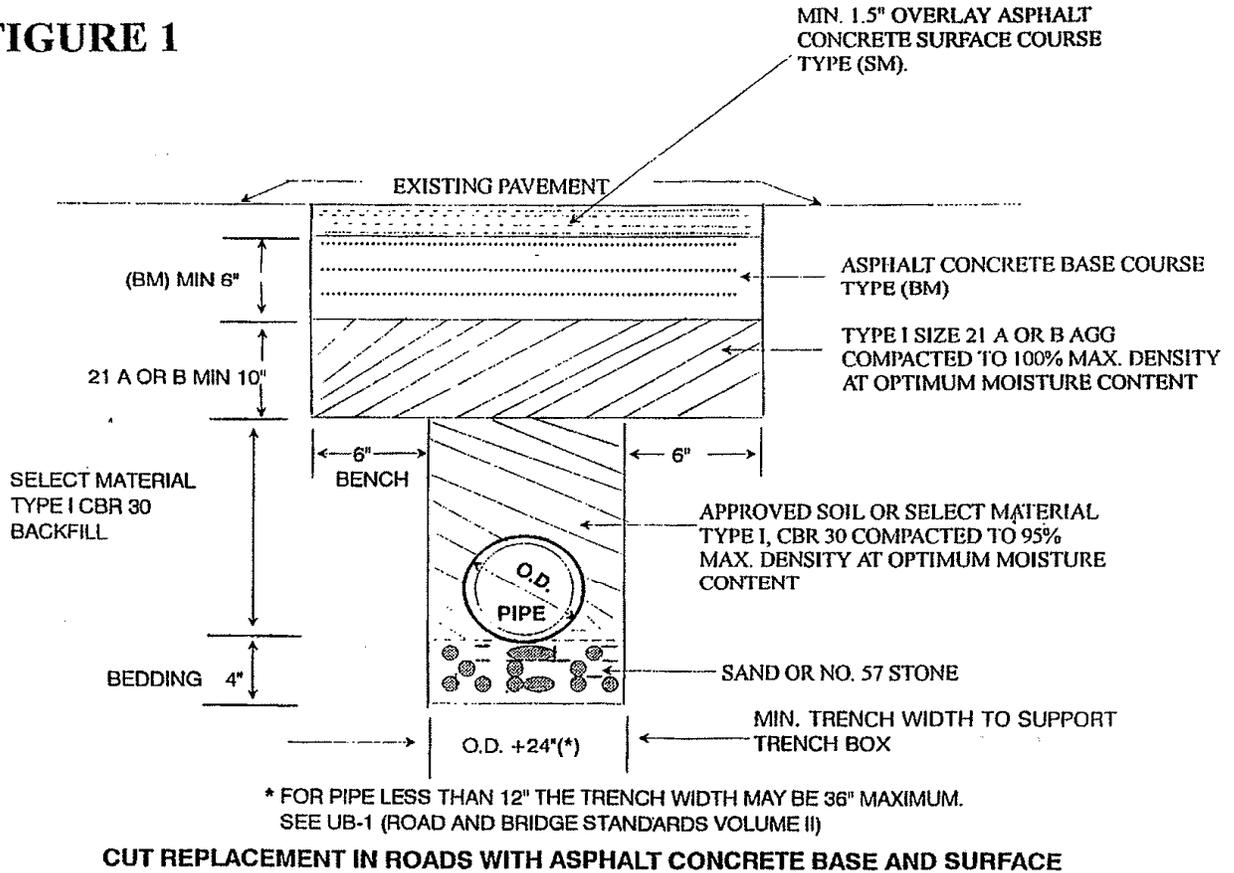
10/01/2000

1. All patches are to be replaced in accordance with the following regulations, detail on Figure 1 and/or direction of the Town's representative.
2. The residential/commercial owner or their representative will be required to replace the surface and base of the roads in accordance with the current VDOT Road and Bridge Standards and this Special Provision.
3. Backfill material shall include a minimum of four (4") inches of bedding materials (sand or #57 stone). The balance of the backfill shall be approved soil compacted to the bottom of the sub-base layer (Type I, Size 21A or 21B). The entire backfill shall be free from wood, decaying material, asphalt, concrete, ice, frost, large clods, stones and debris.
4. Backfill material shall be compacted to a minimum of 95% of the theoretical maximum density at optimum moisture content, as determined by VDOT testing procedures. Use mechanical tamping throughout the depth of the trench in six (6") inch layers to insure that adequate support is provided for the sub-base layer (Type I, Size 21A or 21B).
5. It shall be the option of the Towns' representative to request and review the backfill compaction test results and/or authorize the monitoring of the compaction.
6. Cuts in road with Surface Course and Asphalt Concrete Base shall be replaced with ten (10") inches of Type I, Size 21A or 21B aggregate compacted to 100% of the theoretical maximum density at optimum moisture content covering the entire trench width in addition to a bench of six (6") inches from all sides, this layer shall serve as sub-base. An Asphalt Concrete Base course of six (6") inch minimum thickness or matching the existing base thickness, shall be placed over the sub-base. A Surface Asphalt Concrete course of a minimum 1½" shall be placed on top of the base covering the trench width. The Asphalt Concrete Surface course shall be slightly higher 1/8" to 1/4" than the existing surface to provide a smooth grade into the existing pavement surface.
7. Cuts in surface treated roads with aggregate base course shall be replaced with the same layers as roads with asphalt base except the sub-base layer (Type I, Size 21A) is reduced to six (6") inches and the base asphalt layer to four (4") inches but still keeping a six (6") bench. The surface course shall be a surface treatment matching the existing surface.
8. The cut to be backfilled shall be dry as practicable at the time of the backfilling by pumping, bailing, draining or other approved dewatering methods.
9. All cuts' sides shall be trimmed to neat straight lines and a tack coat shall be applied at a rate of 0.05 – 0.15 gallons per square yard of RC – 250 or CAE – 2 before placing the plant mix.
10. Replacement of pavement shall be from edge of pavement except when individual cuts are made and not covering the entire width of the pavement.
11. Placement of all Asphalt Concrete and surface treated courses shall be rolled where possible with a unit having a manufacturer's rating of ten (10) tons and rolled until the aggregate is keyed into the bitumen. Where rolling is not possible, a mechanical tamp will be used. In all cuts stone is to be placed in the trench daily up to a maximum length of 500 feet, at which time the pavement shall be covered with a temporary or permanent asphalt patch. If the application of the bituminous layer is delayed for adverse weather conditions, the owner/contractor shall provide and maintain a base

course that is acceptable to the Town until such time as the appropriate pavement patch can be applied and completion of the installation of the gas, sewer, water, lines, etc., the owner/contractor shall restore the pavement in the manner prescribed within ten (10) days.

12. The owner/contractor will be responsible for any depression greater than 1/4" that occurs within three (3) years of the completion of the patching. Correction shall consist of milling and replacing 1 1/2" of the surface mix.

FIGURE 1



United States Postal Regulations

United States Postal Service USPS Notice to Rural Route Customers 10/01/2000

Each year the U.S. Postal Service designates a Mailbox Improvement Week for customers served by rural delivery routes. During that week customers on rural routes are encouraged to examine and improve, where necessary, the appearance of their mailboxes. The third full week in May has been designated as Mailbox Improvement Week for this year.

The purpose of Mailbox Improvement Week is to call attention to the need for providing mail receptacles which are designed to protect the mail from weather and are neat in appearance, conveniently located and safe to use. Neat attractive mailboxes make a significant contribution to the appearance of the countryside and the streets in suburban areas.

Mailboxes that meet these four important requirements contribute to a more efficient delivery operation and the result is improved services to the entire route. There are two approved styles of boxes: (1) Traditional design in three standard sizes, (see exhibit A) and (2) contemporary design (see exhibit B).

Mailboxes of the approved traditional or contemporary design are required whenever a mailbox is newly installed or an unsuitable receptacle is replaced. Exception: Custom built rural type mailboxes may be used if the postmaster gives prior approval.

Where box numbers are assigned, the box number must be shown on the side of the box visible to the approaching carrier or on the door where boxes are grouped. Customers are encouraged to group boxes wherever is practicable especially at or near crossroads, at turnouts or at places where a considerable number of boxes are located.

In areas where snow removal is a problem, the use of a semi-arch or extended arm type of support is suggested (see exhibit C). This allows snowplows to sweep near or under boxes without damage to supports and provides easy access to the boxes by carrier and customers.

If the use of street names and house numbers has been authorized, the house number should be shown on the box. If the mailbox is located on a street other than the one on which the customer resides, the street name and house number must be inscribed on the box. In all instances, placing the owner's name on the box is optional. Generally, boxes should be installed with the bottom of the box 3½ and 4 feet from the roadway. However, due to varying road and curb conditions and other factors, it is recommended that customers contact the postmaster or carrier prior to initially erecting or replacing their mailbox and support.

Mailboxes on rural routes must be located on the right-hand side of the road in the direction traveled by the carrier. The box must be placed and served to comply with state laws and highway and postal regulations. The carrier must have access without having to leave the vehicle. Supports for mailboxes should be of adequate strength and size to properly support the box.

Reports have been received that some mailbox supports are so massive that they are damaging the vehicles and causing serious injuries to people who accidentally strike them. The use of heavy metal posts, concrete posts and miscellaneous items of farm equipment, such as milk cans filled with concrete, should be avoided. The ideal support is an assembly that, if struck, will bend or fall away from the striking vehicle instead of severely damaging the vehicle and injuring its occupants. Boxes and supports should be kept painted and free from rust.

Your participation and cooperation in Mailbox Improvement Week will be greatly appreciated by your rural carrier and the Postal Service.



Exhibit A



Exhibit B

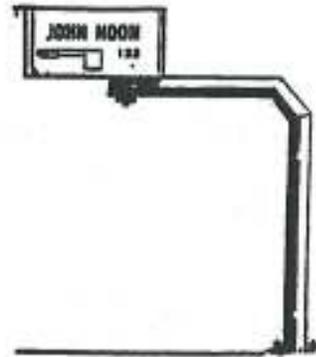
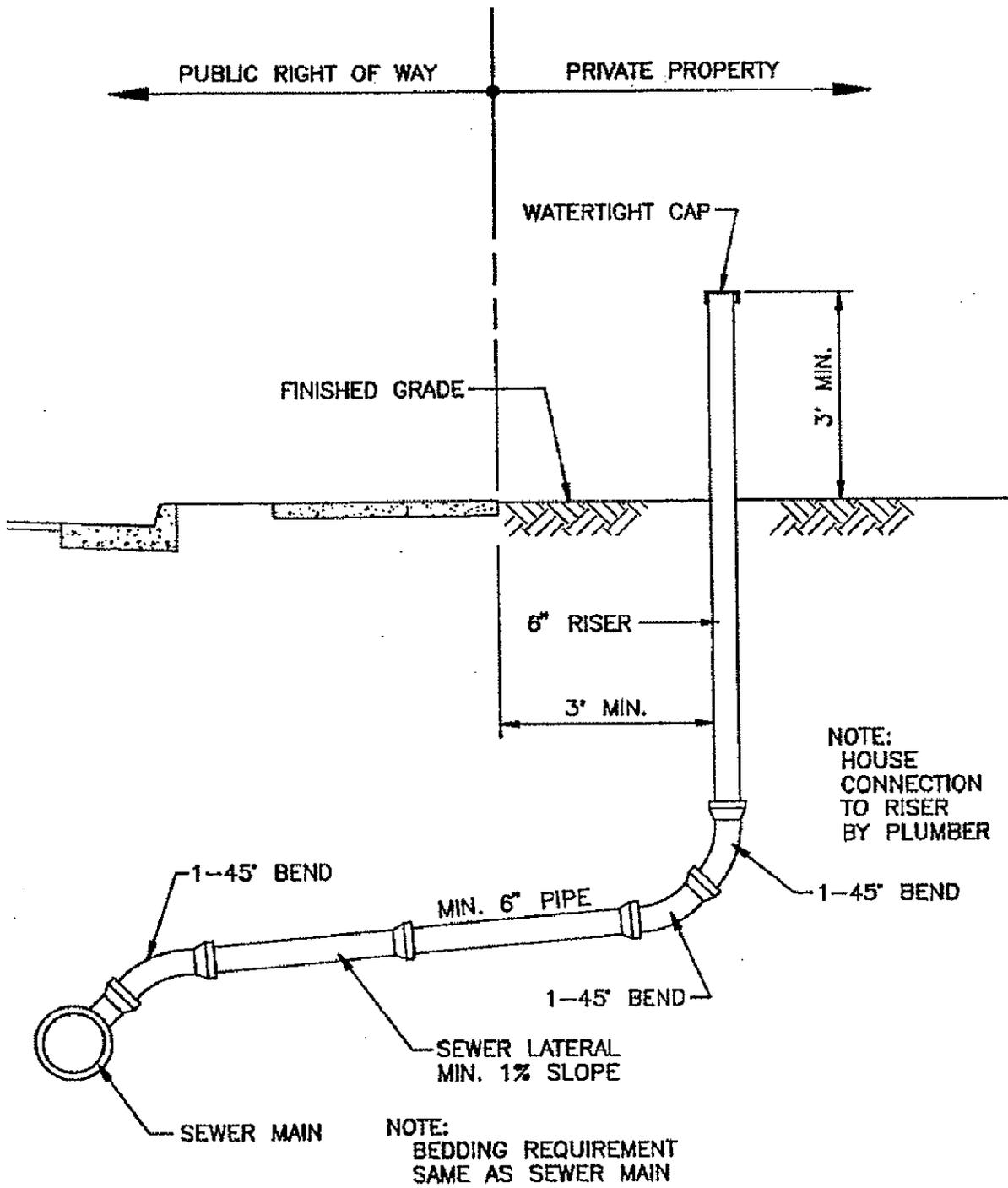


