VIRGINIA CHESAPEAKE BAY

NON-TIDAL NETWORK WATER QUALITY MONITORING PROGRAM

STANDARD OPERATING PROCEDURES MANUAL

Revised April 2024

Chesapeake Bay Program

Virginia Department of Environmental Quality

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Richmond, Virginia 23219

CONTENTS

List of Acronyms

BRRO	Blue Ridge Regional Office
CAR	Corrective Action Request
CBM	Chesapeake Bay Monitoring
CBLO	Chesapeake Bay Office of the Virginia Dept. of Environmental Quality
CBP	Chesapeake Bay Program
CBPWQ	Chesapeake Bay Program Water Quality
CEDS	Comprehensive Environmental Data System
C4	Chesapeake Center For Collaborative Computing
CSSP	Coordinated Split Sample Program
DCLS	Division of Consolidated Laboratory Services
DEQ	Virginia Department of Environmental Quality
DI	Deionized Water
DO	Dissolved Oxygen
EDT	Electronic Data Transfer
EWI	Equal Width Increments
IMNW	Integrated Monitoring Networks Workgroup; formerly the Non-tidal Water Quality Workgroup
NIST	National Institute of Standards and Technology
NRO	Northern Regional Office in Woodbridge, VA
NTWQG	Non-Tidal Water Quality Workgroup of the Chesapeake Bay Monitoring and Assessment Subcommittee
OIS	Office of Information Systems
PFD	Personal Flotation Device
PRO	Piedmont Regional Office in Glen Allen, VA
PMTF	Procedure Modification Tracking Form
QA	Quality Assurance
QAPP	Quality Assurance Project Plan

QC	Quality Control
SOP	Standard Operating Procedure
SCRO	South Central Regional Office in Lynchburg, VA
USGS	United States Geological Survey
VDEQ	Virginia Department of Environmental Quality
VRO	Valley Regional Office in Harrisonburg, VA
WQAP	Water Quality Assessments & Planning
WQM	Water Quality Monitoring portion of the CEDS database program
WQMSOP	DEQ's Water Quality Monitoring Standard Operating Procedures

1 PROGRAM PLANNING AND REQUIREMENTS

1.1 REFERENCE MATERIALS

The sampling protocols in this document are those agreed upon by the Chesapeake Bay Integrated Monitoring Networks Workgroup (IMNW; formerly the Non-tidal Water Quality Workgroup). The IMNW is composed of representatives from each state participating in the non-tidal network monitoring and representatives from USGS and the EPA Chesapeake Bay Program Office.

See Appendix D of the *Virginia Chesapeake Bay Non-tidal Network Water Quality Monitoring Program Quality Assurance Project Plan* (QAPP), for sampling procedures and protocols. The protocols are adapted from United States Geological Survey (USGS) protocols with some slight modifications as approved by the IMNW or DEQ CBP program manager (see http://water.usgs.gov/owq/FieldManual/ for full description of USGS protocols).

Certain protocols in this document refer to the *DEQ Water Quality Monitoring SOP (WQMSOP)*, which is available on the *DEQ Water Quality Monitoring webpage* and to all DEQ personnel on the WQM agency drives.

1.2 FREQUENCY OF SAMPLING

DEQ personnel will monitor each site monthly. DEQ sites designated as primary stations will also be sampled at minimum an additional eight times a year by USGS personnel during storm events. The eight storm samples will be collected during no fewer than four independent storm flow periods. Refer to the *USGS Quality Assurance Project Plan: Virginia Nontidal Monitoring Network* for more details on the USGS storm sampling.

1.3 SCHEDULING/RESCHEDULING OF RUNS

Sampling runs are scheduled into the Water Quality Monitoring Module (WQM) of the Comprehensive Environmental Data System database (CEDS) by the 25th of the month prior to the sampling event. Once entered into WQM, the schedule may be modified as needed to accommodate changes due to weather disturbances, equipment failure or other problems that might arise. If necessary, a run may be rescheduled to within 2 weeks of the next scheduled sampling date for that run.

The lowest average streamflow expected to occur for seven consecutive days with an average frequency of once in ten years is referred to as 7Q10 and for some streams the 7Q10 flow is zero. While these data should not necessarily be utilized for assessment purposes, for the non-tidal network the samples are important to obtain. If at all possible, maintain the sample schedule under both high and low stream flow conditions. The goal is to obtain representative water samples under the full range of stream conditions.

1.4 PERTINENT TELEPHONE NUMBERS

USGS-VA	
Alyssa Thorton 804-261-2609 (o) 804-317-5563 (c)	**Jimmy Webber** 804-261-2621 (o) 804-461-0812 (c)
PRO	
Matt Carter 804-659-2695 (o) 804-994-3649 (c)	**Roland Whitehead** 804-720-2229 (o)
NRO	
Jeff Talbott 571-408-1616 (o) 540-846-3550 c)	**Tim Jones** 571-866-6515 (o)
BRRO	
Scott Hasinger 540-524-8006 (o)	**Royce Steiner** 540-597-8984 (o)

VRO	
Jared Purnhagen 540-217-7484 (o)	**Phil Hurst** 540-217-7073 (o)
CBP	
Cindy Johnson 804-659-2653 (o) 804-334-7590 (h)	**Meighan Wisswell** 571-866-6494 (c)

DCLS 804-648-4480			
CBNUT-3, PNC and PP	***CHLOROPHYLL, SOLIDS and DOC***	***Microbiology***	***SAMPLE SUPPORT SERVICES***
Jay Armstrong ext.328 (o)	**Ryan Lewis** ext.533 (o)	**Johnesta Fonville** ext. 266 (o)	**Elaine Mason** ext.138 (o) **Terri Harper** ext. 140 (o)

1.5 STATION LOCATIONS

The Non-tidal network site locations (in NAD83) and DEQ and USGS station IDs are listed in Table 1-1.

Note: Station latitudes and longitudes listed in this table are those utilized by the regions for sample collections. Some may differ from the legacy Storet database latitudes and longitudes.

Table 0-1 Non-tidal network sites.

Office	USGS STAID	DEQSTAID	DEQ Description	Lat (NAD83)	Long (NAD83)	River	Network Station Type
USGS	01654000	1AACO014.57	Rt. 620 Br.	38.81133333	-77.23022222	Accotink Cr.	Primary[4] (dropped by DEQ in 2012)
NRO	01638480	1ACAX004.57	Rt. 663	39.255	-77.5766667	Catoctin Creek	Secondary[5]
USGS	01646000	1ADIF000.86	Rt. 193	38.97583333	-77.2461111	Difficult Run	Primary[3]
USGS	01658500	1ASOQ006.73	Rt. 619	38.58722222	-77.42888888	Quantico Creek	Primary[3]
USGS	01621050	1BMDD005.81	Rt. 726 Bridge	38.4866666	-78.96055555	Muddy Creek	Primary[3]

Office	USGS STAID	DEQSTAID	DEQ Description	Lat (NAD83)	Long (NAD83)	River	Network Station Type
USGS	01634000	1BNFS010.34	Rt. 55 Br. Warren/ Shenandoah County	38.97644444	-78.33633333	Shenandoah River	Primary[3]
USGS	01631000	1BSSF003.56	Luray Ave. at water intake at G.S.	38.91372282	-78.20977222	Shenandoah River	Primary [3]
VRO	01628500	1BSSF100.10	Rt. 708 Br.	38.3130556	-78.77102778	Shenandoah River	Primary[1]
VRO	01626000	1BSTH027.85	137 ft downstream of Rt 664 Br. City of Waynesboro	38.05735845	-78.90780171	South River	Secondary
PRO	02039500	2-APP110.93	Rt.45 Br. at Farmville (Co. of Prince Edward)	37.30740205	-78.3893	Appomattox River	Primary[1]
VRO	02011500	2-BCC004.71	Rt. 39 at Gaging Station	38.06986111	-79.89763889	Back Creek	Secondary
VRO	02015700	2-BLP000.79	Rt. 614 Br. at gaging station	38.19527778	-79.57072222	Bullpasture River	Secondary
USGS	02042500	2-CHK035.26	Rt. 618 at gaging station	37.43611111	-77.06111111	Chickahominy River	Primary[3]
VRO	02020500	2-CFP004.67	Downstream of Rt. 42 Br.	37.98716666	-79.49408333	Calfpasture River	Secondary
PRO	02041000	2-DPC005.20	Rt. 153 Br.	37.28403928	-77.86861092	Deep Cr.	Secondary
USGS	02037500	2-JMS113.20	Rt. 161 Br.	37.53141666	-77.48369444	James River	Primary[3]
BRRO	02024752	2-JMS279.41	Blue Ridge Pkwy Br.	37.55546246	-79.36701020	James River	Primary [1]

Office	USGS STAID	DEQSTAID	DEQ Description	Lat (NAD83)	Long (NAD83)	River	Network Station Type
			above Big Island				
VRO	02031000	2-MCM005.12	Rt. 614 Bridge at gaging station	38.10269164	-78.59293242	Mechums River	Secondary
VRO	02024000	2-MRY014.78	Rt. 60 at Ben Salem Wayside	37.75222222	-79.39194444	Maury River	Secondary
VRO	02034000	2-RVN015.97	Rt 15 Br.	37.85805556	-78.26694444	Rivanna River	Primary[1]
USGS	01667500	3-RAP030.21	Rt. 522 Br.	38.35901857	-77.97333049	Rapidan River	Primary [3]
NRO	01665500	3-RAP066.54	Rt. 29	38.27985275	-78.34084042	Rapidan River	Secondary
NRO	01666500	3-ROB001.90	Rt. 614 Br.	38.32533333	-78.09458333	Robinson River	Secondary
NRO	01664000	3-RPP147.49	Rt. 15/29 Br.	38.5289	-77.8203	Rappahannock River	Primary[1]
USGS	01669520	7-DRN010.48	Rt. 603 Br.	37.63361111	-76.69583333	Dragon Swamp	Primary[3]
PRO	01671100	8-LTL009.54	Rt. 685 Br.	37.87291790	-77.51331695	Little River	Secondary
NRO	01674000	8-MPN094.79	Rt. 605 Br.	38.0603	-77.3847	Mattaponi River	Primary[1]
USGS	01671020	8-NAR005.42	Rt. 30 Br. (Morris Br.)	37.85	-77.42805556	North Anna River	Primary[3]
NRO	01673800	8-POR008.97	Rt. 208 Br.	38.17130556	-77.59455556	Po River	Secondary
USGS	01674182	8-PCT000.76	Rt. 301 Br.	37.96025	-77.343556	Polecat Creek	Primary[1]
USGS	01632900	1BSMT004.60	Rt. 620 Br.	38.69345016	-78.64279350	Smith Creek	Primary[1]
USGS	02041650	2-APP016.38	Rt. 600 Br (Chesterfield County)	37.22543	-77.4764	Appomattox River	Primary [2]
USGS	02035000	2-JMS157.28	Rt. 45 Bridge at Cartersville	37.67111	-78.0858	James River	Primary [2]

Office	USGS STAID	DEQSTAID	DEQ Description	Lat (NAD83)	Long (NAD83)	River	Network Station Type
USGS	01668000	3-RPP113.37	USGS cableway	38.3093	-77.5293	Rappahannock River	Primary [2]
USGS	01674500	8-MPN054.17	Rt. 628 Br.	37.8839	-77.1650	Mattaponi River	Primary [2]
USGS	01673000	8-PMK082.34	Rt. 614 Bridge	37.76792	-77.3319	Pamunkey River	Primary [2]

[1] These sites will be sampled jointly by VADEQ and USGS. These sites have been added to the USGS River Input Monitoring Program and may be referred to as "RIM ADD ON" sites.

[2] These Fall line sites have been sampled since 1984 by USGS in cooperation with the VA DEQ Chesapeake Bay Office as Virginia River Input Monitoring Program sites.

[3] These Fall line sites will be sampled for both base flow (monthly routine sampling) and targeted storm events by USGS in cooperation with the VA DEQ Chesapeake Bay Office as Virginia River Input Monitoring Program sites.

[4] Routine monitoring of Accotink Creek was dropped by DEQ in October 2012. USGS-MD conducted ambient monthly monitoring (CBP parameters) at the site using CBP protocols until January 2015, when USGS-VA began the routine monitoring of Accotink Creek. USGS-VA continues to conduct storm sampling.

[5] Routine monitoring of Catoctin Creek was dropped by DEQ in October 2012. Maryland DNR conducted ambient monthly monitoring (CBP parameters) at the site using CBP protocols until June 2015. DEQ-NRO resumed monthly sampling at this site as a secondary station in July 2015.

2 PREPARATION FOR SAMPLING

In preparation for a sampling run where field measurements are to be taken, be sure that operating manual instructions for all field equipment have been followed concerning preventive maintenance and calibration. Where possible, backup instruments and sample collection strategies should be prepared and taken in the field.

2.1 CREATE SITE FILES

Site files should consist of:

1. Site location coordinates (NAD 83) and map
2. Gage coordinates and description in relation to site location
3. Driving routes to sampling stations
4. Additional helpful information as needed such as directions to nearest hospital, site photographs and traffic safety plans

2.2 CLEANING SAMPLING EQUIPMENT

2.2.1 Routine Cleaning

All Churn Splitters, funnels, 1L sample collection bottles, nozzles and reused 250mL TNUTL sample bottles must be cleaned using detergent and rinsed prior to each field use (at the end of each sampling day or prior to sampling). USGS cleaning protocols must be followed as closely as possible- *please refer to the National Field Manual.*

Briefly, the steps for routine pre-cleaning are:

1. Wash sink, counter and scrub brushes with non-phosphate, laboratory-grade detergent such as Liquinox or Alconox, being sure to wipe the insides of the sink with a sponge or soft scrub brush. Rinse all surfaces well with tap water.
2. Place nozzles, sample collection bottles, sample bottles, and funnels inside the churn.
3. Use the non-phosphate, laboratory-grade detergent in a 0.2 to 2-percent solution, volume-to-volume and fill the churn to the top with tap water. All sample collection bottles, sample containers and nozzles must be completely submerged.
4. Soak all items as close to 30 minutes as possible.

5. If needed, use a soft sponge or scrub brush to remove particulates. Check spigot and funnel for particulates.
6. Wash and rinse the top of the churn. Open spigot to allow detergent solution to drain through it.
7. Rinse all items thoroughly with tap water until no bubbles are formed when tap water is added to the item. Open churn spigots to rinse them.
8. Rinse all items with DI water three (3) times.
9. Place items on drying rack and allow to air dry.
10. Replace the covers on sample bottles and the churn. Bag the churn to transport to the field.

2.2.2 Biannual Acid Wash

All churn splitters, funnels and 1L sample collection bottles, nozzles, and reused 250mL TNUTL sample bottles must be acid washed in a 10% HCL solution every six (6) months and whenever equipment blanks indicate a contamination problem exists. Regional offices may acid wash during routine equipment cleanings if preferred.

Note: this requirement differs from USGS protocols, which recommend acid washing with 5% HCl.

1. Clean the equipment following the steps in *Section 2.2.1.*
2. Transport the equipment to the safety hood in the lab.
3. All applicable safety gear must be worn when working with acid, including safety glasses or full face mask, lab coat and gloves.
4. Thoroughly rinse with 10% HCL solution the churn, funnel, 1L sample collection bottles, nozzles, any 250mL bottles that are being reused and their caps.