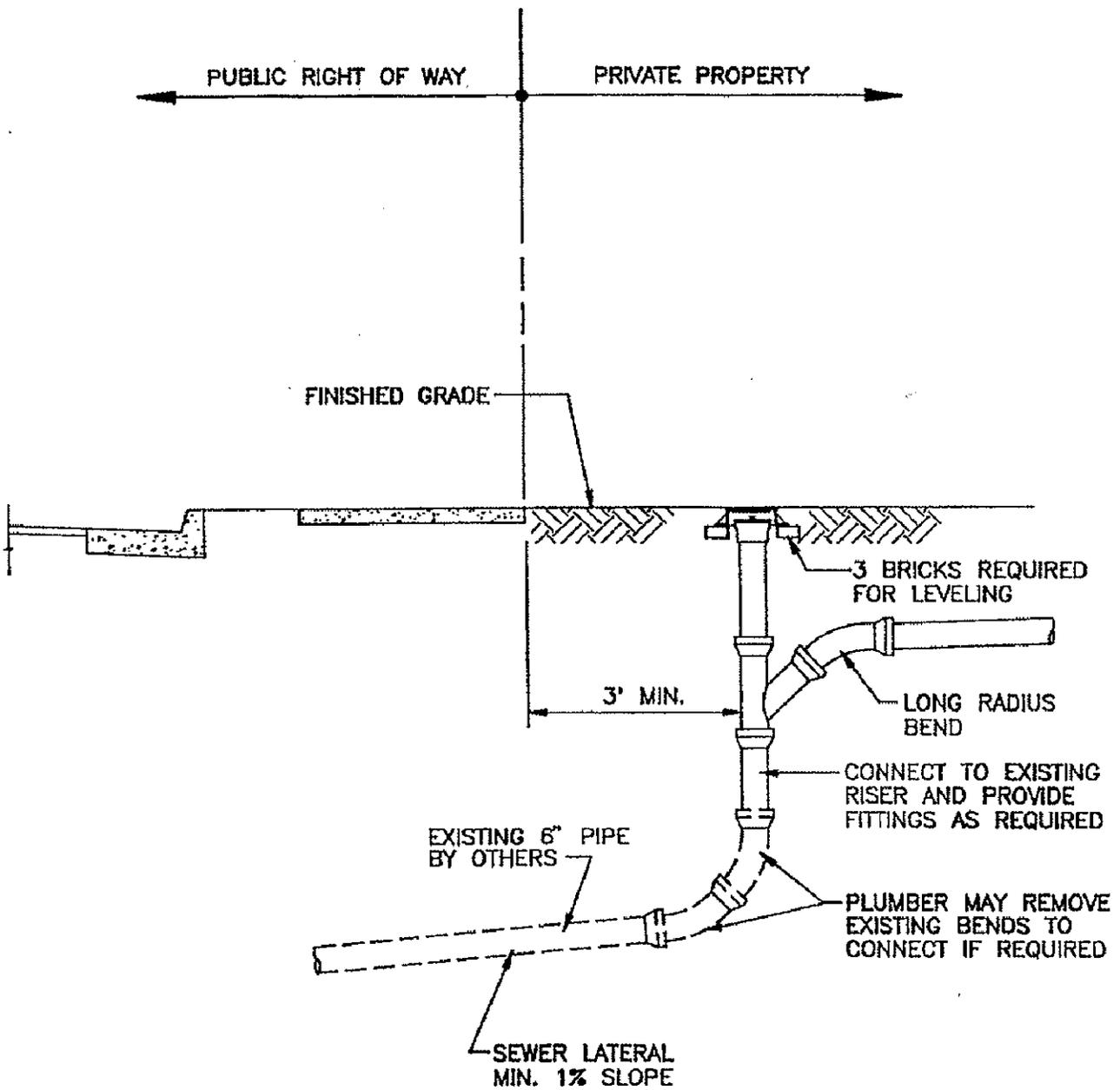
Exhibit C

GPO : 1986 O - 153-032



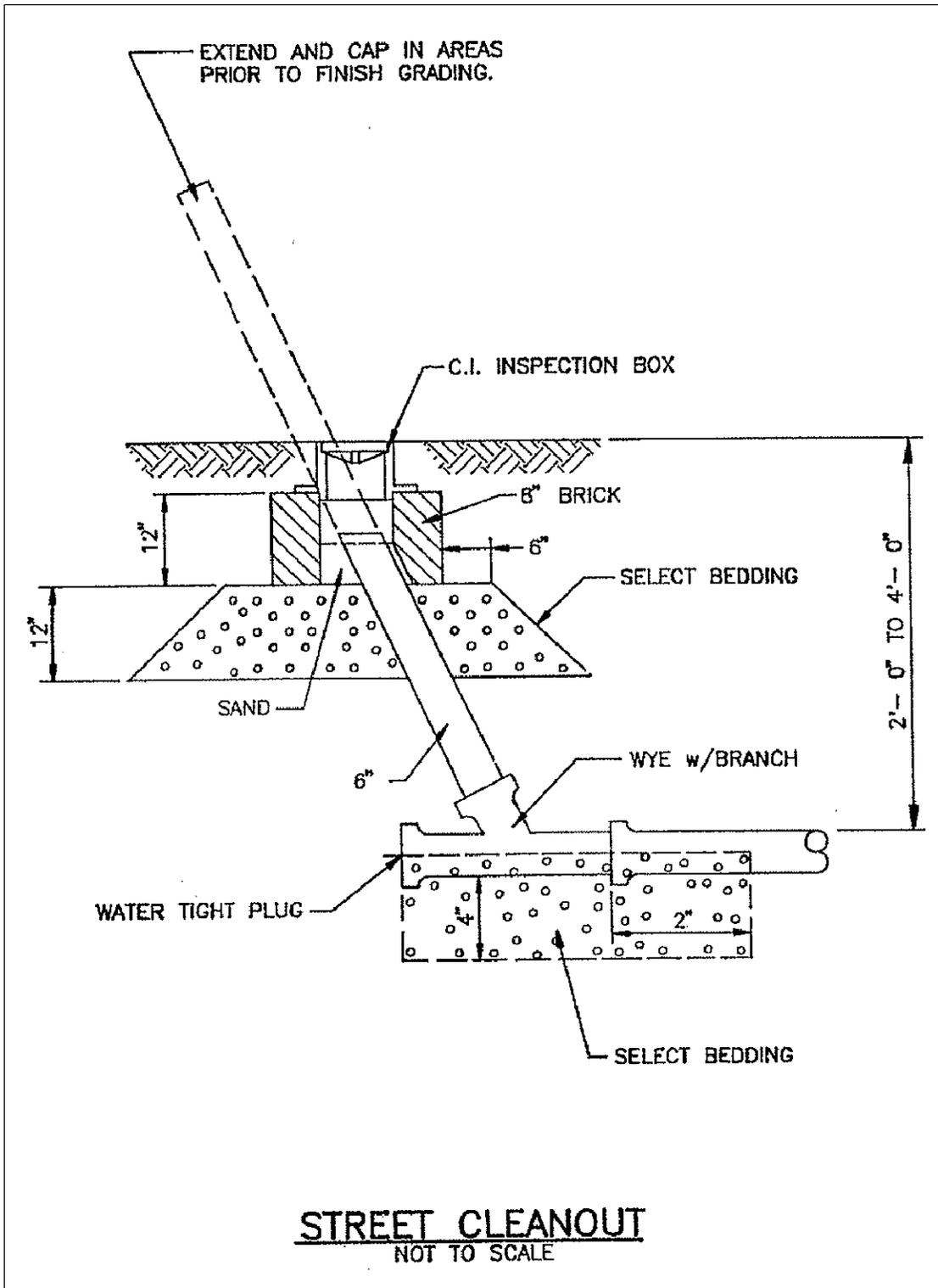
SEWER LATERAL BY DEVELOPER
 NOT TO SCALE

	TOWN OF SMITHFIELD DESIGN AND CONSTRUCTION STANDARDS	
SEWER LATERAL BY DEVELOPER		
DWG #:	S-1	SCALE: N.T.S.
DWN BY:	TOWN	03/06/06

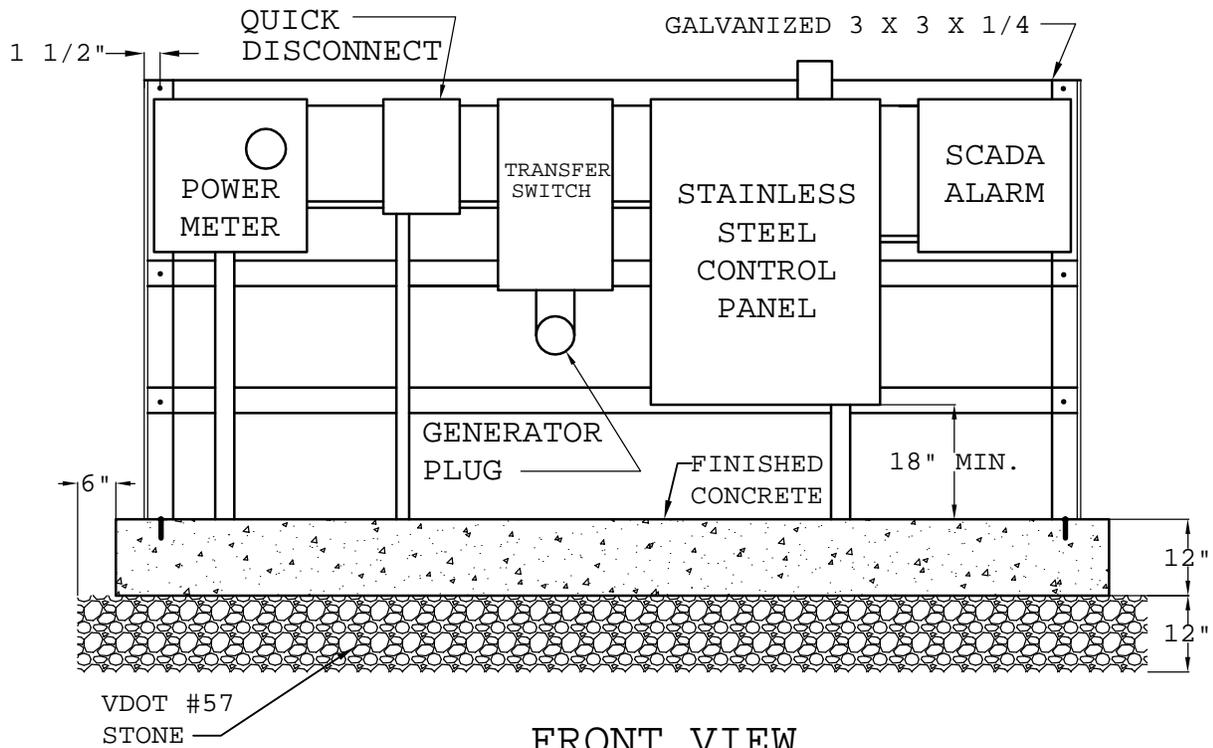


SEWER LATERAL BY PLUMBER
 NOT TO SCALE

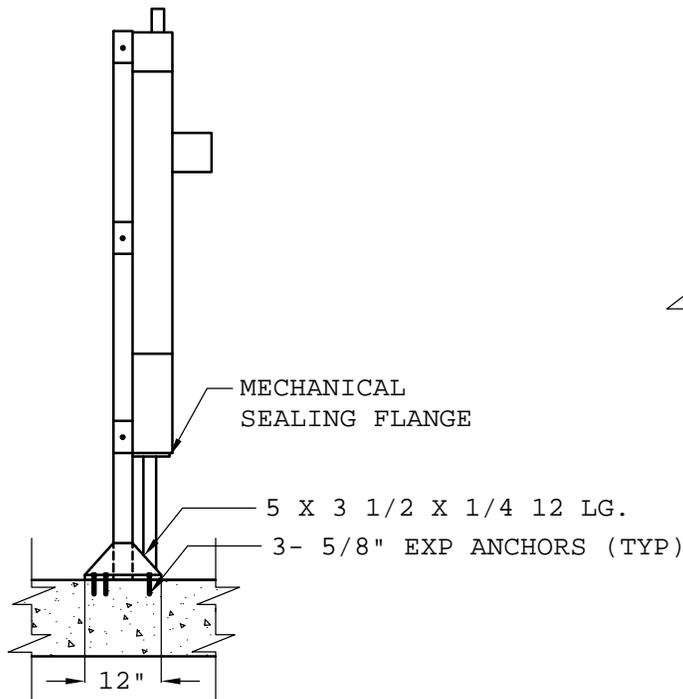
	TOWN OF SMITHFIELD DESIGN AND CONSTRUCTION STANDARDS	
	SEWER LATERAL BY PLUMBER	
DWG #: S-2	SCALE: N.T.S.	
DWN BY: TOWN	03/06/06	



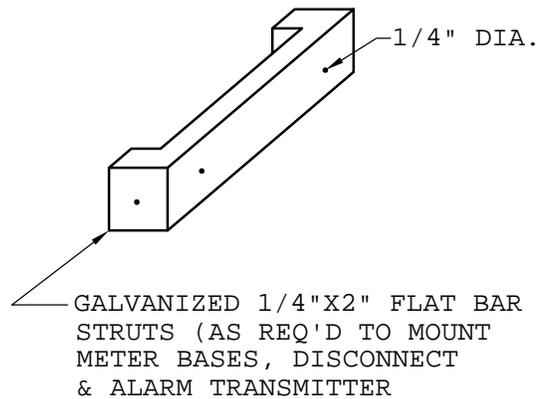
	TOWN OF SMITHFIELD	
	DESIGN AND CONSTRUCTION STANDARDS	
STREET CLEANOUT		
DWG #:	S-3	SCALE: N.T.S.
DWN BY:	TOWN	03/06/06



FRONT VIEW



RIGHT SIDE VIEW



PANEL TO CONNECT TO WET WELL THROUGH 3" PVC CONDUIT

	TOWN OF SMITHFIELD	
	DESIGN AND CONSTRUCTION STANDARDS	
PUMP CONTROL PANEL		
DWG #:	S-4	SCALE: N.T.S.
DWN BY:	CBN	03/06/06

PROVIDE INSULATED BARRIER TYPE TERMINAL STRIPS WITH SOLDERLESS BOX LUGS IN TOP SECTION FOR CONNECTING CONDUCTORS IN CORDS FROM PUMPS AND FLOAT SWITCHES TO CONDUCTORS IN CONDUIT FROM CONTROL PANEL. PROVIDE BARE COPPER GROUND BUS BONDED TO BOX WITH DRILLED AND TAPPED HOLES FOR 1/4" BRASS MACHINE SCREWS FOR CONNECTING ALL EQUIPMENT GROUND CONDUCTORS.

PROVIDE EIGHT STRAIGHT MALE-TREAD, CORD CONNECTORS WITH SEALING GASKETS AND LOCK NUTS (CROUSE-HINDS CGB-SG SERIES OR EQUAL) INDIVIDUAL PLATE. FOUR SHALL BE 1/2" CONDUIT SIZE, TWO 1" CONDUIT SIZE. PROVIDE NOEPRENE BUSHINGS IN CONNECTORS TO MATCH SIZES OF CORDS FROM PUMPS & FLOAT SWITCHES

16 GAUGE STAINLESS STEEL DIVIDER PLATE WITH 1" TURNED-UP FLANGE AT FRONT. SECURE WITH CONTINUOUS WELD ALL AROUND

1/2" DIA. STAINLESS STEEL ROD FOR SUPPORT OF STAINLESS STEEL BASKET-WEAVE CORD GRIPS ON EACH CORD FROM A PUMP OR A FLOAT SWITCH. DRILL AND TAP EACH END FOR MACHINE SCREWS

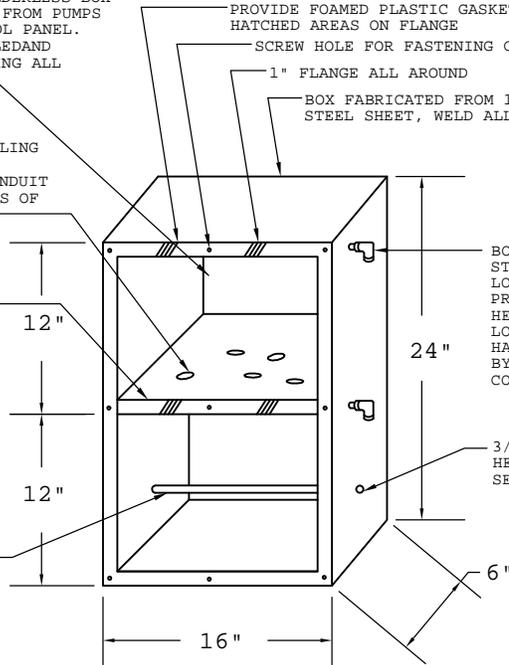
PROVIDE FOAMED PLASTIC GASKET ON HATCHED AREAS ON FLANGE
SCREW HOLE FOR FASTENING COVER (TYP.)