Do not acid wash any items containing metal. Do not drain acid solution through the spigot of the churn as the spring of the spigot is metal.

5. Rinse each item thoroughly three (3) times with tap water and follow with a thorough rinse using DI water.
6. Place each item on drying rack and allow to air dry.
7. Replace covers on sample bottles and bag the churn to transport to the field.

2.3 EQUIPMENT LIST

All 250mL sample bottles (reused), 1-Liter sample collection bottles, nozzles, and churn splitters need to be washed and rinsed with DI water prior to their use in the field (*see Section 2.2*). New sample containers need only to be rinsed with sample prior to their use in the field.

1. Wading sampler DH-81 and nozzles
2. Weighted bottle sampler US WBH-96
3. Bridge sampler DH-95
4. Bridge board and reel
5. Pre-cleaned and bagged 4L Churn splitters (1 per station); 8L churn for QC site
6. Pre-cleaned, capped 1L sample collection Bottles (1 per station); 1-2 additional sets for QC samples
7. Pre-cleaned or new capped sample bottles:
    a. 250 mL TNUTL
    b. ½ gallon cubitainer for BAYT3-2
    c. 125mL if an ambient bacterial sample (e.g., FCMFECQENT) will be collected
    d. 1 quart cubitainer for SSC-C2 (to be half-filled)
8. Sulfuric acid
9. Wading rod
10. Tag-line
11. Rope
12. Wire cutters
13. Bucket with attachment for bacteria bottle
14. Calibrated multi-parameter instrument
15. Gloves – nitrile and leather
16. Wagon
17. Sample labels
18. Field forms
19. Cell phone

20. Site Map
21. Safety equipment
22. Waders
23. Cooler with ice

When collecting QA/QC samples you will need the following additional bottles:

Equipment blanks:

- new or detergent washed and rinsed 250mL TNUTL bottle
- ½ gallon BAYT3-2 cubitainer
- quart cubitainer (for SSC-C2, if applicable)
- 125mL bacteria bottle (if required for other programs)

Duplicate samples:

- new or detergent washed and rinsed 250 ml TNUTL bottle
- ½ gallon BAYT3-2 cubitainer
- quart cubitainer (for SSC-C2, if applicable)
- 125mL bacteria bottle (if required for other programs)

2.4 SCHEDULING SAMPLE RUNS

Schedule the sample run in the Monthly Run Screen of the CEDS WQM module by the *25th day of the month* prior to the month the run is to be conducted**.**

Samples must be entered under special study code 045128 and program code of BN.

Print out the sample labels from the Monthly Run screen with the correct sample date on them for use in the field. If QA/QC samples will be collected, be sure to schedule the QA/QC run and print those labels as well (see *Appendix C* for information on scheduling QA/QC in CEDS).

Additional paperwork needed for field sampling includes the following (refer to the Appendices for copies of these documents):

1. A WQM field data sheet
2. Site specific SOPs, if desired

3. DCLS Sample sheets
4. Corrective Action Request form, if required
5. Procedure Modification Tracking form, if required

2.5 MULTIPROBE INSTRUMENT CALIBRATION

Instruments must be calibrated according to the schedule and procedures outlined in *Section 3: Field Probe Calibration and Maintenance (WQMSOP)* and summarized below in *Table 2-1*.

At the end of each sampling day instruments must also be checked for drift in accordance with the manufacturer's instructions and the procedures in the *WQMSOP*.

All calibration and end of day drift results need to be documented in a logbook in accordance with the WQMSOP (multiprobe calibration sheet template provided in Appendix A of this document).

Up-to-date instruction manuals for each multiprobe must be kept on file at each regional office.

- Calibrate probes in a temperature-controlled environment.
- Allow the probe to stabilize before calibrating. A probe is considered stable if the readout indicates it is stable or does not significantly change (≈ ±0.01 units) within ten seconds.
- Always use unexpired standards to calibrate or verify.

Beginning of the week: calibrate sonde for all planned sampling parameters

During the week: mid-week calibrations are parameter specific. Refer to *Table 2-1*.

- Logbooks must be used to confirm the previous day's post-calibration, or drift, checks are within the calibration tolerances listed in *Table 2-2*.
- If post-calibration checks from the previous sampling day during the same sampling week are outside the tolerance limits in *Table 2-2*, recalibrate prior to sampling using the factory reset calibration method.
- If no sampling or post calibration checks occurred on the previous day, recalibrate all parameters.

Table 2-1 Calibration schedule summary of common multiprobe parameters.

<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Beginning of Week</th><th colspan="3">During the Week</th></tr>
<tr><th>Do Not Recalibrate</th><th>Factory Reset Recalibration</th><th>Service Required</th></tr>
<tr><td>pH</td><td rowspan="2">Calibrate prior to sample run at start of week</td><td rowspan="2">Previous day end of day check within calibration tolerance</td><td rowspan="2">Previous day end of day check within end of day check tolerance</td><td rowspan="4">Previous day end of day check outside end of day check tolerance</td></tr>
<tr><td>Specific Conductance</td></tr>
<tr><td>Barometric pressure</td><td colspan="3">Check daily prior to DO calibration</td></tr>
<tr><td>Dissolved oxygen</td><td colspan="3">Calibrate daily</td></tr>
<tr><td>Depth</td><td colspan="4">Calibrate at each site</td></tr>
<tr><td>Others</td><td colspan="4">Consult manufacturer’s instructions and/or program specific QAPP/SOP</td></tr>
</table>

(Standard Operating Procedures Manual for the Department of Environmental Quality Water Quality Monitoring, 2024)

2.5.1 Multiprobe Calibration Acceptance Thresholds

Calibration procedures:

- Refer to *Section 3.3 Multiprobe Calibration and Reference Checks in the WQMSOP* for detailed calibration and reference checks procedures.
- Refer to *Table 2-2* below for a summary of calibration and end of day drift check acceptance criteria.

End of day checks:

The end of day check is not a calibration.

- Field probes should be checked for drift at the end of each sampling day according to the procedures in *WQMSOP Section 3*.
- The probe is verified by checking against standards in a controlled environment.
- **If the end of day check meets or exceeds the tolerance values outlined in Table 2-2, do not enter associated field data into CEDS.**
- If a sensor fails a quality assurance check, it should undergo maintenance/repair.

Table 2-2 Summary of calibration and end of day reference check acceptance criteria.

Parameter	Standard	Acceptance Criteria			
		Calibration		End of Day Check	
		Tolerance	Range	Tolerance*	Range
Barometric pressure (mmHG)	Lab barometer or local weather station	± 5 mmHG from reference			
Diss. oxygen (mg/L)	Theoretical DO** based on BP and temperature	± 0.10 from theoretical		Maintenance threshold: ± 0.20 from theoretical Data entry threshold: ± 0.30 from theoretical	
pH (SU)* **	4.0	± 0.1	3.9 - 4.1	± 0.2	3.8 - 4.2
	7.0		6.9 - 7.1		6.8 - 7.2
	10.0		9.9 - 10.1		9.8 - 10.2
Spec. cond. (µS/cm)	1,413	± 2.0%	1,385 - 1,441	± 5.0%	1,342 - 1,483
	12,880		12,622 - 13,138		12,236 - 13,524
Depth (m)	0****	± 0.3			
Turbidity	Consult program SOP/QAPP	± 5%			
Chlorophyll		± 20%			
Chloride		± 10%			
Others	Consult manufacturer's instructions and/or program specific QAPP/SOP				

(Standard Operating Procedures Manual for the Department of Environmental Quality Water Quality Monitoring, 2024)

*If end of the day checks meet or exceed tolerance range, do not enter associated field data into CEDS.
** Calculate theoretical DO values using **Appendix B in WQMSOP**.
***pH is temperature dependent. Please check the temperature adjusted values provided by the manufacturer of the pH standard in use.
****Calibration value for depth is instrument specific. YSI EXOs are calibrated at 0 m.

Optical Dissolved Oxygen

Calibration

- **Dissolved oxygen must be calibrated before each sampling event.**
- Follow the manufacturer's recommended procedure for calibrating DO based on simulated saturation conditions (water-saturated air or air saturated water method).

- **After calibration, the optical DO reading (mg/L) must be within ± 0.10 mg/L of the calculated theoretical level.**

End of day drift check

- Theoretical and actual DO saturation values must be within ± 0.29 mg/L.
- **Do not enter DO data into CEDS if the reported end of day DO value is ± 0.30 mg/L of theoretical levels**.
- Service DO sensors whenever end of day check values are greater than 0.20 mg/L of theoretical DO levels.

Specific Conductance

Calibration

- Sp. Conductance does not need to be calibrated each day if the previous day's end of day drift check is within the calibration tolerance listed in *Table 2-2*.
- Always use a conductivity standard that closely approximates the expected field values.
- **After calibration, the sp. conductance reading (µS/cm) must be within ± 2.0% of the standard used.**

End of day drift check

- Check the sensor for a false positive reading by rinsing the probe with lab grade water and blotting dry. The reading should be 0 µS/cm.
- Use conductivity solution of the same concentration as that used for calibration.
- Determine if the values are within the acceptable range by consulting *Table 2-2*.

pH

Calibration

- A two- point calibration is acceptable as long as the pH buffer solution used for the calibration closely brackets the expected field values.
- Always use fresh pH buffer solution for the calibration.
- **After calibration, pH values must be within ± 0.1 SU of the pH standards for the calibration.**

End of day drift check

- Used buffer solution may be used for initial rinsing of pH sensors.
- Checks must be done for each of the points used in the calibration.
- Determine if the values are within the acceptable range by consulting *Table 2-2*.

Depth

Calibration should be done at the sample site.

Temperature

Regular checks of sonde thermistors must be within ±0.5 °C of those taken with a National Institute of Standards and Technology (NIST) traceable thermometer.

Periodically compare the field probe temperature reading to a laboratory thermometer of known accuracy. Record both readings on the log sheet. **Notify the QA Coordinator if the temperature difference is > 0.5 °C.**

Central office personnel will conduct temperature checks for multiprobes against an NIST certified thermistor annually when conducting site visits.

Barometric Pressure

Compare the instrument value to the laboratory barometer or use *Appendix B from the WQMSOP* to calculate the barometric pressure in mm Hg from the nearest National Weather Service or NOAA weather station barometric pressure readings.

If the difference between the sonde reading and the traceable barometer is greater than 5 mmHg, the multiprobe barometer needs to be calibrated to the traceable barometer. See *WQMSOP* for calibration procedure.

2.5.2 Factory Reset Calibration

Factory reset calibrations should be performed if a previous day's post-calibration checks are outside the tolerance limits in *Table 2-2*. This process is specific to YSI EXO models, always follow the manufacturer's instructions for all calibration processes.

1. In the calibration setting, select the desired parameter
2. Select "Restore Default Cal". Select "yes" to confirm
3. Calibrate parameter according to normal calibration procedures

2.5.3 Multiprobe Preparation for Use

Prior to departing the office for field monitoring, ensure the following:

1. Multiprobe instrument has been calibrated according to the schedule in the *WQMSOP* and summarized in *Section 2.5*.
2. Multiprobe cable is of sufficient length to sample all sites.
3. Sensors are kept moist by attaching the calibration cup or other container that has a small amount of tap water. Sample water may be used when traveling between stations.
4. Battery life is conserved by turning off the probe and display to conserve battery life while not in use.
5. Equipment is kept in a temperature-controlled environment such as the vehicle passenger compartment while traveling, and store inside the regional office when not in use.

2.6 GENERAL SAMPLE CONTAINER HANDLING AND PRESERVATION

Samples must be preserved in accordance with laboratory requirements and in a manner consistent with the *WQMSOP*. Samples not preserved properly may be rejected by DCLS.

A temperature testing bottle containing solution that is usually red in color must be included in every cooler to be delivered to DCLS to ensure samples are adequately preserved to 4 ±2 °C. Samples will be rejected if not delivered at the appropriate temperature (4 ±2 °C).

Unless specified, pack sample coolers with collected samples as follows:

- Place all samples in an ice filled cooler immediately after collection.
- Always place sample containers upright.
- If possible, cover containers with ice so container openings are just above the ice.
- Prior to shipping, drain melted ice from the cooler and top off the cooler with fresh ice to the level of necks of sample bottles.

2.7 BACKUP SAMPLING EQUIPMENT

Whenever feasible, backup equipment should be taken in the field for use in the event of problems with sampling gear, such as the multiprobe. The following is a list of suggested supplemental equipment that should be available if problems occur:

- Backup multiprobe field unit or individual units (if available)
- Thermometer (if backup multiprobe units are unavailable).
- A Winkler sampling kit (if backup multiprobe units are unavailable).

Each region must also make sure that there are adequate supplies of coolers, ice, cubitainers, sample data sheets, sample tags, and indelible pens.

2.8 DETERMINING STREAM GAGE HEIGHT AND ISOKINETIC THRESHOLDS

1. Prior to leaving for the site*, visit the USGS website for current streamflow data in Virginia*, enter the USGS_STAID for the station of interest (*Table 2-3*) in the box entitled "Select sites by number or name" and get the most recent gage height for the site to be sampled.
2. The gage height is used to help determine the type of equipment that will be needed to sample the site. Check the gage height against *Table 2-3*.
3. Monitoring staff should consider both the recorded gage height and the on-site conditions to determine if stream velocity meets or exceeds 1.5 f/s.

    a. A DH-95 or DH-81 with the appropriate isokinetic nozzle must be used when flow velocity meets or exceeds 1.5 ft/s.

    b. A DH-95 may not be used when gage height exceeds 15 feet.

    c. Where velocity is under 1.5 ft/s or gage height exceeds 15 feet the WBH-96 must be used.

Both the DH-95 or DH-81 and the WBH-96 should be taken to all sites to ensure that sampling can occur regardless of stream velocity.

Table 2-3 Historical gage height thresholds where velocity begins to exceed 1.5 ft/sec.