1" FLANGE ALL AROUND

BOX FABRICATED FROM 16 GAUGE STAINLESS STEEL SHEET, WELD ALL JOINTS AND CORNERS

BOX VENT 3/4" STAINLESS STEEL STREET ELBOW WITH LOCKNUT ON INSIDE OF BOX. PROVIDE BRONZE INSECT SCREEN HELD IN PLACE BY CLOSE NIPPLE. LOCATE VENTS ON LEFT OR RIGHT HAND SIDE OF BOX AS REQUIRED BY SPECIFIC PUMPING STATION CONDITIONS (TYP.)

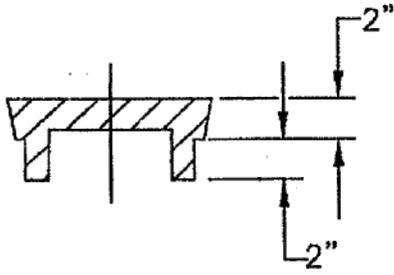
3/16" STAINLESS STEEL FLAT HEAD MACHINE SCREW FOR SECURING ROD TO BOX (TYP.)



NOTES:

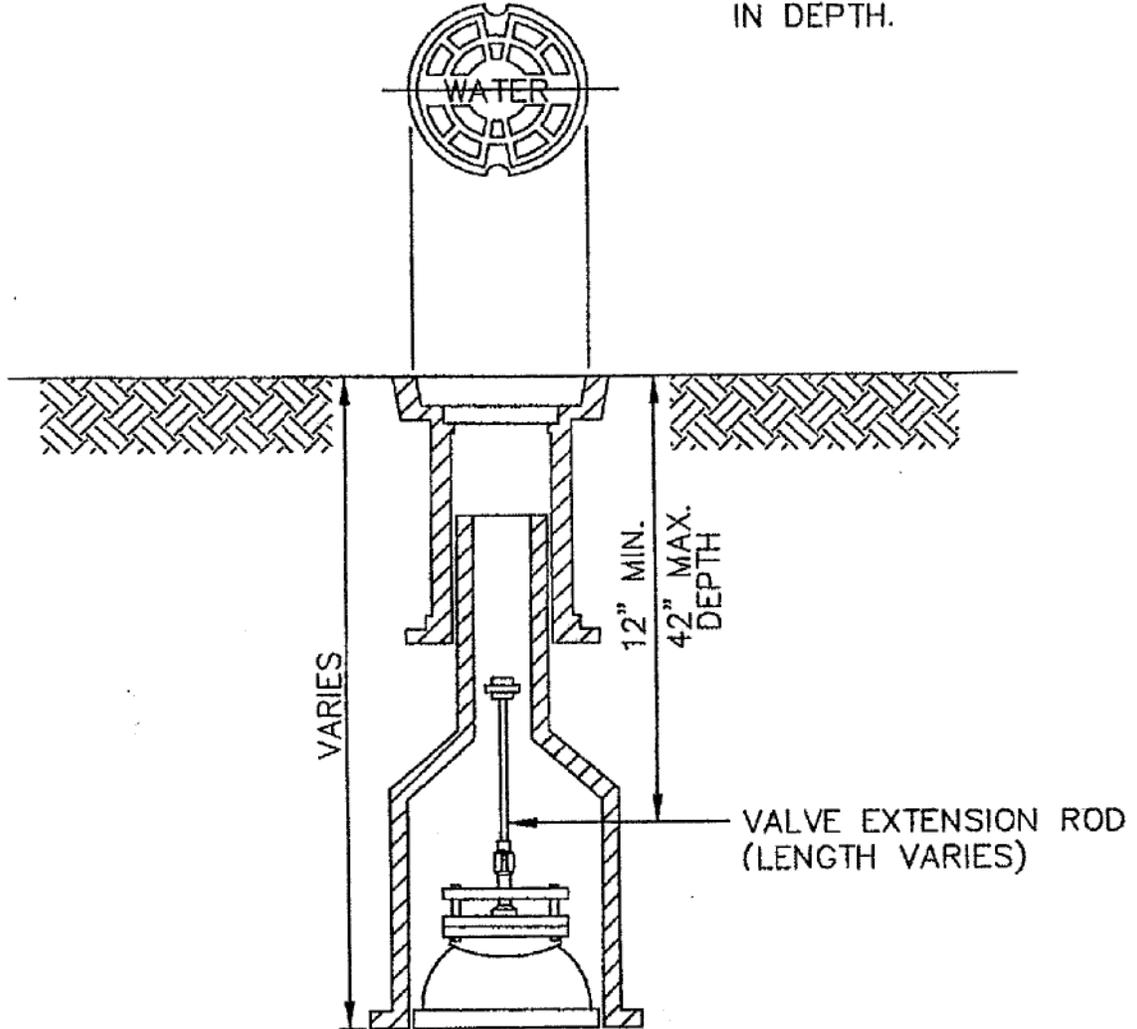
1. THE TERMINAL BOXES WILL BE FURNISHED BY THE OWNER. CONTRACTOR RESPONSIBLE FOR INSTALLATION, CONNECTORS, TERMINAL STRIPS, WIRING, ETC. FOR A COMPLETE FUNCTIONAL INSTALLATION.
2. PROVIDE SINGLE 16 GAUGE STAINLESS STEEL COVER PLATE (NOT SHOWN) FOR BOX SECURED TO FLANGES WITH TEN 1/8" FLAT HEAD STAINLESS STEEL SELF TAPPING SCREWS.
3. SECURE BOX TO CONCRETE PUMP CHAMBER TOP WITH FOUR 3/8" STAINLESS STEEL LAG BOLTS SET IN EXPANSION ANCHORS IN THE CONCRETE. SECURE TO STEEL PUMP CHAMBER TOP WITH FOUR 3/8" STAINLESS STEEL MACHINE BOLTS WITH NUTS, FLAT WASHERS AND LOCK WASHERS, DRILL HOLES IN STEEL TOP FOR SCREWS. REINFORCE BOTTOM FLANGES OF TERMINAL BOX WITH 1/8"x1"x12" FLAT STAINLESS STEEL BARS WHERE LAG BOLTS OR MACHINE BOLTS ARE LOCATED.

	<p>TOWN OF SMITHFIELD DESIGN AND CONSTRUCTION STANDARDS</p>	
	<p>JUNCTION BOX DETAIL</p>	
<p>DWG #: S-5</p>	<p>SCALE: N.T.S.</p>	
<p>DWN BY: TOWN</p>	<p>03/06/06</p>	



NOTES:

- 1) BUFFALO PATTERN TWO PIECE SLIDING TYPE. ADJUSTABLE VALVE BOX W/ 5 1/4" SHAFT.
- 2) VALVE BOX LID SHALL BE A MINIMUM OF 4" IN DEPTH.



**VALVE BOX AND
VALVE EXTENSION DETAIL
(NTS)**

	TOWN OF SMITHFIELD DESIGN AND CONSTRUCTION STANDARDS	
	VALVE BOX AND VALVE EXTENSION DETAIL	
DWG #:	W-1	SCALE: N.T.S.
DWN BY:	TOWN	03/06/06

Town of Smithfield

2003 Geodetic Control



LANDMARK
DESIGN GROUP

TOWN OF SMITHFIELD
2003 GEODETIC CONTROL NETWORK

THE DATA PUBLISHED HEREIN FOR MONUMENTS A THROUGH T WAS PREPARED FOR THE TOWN OF SMITHFIELD, VIRGINIA, DECEMBER 19, 2003, BY THE LANDMARK DESIGN GROUP, INC.

THE HORIZONTAL VALUES FOR THE STATIONS DESCRIBED WERE ESTABLISHED UTILIZING GPS AND CONVENTIONAL SURVEY METHODS. BALDWIN & GREGG, LTD. PERFORMED THE GPS OBSERVATIONS, HOLDING THE PUBLISHED COORDINATE VALUES FOR EXISTING ISLE OF WIGHT COUNTY CONTROL STATIONS 2, 6, AND 11. EXISTING ISLE OF WIGHT COUNTY STATIONS 1-8, 11, 12 AND 18 WERE OBSERVED FOR THE CREATION OF THIS NETWORK; IT IS ADVISED THAT CARE SHOULD BE TAKEN WHEN UTILIZING THE PUBLISHED ISLE OF WIGHT COUNTY CONTROL WITH THE HORIZONTAL CONTROL DATA SHOWN HEREIN.

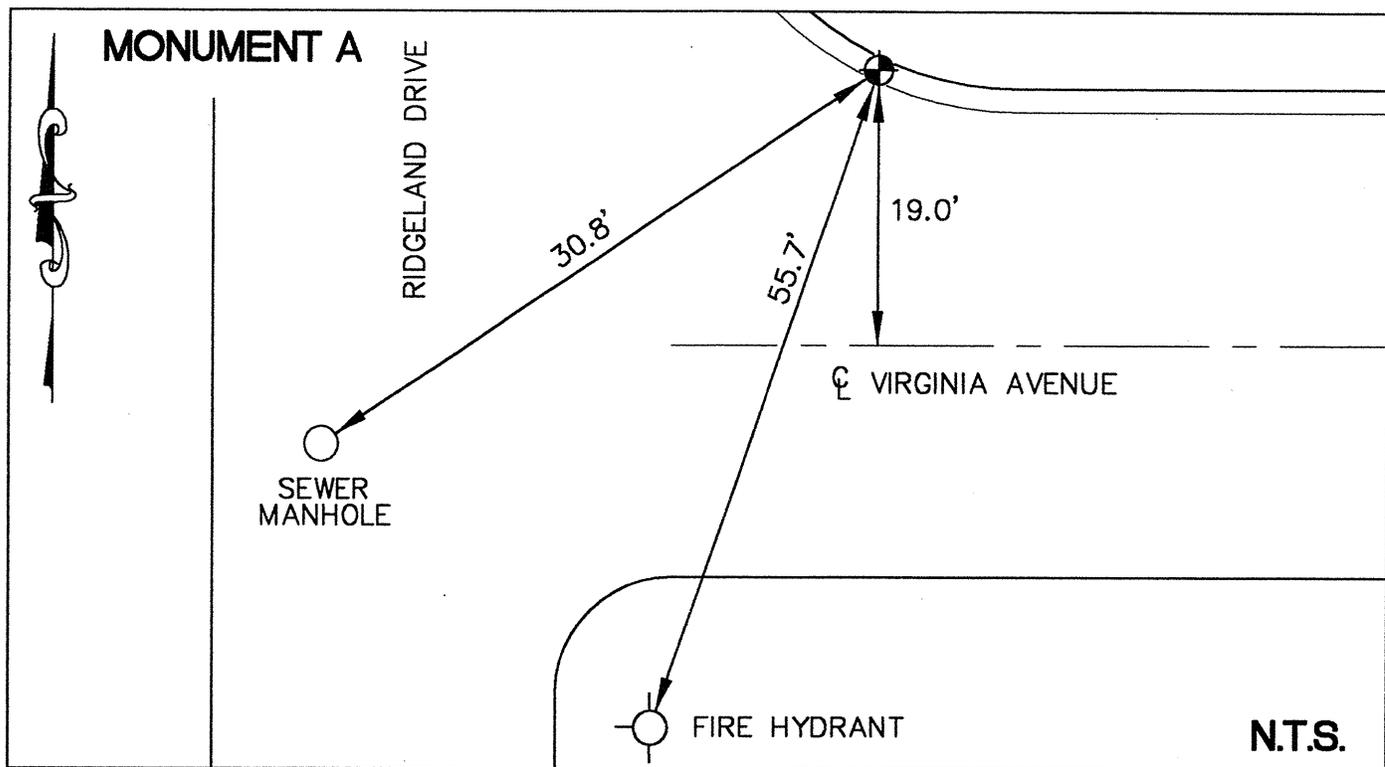
ELEVATIONS LISTED FOR MONUMENTS A THROUGH T WERE ESTABLISHED UTILIZING THREE-WIRE LEVELING METHODS, HOLDING PUBLISHED ISLE OF WIGHT COUNTY STATION 2 HAVING A PUBLISHED ELEVATION OF 40.6, NAVD88. DURING THE COURSE OF THE PROJECT IT WAS DISCOVERED THAT PUBLISHED ISLE OF WIGHT COUNTY STATIONS 1, 3 AND 4 HAD THE FOLLOWING ELEVATION DIFFERENCES:

STA	PUBLISHED ELEVATION	LMDG CORRECTED ELEVATION (1)
1	39.1	38.6
3	29.7	29.5
4	33.2	33.1

(1) CORRECTED ELEVATIONS ARE BASED ON DATA OBTAINED BY THREE-WIRE LEVELING METHODS, HOLDING THE PUBLISHED ELEVATION FOR ISLE OF WIGHT COUNTY STATION 2. STATIONS 5 THROUGH 8 WERE OBSERVED AND WERE FOUND TO BE CONSISTENT WITH THE PUBLISHED DATA.

PLEASE NOTIFY THE TOWN OF SMITHFIELD IF ANY OF THE CONTROL MONUMENTS AS DESCRIBED HEREIN ARE MISSING OR FOUND DISTURBED.