USGS_STAID	DEQ_STATION	Gage height threshold (feet) where velocity begins to exceed 1.5 ft/sec	USGS_STAID	DEQ_STATION	Gage height threshold (feet) where velocity begins to exceed 1.5 ft/sec
01626000	1BSTH027.85	2.55	01673800	8-POR008.97	2.15
01628500	1BSSF100.10	2.80	01674000	8-MPN094.94	5.60
01631000	1BSSF003.56	2.00	02015700	2-BLP000.79	2.00
01634000	1BNFS010.34	2.65	02011500	2-BCC004.71	3.20
01638480	1ACAX004.57	3.10	02020500	2-CFP004.67	2.10
01654000	1AACO014.57	2.37	02024000	2-MRY014.78	2.05
01664000	3-RPP147.49	3.60	02031000	2-MCM005.12	5.25
01665500	3-RAP066.54	2.15	02037500	2-JMS113.20	4.30
01666500	3-ROB001.90	2.65	02039500	2-APP110.93	4.50
01667500	3-RAP030.21	1.50	02041000	2-DPC005.20	2.40
01671100	8-LTL009.54	2.70	02034000	2-RVN015.97	3.00
02024752	2-JMS279.41	5.70			

3 FIELD PROCEDURES

3.0 DEFINITIONS

Term	Definition
Median	The value in a set of measurements ordered from lowest to highest that has an equal number of values below and above it.
DH-95	Isokinetic hand line/reel sampler that may be used when stream flow exceeds 1.5 ft/s. **Sampler is isokinetic when used with a nozzle or a grab sampler if used without nozzle.**
DH-81	Sampler that is used to collect water quality samples while wading. **Sampler is isokinetic when used with a nozzle or a grab sampler if used without nozzle.**
EWI	Equal-width-increment sampling method. A method of dividing a stream into several cross sections. Sampling occurs at the mid-point of the cross sections.
Isokinetic sampling	Using an appropriately sized nozzle and constant transit rate such that the volume of water collected at each location along a sampling cross-section, relative to the total volume collected, is proportional to the discharge at that location. Isokinetic sampling ensures that the concentration of each parameter in a sample is representative of the concentration in the water column at the time of sampling.
LEW	Left edge of water (stream)
REW	Right edge of water (stream)
Transit rate	The speed at which a sampler is lowered and raised through the water column.
Vertical	The process of lowering and raising the sampler through the water column or the location of the equal width midpoint where the sampler is lowered and raised.
WBH-96	Weighted bottle sampler used with 1 Liter narrow mouth sample bottle. **The WBH-96 may only be used when flow is <1.5 ft/s or the depth of the stream exceeds 15 feet.**

3.1 HEALTH AND SAFETY

All preparation and sampling must be done with safety in mind.

- All acid washing of equipment must be done under a vacuum hood and while wearing protective eyewear, gloves, and clothing covering exposed skin.

- On the bridges wear personal flotation devices (PFDs) or reflective vests and gloves (if operating the reel) and keep wire cutters with you. Ensure there is adequate room away from traffic. Close the shoulder of the road with cones and place shoulder closed signs as needed.
- Use gloves when preserving samples with acid.
- Know where the nearest hospital is in relation to the sampling site.

NOTE: Refer to *WQMSOP* for detailed safety protocols and *Appendix B* of this document for site specific safety information.

3.2 SAMPLE COLLECTION PROCEDURES

Several points across the stream are sampled employing the *equal width interval* sampling protocol using appropriate equipment and personnel from *Table 3-1*.

Table 3-1 Stream flow thresholds with equipment and personnel requirements.

STREAM FLOW	EQUIPMENT	NOZZLE	PERSONNEL
>1.5 ft/s	DH-95 or DH-81	yes	2 people
<1.5 ft/s	WBH-96 or DH-81	not required	1 or 2 people
depth > 15 ft	WBH-96	n/a	1 or 2 people

When using the DH-81 in flows under 1.5 ft/s, samples should be taken with no nozzle in place.

Note: once the nozzle has been removed, the DH-81 is no longer an isokinetic sampling device, therefore, this method must not be employed when flows equal or exceed 1.5 ft/s

Upon Arrival at site location:

1. Set out safety cones and signs and put on safety vest and/or PFD as applicable.
2. If not already determined, use the wire weighted gage to obtain the gage height, check the gage height from the USGS Website, or use the gauge height last observed at the office, in addition to on-site conditions, to determine if flow exceeds 1.5 ft/s (*Table 2-3* or site-specific SOP from *Appendix B*).
3. Confirm appropriate sampling equipment (*Table 3-1*).

4. Determine stream width and use to find the number of sampling intervals following the procedure in *Section 3.2.1* and *Table 3-2*.

5. Lower the multiprobe instrument over the bridge until the sonde is submerged at 0.3 meters below the surface at the first vertical sampling location. Allow the multiprobe instrument to equilibrate.

    a. **Field measurements should be taken concurrently with samples at each interval.**

6. Following the *WQMSOP*, collect the field measurements in situ (water temperature, specific conductance, pH and dissolved oxygen) from the center of each sampling location.

    a. Record all field measurements from each location on the field sheet.

    b. Fill in any important information on conditions at the site or important events that occur on-site, especially those that might affect water quality or data integrity (e.g. river especially muddy, meter calibration problems).

    c. ***The median value for each field parameter must be recorded in CEDS.***

7. Use the appropriate equipment to sample the stream based on stream velocity (see *Table 3-1* and *Sections 3.2.2 - 3.2.7*).

While not required by the DEQ SOP, USGS and the Bay Program highly recommend the use of gloves when collecting samples to minimize the potential for contamination from handling the sampling equipment prior to transferring the sample to the churn during the collection process.

3.2.1 Determining Stream Width and Sampling Locations

METHOD 1:

Use a tag line or range finder to measure the distance between the left and right edges of the stream. **Round numbers to nearest whole foot.**

METHOD 2:

Most bridges are marked by USGS so that stream width can easily be determined.

Markings consist of:

- A zero mark at left end of bridge (left stream channel)
- A total stream width mark and measurement at the right end of bridge (right stream channel)
- Distance marks between the channel marks:

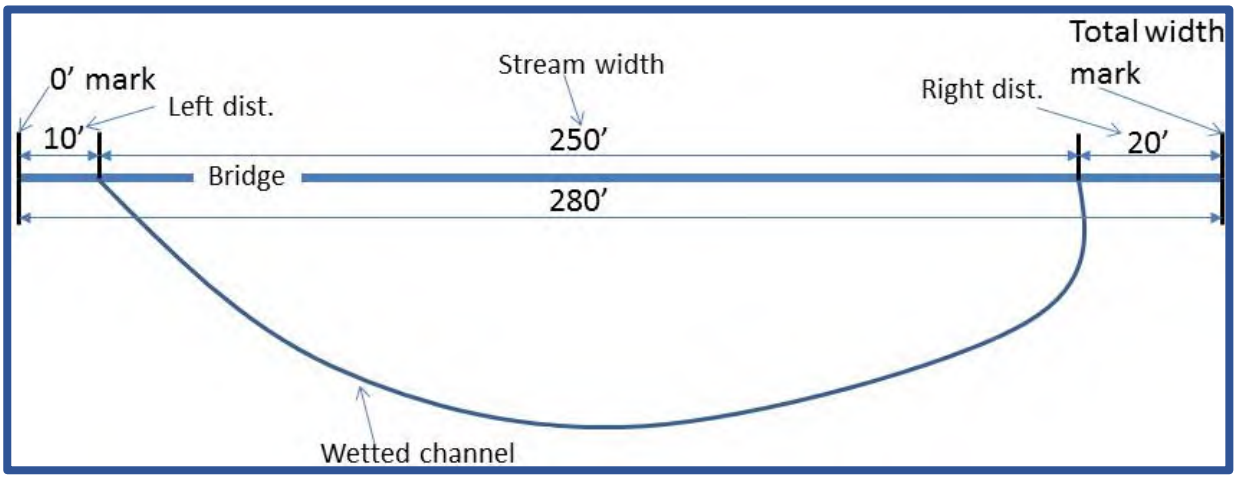
- A single mark = 10 ft.
- A double mark = 50 ft.
- A triple mark = 100 ft.

1. Determine stream width by locating stream edges in relation to the zero and total channel width marks.

    a. If the wetted channel is narrower than the marked channel (as is typically the case), subtract the distances from the wetted channel edges to the marked channel edges from the marked channel width to obtain the wetted channel width (see Fig. 1 and example below).

    b. If the wetted channel is wider than the marked channel on the bridge, add the distances from the wetted channel edge to the marked channel edges.

Figure 1 Stream cross section diagram showing wetted channel and marked channel widths.



Example:

The total marked channel width on the bridge bridge is 280 feet.

The left edge of the stream (left dist) is 10 feet from the zero mark on the left end of bridge.

The right edge of the stream (right dist) is 20 feet from the total stream width mark on the right end of the bridge.

Stream width = marked width (280')- left dist (10') – right dist (20') = <u>250'</u>

For stream width of 250 feet, 5 verticals are required.

2. Determine the number of sampling verticals needed based on stream width. Use *Table 3-2*.

Note: the table below only suggests the minimum number of verticals to be sampled. The goal is to get a representative sample; therefore, more verticals may be required based on stream conditions at the time of sampling.

Table 3-2 Number of verticals to sample based on stream width.

Width of Waterway (ft.)	Minimum # of Verticals
0-25	1
26-100	3
101-250	5
251-500	7
>500	9

3. Determine the size of the equal width increment by dividing the stream width by the number of verticals needed.

A stream of 250 feet wide requires 5 verticals. 250ft/5verticals = 50ft width intervals between verticals.

4. Find the sampling locations.
   a. Divide the equal width increment by 2 (since sampling occurs in the middle of each increment), and round to the nearest whole foot.
   b. Sample that distance from the left edge of the stream.

In our example, the first vertical would be at 25 ft from the left stream edge.

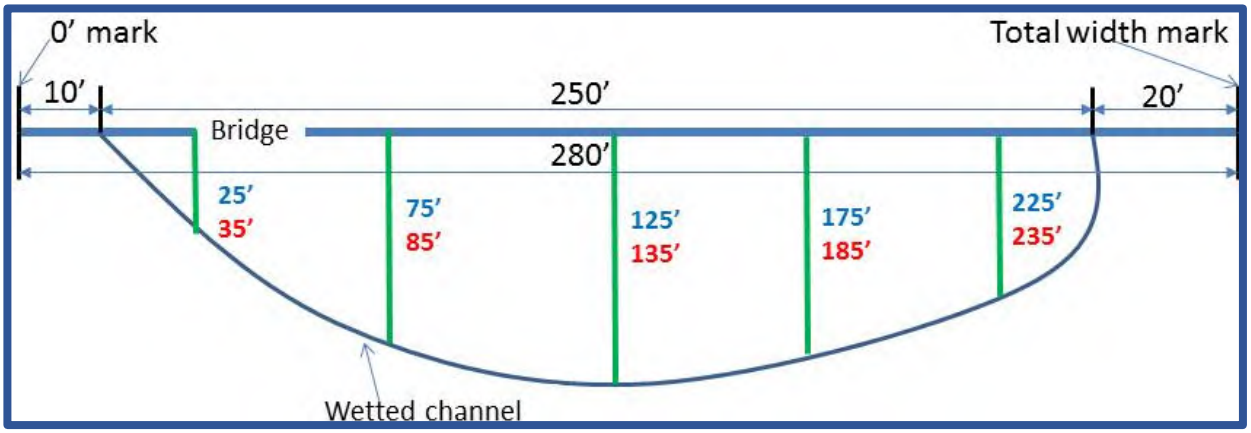
   c. If using bridge marks add the distance between the zero-channel mark and the left edge of the stream to the halved equal width increment and sample that distance from the zero mark on the bridge.

In our example, the first vertical would be at 35 ft from the 0 ft. mark.

   d. For subsequent sampling sites add the equal width increment to the previously determined location.

Therefore, in our example, the vertical sampling locations would be at 35, 85, 135, 185 and 235 ft. from the 0 ft. mark on the bridge (Fig. 2).

Figure 2 Stream cross section diagram showing locations of vertical sampling locations (green bars). Blue numbers next to bars = distances of sampling points from left stream edge. Red numbers = distances of sampling points from 0 ft. mark on bridge.



3.2.2 Preparing the WBH-96 (weighted bottle sampler)

Use requirement: Stream velocity less than 1.5 ft/s or gauge height greater than 15 ft.

Sample from the upstream side of the bridge whenever feasible.

1. Check the stream for sandbars, obstacles etc.
    a. If an obvious obstruction exists in the stream, adjust sampling locations as necessary and **record any adjustments on the field data sheet** – e.g. if a sandbar exists at the site of a vertical sampling point, move the sampling point to obtain a representative sample in the cross section.
2. Determine the transit rate for sampling at the vertical sampling location with the greatest discharge (i.e. greatest depth x velocity).
    a. Uncap and secure the narrow mouth sample bottle in the WBH-96 sampler and lower the sampler until the bottom of the sampler touches the surface of the water.
    b. Submerge and raise the WBH-96 at a uniform rate to ensure that the sample bottle is still filling when it breaks the surface. You should be able to see bubbles exiting from the bottle the entire time of sampling. The bottle must be at least ½ filled but not fuller than to the bottom of the neck of the sample bottle.

c. **If the container is overfilled or under filled, use the sample as a rinse or, pour out the container and refill.** The ideal transit rate is achieved when the sample bottle is ½ - ¾ filled after 1 deployment at the highest-discharge vertical sampling location.

3. Rinse churn splitter and funnel.

    a. Pour 0.5 -1 Liter of water collected in the sample bottle into the churn splitter and thoroughly rinse. Be sure sample water comes in contact with all the internal surfaces of the churn including through the funnel and spigot.

    b. Pour out any remaining water from the sample bottle and churn, replace the bottle in the WBH-96 and cover the churn.

3.2.3 Preparing the DH-95 (isokinetic sampler) equipped with isokinetic nozzle

Use requirements: 2-3 people, stream velocity greater than 1.5 ft/s and gage height less than 15 ft.

In addition to the instructions presented here, please refer to those of the manufacturer before attempting to assemble and use the DH-95.

A minimum of two people are required when sampling with the DH-95. One person will serve as a spotter for the sampler and the other person operates the reel. When using the "clean hands/dirty hands" sampling technique – the reel operator should be dirty hands and the spotter should be clean hands.

1. Assemble the equipment.

    a. Attach the crank arm to the reel and cable.

    b. Attach the bridge board rollers underneath the center of the bridge board platform and tighten the wingnut finger tight. The rollers should be attached so that the roller wheels are positioned on the left and right sides of the platform.

    c. Attach the reel and cable to the bridge board by placing the reel on the top of the bridge board platform such that the bolts on the base of the reel go through the holes of the platform. The reel should be positioned such that the counter will face the person operating the reel. Place wingnuts on the bolts of the reel and tighten until they are finger tight.

    d. Once the bridge board is completely assembled and the reel operator has secured the bridge board in place, attach the steel rod of the DH-95 sampling device to cable clevis and secure using the cotter pin.

e. Place the DH- 95 cap on a 1 L wide mouth Nalgene sample bottle and then insert the nozzle (usually 5/16”) into the cap. Slide the sample bottle into the DH-95 sampler with the rectangle side up (air hole up) and lock the bottle in place with the rubber tubing.

Note: a nozzle must be used for isokinetic sampling. Using this sampler without a nozzle results in a grab sample.

f. Lean bridge board or boom out over the bridge so that the sampler dangles over the water away from the side of the bridge (if necessary, have the spotter hold sampler away from the bridge until the sampler is lowered below the bridge surface). **Keep one foot on the base of the bridge board at all times to keep it balanced.** If the bridge board is difficult to balance with the sampler attached, additional balance can be obtained by adjusting the rollers on the boom to allow more or less of the boom to overhang on the bridge.

2. Determine transit rate and nozzle size needed and rinse the churn splitter.

a. Locate the site of the deepest/fastest sample location (will usually be the point closest to the center of the bridge). This will be the location where you will determine the sampler nozzle size and transit rate that will be utilized for all subsequent samples across the bridge.

b. Lower the DH-95 sampler until the tail fin barely touches the surface of the stream. Wait for the sampler to align itself to the direction of stream flow of water.

c. Set the reel counter to zero by setting the pointer to the phi symbol.

Note: the reel counter can be disengaged by pulling the lever out from the reel. The counter can be set to zero prior to lowering the DH-95 sampler; however, be sure to push the lever in when sampler is at the water surface to start the reel counter.

d. Lower the sampler at a transit rate of approximately 1 ft/sec until you feel the sampler touch bottom. The tail of the sampler should touch the stream bottom but the body should not. This occurs when a slight impact is first felt while lowering the sampler, but before the cable goes slack. If a second, heavier impact is felt and the cable goes slack, the body has contacted the bottom sediment and there is a risk of sediment-contamination in the sample. When this occurs, the sample collected must be discarded and a new sample must be taken at that vertical sampling point. Determining the point at which retrieval should begin is challenging for new users and requires training from experienced field personnel.

e. Immediately raise the sampler through the water column **using the same transit rate** as was used when lowering the sampler through the water column.

f. Retrieve the sampler being sure to keep the sampler safely away from the bridge surface. Check the volume in the sample bottle. The ideal transit rate is achieved when the sample bottle is ½ - ¾ filled after 1 deployment at the highest-discharge vertical sampling location.

g. *Adjust transit rate:* If the sample bottle is over- or under filled, pour out the sample and adjust the transit rate or nozzle size (or a combination of both) until the sample bottle fills ½ - ¾ full when the sampler is raised out of the water column. To increase the sample size, decrease the transit rate or increase nozzle size. To decrease sample size, increase the transit rate or decrease the nozzle size.

h. Once the correct transit rate is determined, use the water collected to rinse the churn splitter as in *Section 3.2.2* above.

3.2.4 Preparing the DH-81 (wadeable isokinetic sampler) equipped with nozzle

Use requirements: 1-2 people, stream flow >1.5 ft/s and gage height less than 15 ft.

- The DH-81 used as an isokinetic sampler requires stream velocities greater than 1.5 ft/s.
- If stream velocity is greater than 1.5 ft/s and considered safely wadable, the DH-81 may be used, and should be fitted with a sampling nozzle.
- In flows greater than 1.5 ft/s that are unsafe to wade, the DH-95 should be used from the nearest bridge**.**
- **If the stream is safely wadeable and flow is <1.5 ft/s, the DH-81 should be used without a sampling nozzle to collect grab samples at each vertical sampling point.**

1. Assemble equipment.
    a. Screw the cap onto the sample bottle.
    b. Attach the nozzle (usually 5/16”) to the cap or exclude nozzle **(only permissible in flows < 1.5 ft/s)**.
    c. Place the DH-81 adapter over the cap and snap into place so that the air hole (rectangle) points upward.
    d. Attach the wading rod.
2. Determine transit rate and rinse the churn splitter.

a. Enter the stream down river of the sampling location and walk up to the sampling location with the deepest/fastest velocity. This location will be used to determine the size of the sampler nozzle needed and transit rate that will be utilized for all subsequent samples across the stream. As with the DH-95, the DH-81 requires a constant transit rate when lowering and raising the sampler. If necessary, mark the wading rod in 0.5 ft increments so that you have a visual reference.

b. Raise and lower the sampler at the same transit rate such that the sample bottle is ½ - ¾ full after one vertical sampling at the deepest and fastest vertical sampling point.

c. *Adjust transit rate*: If the sample bottle is over- or under filled, pour out the sample and adjust the transit rate or nozzle size (or a combination of both) until the sample bottle fills ½ - ¾ full when the sampler is raised out of the water column. To increase the sample size, decrease the transit rate or increase nozzle size. To decrease sample size, increase the transit rate or decrease the nozzle size.

d. Once the correct transit rate is determined, use the water collected to rinse the churn splitter as in *Section 3.2.2* above.

3.2.5 Collecting Integrated EWI Samples and Bacteria Samples

1. Move to the 1st sampling location on the far left of the stream and obtain sample. Using the transit rate established previously, lower and raise the WBH-96, DH-95 or DH-81 sampler to obtain sample from the first sampling location. Since the stream at the edges is shallower than in the center cross-section you may only have sufficient water to fill 1/8 or less of the bottle.

2. Obtain a sample at each vertical location as indicated in step 1, emptying the bottle into the churn splitter after collecting.

3. Repeat the process with equal numbers of depth integrated samples taken at the midpoint of each transect until there is sufficient volume to fill the 4 Liter churn with at least 3.25 Liters of sample (5.25 for an 8 Liter churn or 8.5 Liters if collecting duplicates in a 14 Liter churn).

4. Repeat steps 1-3 using a slower transit rate if the churn overfills.

5. **Do not fill bacteria samples from churn.** Collect discrete bacteria samples from deepest/fastest site using bucket with attachments for bacteria bottles, a “bird house” sample bottle holder, or in situ if wading.

3.2.6 Using a Churn to Composite and Dispense Samples

1. Rinse the sample containers thoroughly using some of the sample water from the churn. Ensure that rinse water contacts all internal surfaces of each sample bottle.

Note: If acid preservative was added to some sample bottles as part of the field prep, DO NOT RINSE THESE BOTTLES WITH SAMPLE.

2. If applicable, remove the funnel from the top of the churn.
3. Using care not to break the surface of the water with the wand, thoroughly mix the sample by raising and lowering the wand at a constant churn rate of at least 9 inches per second. Raise and lower the wand approximately 10 times prior to pouring sample into sample containers.
4. Fill containers in order from largest to the smallest.
5. Churn continuously without breaking the water surface while filling.

Do not completely empty the churn when filling containers – approximately one Liter of water must remain in the 4 Liter churn (three Liters in an 8 Liter churn and four Liters in the 14 Liter churn) upon completion of filling the sample bottles.

Do not fill bacteria samples from churn.

6. Preserve TNUTL sample with Sulfuric acid to pH<2. **Use gloves when handling the acid.**
7. Fill out field sheets and sample labels (detailed in *Section 3.3.1* and *3.3.2* below).
8. Affix labels to samples and place samples on ice in a cooler**. Labels, field sheets and CEDS information must match exactly.**
9. Return samples to RO, conduct a calibration check of the multiprobe field instrument, check sample labels against field data sheet and enter field data into CEDS. Be sure to enter any field observations/problems in the Comment field of CEDS.
10. Clean and store instruments and equipment as described in *Section 2.2*.

3.2.7 QA/QC Sampling

Refer to *Appendix C: QA/QC checklist* for WQM for more information on scheduling QA runs in CEDS.

QA/QC samples to be collected for the non-tidal network are:

- Field samples and duplicates
- Equipment Blanks
- Reagent Blanks

- DI-system Blanks

Equipment Blanks (classified as "Field Blanks" by the CBP and in C4)

- Ensure the sampling device has been effectively cleaned to prevent any carry-over from previous samples.
- Ensure sample collection and processing have not resulted in contamination.
- Demonstrate that sample handling and transportation have not introduced contamination.

Equipment blanks are prepared by:

1. Thoroughly rinsing sampling equipment with DI water.
2. Blank water is then poured into the sample collection containers and transferred to the churn.
3. This process is repeated to mimic the number of sample collections routinely required to obtain the associated water quality sample at the station.
4. The composite sample is then sub-sampled and dispensed from the churn as usual to obtain the equipment blank sample.
5. Processing, preservation, and transportation of the equipment blank must be identical to the handling of the water quality samples.

Equipment blanks shall be prepared at the sampling site **prior** to collection of the water samples.

In Virginia we have taken several steps to minimize the likelihood of contamination once the churns have been cleaned:

- Churns are cleaned at the regional office to prevent the possibility of inadequately cleaning the churns in the field. Churns, sampling bottles and intake nozzles are bagged to minimize the likelihood of contamination during transport to the site.
- A different churn is utilized at each site eliminating the possibility of cross-contamination between stations and eliminating the need to clean the churns in the field between sites.
- The churns, funnels, sampling equipment and sample bottles are rinsed with sample water prior to the collection of the samples to mitigate any contamination that might occur in the bagging process.

These steps do not replace the need to collect equipment blanks in the field.

Equipment blank sample parameters:

- All normally collected parameters (BAYT3-2, TNUTL, and SSC-C2 etc.) using the dispensing methods described in Section 3.2.6 for regular samples.
- Equipment blank container numbers should be 21-29 and be the routine container number plus 20.

Equipment blank frequency and sites of collection:

- **One equipment blank per station per year shall be collected in the field, prior to collection of the water samples.** This applies to both primary and secondary stations.
- Equipment blank collection must be random, both in terms of the station and temporal distribution over the collection year. Refer to *Appendix E: Procedure for Randomly Selecting a Station for Equipment Blank and Duplicate QC Sampling*.

Equipment blank collection and preservation procedures:

1. Rinse the 1 Liter Nalgene sample collection bottle, nozzle, cap and funnel with deionized water or analyte free water. Then thoroughly rinse the churn, being sure DI water rinses all internal surfaces of the churn including the spigot.
2. Pour DI water into the 1 Liter Nalgene sample collection bottle, replace the cap and nozzle and transfer a sufficient volume of DI water through the funnel into the churn to ensure any contamination that might occur in the nozzle would be included in the equipment blank. Remove the nozzle and cap and transfer the remainder of the DI water through the funnel into the churn.
3. Repeat the transfer of DI water from the sample collection bottle to the churn the same number of times that is routinely required to obtain the associated water sample from the station (based on the number of verticals that are determined necessary for the specific site). The 8 Liter churn must be filled with at least 5.25 Liters of water (8.5 Liters of water for a 14 Liter churn).
4. Rinse and fill sample containers from the composite sample contained in the churn.
5. Preserve and label samples following the procedures in the *WQMSOP* and place in a cooler of ice to be sent to the laboratory for analysis. **Processing, preservation, and transportation of the equipment blank must be identical to the handling of the water quality samples from the site.**

Field Duplicates

- A field duplicate sample set consists of two samples collected and processed as closely as possible to the sample point in space and time so that the samples are essentially identical in composition.
- They are two separate samples taken from the same source, stored in separate containers, and analyzed independently.

- Field duplicate (split) samples are usually taken in the field from a single container (churn) that contains a composite stream sample.
- Duplicates are useful for documenting the precision of the sampling process, i.e., estimating the reproducibility of the water-quality sample measurements.

Field duplicates sample parameters:

- All normally collected parameters (BAYT3-2, TNUTL, and SSC-C2 etc.) using the dispensing methods described in *Section 3.2.6* for regular samples.
- Field duplicate container numbers should be 11-19 and be the routine container number plus 10.

Field duplicates frequency and sites of collection:

- **Two duplicates are required per year for every primary station (one from USGS and one from DEQ).**
- **One duplicate per year is required for every secondary site.**
- Refer to *Appendix E: Procedure for Randomly Selecting a Station for Equipment Blank and Duplicate QC Sampling*.

Field duplicates collection and preservation procedures:

1. Using the appropriate sample collection procedures *(Section 3.0)* for the station where the duplicate samples will be collected, rinse and fill the 8 Liter churn with least 5.25 Liters of sample water (if using a 14 Liter churn use 8.5 Liters of water).
2. If the churn has a funnel, remove the funnel from the top of the churn.
3. Using care not to break the surface of the water with the wand, thoroughly mix the sample by raising and lowering the wand at a constant churn rate of at least 9 inches per second. Raise and lower the wand approximately 10 times prior to pouring sample into sample containers.
4. Sample-rinse containers thoroughly.
5. While continuously churning the sample (without breaking the surface of the water) fill all containers in order from largest to the smallest.
6. **Do not completely empty the churn when filling containers** – four Liters must remain in the 14 Liter churn upon completion of filling the sample bottles.
7. Preserve and label samples following the procedures in the *WQMSOP* and place in a cooler of ice to be sent to the laboratory for analysis.

Note: If the EWI volume required for the split duplicate sample set is too great (i.e. churn is not large enough), the duplicate may consist of concurrently collected interval samples, which are

transferred into two separate containers (churns) and then processed as individual samples. Sequentially collected and processed duplicates are unacceptable.

3.3 DOCUMENTATION

Examples of all required documentation are provided in *Appendix A: Lab sheets and forms*. Field sheets, corrective action request forms (CAR) and procedure modification tracking forms (PMTF) must be sent to the CBP program at Central Office. All other documents must be maintained at the regional office and made available to Central Office personnel during site visits.

3.3.1 Field Data Sheet

Each station will require one *"DEQ Non-tidal Network Monitoring Field Sheet" (See Appendix A for template)*. All station information, field measurements and water sample information are entered onto this sheet. Record temperature, DO, and pH to the hundredth place, and specific conductance to the tenth place and enter data into CEDS as such.

Field personnel must fill in the following items with indelible ink:

General information:

Be sure this matches sample tag!

1. Station description - (DEQ Station ID, see *Table 0-1)*
2. Date (mm/dd/yyyy)
3. Time (24-hr military format)
4. Sampling personnel
5. Samples collected, sample type, and sample event
6. Special Program Code (SPG code) of **BN**

Note: Sample depth of sonde = 0.3 m but a depth 0 m must be entered on sample tags and in CEDS.

Field parameters:

1. Weather code:

   1 = cloudy

2 = precipitation

3 = clear

4 = fog

2. Gage height in feet at start of sampling (may be obtained from USGS website upon returning to regional office)
3. Water temperature (WTEMP), DO, pH and specific conductance (Sp. Cond)

Circle median to indicate the median value from EWI transects was utilized to report

Sampler/sampling information:

1. Circle Sampler used
2. Circle Nozzle size
3. Provide total stream width
4. Provide position of left edge of water and right edge of water channel marks (if available)
5. Provide sampling points (where EWI sampling is utilized)

Site description:

1. Location of sample collection
2. Event type: R (routine monthly fixed interval sample) or RSI (routine storm impacted monthly fixed interval sample)

Note: A routine, storm-impacted event is defined as having a rising discharge (cfs) of at least twice that of the pre-storm, average daily discharge. Staff should use the USGS stream gage network real time streamflow data to help make this determination. *Streamflow data is available online at the USGS current streamflow webpage.*

3. Stream habitat: pool, riffle, open, channel, braided or backwater
4. Composition of bottom (if discernable): bedrock, rock, cobble, gravel, sand, silt, concrete or other
5. Stream color: brown, green , blue, gray, clear or other
6. Weather: clear, partly cloudy or cloudy
7. Precipitation: light, medium or heavy; snow, rain or mist
8. Relative air temperature: very cold, cold, very hot, hot or warm

9. Wind: calm, light breeze or gusty

Cross section notes:

1. Fill in vertical location relative to left and right channel bank
2. Indicate which bank the vertical location was relative to
3. Sample time
4. Water temperature (WTEMP)
5. pH
6. DO
7. Specific Conductance (Sp Cond)
8. Comments

Fill in the multiprobe instrument probe values for temperature, specific conductance, pH and D.O. at each vertical.

Calibration end of day check information

1. As described in *Section 2.5.1* and in accordance with *WQMSOP*.

3.3.2 Sample Tags

After scheduling a sample run in CEDS, sample tags are printed on adhesive Avery style labels. The sample collector will record the sample time using an indelible ink pen. The label can stick directly to most plastic or glass sample bottles. For cubitainers or other specialized containers, the label is stuck to a wire tag and securely tied to the container. **Labels must contain key sample information as noted in *WQMSOP*.**

3.3.3 DCLS Laboratory Sheet

DCLS Laboratory Sheets will be completed for samples in the event scheduling is not possible through WQM. (*See Appendix A*)

Be sure the following information matches the sample tags exactly:

1. Station description
2. Date (yy/mm/dd)
3. Time (24-hr military format)

4. Sample depth (m)
5. Group Code
6. Container Number
7. Unit code
8. Collector's initials

3.3.4 Corrective Action Request

The corrective action form is utilized to identify problems that could affect data validity and possible courses of action to correct them (*see Appendix A*).