**TOWN OF SMITHFIELD
2003 GEODETIC CONTROL NETWORK**



LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE TOP OF CURB ON THE NORTHEAST CORNER OF THE INTERSECTION OF RIDGELAND DRIVE AND VIRGINIA AVENUE

MONUMENT A

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°59'33.60246"

W 76°36'35.90327"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,526,414.2471

EASTING (FT): 12,034,863.5870

SCALE FACTOR: 0.999966671

CONVERGENCE: 01°08'49.57536"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 34.4

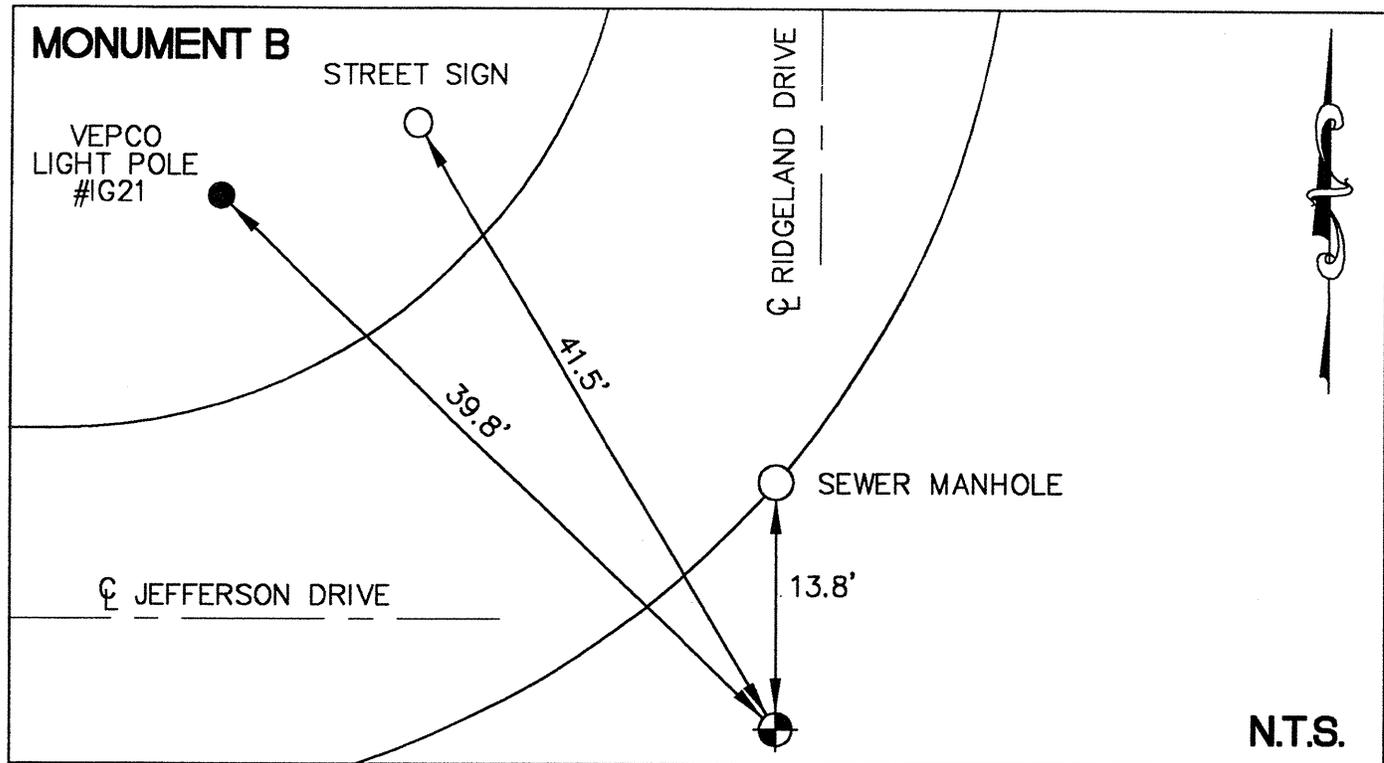
DATE: 12/19/03

**LANDMARK
DESIGN GROUP**
Engineers • Planners • Surveyors
Landscape Architects • Environmental Consultants

5544 Greenwich Road
Suite 200
Virginia Beach, VA 23462
Tel. (757) 473-2000
Fax (757) 497-7933
Email: lmdg@landmarkdg.com

**BALDWIN
& GREGG LTD.**
SURVEYORS • ENGINEERS • PLANNERS

TOWN OF SMITHFIELD
2003 GEODETIC CONTROL NETWORK



LOCATED:

MONUMENT IS A 2" ALUMINUM DISK SET 0.3' BELOW THE NATURAL GROUND SURFACE AT THE SOUTH SIDE OF THE CURVE CREATING THE INTERSECTION OF JEFFERSON DRIVE AND RIDGELAND DRIVE

MONUMENT B

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°59'16.55967"

W 76°36'38.52595"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,524,686.7085

EASTING (FT): 12,034,685.3565

SCALE FACTOR: 0.999967211

CONVERGENCE: 01°08'47.98359

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 33.2

DATE: 12/19/03

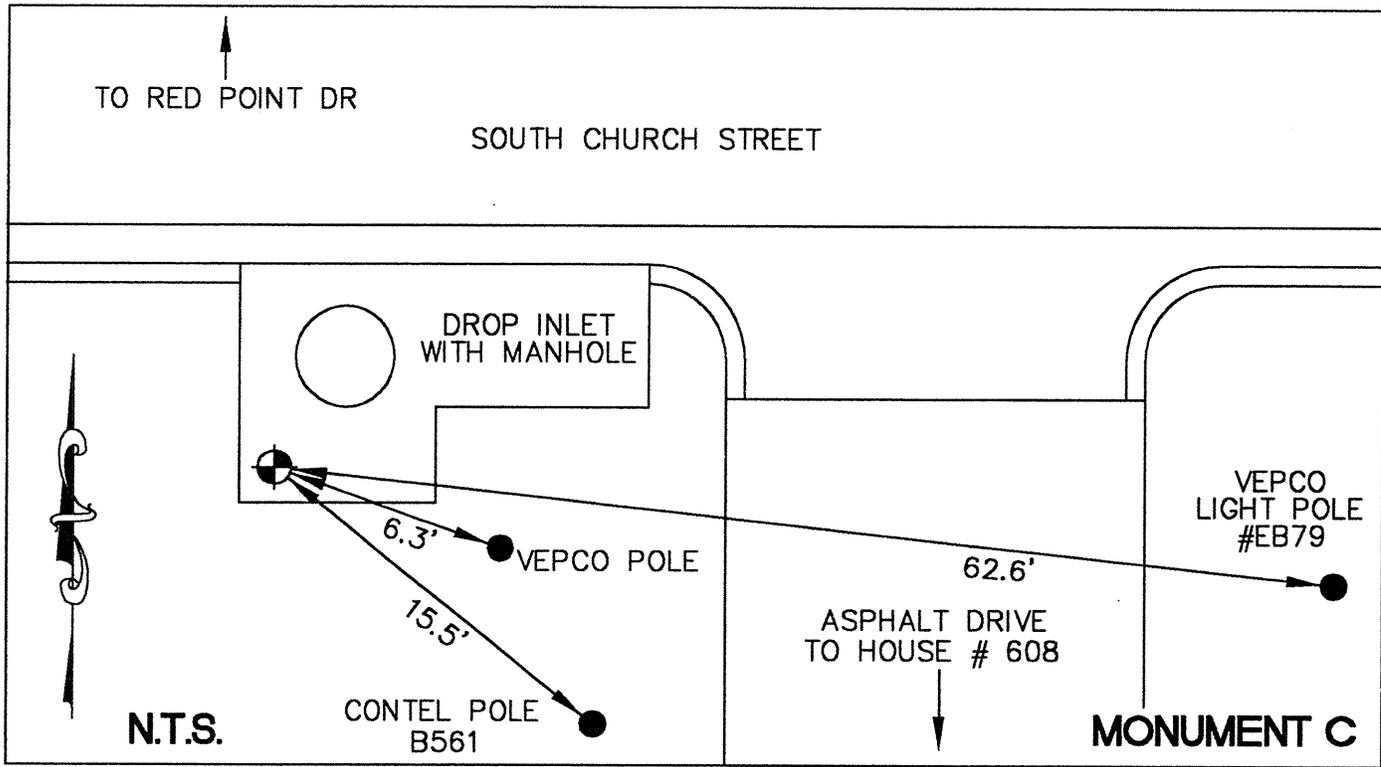
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**TOWN OF SMITHFIELD
2003 GEODETIC CONTROL NETWORK**



LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE SOUTHWEST CORNER OF A DROP INLET LOCATED AT THE INTERSECTION OF SOUTH CHURCH STREET AND THE DRIVEWAY LEADING TO 608 SOUTH CHURCH STREET

MONUMENT C

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'55.30549"

W 76°37'00.40083"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,522,502.1350

EASTING (FT): 12,032,953.8735

SCALE FACTOR: 0.999967894

CONVERGENCE: 01°08'34.70719"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 23.7

DATE: 12/19/03

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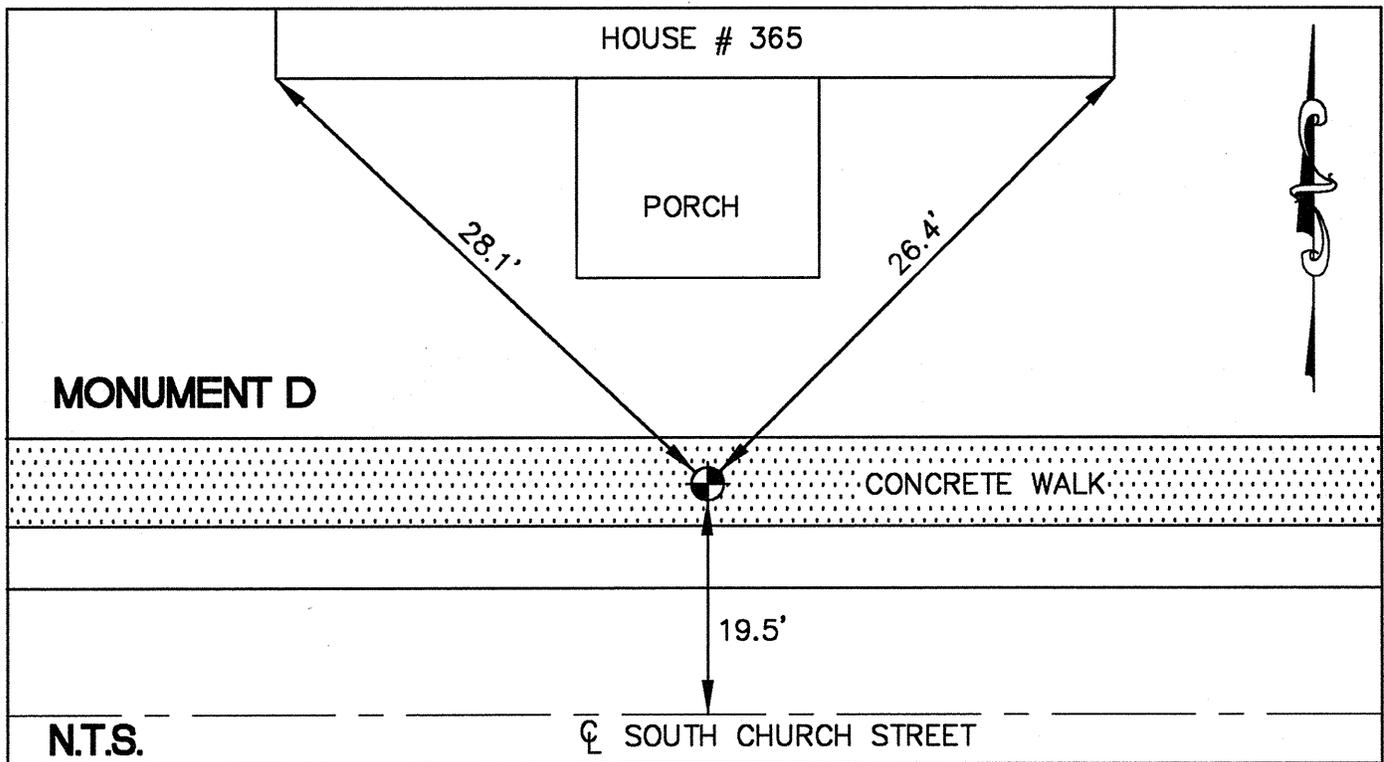
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2003 GEODETIC CONTROL NETWORK



LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE CENTER OF THE SIDEWALK ON THE NORTH SIDE OF SOUTH CHURCH STREET IN FRONT OF 2 STORY FRAME HOUSE # 365 SOUTH CHURCH STREET (NOT SUITABLE FOR GPS)

MONUMENT D

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'55.50063"

W 76°37'31.76161"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,522,471.2276

EASTING (FT): 12,030,409.4786

SCALE FACTOR: 0.999967888

CONVERGENCE: 01°08'15.67355"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 25.0

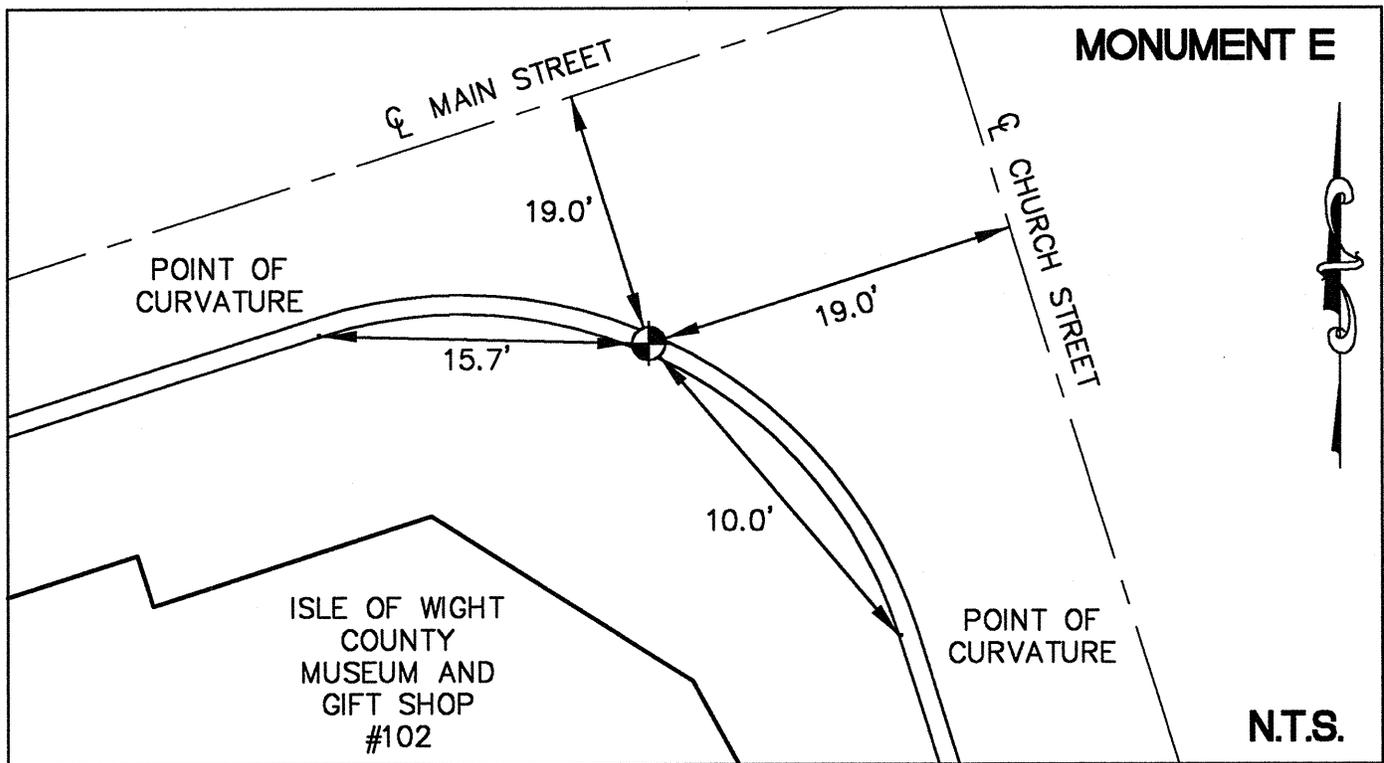
DATE: 12/19/03

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**TOWN OF SMITHFIELD
2003 GEODETIC CONTROL NETWORK**



LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE TOP OF THE GRANITE CURB AT THE SOUTHWEST INTERSECTION OF MAIN STREET AND CHURCH STREET, IN FRONT OF THE ISLE OF WIGHT COUNTY MUSEUM AND GIFT SHOP (NOT SUITABLE FOR GPS)