In order for the corrective action plan to work, all personnel associated with the program must report all suspected abnormalities. This is especially important to field personnel because identification and correction of problems in sample collection and handling is essential for an effective program.

The originator should use this form to:

- Identify the problem
- List possible causes (if known)
- Note the date the problem was identified
- Identify samples or field data that may be invalid as a result of the problem
- Make recommendations for corrective action (if possible).

Forward the CAR to the CBP QA/QC officer who will review the form with the program manager and/or the Data Integrity Workgroup for recommended solutions. Once a decision has been made regarding the appropriate course of action, the Chesapeake Bay Office will notify the originator of the results. If appropriate, any other regional personnel involved in collection of samples for the Virginia non-tidal water quality monitoring program will also be notified of any modifications to sampling procedures that may be required.

3.3.5 Procedure Modification Tracking Form

A procedure modification tracking form should be used to notify CO of any necessary short or long-term changes to sampling protocol. An example of such a change would be a station relocation due to bridge construction. (*See Appendix A*).

3.3.6 Equipment Calibration logs

Instruments must be calibrated according to the schedule and procedures outlined in *Section 3: Field Probe Calibration and Maintenance of the WQMSOP* and summarized in *Table 2-1*.

Equipment Calibration logs must also be maintained according to the *WQMSOP*. (*See Appendix A for template calibration logs*).

3.3.7 Equipment Maintenance Logs

Any maintenance that is performed on equipment must be documented in equipment maintenance logs according to the *WQMSOP.* (*See Appendix A for template equipment maintenance logs*).

4 END OF THE DAY ACTIVITIES

4.1 PREPARING SAMPLES FOR SHIPMENT

1. Drain and repack ice coolers.
    - **a.** Using the drain plug on the coolers, remove any water from the coolers**. DCLS will not pick up any damaged or leaking coolers.**
    - b. Repack samples to the bottom of their caps with ice.
    - c. Check to make sure the sample tags, laboratory sheets (when utilized) and WQM field data sheets match and are completely filled out.
    - d. Place coolers where they will be picked up by the DCLS courier.

4.1.1 Delivering Samples to DCLS

There may be occasions when a DCLS courier is unable to pick up the coolers. Should such a situation arise, deliver the samples to DCLS (*See Appendix C for directions*).

4.2 END OF DAY CALIBRATION DRIFT CHECKS

Before cleaning/servicing the multiprobe sensors, perform a calibration drift check following procedures in the *WQMSOP*.

When checking the system for drift, it is extremely important that the room temperature, sonde temperature, deionized water temperature, and all standard solutions are at thermal equilibrium. If thermal equilibrium is not reached in a reasonable amount of time or the observed values are outside the QC criteria, an additional calibration check should be conducted the next morning.

Copy results onto the Multiprobe Calibrations and Calibration Checks data sheet (*Appendix A*) prior to sending field sheets to the CBP office. When a post cruise calibration check is necessary the following morning, also record and send those results to CBO.

Note: The end of day check is not a calibration. If the end of day checks exceeds the values outlined in Section 2.5.1, do not enter associated field data into CEDS.

If calibration check failures are encountered, please notify DEQ Central Office staff (Cindy Johnson; cindy.johnson@deq.virginia.govc or Meighan Wisswell; meighan.wisswell@deq.virginia.gov) who will make the final decision regarding inclusion of data in WQM. Make sure to thoroughly document the failure in the laboratory calibration log.

4.3 WASH SAMPLING EQUIPMENT

All sample bottles and coolers should be returned to the regions from DCLS via the courier on a regular basis*. Contact Cindy Johnson (804) 659-2653 if there is a problem in getting coolers or sample bottles back from DCLS.*

Churns, funnels, nozzles, 1 Liter Nalgene Sampling bottles and any reused sample containers need to be detergent washed prior to a sample run and acid rinsed every 6 months. This step may be performed prior to each run as a preparation step or in the afternoon after each run as an end of the day activity following the steps outlined in *Section 2.2.*

4.4 ELECTRONIC DATA TRANSFER (EDT) OF SAMPLE INFORMATION (DATA ENTRY INTO CEDS)

Non-tidal field sheets are filled out at each station. Send the WQM data sheet information via WQM to DCLS **prior to 9:00 A.M. on the day following the sampling run.**

4.4.1 Regular Run Information

1. Record each sample sent to DCLS at each station and depth profile.

2. **Enter the field data on the integrated depth description line** in the field data screen. The composite samples collected from the churn will be located on this line; bacteria samples will be located on a separate surface depth description line.

3. ***The stream gage height must be entered in the gage height field for all non-tidal sampling events.***

4. Change the blank/duplicate designation for the BAYT3-2, SSC-C2 and TNUTL depending on the number of transects used to collect the sample.

    a. **If only one transect is used, change the blank/duplicate designation to "V".**

    b. **For most sites more than one transect will be sampled, in which case the selection must be changed to "HV".**

    c. **Bacteria samples must always be coded "R".**

5. Check data entry for errors, and appropriate decimal places.

6. Make scans of the WQM field sheets and send them to CBO via email (CBO will do QC on the data entry).

7. If technical problems arise during the data shipment and the 9:00 am deadline will not be met call *Cindy Johnson (804- 659-2653)* or another appropriate OIS/WQA staff member *(see call list in Appendix C*). If the problem cannot be resolved, send the WQM field sheets to *DCLS Central Receiving* and call *Cindy Johnson at CBO (804-659-2653)*

Note: When entering data in WQM, be sure that DO measurements are entered in the field labeled "DO Optical".

4.4.2 QA/QC Run Information

Entering QA/QC data into the Oracle database requires special steps not normally performed during a regular run. See *Appendix C* for details.

4.5 CORRECTIVE ACTION REQUEST

The corrective action request (CAR) form is used to document problems and the steps needed, or taken, for correction. CAR forms may originate in regions, headquarters, or the labs. The main reason to use a CAR is the need to permanently change any procedure. This may be due to:

- Procedures are causing possible contamination to samples.
- Procedures need to be clarified.
- Methodology is inconsistent with new analysis/studies.

The corrective action form is utilized to identify problems that could affect data validity and possible courses of action to correct them (*See Appendix A for form*). In order for the corrective action plan to work, all personnel associated with the program must report all suspected abnormalities. This is especially important to field personnel because identification and correction of problems in sample collection and handling is essential for an effective program.

- Identify the problem.
- List possible causes (if known).
- Note the date the problem was identified.
- Identify samples or field data that may be invalid as a result of the problem.
- Make recommendations for corrective action (if possible).

APPENDIX A: LAB SHEETS AND FORMS

Revised 03/22/2022

DEQ NON-TIDAL NETWORK MONITORING FIELD SHEET
Special Study # 045128

DEQ Station Name: _____ Sample Date : ____ / ____ / ____

DEQ Station Description: _____

USGS Site Number : _____ Sampling Personnel _____

SAMPLES COLLECTED (circle all sample types collected)			
Parameter code	**Bottle**	**Preservation**	**Sample Type**
BAYT3-2	½ gallon cubitainer (1.875 Liters)	NA	**HV/V/S1/S2/EB**
TNUTL	250 ml HDPE (0.250 Liters)	H_2SO_4	**HV/V/S1/S2/EB**
FCMFECQENT	125 ml plastic bottle with 100 ml line	NA	**R/S1/S2**
SSC-C2	Quart cubitainer (0.9463 Liters)	NA	**HV/V/S1/S2/EB**
Other:			**HV/V/S1/S2/EB**

FIELD MEASUREMENTS (Circle one: Centroid / Median)

GAGE Height : _____ ft Field / USGS website at R/O

GAGE Height where flow exceeds 1.5 ft/sec : _____ ft

Time: _____ **Weather Code:** _____

WTEMP: _____ **pH:** _____

D.O.: _____ **Sp. Cond.:** _____

Other: _____ **Depth of Sonde:** 0.3 M

SAMPLING INFORMATION

SAMPLER:	WBH-96 Weighted Bottle			DH-95 Isokenetic Bridge Sampler				DH-81 Isokenetic Wading Sampler			
NOZZLE:	N/A	3/16"	¼ "	5/16"	N/A	3/16"	¼ "	5/16"	N/A	

Stream Width: _____ Left Bank: _____ Right Bank: _____

Equal Width increment (EWI): (stream width/verticals): _____ feet

Sample Pts (ft)										
EWI (1/2)	_____	+ EWI	_____	+ EWI	_____	+ EWI	_____	+ EWI	_____	+ EWI _____
+ EWI	_____	+ EWI	_____	+ EWI	_____	+ EWI	_____			

Stream Width:	<= 25 ft	26 – 100 ft	101 – 250 ft	251– 500 ft	>500ft
Verticals:	1	3	5	7	9

Location: Wading Cableway Boat Bridge (UP / DOWN) _____ Ft/mi/m above/below bridge

Event Type: R (Routine monthly fixed interval sample) or RSI (Routine storm impacted monthly fixed interval sample)

Site Description: Pool Riffle Braided Open Channel Backwater

Bottom: Bedrock Rock Cobble Gravel Sand Silt Concrete Other: _____

Stream Color: Brown Green Blue Gray Clear Other: _____

Weather: Clear Partly Cloudy Cloudy

Precipitation: Light Medium Heavy Snow Rain Mist NA

Wind: Calm Light Breeze Gusty

Temperature: Very Cold Cold Warm Hot

Cross Section Notes

Sample Date : / / Sampling Personnel:

Sample pt. Location (ft)	Sample pts. measured from Right bank (RB) or left bank (LB)?	Time	Depth (m)	Wtemp Deg. C	pH SU	DO mg/L	SpCond Umhos/cm
	LB / RB		0.3				
			0.3				
			0.3				
			0.3				
			0.3				
			0.3				
			0.3				
			0.3				
			0.3				
Median			0.3				

Comments:

_____

_____

_____

Post Cruise Calibration Check: **Instrument #:**_____

Date/Time				
Specific Conductance	Standard value			
	Instrument value			
pH (write instrument value for those that apply)	Standard value	**4**	**7**	**10**
	Instrument value			
D.O.	Chart value			
	Instrument value			

DCLS LAB SHEET

PROG. CODE	GROUP CODE	PRIORITY CODE	CONTAINER # (Y Y M M D D)	UNIT CODE	REGION CODE	COLLECTOR

SPECIAL STUDY NUMBER	%FRB	WEATHER	TIDE	FLOW SEVERITY	SECCHI DEPTH (m)	FIELD pH
00116	00002	00041	00067	01351	00078	00400

RESIDUAL CHLORINE	FLOW RATE	COLLECTION SPAN	# OF ALIQUOTS	AIR TEMP. (C°)	BAROMETER PRESSURE
50060	00061			00020	00025

	SWL	SPWL	HOURS	YIELD
GW				

TISSUE	TIS (NUM)	SPECIES (NUM)	SAMPLE NO.	TIS (ALPHA)	SPECIES (ALPHA)
	74995	D 74990		84007	84005

TISSUE	IND/SAMPLE	SEX	LENGTH (INCHES)	WEIGHT (LBS.)	LC/H
	81614	84014	00024	00023	84008

LATTITUDE

LONGITUDE

OTHER

DEPTH (m)	FIELD DATA			
	D.O. PROBE (mg/L) 00299	TEMP ° C 00010	COND. (µ MHOS/CM) 00094	SALINITY (ppt) 00096
3				
5				
7				
9				
11				
13				

COUNTY

COM-MENTS

15				
17				
19				
21				

DEQ CORRECTIVE ACTION REQUEST FORM

Section I - Completed by originator

Date:

Submitted By:

Region:

A. Nature of Problem:

B. Possible cause (if known):

C. Date problem identified: _____

D. Samples that may be invalid:

E. Recommended Corrective Action (optional):

D.E.Q. Corrective Action Request -con't.

Section II - Completed by Regional Technical Services Supervisor

A. Recommended Corrective Action:

Technical Services Supervisor, Signature: _____Date:_____

Section III - Completed by CBO Monitoring Project Coordinator

A. Recommended Corrective Action:

B. Follow up action required: YES / NO

C. Implementation will begin on: _____

CBO Project Coordinator Signature: _____Date: _____

Section IV - Completed by Headquarters QA/QC (optional)

A. Recommendations / Comments:

QA/QC Signature: _____Date:_____

MULTIPROBE CALIBRATION LOG SHEET

Sonde Make/Model: **Sonde S/N:** **Region:**

						DO			Specific Conductivity		pH		
Cal Type	**Date/Time**	**Initial and Run ID**	**Temp C**	**BP (mmHg)**	**Chart DO**		**Meter DO**	**Cal DO**	**Cond Std. (uS/cm)**	**Cond Init/Cal**	**pH 7 Init/Cal**	**pH 4 or 10 Init/Cal**	**3rd pH check Init/Cal**
Pre													
Post													
Comments						**DO QA:**			**Cond QA:**		**pH QA:**		
Pre													
Post													
Comments:						**DO QA:**			**Cond QA**		**pH QA:**		
Pre													
Post													
Comments:						**DO QA:**			**Cond QA:**		**pH QA:**		
Pre													
Post													
Comments:						**DO QA:**			**Cond QA:**		**pH QA:**		
Pre													
Post													
Comments:						**DO QA:**			**Cond QA:**		**pH QA:**		

DO QA: YSI ODO Gain 0.75 to 1.25, **Cond QA: YSI Cell Constant** 4.55 to 5.45 **pH QA:** pH 7: -50 to 50 mV, pH 4: 130 to 230 mV, pH10: -230 to -130 mV

MULTIPROBE MAINTENANCE SHEET

From WQMSOP Appendix A

Multiprobe **Maintenance Log**		Sonde Model:				S/N:		
Year:		Date/Initial						
DO (Optical)	**Clean membrane** As needed when dirty							
	Replacing Membrane Yearly or when needed							
pH	**Clean pH sensor** As needed due to slow readings							
	Refill reference junction/ replace Teflon cap (In-Situ and Hydrolab only) Erratic pH readings, calibration fails, or Teflon cap is dark in color							
	Change pH Sensor Yearly or sooner (**YSI**). Erratic pH or calibration fails, buffer mV readings outside range							
Other Sensors	**Clean conductivity Sensor** As needed when dirty							
	Clean depth sensor As needed when dirty							
	Clean temperature sensor As needed when dirty							
	Sensor Wipers As needed when dirty/damaged							
Storage	**Long term storage** (Longer than one month storage)							

Comments:

CBP NON-TIDAL SITE VISIT SUMMARY

Date:

Field personnel:

River:

Region:

Site visit by:

A. Sample preparation Procedures:

A1. Multiprobe calibration:

	Yes	No
1. Calibration normal and in accordance with SOP.	☐	☐
2. All expected parameters calibrated.	☐	☐
3. Expiration date not exceeded on pH buffer, 1.0 Molar stock solution less than 1 year old.	☐	☐
4. Utilized fresh Standards to calibrate conductivity.	☐	☐
5. Instrument operation good, in accordance with SOP.	☐	☐
6. Regional office maintains calibration/maintenance logbook.	☐	☐

A2. Sample Container and Equipment Preparation:

	Yes	No
1. Sample equipment (Churn splitter, 1-Liter sample collection bottles nozzles, and 250ml TNUTL bottles, if applicable) detergent washed, DI water rinsed 3 times.	☐	☐

A3. NIST Thermistor Check

Sonde serial #_____

	18-22 °C	30-35 °C	0-4 °C
NIST certified thermistor value			
Probe value			

Difference between probe & NIST certified thermistor is ± 0.5 ^{o}C?			