MONUMENT E

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'56.09176"

W 76°37'51.56599"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,522,499.1423

EASTING (FT): 12,028,801.7512

SCALE FACTOR: 0.999967869

CONVERGENCE: 01°08'03.65378"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 34.6

DATE: 12/19/03

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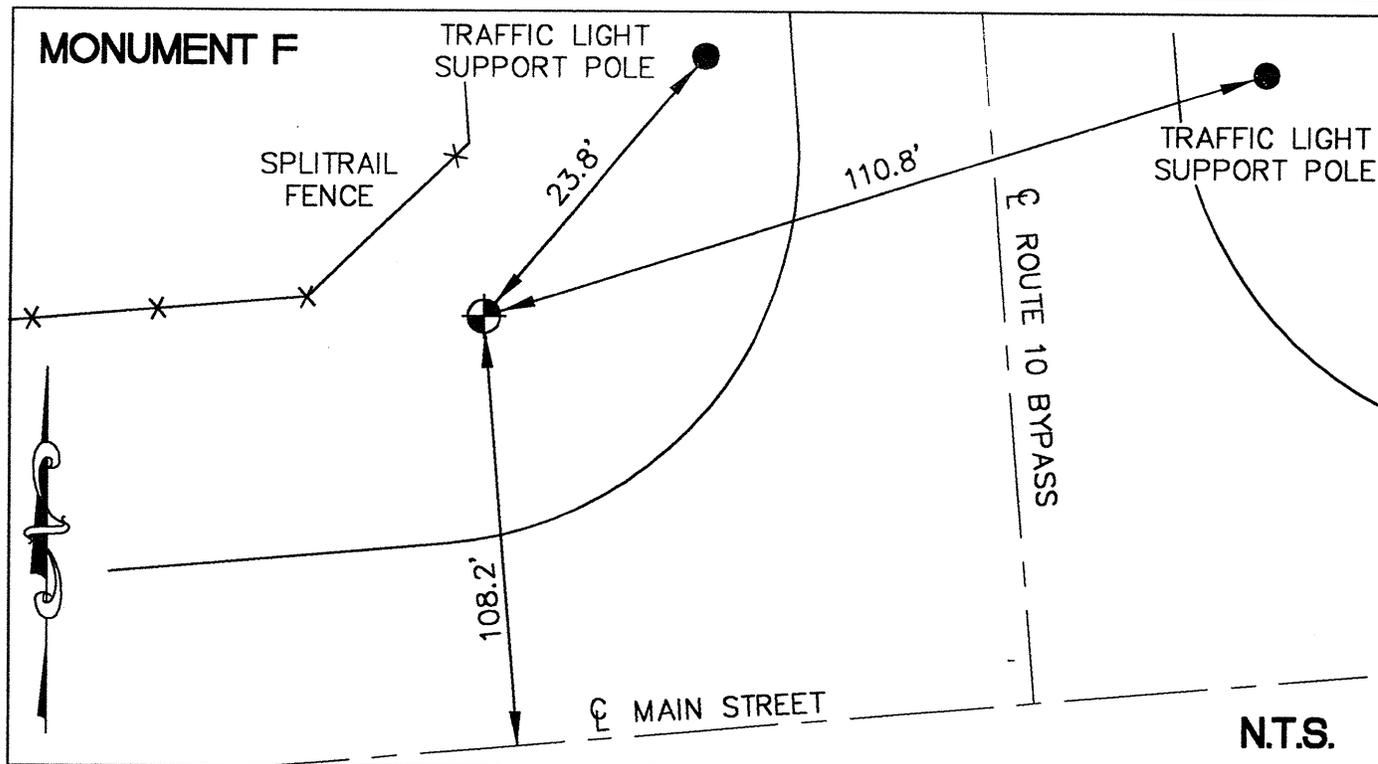
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2003 GEODETIC CONTROL NETWORK**



LOCATED:

MONUMENT IS A 2" ALUMINUM DISK SET 0.3' BELOW THE NATURAL GROUND SURFACE AT THE NORTHWEST CORNER OF THE INTERSECTION OF THE ROUTE 10 BYPASS AND MAIN STREET

MONUMENT F

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'38.65688"

W 76°38'27.45329"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,520,678.7160

EASTING (FT): 12,025,925.2750

SCALE FACTOR: 0.999968437

CONVERGENCE: 01°07'41.87289"

ELEVATION: NAVD 88 (ISLE OF WIGHT)

ELEVATION (FT): 34.6

DATE: 12/19/03

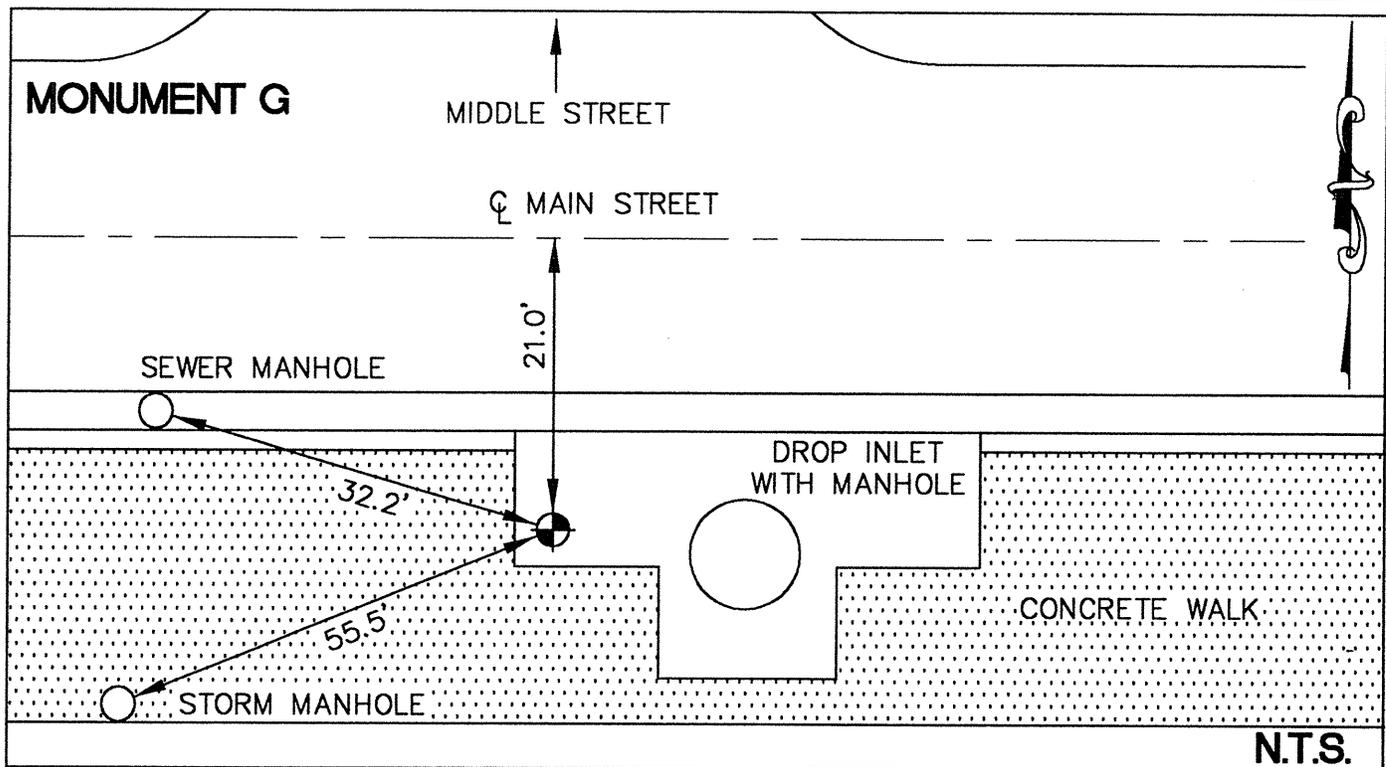
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2003 GEODETIC CONTROL NETWORK**



LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE SOUTHWEST CORNER OF A DROP INLET LOCATED ON THE SOUTH SIDE OF MAIN STREET ACROSS FROM MIDDLE STREET

MONUMENT G

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'32.08690"

W 76°38'43.21921"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,519,989.2275

EASTING (FT): 12,024,659.3040

SCALE FACTOR: 0.999968653

CONVERGENCE: 01°07'32.30416"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 35.0

DATE: 12/19/03

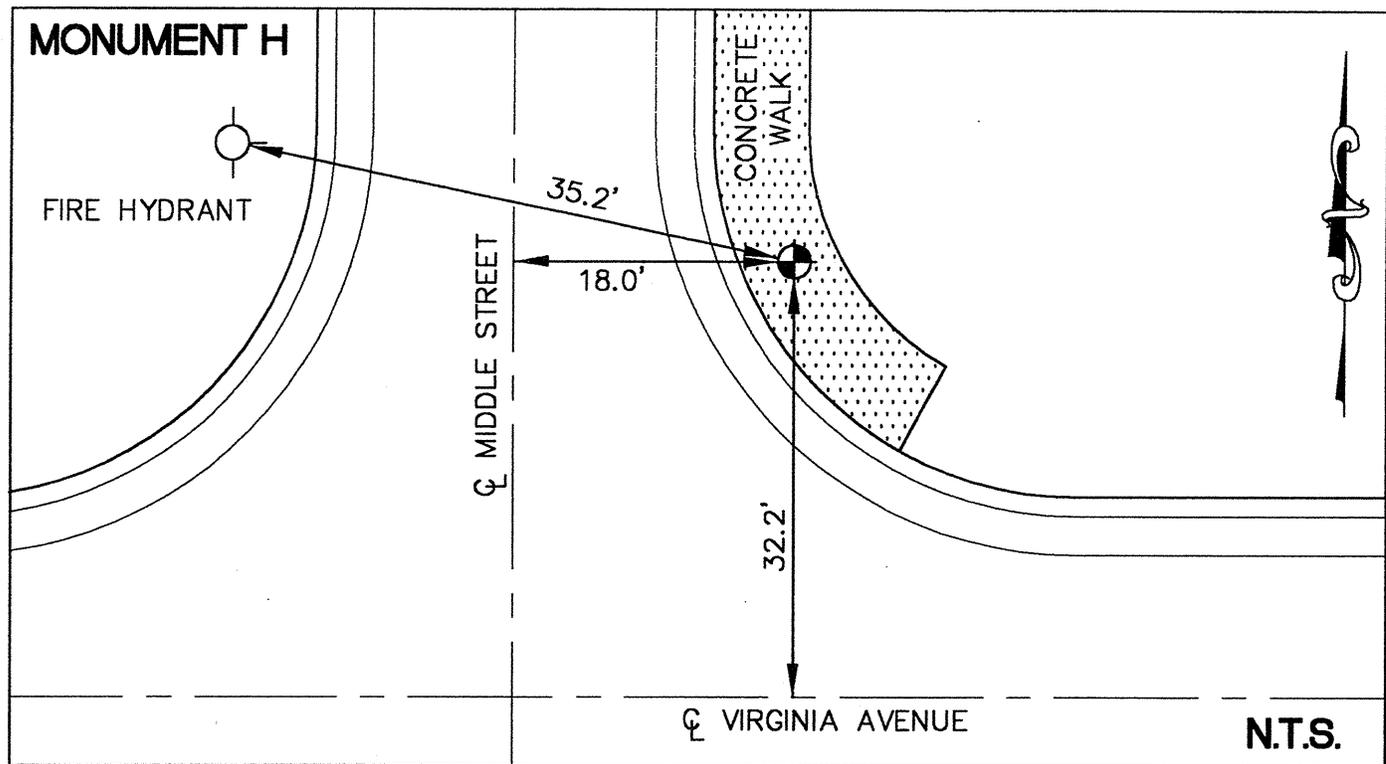
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2003 GEODETIC CONTROL NETWORK**



LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE CENTER OF THE SIDEWALK AT THE NORTHEAST CORNER OF THE INTERSECTION OF MIDDLE STREET AND VIRGINIA AVENUE

MONUMENT H

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'42.59304"

W 76°38'47.07106"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,521,045.4240

EASTING (FT): 12,024,325.9500

SCALE FACTOR: 0.999968308

CONVERGENCE: 01°07'29.96637"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 34.9

DATE: 12/19/03

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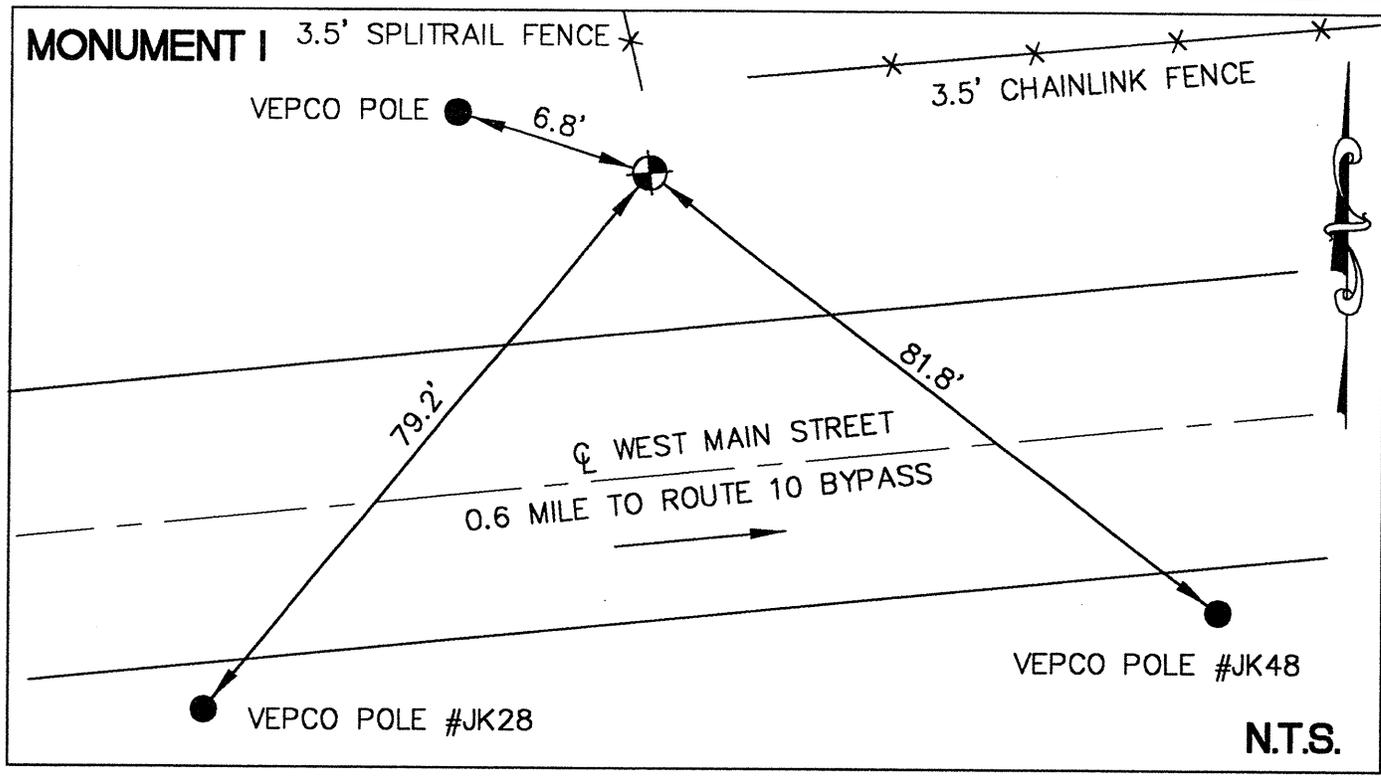
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LOCATED:

MONUMENT IS A 2" ALUMINUM DISK SET 0.4' BELOW THE NATURAL GROUND ON THE NORTH SIDE OF WEST MAIN STREET, SIX TENTHS (0.6) OF A MILE FROM THE ROUTE 10 BYPASS, ON THE WESTERN PROPERTY LINE OF SMITHFIELD MIDDLE SCHOOL

MONUMENT I

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'23.91790"

W 76°39'03.89035"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,519,130.3145

EASTING (FT): 12,022,998.4775

SCALE FACTOR: 0.999968923

CONVERGENCE: 01°07'19.75833"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 59.1

DATE: 12/19/03

LANDMARK

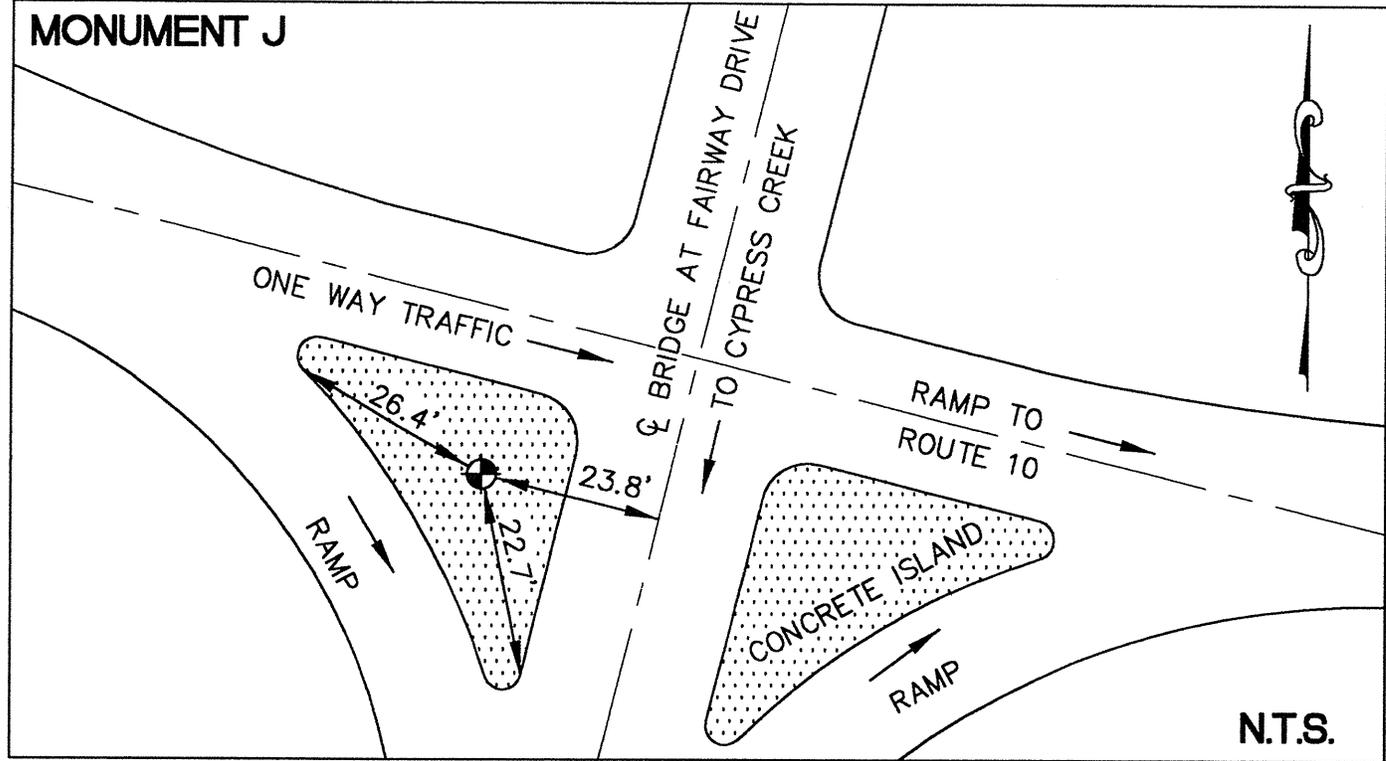
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2003 GEODETIC CONTROL NETWORK**



LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE CENTER OF A CONCRETE ISLAND NEAR THE ON-RAMP TO FAIRWAY DRIVE SOUTH

MONUMENT J

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'13.52592"
W 76°37'59.10159"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,518,182.9880
EASTING (FT): 12,028,275.5880
SCALE FACTOR: 0.999969268
CONVERGENCE: 01°07'59.08024"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 54.9

DATE: 12/19/03

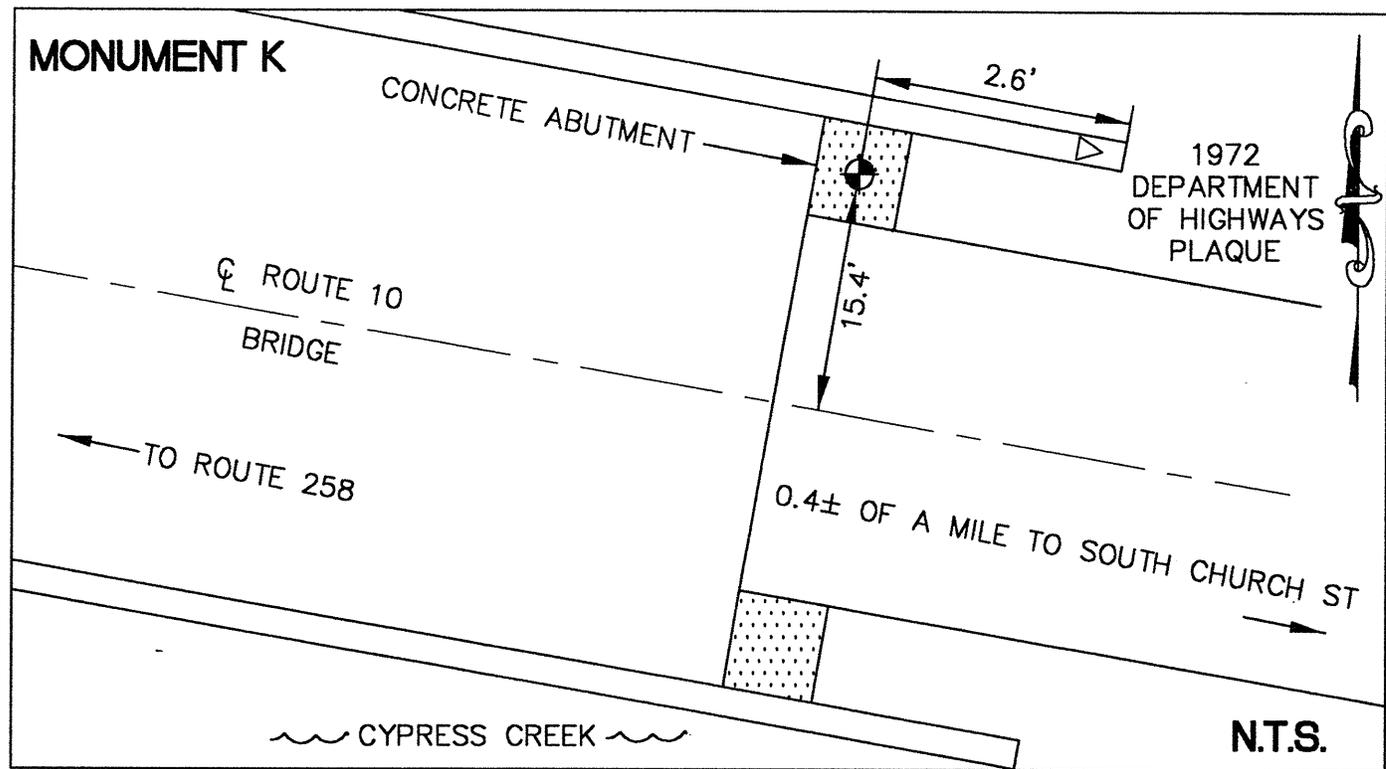
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LOCATED:

MONUMENT IS A 1" BRASS DISK SET ON A CONCRETE ABUTMENT ON THE NORTHEAST SIDE OF THE ROUTE 10 BRIDGE OVER CYPRESS CREEK

MONUMENT K

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°57'53.48806"

W 76°36'44.19287"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,516,277.7385

EASTING (FT): 12,034,393.6770

SCALE FACTOR: 0.999969941

CONVERGENCE: 01°08'44.54420"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 22.1

DATE: 12/19/03

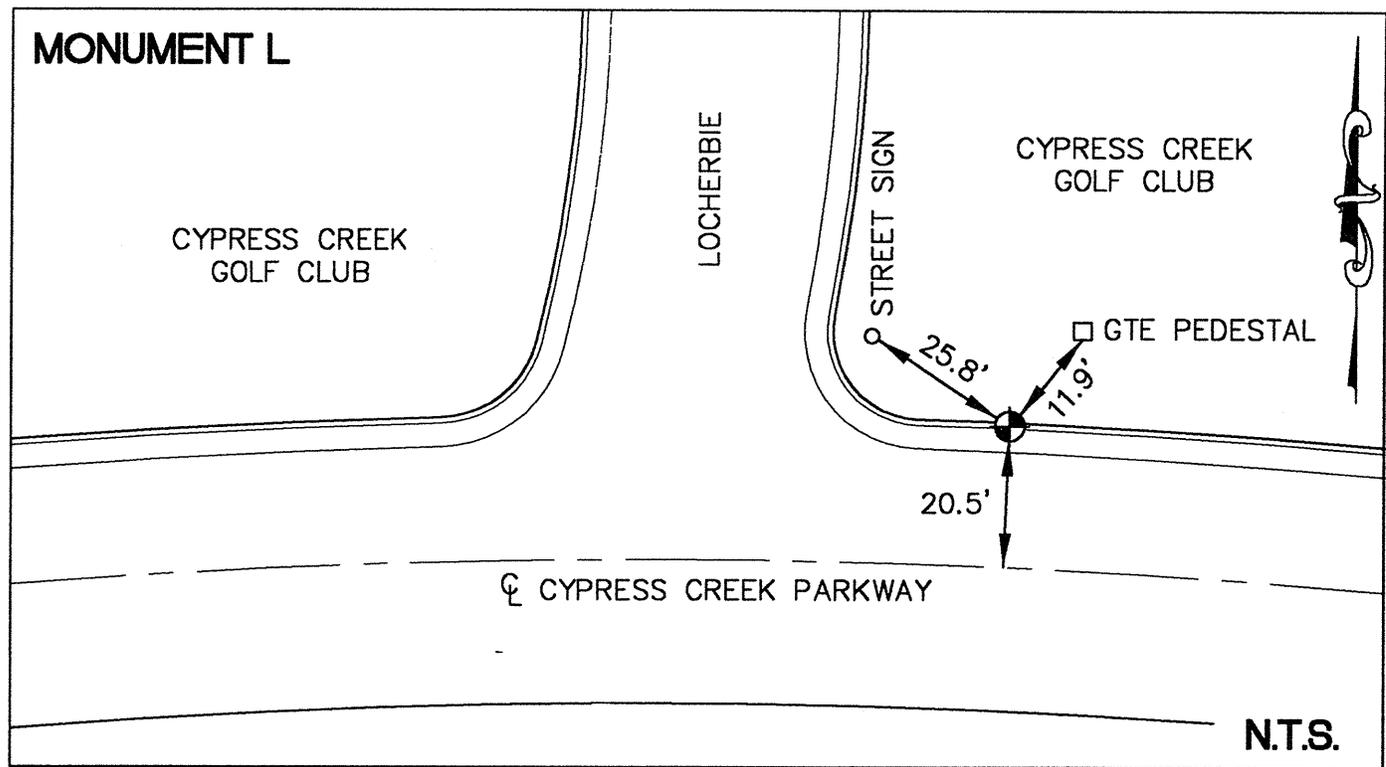
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LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE TOP OF THE CURB AT THE NORTHEAST CORNER OF THE INTERSECTION OF LOCHERBIE AND CYPRESS CREEK PARKWAY

MONUMENT L

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°57'47.86677"

W 76°37'27.42163"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,515,639.4170

EASTING (FT): 12,030,897.4390

SCALE FACTOR: 0.999970132

CONVERGENCE: 01°08'18.30759"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 31.3

DATE: 12/19/03

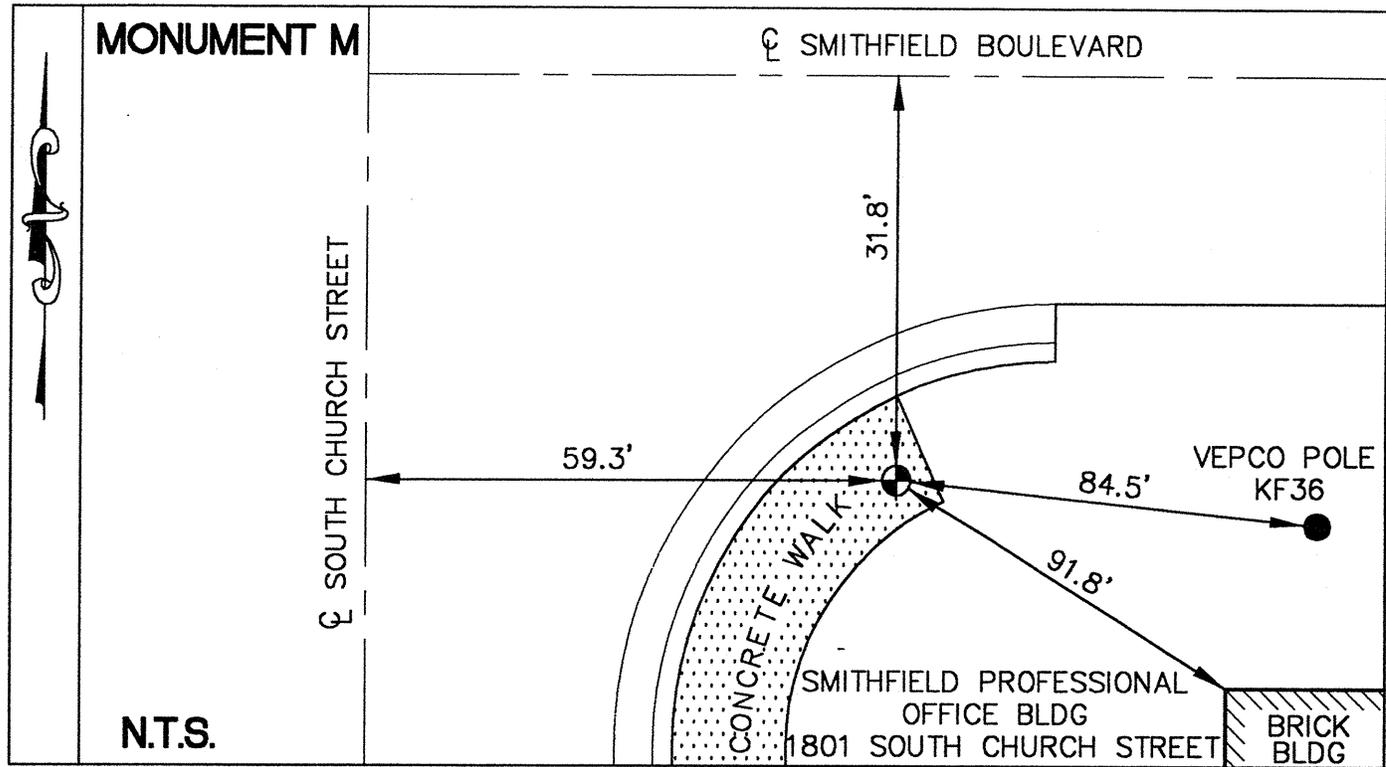
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LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE SIDEWALK ON THE SOUTHEAST CORNER OF THE INTERSECTION OF SOUTH CHURCH STREET AND SMITHFIELD BOULEVARD