Comments:

B. Field Collection Procedures:

B1. Water Sample Collection:

	Yes	No
1. Prior to sampling R/O checked gage height to determine which equipment should be utilized in the field.	☐	☐
2. The appropriate sampling method was used for the site/flow.	☐	☐
3. The WBH-96, DH-95 or DH-81 sample bottle was ½ - ¾ full at the deepest, fastest vertical.	☐	☐
4. A uniform transit rate was utilized to sample. all the required sampling points.	☐	☐
5. The churn was rinsed with sample prior to use.	☐	☐
6. Sample bottles sample rinsed prior to sample collection.	☐	☐
7. Sufficient sample volume collected for all parameters.	☐	☐
8. Sample was thoroughly and continuously mixed by churning at a rate of approximately 9 in. per second when filling sample containers.	☐	☐
9. 1 Liter of water was left in the 4 Liter Churn (3 in 8 Liter churn or 4 Liters when using a 14 Liter churn).	☐	☐
10. Samples properly labeled using ink.	☐	☐
11. Samples iced immediately/preserved according to SOP.	☐	☐

B2. Multiprobe Procedures:

	Yes	No
1. Multiprobe readings stabilized prior to recording information on data sheets.	☐	☐
2. Site readings obtained from center of all sampling points and all data written on field sheet.	☐	☐

B3. Miscellaneous:

	Yes	No	N/A
1. Duplicate samples obtained according to SOP.	☐	☐	☐
2. Equipment blank samples obtained according to SOP.	☐	☐	☐
3. Is PMTF required?	☐	☐	

Comments:

_____

_____

_____

C. End of the day Procedures:

C1. Field Personnel End of the day procedures:

	Yes	No
1. Mulitprobe instrument calibration check conducted according to SOP/normal.	☐	☐

C2. Data Entry Audit

1. Three months of field sheets were selected randomly by CO personnel to review.	☐	☐
2. Percent errors found equaled 10 percent or less	☐	☐

a. Total number errors found = _____

b. Total number data points reviewed = _____

Percent error = step a/step b*100% = _____

VIRGINIA NON-TIDAL NETWORK MONITORING PROGRAM PROCEDURE MODIFICATION TRACKING FORM

This form is used to document modifications made to the Virginia Non-tidal Network Monitoring Program's procedures or methods. A detailed method description including the proposed modification should be completed prior to submittal to DEQ's Chesapeake Bay Program at the Central office.

DATE SUBMITTED	DATE APPROVED
REQUESTOR NAME	ORGANIZATION
NEWLY PROPOSED MODIFICATION [ ] FIELD APPROVED MODIFICATION [ ] APPROVED BY: DATE:	
TYPE OF PROCEDURE/METHOD	SAMPLING [ ] ANALYTICAL [ ] FIELD MEASUREMENT [ ] OTHER [ ] SPECIFY:
DURATION	PERMANENT [ ] EFFECTIVE DATE: TEMPORARY [ ] START DATE: END DATE:
PROCEDURE/METHOD DESCRIPTION	
MODIFICATION DESCRIPTION	
JUSTIFICATION FOR MODIFICATION	
ANALYTICAL PARAMETERS THAT MAY BE AFFECTED BY THIS CHANGE	
AFFECTED QA PLAN(S) (INCLUDE TITLE, REVISION AND DATE)	
PMTF COMPLETED BY	

CBO REVIEW/APPROVAL: NAME:_____
TITLE:_____

SIGNATURE:_____ DATE:_____

APPENDIX B: USGS/DEQ SITE FILES

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 8/25/70

By: M.S. Blincoe

Revised: M.S. Alling, 1985

D.W. Henry, 1992

D.A. Nissen, 5/8/00

D.A. Nissen, 4/23/01

J.K. Lambert 4/13/04

M.L. Hutchison 3/22/05

Description of Gaging Station **#01654000 Accotink Creek near Annandale, Virginia.**

LOCATION -- Lat. 38° 48' 46”, long 77°13' 43", Fairfax County, on the left bank, 800 ft upstream from bridge on State Highway 620, .2 mi upstream from Long Branch, and 2.3mi southwest of Annandale. To reach station from 495, take the Braddock Road exit, turn west on State Route 620 and drive 0.6 miles until you reach the Fairfax County sewage pumping station immediately before Accotink Creek; turn right into parking area. Walk/drive about 800 ft upstream along left bank to gage house.

ESTABLISHMENT – Established August 12, 1970, by C.E. Graves, H.R. Meeks, M.W. Blincoe, P.M. Shackelford and L.V.Snow. Prior to this date, gage located 800 ft downstream at different datum, established May 12, 1949 by R.E. Curtis and M.S. Berry, non-recording gage 800 ft downstream at different datum, established March 3, 1947 by C.M. Thayer

DRAINAGE AREA-- 23.5 square miles.

GAGE -- DCP Satlink (15 minute interval readings) installed October 5, 2004, in a 48-inch aluminum house and well. Reference Point established on shelf at elevation 14.46ft for inside gage height check. Range in stage of recorder is 0.0 to 11.33 ft. Inside gage consists of enameled sections (0.00 to 10.12 ft), fastened to a 2" x 6" timber bolted to the inside of the well. A steel tape with an 8-inch float activates the recorder set to the inside staff gage (base gage) with integral tape pointer gage. Maximum and minimum indicator clips are attached to this steel tape. The gage is equipped with two 2-inch intakes, with 2-inch riser pipes and gate valves, using tank and pump flushing system. Lag screw in tree as a reference point provides outside check readings.

Datum of gage is 191.24 feet above mean sea level.

Elevations as follows:

Bottom of well	0.0 ft
Top of lower intake	0.30 ft 6/3/02
Top of upper intake	1.25 ft 6/3/02
Floor	11.33 ft
Instrument shelf	13.89 ft
IG RP	14.46 ft

HISTORY -- March 3, 1947 to May 12, 1949 – Non-recording gage 800 ft downstream at different datum established by C.M. Thayer.

May 12, 1949 to Aug. 12, 1970 – Recording gage located 800 ft downstream at different datum, established by R.E. Curtis and M.S. Berry. The present recording gage was started in use on Aug. 12, 1970. No other gages have been operated on this stream.

REFERENCE AND BENCHMARKS. – R.M. Nos. 1, 2, 3, 4 and 6 destroyed.

R.M. No. 5, Elevation 15.42 ft, chiseled square, left downstream wingwall of downstream bridge.

R.M. No. 7, Elevation 10.005 ft, bolt concrete pier 4 ft upstream and 6 ft shoreward of centerline of gage.

R.M. No. 8, Elevation 11.93 ft, curved spike in downstream shoreward side of 4± ft diameter oak tree, 50 ft upstream of gage on left bank, 2 ft above ground.

R.M. No. 9, Elevation 16.41 ft, chiseled square on the left upstream wingwall of the upstream bridge.

RP, Elevation 8.38 ft., May 4 2004, lag screw driven horizontally in the upstream side of a double hackberry tree, 5 ft downstream of the intakes over the streambed.

CHANNEL AND CONTROL. – The channel bends to the left above and to the right below the gage and is fairly deep. Streambed is composed of loose gravel and sand with immediate banks wooded giving way to open grassland on the right bank in the flood plains. The channel at the gage is about 25 feet wide at low flow; 50 feet wide at bankfull stage and 200 feet + wide at flood stage.

The control is a rock and gravel riffle about 70 ft below gage, and is subject to shifting. Bankfull stage is about 8 ft.

DISCHARGE MEASUREMENTS. – Wading measurements are normally made within 200 ft upstream or downstream of gage, the section is smooth gravel upstream and downstream. Medium and high-water, measurements are made 800 ft downstream from the gage on the downstream side of east bound Braddock Road Bridge.

A contracted opening measurement (No. 576) with flow over road, was made on the 15.96-foot stage of June 22, 1972.

FLOODS. -- Maximum discharge 12,000 cfs, June 22, 1972, gage height 15.96 ft. Flood of Sept 26, 1975, discharge 6,420 cfs, gage height of 12.90 ft. (from flood marks).

POINT OF ZERO FLOW. -- Somewhat unstable. Minimum flow 0.001 cfs at 1.30 ft on Aug 19, 2002 (volumetric measurement). Point of zero flow determined to be at 1.30 ft on July 22, 1999, 1.34 ft on Sep 18, 2001, 1.35 ft on July 8, 2002, 1.45 ft on Sept 09, 2003, 1.42 ft on Oct 01, 2003, and 1.41 ft on Aug 23, 2004.

WINTER FLOW. -- Stage discharge relation affected by ice during cold winters.

REGULATION AND DIVERSION. -- None.

ACCURACY.— Good.

COOPERATION — USGS Real-time Data at www.usgs.gov

SKETCH AND OR MAPS.— Attached.

PHOTOGRAPHS. – See attached photograph.

OBSERVER.—N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 09/14/67

By: R.N. Pollard

Revised: B.R. Beegle, 05/31/90

T.L. Gibson, 02/28/01

Updated: J.K. Lambert 4/13/04

D.A.Nissen 5/24/2006

Description of Gaging Station **#02039500 Appomattox River at Farmville, Virginia.**

LOCATION.-- Lat 37°18'25", long 78°23'20", Cumberland County, on left bank at downstream side of bridge on State Highway 45 (Farmville to Cumberland) at northern edge of Farmville and 1.1 miles downstream from Buffalo Creek. Farmville Quad.

To reach gage from Charlottesville take Rt. 20 South to Dillwyn and turn right on Rt. 15 South. Stay on Rt. 15 until you come to Rt. 15 Business and turn left. Stay on Rt. 15 Business until you reach Rt. 45 in downtown Farmville. Turn left on Rt. 45 North and stay on Rt. 45 until you reach the river and gage.

To reach gage from Kingsville, take Rt. 15 North until you reach the intersection of Rt. 15 North, Rt. 15 Business, and Rt. 45. Stay straight onto Rt. 45 North until you reach the river and gage.

ESTABLISHMENT.—March 25, 1926 by J.J. Dirzulaitis and O.D.Mussey.

Station Description of Appomattox River At Farmville, VA - Continued

DRAINAGE AREA.—303 square miles.

GAGE. —DCP recorder system with 15-minute readings installed August 19, 2004 in concrete house. A steal tape with 4-inch float activates the recorder set to the inside base gage with integral tape pointer gage on shelf. Maximum and minimum indicators are attached to this steal tape. Reference Point established on shelf at elevation 24.24 for inside gage height check. The National Weather Service has gage-height monitoring equipment in the gage with a telemark phone system attached (804-392-8344) Datum of gage is 281.93 ft above mean sea level datum of 1929, referred to BM RV 149.5 (levels by Survey engineers August 25, 1941).

Intakes are two 2-inch galvanized steel pipes (upper intake has about 4ft. of 3" plastic sleeve driven into the pipe from the outside) equipped with 2-inch gate valves and 2-inch riser pipes to flushing tank besides shelf. Flushing pump is lift type with 1 ¼ inch pipe extension in well.

Inside gage consists of enameled gage section (about 1.90 to 20.34 ft) fastened to 2" x 6" board attached vertically to inside concrete wall of gage house.

Range in stage of recorder is 2.0 to -- ft.

Outside gage is wire-weight gage located on downstream side of bridge.

Zero of gage is 257.34 feet above mean sea level from levels by Virginia Department of Highways.

IG RP	24.24 ft
Bottom of well	1.4 ft
Lower intake	2.1 ft
Upper intake	4.7 ft
Ground at gage	11.0 ft
Bottom of well door	15.4 ft

HISTORY —Prior to May 4, 1965 a graphic water-stage recorder was used and March 25, 1926 to Nov. 28, 1928, a chain gage was used at the same site and datum. CR10X installed 5/18/01 and changed to DCP recorder system with real time on August 19, 2004.

Station Description of Appomattox River At Farmville, VA - Continued

REFERENCE MARKS – R.M. Nos. 1 through 5 and 7 were destroyed or have been unable to locate.

R.M. No 6, Elevation 29.07 ft. bronze tablet A65 (USC&GS) set in concrete bridge, left, upstream end, in sidewalk by curb.

R.M. No 8, Elevation 11.138 ft., is a chiseled circle on top of upstream, streamward, 4 ft wide slab of concrete under 1st bridge span (left bank). Established 10/18/73.

R.M. No 9, Elevation 30.630 ft. gage datum. Top of bolt holding guardrail onto concrete on downstream left side of bridge, 1 foot left of Station zero. Painted orange. Established 6/83.

Check Bar. Elevation 31.085 ft.

CHANNEL AND CONTROL. – One channel at all stages. Channel has slight curvature above gage and bridge but is fairly straight below for approximately 200 ft. Banks below the gage are fairly steep then open grass fields with both sides mowed and maintained. Above gage and bridge the banks are steep and wooded along edges only. Streambed is sand and gravel with only scattered rocks.

DISCHARGE MEASUREMENTS. – Wading measurements can be made 10 ft below the gage up to a gage height of 5.0 ft. Above this stage measurements can be made at gage. Initial point of sounding is left end of bridge rail, downstream side, distances marked off with paint every 10 ft shoreward and in 5 ft intervals over stream.

Flow smooth and moderately swift with water confined between abutments at measuring section. Correction for horizontal angle, averaging about 0.92, are necessary probably at all stages measured from bridge. Occasionally during high stages debris may build up on R.R. bridge downstream causing some backwater conditions.

Sounding weights for bridge measurements in relation to stage are listed below:

Weight	Gage Height
15 lb. c	5.0 to 8.5 feet
30 lb. c	8.5 to 10.5 feet
50 lb c	10.5 to 12.0 feet
75 lb c	12.0 to 14.0 feet

Station Description of Appomattox River At Farmville, VA - Continued

100 lb c above 14.0 feet

FLOODS. – Flood of August 15, 1940 reached a stage of 23.60 ft., 21,000 cfs. Flood of June 22, 1972 reached a stage of 29.70 ft (gage datum) discharge, 33,100 cfs.

POINT OF ZERO FLOW. —October 17, 2000 was 2.47 ft., August 16,2002, 2.43ft.

WINTER FLOW.— Stage-discharge relation affected by ice in extreme cold periods.

REGULATION AND DIVERSION.— Diurnal fluctuation at low flow caused by Price Edward Mill (.2 mile upstream) and disposal plant above station. No Diversions.

ACCURACY.— Records should be good.

COOPERATION.— NWS has gage-height monitoring equipment installed in gage with a telemark phone system attached (434) 392-8344. Real time data at USGS home page (www.va.usgs.gov).

SKETCH and/or MAPS.—See Attached.