MONUMENT M

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°57'57.35637"

W 76°36'24.30411"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,516,701.2020

EASTING (FT): 12,035,999.5810

SCALE FACTOR: 0.999969811

CONVERGENCE: 01°08'56.61519"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 41.1

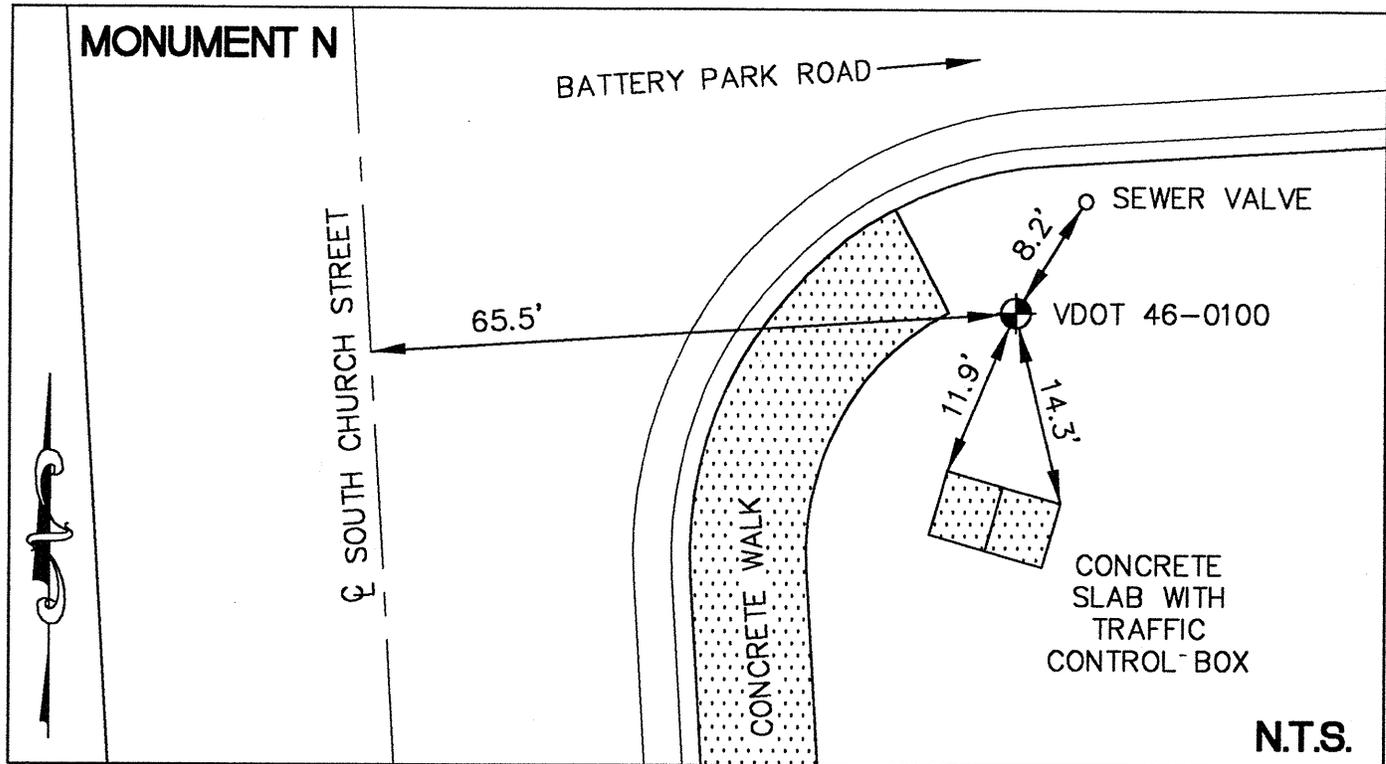
DATE: 12/19/03

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LOCATED:

MONUMENT IS AN EXISTING DEPARTMENT OF TRANSPORTATION MONUMENT STAMPED 46-0100 SET 0.2' BELOW NATURAL GROUND ON THE SOUTHEAST CORNER OF THE INTERSECTION OF SOUTH CHURCH STREET AND BATTERY PARK ROAD

MONUMENT N

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'22.92529"

W 76°36'35.18322"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,519,268.9065

EASTING (FT): 12,035,065.1025

SCALE FACTOR: 0.999968955

CONVERGENCE: 01°08'50.01238"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 41.2

DATE: 12/19/03

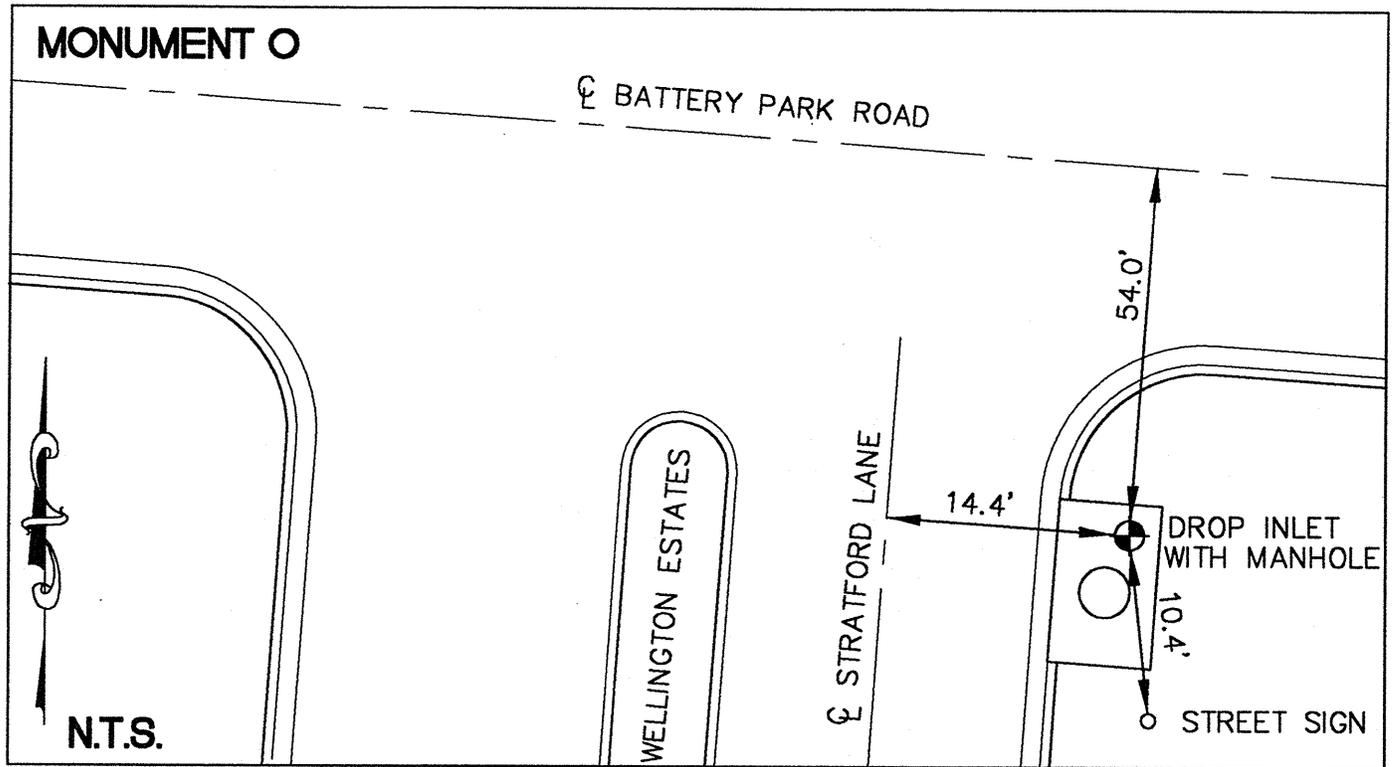
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LOCATED:

MONUMENT IS A 1" BRASS DISK SET IN THE TOP OF A DROP INLET AT THE SOUTHEAST CORNER OF THE INTERSECTION OF BATTERY PARK ROAD AND STRATFORD LANE

MONUMENT O

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'27.77708"

W 76°35'54.86818"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,519,825.1860

EASTING (FT): 12,038,325.9745

SCALE FACTOR: 0.999968795

CONVERGENCE: 01°09'14.48058"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 23.1

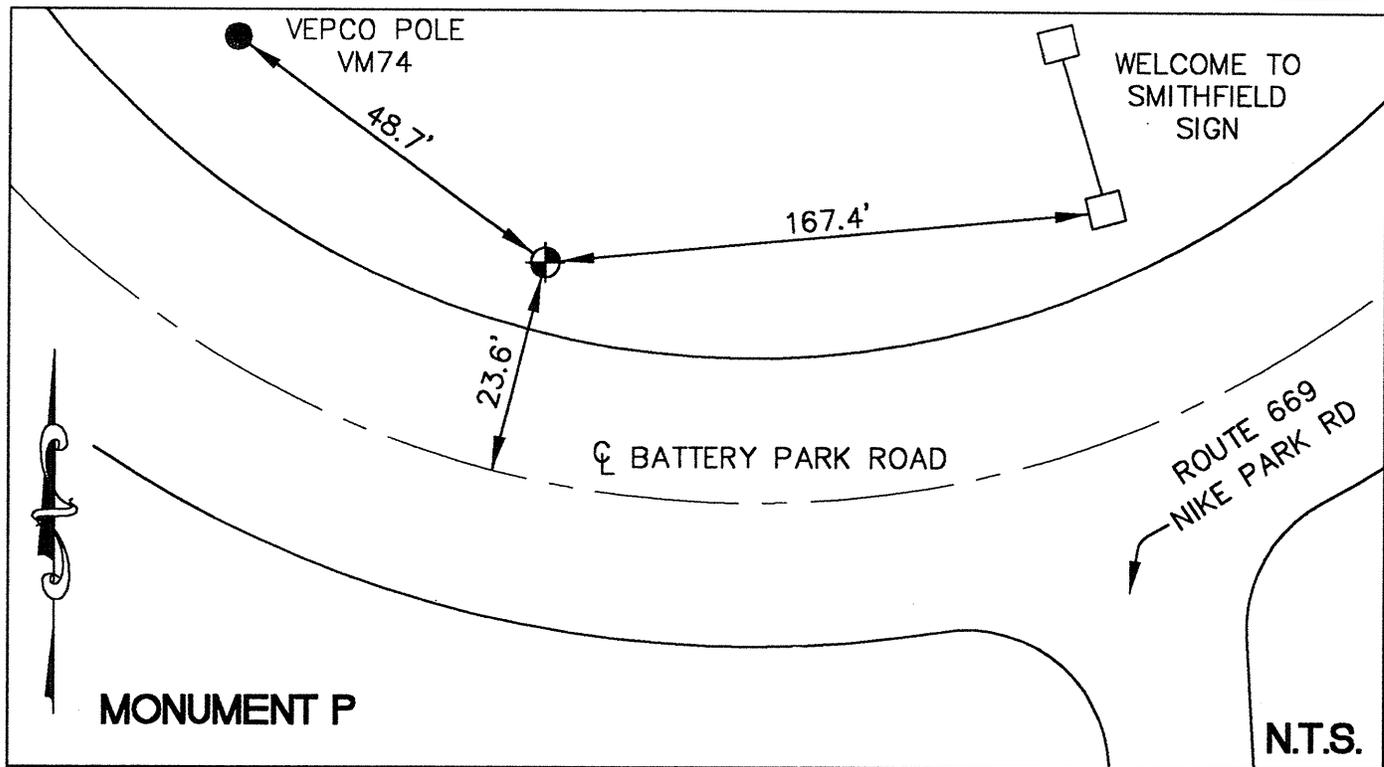
DATE: 12/19/03

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2003 GEODETIC CONTROL NETWORK



LOCATED:

MONUMENT IS A 2" ALUMINUM DISK SET 0.3' BELOW NATURAL GROUND ON THE NORTH SIDE OF BATTERY PARK ROAD APPROXIMATELY 167.4' WEST OF SOUTHERNMOST CORNER OF "WELCOME TO SMITHFIELD" SIGN

MONUMENT P

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°58'32.22952

W 76°35'14.79888

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,520,341.0670

EASTING (FT): 12,041,567.6040

SCALE FACTOR: 0.999968648

CONVERGENCE: 01°09'38.79963"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 22.7

DATE: 12/19/03

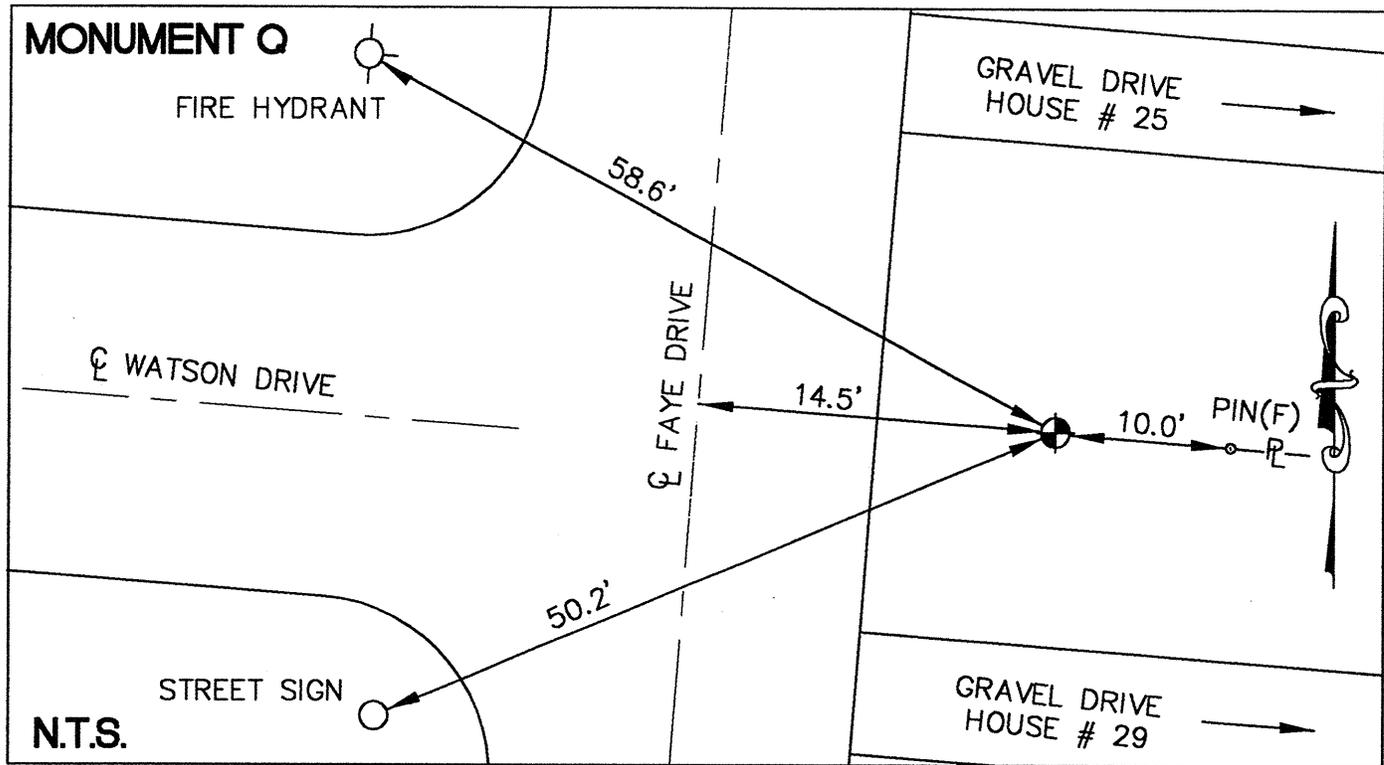
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LOCATED:

MONUMENT IS A 2" ALUMINUM DISK SET IN CONCRETE 0.2' BELOW NATURAL GROUND EAST OF THE INTERSECTION OF WATSON DRIVE AND FAYE DRIVE

MONUMENT Q

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°59'22.58358"

W 76°35'40.80565"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,525,389.9235

EASTING (FT): 12,039,354.9805

SCALE FACTOR: 0.999967019

CONVERGENCE: 01°09'23.01548"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 20.5

DATE: 12/19/03

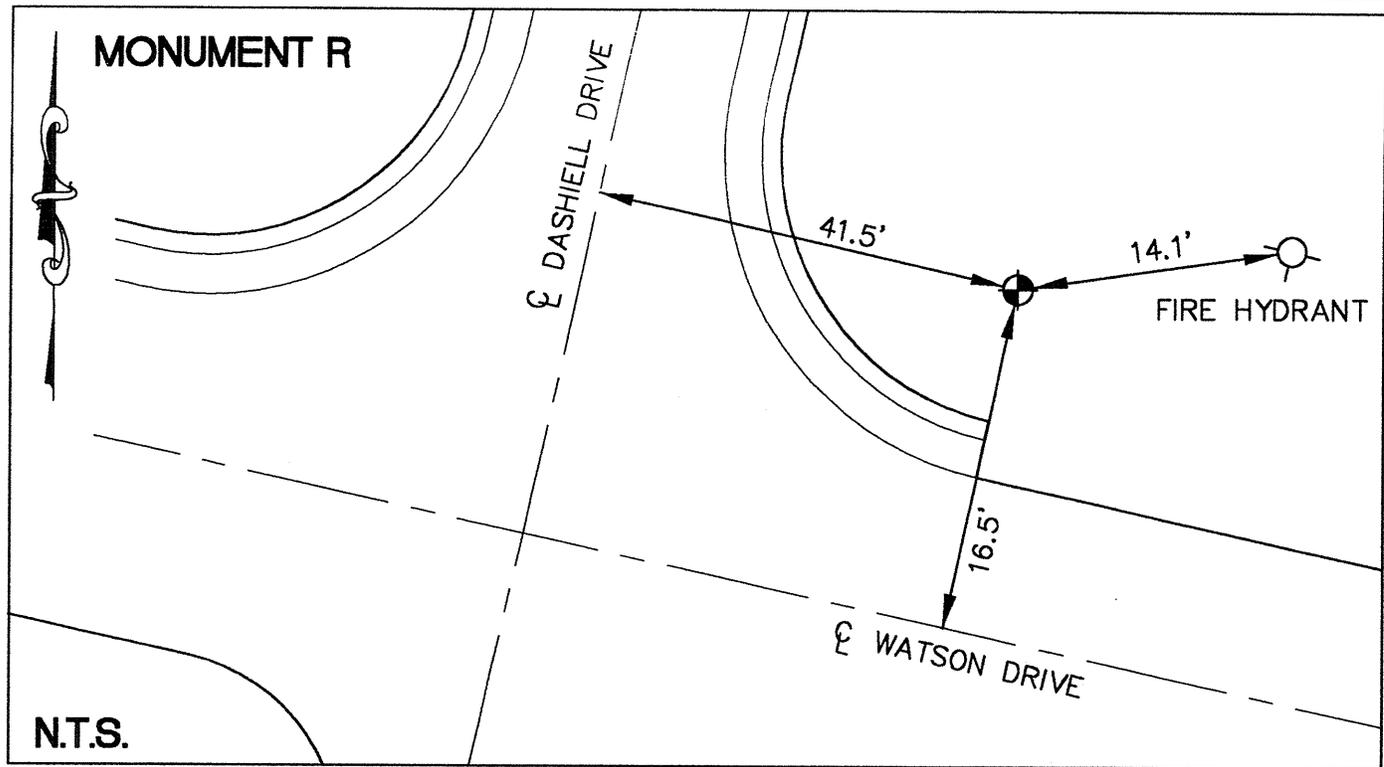
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LOCATED:

MONUMENT IS A 2" ALUMINUM DISK SET 0.3' BELOW NATURAL GROUND AT THE NORTHEAST CORNER OF THE INTERSECTION OF DASHIELL DRIVE AND WATSON DRIVE

MONUMENT R

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°59'25.94613"

W 76°36'03.35734"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,525,693.0630

EASTING (FT): 12,037,518.9265

SCALE FACTOR: 0.999966913

CONVERGENCE: 01°09'09.32830"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 24.1

DATE: 12/19/03

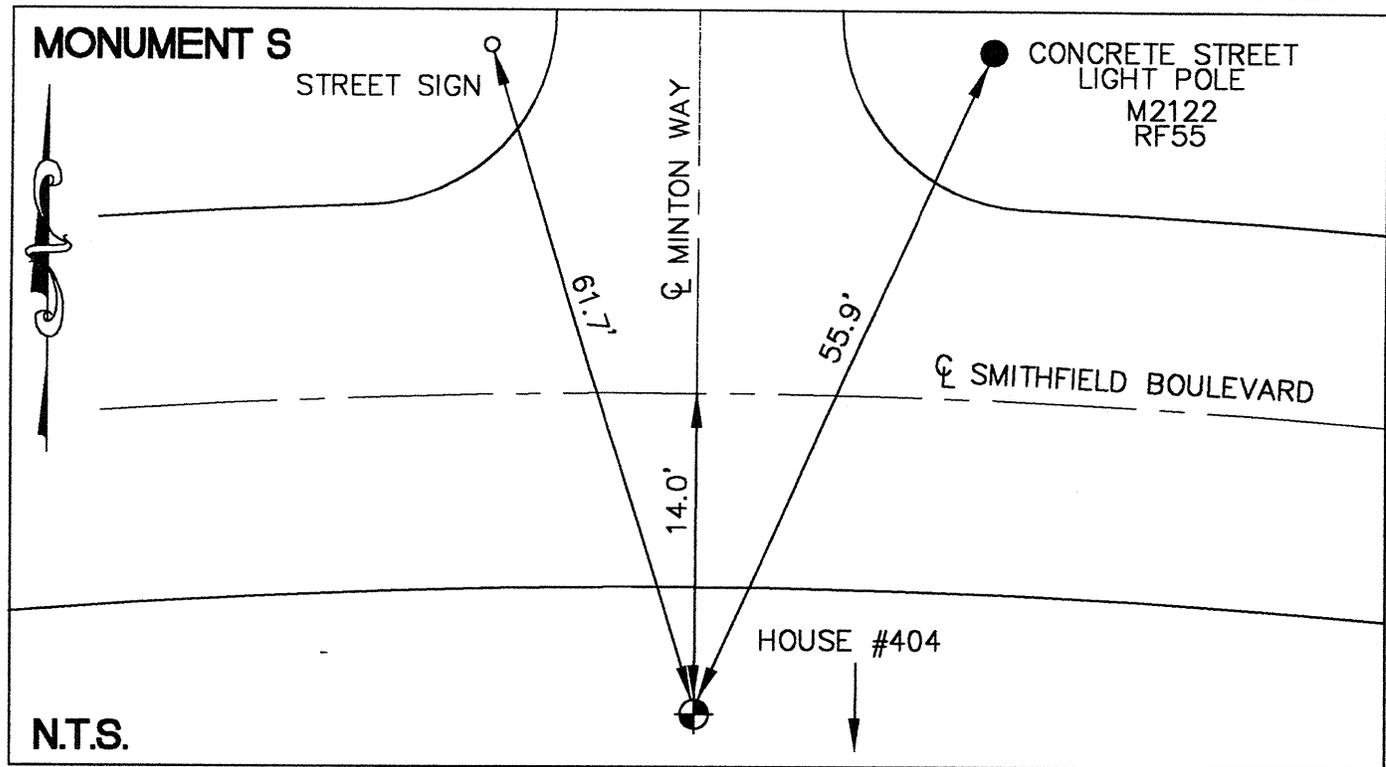
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LOCATED:

MONUMENT IS A 2" ALUMINUM DISK SET 0.2' BELOW NATURAL GROUND SOUTH OF THE INTERSECTION OF MINTON WAY AND SMITHFIELD BOULEVARD, IN FRONT OF 404 SMITHFIELD BOULEVARD

MONUMENT S

GEODETIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°57'57.40014"
W 76°35'40.77049"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,516,776.7015
EASTING (FT): 12,039,531.6970
SCALE FACTOR: 0.999969809
CONVERGENCE: 01°09'23.03682"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 22.8

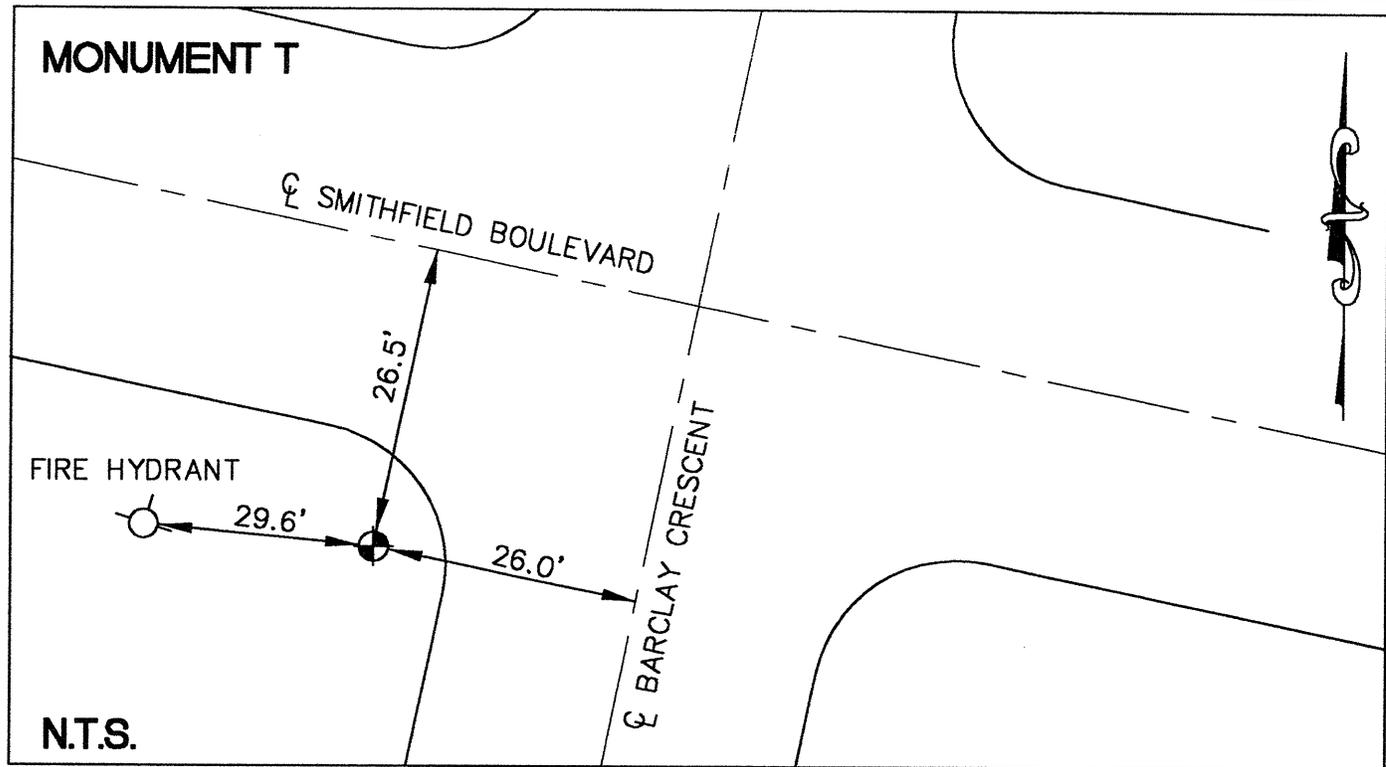
DATE: 12/19/03

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LOCATED:

MONUMENT IS A 2" ALUMINUM DISK SET 0.3' BELOW NATURAL GROUND AT THE SOUTHWEST CORNER OF THE INTERSECTION OF SMITHFIELD BOULEVARD AND BARCLAY CRESCENT

MONUMENT T

GEODETTIC COORDINATES: NAD 83 (ISLE OF WIGHT 1996)

N 36°57'54.80813"

W 76°35'21.18219"

STATE PLANE COORDINATES: NAD 83 - SOUTH ZONE (US SURVEY FOOT) (ISLE OF WIGHT 1996)

NORTHING (FT): 3,516,546.7405

EASTING (FT): 12,041,126.3440

SCALE FACTOR: 0.999969897

CONVERGENCE: 01°09'34.92544"

ELEVATION: NAVD 88 (ISLE OF WIGHT 1996)

ELEVATION (FT): 18.6

DATE: 12/19/03

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