PHOTOGRAPHS. – N\A

OBSERVER.—N\A

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Water Resources Division

Station Number:

02011500

Description Updated:

01-30-03

By: D.W. Adams

DESCRIPTION OF GAGING STATION ON: Back Creek near Mountain Grove, Va.

LOCATION.--Lat 38º04'10", long 79º53'50", Bath County, Hydrologic Unit 02080201 on left bank 0.3 miles downstream from Cummings Run, 0.8 miles downstream from bridge on State Highway 39, and 2.1 miles south of Mountain Grove.

To reach station from I-64 (traveling west), turn off at first Covington exit, follow Rt 60 toward Covington about 2 miles to intersection with Rt 220, bear right on Rt 220, drive north about 25 miles thru Hot Springs to Warm Springs and intersection with Rt 39, turn left on Rt 39, drive about 9.5 miles to gage on left side road.

ESTABLISHMENT.--Oct. 1, 1951 by C. A. Shepherd and M. S. Berry. The Virginia State Water Control Board operated the station 1958 thru 1984 water years. Operation of the station taken over again by U.S. Geological Survey on Oct. 1, 1984.

DRAINAGE AREA.--134 square miles.

GAGE.--Corp of Engineers Handar 560 DCP that transmits gage height and water temperature. The gage is 48 inch corrugated metal pipe. There is an 8 ft house section over an 8 and 5 ft (total 13 ft) well sections.

Some elevations of gage features are as follows:

0.0 ft, bottom of well

1.0 ft, bottom intake

1.4 ft, top intake

14.71 ft, top house f1oor

17.76 ft, top recorder shelf

The intakes are 2 inch galvanized pipe, both about 30 ft long, gate valves, and riser pipes connected to a flushing tank. A pitcher pump lifts water from well to tank for flushing. A 3 inch PVC pipe conduit comes out back of house to stream and is about 1 1/2 ft under the ground, for the water temperature probe. An electric tape gage and float tape pointer serve as upper references. The inside staff gage consist of enameled sections 0.0 to 15.9 ft fastened to a 2" X 6" board which is bolted to pipe well sections. The outside gage is slope gage, range 1-7 ft, at left edge of water, a staff gage on back of gage house range 3-10.1 ft., and a staff gage on a boulder about 30 ft below gage.

View of gage house, outside gage, and control

HISTORY.--Station 02011460 Back Creek near Sunrise 15.4 miles upstream has been in operation since Jun. 20, 1974. Station 02011470 Back Creek at Sunrise 10.8 miles upstream has been in operation since Oct. 1, 1984. Station 02011480 Back Creek on Route 600 near Mountain Grove, 5.5 miles upstream was operated from October 1973 to December 1984, when it was discontinued.

REFERENCE AND BENCH MARKS.--

RM #1-5 have been destroyed.

RM #6, elevation 9.135 ft, is point on rock, painted orange, at left edge of water, 55 ft downstream from gage.

RM #7, elevation 8.419 ft, is point on rock, painted orange, at left edge of control, 50 ft downstream from gage.

RM #8, elevation 15.280 ft, is chisled square on high point of rock outcrop about 81 ft upstream from center of house on outstream side of road, 46 ft from edge of road, 23 ft instream from telephone pole. About 1 ft outstream from instream edge of rock.

DATUM OF GAGE.--1,701.45 ft above sea level.

CHANNEL.--Channel is fairly straight for 300 feet above and below the control. Right bank is steep, wooded, and not subject to overflow. Left bank has a gradual slope to Rt 39, is wooded and will overflow the road at about an 11 ft stage, then across the road the bank is steep and wooded again. The stream bed is ledge rock overlain with sand and gravel.

CONTROL.--The control located 50 ft downstream of gage is a ledge rock outcrop, clean and permanent. Some shifting will occur as sand and gravel washes on and off the right end of the control. The ledge rock is the control at all but extremely high stages when channel control will take over.

DISCHARGE MEASUREMENTS.--Low flow wading measurements can be made about 100 ft below gage or in near vicinity of gage. Low or medium flow measurements made in vicinity of gage. High flow measurements are made from a stand-up cable car on cableway located about 220 ft upstream from gage where depth will equal gage height. An idea of what weight to use on measurements from cableway are as follows: to 4 ft 30#, 5 ft 50#, 6 ft 75#, 7 ft 100#. The cable way consists of a slide-hill anchor on right bank and an "A" frame on left bank. Cable is marked off in 10 ft sections with zero at anchorage loop on right bank and station 188 at "A" frame on left bank. The cable is a 1 inch, 6x25 IWRC wire rope.

FLOODS.--The maximum stage during period of record is 12.41 ft on Jan. 19, 1996.

POINT OF ZERO FLOW.--1.43 ± .10 on October 2, 2001.

WINTER FLOWS.--Stage-discharge relation will be effected by ice during cold winters.

REGULATION AND DIVERSION.--Flows will be regulated by unknown amount by dam on Back Creek 11.3 miles upstream and by dam on Little Back Creek 14.4 miles upstream. Both dams are part of the Bath County Pump Storage Project jointly operated by Virginia Power Co. and Allegheny Power Co. Since the initial filling of about 42,800 ac-ft, which will be used over and over again, the normal flow of both streams is supposed to pass thru the reservoirs. There is an additional 3,100 ac-ft (total at both reservoirs) of storage for flood waters which will be released shortly after the flood and could effect flood peaks at the station. Some regulation will occur with normal operation of gates and valves to control pool elevations at both reservoirs.

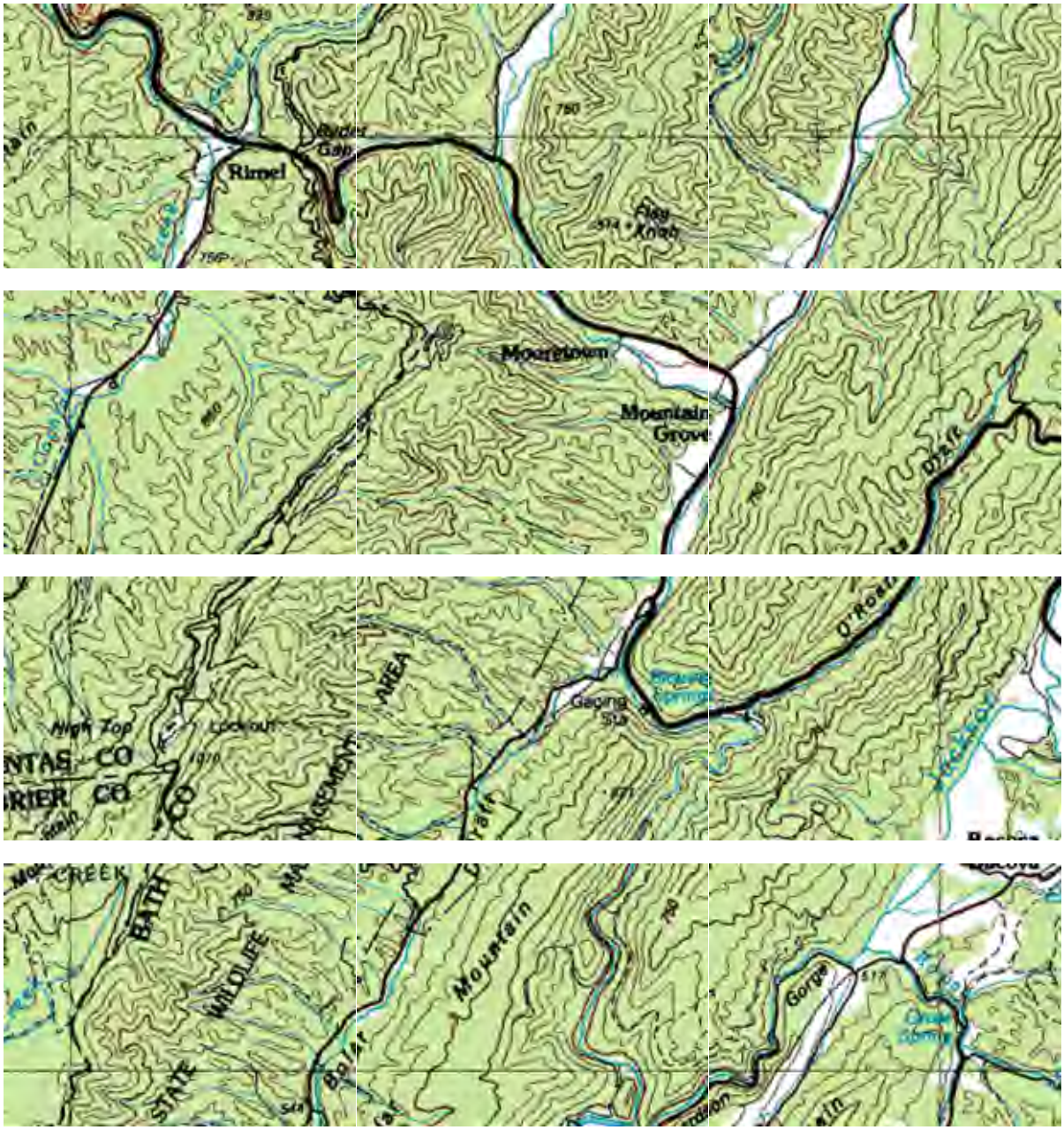
ACCURACY.--Records good.

COOPERATION.--Norfolk District, Corps of Engineers.

SKETCH.--Attached

PHOTOGRAPHS.--See files.

Target is UTM 17 599298E 4214165N - **WARM SPRINGS** quad [Quad Info]




CATHRIGHT
TMGSWMA
Coles
Bacova
Junction
Crowdertown

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 6/5/69

By: C.E. Graves, Jr.

Revised: E.D. Powell, 1972

M.S. Alling, 1985

D.W. Henry, 5/13/92

D.A. Nissen, 3/09/01

Updated: J.K. Lambert 4/12/04

Description of Gaging Station **#02015700 on Bullpasture River near Williamsville, Virginia.**

LOCATION: -- Lat. 38°11'43", long 79°34'14", Bath County, on left bank 15 ft below bridge on State Highway 614 at Williamsville. Station is about 0.62 miles upstream from confluence with Cowpasture River.

To reach gage from Warm Springs, drive north 4.4 miles on 614, then northeast 14.6 miles to Williamsville via Burnsville. To reach station from Millboro Springs go west 0.7 miles to U.S. Highway 39 to State Highway 678. Turn right (north) and drive about 16 miles to Williamsville. Follow State Highway 678 south from U.S. Highway 250 at McDowell about 13 miles to Williamsville.

ESTABLISHMENT —July 12, 1974 by C.E. Graves, E.D. Powell, M.S. Alling and R.E. Lawson. Prior to this date, the gage was located 1,000 ft upstream at a different datum, established August 2, 1960 by R.N. Pollard and D.B. Richwine.

Station Description for #02015700 Bullpasture River nr Williamsville, Va. - Continued

DRAINAGE AREA.—110 square miles.

GAGE. —DCP Satlink system connected to a pressure transducer in a 48-inch corrugated metal house.

Outside staff gage and slope gage was established at the new orifice site on October 30, 1996. Length of the orifice line is 75 ft.

Datum of gage is 1,610.14 ft above mean sea level.

Elevations as follows:

Orifice	.50 ft
Bottom of outside staff gage	. 54 to 4.96 ft
Outside slope gage from	4.96 to 9.10 ft
Outside staff gage from	8.80 to 16.49 ft
Floor	___.__ ft
Instrument shelf	___.__ ft
Wire weight removed	July 1, 2002

HISTORY. —August 2, 1960 to July 12, 1974 – Continuous recording gage installed in 48-inch corrugated metal pipe well by R.N. Pollard and D.B. Richwine located 1000 ft. upstream of current site.

The present recording gage was started in use on July 12, 1974. Located 1,000 ft downstream from the original sight at a different datum. A Stevens continuous strip chart recorder activated by nitrogen purge manometer was used until February 2001 when it was replaced with a H-500 data logger with ATA card Activated by nitrogen purge manometer.

The orifice used from 1974 to 1995 was anchored to a large boulder on the left bank at the downstream side of the bridge (elevation 1.98-ft) until the boulder was moved during the 1995 flood. A new orifice was attached to a concrete block 25 ft below the gage in October 1996. An outside staff and slope gage was established at this point from 0.54 to 16.49 ft.

REFERENCE AND BENCH MARKS. – R.M. Nos. 1 and 2, superseded or destroyed.

R.M. No. 3, chiseled square on the right upstream top of the wingwall, streamward corner, elevation 23.88 ft.

R.M. No. 4, chiseled square on the left downstream top of the wingwall, instream corner, elevation 24.40 ft.

R.M. No. 5, chiseled square on the right downstream top of the wingwall, instream corner, elevation 24.085.

CHANNEL AND CONTROL: – Channel is fairly straight for 200 ft above gage and 1,200 ft below gage, beyond these points it curves left and meanders. One channel at all times, not subject to overflow.

Control consists of riffle containing large river rock and bedrock about 80 ft below bridge. Seems fairly stable with very few shifts.

Bankfull stage 9.0 ft.

DISCHARGE MEASUREMENTS: – Good wading section just upstream of the mouth of Cowpasture River, 0.7 mile below gage. High wading is possible about 800 ft downstream of gage, just above island, at a gage height of about 4.0 ft. Bridge marked off on upstream side and downstream side at 5-ft intervals. Horizontal angles are present on right U.S.S bridge and no angles are used for D.S.S bridge. At stages 6.0 ft and above, use 150-lb weight. Use data logger or the outside gage for the gage height because at high flows wire weight is in trough of standing wave.

Slope Area measurement (No.271) for the 12.79 foot stage of November 4, 1985 was started 2,000 feet upstream from current site.

FLOODS. – According to resident near gage, flood of March 27, 1913 reached a stage of 11.18 ft and that of March 1936, 8.44 ft, both old gage datum. Maximum discharge for period of record, 22,900 cfs, Nov. 4, 1985, from rating curve extended above 3,300 cfs on basis of slope-area measurement of peak flow. Max. Gage height, 12.79 ft, from flood marks, Nov. 4, 1985, current datum. Flood of September 6, 1996 reached a gage height of 12.50 ft, discharge of 21, 600 cfs.

POINT OF ZERO FLOW. — 0.56 ft ∀ .05, Oct. 10, 2000. Minimum discharge, 19 cfs Jan. 4, 1981, result of freeze up. O.55 Sep. 21, 2001.

Station Description for #02015700 Bullpasture River nr Williamsville, Va. - Continued

WINTER FLOW.—Stage-discharge relation affected by ice during severe cold periods.

REGULATION AND DIVERSION.— None.

ACCURACY.— Good.

COOPERATION.— Real time data at USGS home page (http://waterdata.usgs.gov)

SKETCH.— See attached sketches and maps.

PHOTOGRAPHS. –

OBSERVER.—N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 11/18/71

By: E.D. Powell

Revised: M.S. Alling, 06/19/85

D.W. Henry, 5/13/92

D.A. Nissen 03/13/01

D.A. Nissen 03/06/02

J.K. Lambert 04/12/2004

Description of Gaging Station **# 02020500, on Calfpasture River above Mill Creek at Goshen, Virginia**

LOCATION: -- Lat. 37°59'16", long 79°29'38", Rockbridge County, on left bank 20 ft upstream from bridge on State Highway 42 at Goshen, and 400 ft upstream from Mill Creek.

ESTABLISHMENT: —December 20, 1938 by J.J. Dirzulaitis. Prior to this date the gage was 800 feet downstream of present gage at a different datum, established 1925. Datum of present gage was reset 2.00 feet on October 1, 1999.

DRAINAGE AREA.—144 square miles.

GAGE. — DCP Satlink system connected to a pressure transducer, in a 30-ft concrete house on left bank. Inside gage is enamel sections 0.0 to 16.9 ft, on 2" x 6" pressure treated board attached to inside wall of gage house. Maximum stage indicator clip with integral tape indicator gage at shelf. Water enters the well through two 2" intakes at gage height of 2.00 ft. and 4.70 ft. Upper intake is equipped with gate valve and riser pipes, using tank and pump flushing system. Intakes

are used for high water marks and maximum stage indicator clips only. Orifice is encased in 2-inch galvanized pipe and anchored in concrete to the bedrock of the stream. Wire-weight gage is located on USS of bridge directly above orifice. Check bar elev.25.56 ft.

Datum of gage is 1,382.84 feet above mean sea level. Virginia Department of Emergency Management, IFLOWS branch has gage height radio transmitter at station. The outside gage 2" x 6" pressure treated board, attached to the side of gage house ranges from 10.20 to 23.70.

Elevation as follows:

Bottom of well	1.80 ft
Lower intake	2.00 ft
Upper intake	4.70 ft
Right Bank overflow	10.26 ft
Left bank overflow	10.91 ft
Bridge floor	22.56 ft
Right bottom of bridge beam	18.58 ft
Left bottom of bridge beam	18.62 ft
Gage floor	23.29 ft
Gage shelf	26.60 ft

HISTORY: - 1925 to Dec. 20, 1938 a chain gage station was operated below Mill Creek 800 ft downstream of present gage. The present continuous recording gage was started in use on December 20, 1938.

An artificial concrete control, "Columbus Type" was completed prior to installation of recorder in 1938 and was located 250 ft downstream of gage house. This concrete control was stable until the stage of June 1982. This stage washed out a 20-ft section of the control. The stage of November 1985 washed out another section and stages since have caused further deterioration to this control, until the remains of this control was removed by bulldozer prior to October 1996.

Department of Emergency Services installed equipment May 23, 1991. A Crest-stage gage was in use from October 1996 to September 1998. The continuous record was restarted on October 1998 with a CR10 data logger, with a 15-minute reading, activated by an H-350 Lite

pressure transducer. This data logger was replaced with an upgraded H-500 data logger on February 2001.

Datum of gage was reset 2.00 feet on October 1, 1999.

REFERENCE AND BENCHMARKS: – R.M. No. 2 - Destroyed.

R.M. No.1, Elevation 14.125 ft, is chiseled shelf in top of upstream concrete wingwall to left abutment of highway bridge. Not used.

R.M. No. 3, Elevation 22.42 ft, is chiseled square on top of USLLB bridge seat, upstream stream ward corner, painted orange.

R.M. No. 4, Elevation 23.265 ft is chiseled square on top of DSLB bridge wheel guard, down stream shoreward corner, painted orange.

R.M. No. 5, Elevation 5.88 ft. is chiseled square on shore ward side of old slope gage pier, 10-ft. instream of stream ward side of gage.

CHANNEL AND CONTROL – The channel is fairly straight for 1,000 feet above and below gage. Mouth of Mill creek is located 400 feet downstream of gage. One channel at all times, bankfull stage about 10 feet.

The old concrete control was removed by bulldozer prior to October 1996 and a new cobble and gravel control has formed about 150 ft $\pm$ below the gage that probably will be subject to shifts as stages move the cobble in and out of this area.

DISCHARGE MEASUREMENTS. – Wading measurements made in the vicinity of the control. High wading measurements made 20 to 50 feet below bridge or 700 feet upstream of gage. Bridge measurements are usually made from downstream side due to frequent debris on upstream side of pier. Traffic director is needed for crane measurements done on this bridge.

Slope Area measurement (No. 511) for the 20.23-foot stage of Nov. 4, 1985 was started about one mile upstream of gage, just past the end of Rt. 615 on the right bank. Slope area measurement (No. 374) for the 11.97-foot stage of May 30, 1971 was started about 3600 feet upstream of gage.

FLOODS. – Maximum stages during period of record 20.23 ft, Nov. 4, 1985, discharge 56,300 cfs. Flood of October 6, 1972 reached a stage of 12.78-ft. Flood of September 6, 1996 reached a stage of 16.38, discharge 35,800, datum then in use.

POINT OF ZERO FLOW. — 1.01 ft July 25, 2000; 1.04 ft. September 21, 2001

WINTER FLOW. —Stage-discharge relation affected by ice during severe cold periods.

REGULATION AND DIVERSION: — None.

ACCURACY: — Good

COOPERATION — IFLOWS (www.afws.net) Real time data at USGS home page (http://waterdata.usgs.gov)

SKETCH. — Attached.

PHOTOGRAPHS. –

OBSERVER.—N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 06/05/80

By: D.W. Henry

Revised: T.L. Gibson 03/07/01

Description of Gaging Station **# 02041000 Deep Creek near Mannboro, Virginia.**

LOCATION.-- Lat 37°16'59", long 77°52'12", Amelia County, on left bank 300 ft upstream from bridge on State Highway 153, 0.9 miles upstream from Sweat house Creek, 3.4 miles northwest of Mannboro, and 7.5 miles southeast of Amelia. Gage is 5.0 miles upstream from mouth. Topo quad: Mannboro, VA map attached.

To reach gage from Mattoax gage take Rt. 635 back to Rt. 604, turn left and stay on RT. 604 until you reach Rt. 360. Turn left onto Rt. 360 and proceed until you come to Rt. 153 on your right. Take Rt. 153 until you reach Deep Creek.

ESTABLISHMENT.—September 5, 1946 by G.M. Thayer and R.H. Tice, staff gage read daily by observer. Recording station established Sept. 2, 1949 at same datum and site.

DRAINAGE AREA.—158 square miles.

GAGE.—A DCP recorder system in a 48-inch corrugated pipe house and well. Datum of gage is 177.20 ft, National Geodetic Vertical Datum of 1929.

Gage is equipped with two 2-inch intakes with riser pipes, gate valves, handle extensions and lift-type pump, with flushing tank.

Outside gage consists of reference point at upstream side of highway bridge, 300 ft below gage. R.P. is chiseled "V" located 82 ft. from left upstream side of bridge on upstream handrail at elevation of 21.545 ft, gage datum.

Elevations as follows:

House floor	14.65 ft
Recorder shelf	17.39 ft
Lower intake	0.4 ft
Upper intake	1.4 ft
Reference point	21.545 ft
IG RP	ft.

HISTORY.—No other gage has been operated on this stream. Deep Creek is a tributary to the Appomattox River. A new bridge was built in 1996 on Rt. 153.

REFERENCE AND BENCH MARKS. – R.M. Nos. 1 – 6 have been destroyed or unable to locate.

R.M. No. 7, Elevation 11.545 ft. is head of bolt in 3" plastic pipe, 33 ft. north of gage door (downstream) on the edge of old road.

REFERENCE AND BENCH MARKS CONTINUED-

R.M. No 8, Elevation 11.60 ft., is head of bolt in 3" plastic pipe, 20 ft. north of walkway on edge of bank.

R.M. No. 9, Elevation 16.25 ft., is a chiseled square on top of footing, downstream side of bridge, left bank.

R.M. No. 10, Elevation 17.30 ft., is a chiseled square on top of footing, upstream side of bridge, left bank.

RP Elevation 21.23 ft., is a chiseled "v" located 82 ft. from left upstream side of bridge.

CHANNEL AND CONTROL. – Streambed composed of sand. One channel at stages below 5 ft that is straight for approximately 500 ft above and below gage. Gage area swampy with numerous overflow channels at high stages. Roadbed subject to overflow at very high stages on left bank.

Low-water control is riffles caused by sand bars and slight constriction located 550 ft below gage (200 ft below highway bridge), and is subject to shifts. Medium and high-water is controlled by channels and highway bridge and roadfill. Possible backwater effect at extreme high stages in conjunction with stages in Appomattox River.

DISCHARGE MEASUREMENTS. – Low-water measurements can be made by wading "on" control, 200 ft below bridge, up to a stage of 4.5 ft ∀. Medium and high-water can be measured from upstream side of highway bridge using sounding weights. Crane measurements will probably be necessary at gage heights of 11∀ft and above. Measuring conditions are good at all stages except very high when road is subject to overflow.

FLOODS. – Flood of Oct. 6, 1972 reached a stage of 24.04 ft from floodmarks (15,000 cfs).

Flood of September 6, 1979 reached a stage of 16.27 (12,100 cfs).

Flood of August 1940 reached a stage of 14.8 ft.

POINT OF ZERO FLOW.— 1.12 ft ∀ July 8, 1976. 0.38 ft. September 14, 1998.

0.40 August 23, 1999. 07/15/02 0.83ft.

WINTER FLOW.—Stage discharge relation affected by ice in cold winters.

REGULATION AND DIVERSION.— None

ACCURACY.— Measuring conditions and records should be good. Stage discharge relations are subject to shifts.

COOPERATION.—Real-time data located on the USGS home page at www-va.usgs.gov

SKETCH and/or MAPS.— See attached.

PHOTOGRAPHS. – N/A

OBSERVER.—N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 04/21/72

By: E.D. Powell

Revised: D.W. Henry, 05/09/91

T.L. Gibson, 05/09/01

R.E.Lawson, 05/19/05

J. Howard, 03/27/13

Description of Gaging Station **# 01671100 on Little River near Doswell, Virginia.**

LOCATION.—Lat.37°52'21" long.77°30'48" Hanover County, on left bank downstream side of bridge on State Highway 685, 0.8 miles southwest of Verdon, 2.9 miles west of Doswell, and 9.6 miles upstream from mouth.

To reach gage from Doswell, go north on State Highway 1, cross C&O overpass and turn left on State Highway 684. Go 2.5 miles to state Highway 685 at Verdon. Proceed 0.8 miles on State Highway 685 to gage.

ESTABLISHMENT.—Established Sept. 1, 1961, by D.B. Richwine and H.R. Meeks.

DRAINAGE AREA.—107 square miles.

GAGE.—A DCP recorder system (Real-time data located at the USGS home page at www-va.usgs.gov) in 48" corrugated aluminum house and well, 26 ft high. The range in stage of the recorder is from 0.0 to 22.5 ft. Two 2-inch intakes, gage valves, and valve stems replaced with

PVC plastic August 1990. Intakes are equipped with gate valves and riser pipes using tank and pump flushing system. The outside gage is a reference point on the downstream side of highway bridge (Chiseled "∇ ") elevation 20.49 ft. The inside gage is enameled sections 0.0 to 20.3 ft attached to inside gage board (treated 2"x6").

Datum of gage is 132.30 ft.

Elevations as follows:

Bottom of well	0.0 ft
Top of No.1 intake (outside)	1.57 ft
Top of No.2 intake (outside)	2.42 ft
House floor	17.54 ft
Instrument shelf	20.6 ft
Bridge floor	17.6 ft
Bridge beam (bottom)	16.1 ft

HISTORY. —Original steel house and well replaced with aluminum Sept. 1979. A new bridge was built at same site in 2000. The gage was disassembled but the well was left in place. No record for the 2000 water year. The gage was reassembled at same site and datum Oct. 2000.

REFERENCE AND BENCH MARKS. – R.M.'s Nos. 1-5 destroyed due to new bridge construction.

R.M. No. 6, Is a 1-inch bolt holding guardrail to bridge located on the upstream, left side of bridge. Elevation: 21.12 ft.

R.M. No. 7, Is a 1-inch bolt holding guardrail to bridge located on the downstream, right side of bridge. Elevation: 21.50 ft.

R.M. No. 8, Is a bolt in a 2-inch PVC pipe in concrete located 86 ft. from downstream left abutment, 42 ft. from center of road. Elevation: 17.16 ft.

R.P. Chiseled triangle, located on the downstream side of bridge, 34 ft. from center of gage . Elevation 20.49 ft

STATION DESCRIPTION FOR LITTLE RIVER AT DOSWELL - CONTINUED

CHANNEL AND CONTROL. – Low-water control is a stream worn layer of a granite outcrop, subject to minor shifts from weeds and leaves. The channel is straight for about 100 ft downstream where it breaks to the right for 100 ft and then divides around a small, lightly wooded island. The stream is straight upstream for about 100 ft where it also breaks to the right. Dense woods line the banks upstream and downstream. High water controlled by channel, with sharp fall in elevation below control.

DISCHARGE MEASUREMENTS. – Wading measurements can be made about 1.8 miles upstream (0.25 road miles) to a stage of about 3.25 ft. Corrections for channel storage needed for measurements during changing stage. Other measurements made from USS of highway bridge 25 ft above gage. Bridge is marked off in 5-ft intervals on upstream and downstream sides. For high flows, a 150-LB weight is necessary.

FLOODS. – Flood of August 21, 1969, reached a stage of 11.09 ft, discharge 12,000 cfs. Flood of June 22, 1972 reached a stage of 9.88 ft., discharge of 8,300 cfs.

POINT OF ZERO FLOW.— 1.11 ft (Oct. 6, 1983); 0.93 ft (August 28, 1990).

WINTER FLOW.—Ice effect under extreme weather conditions.

REGULATION AND DIVERSION.— Frequent quarry dewatering by the General Crushed Stone Co. above gage adds about 0.5 cfs at times.

ACCURACY.— Records should be good at all stages.

COOPERATION. — none

SKETCH and/or Maps.— See attached.

PHOTOGRAPHS. – File folder in office.

STATION DESCRIPTION FOR LITTLE RIVER AT DOSWELL - CONTINUED

OBSERVER.—N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 04/21/72

By: E.D. Powell

Revised: R.E.Lawson 05/18/05

D.W. Henry, 05/19/92

M.S. Alling, 06/18/85

Description of Gaging Station **#01674000 on Mattaponi River near Bowling Green, Virginia**

LOCATION.-- Lat 38°03'42", long 72°23'10", Caroline County, on right bank at downstream side of old highway bridge 0.1 miles upstream from bridge on State Highway 605, 2.2 miles northwest of Bowling Green, 2.4 miles upstream from South River, and 7.1 miles downstream from confluence of Matta and Poni Rivers.

To reach station from intersection on State Highways 207 and 2, in Bowling Green, drive northwest 0.3 miles on State Highway 2 to State Highway 605, turn west (left) and drive 2.0 miles to entrance of old roadbed about 1,500 ft west of bridge over Mattaponi River. Turn sharp right (northeast into old roadway) and drive about 1,300 ft to gage.

To reach station from US Highway 1 at Thornburg, drive 3.1 miles south on US Highway 1 to State Highway 605, turn east (left) and drive 9.1 miles on State Highway 605 to entrance on left of old roadway, 1,500 ft before bridge over Mattaponi River. Turn left into old roadway and proceed 1,300 ft to gage.

DEQ internal note: NRO samples from Route 605 (since Nov. 2020 due to access issues to old bridge)

ESTABLISHMENT.—Established by R.E. Curtis on Sept. 8, 1942 moved to right bank on August 17, 1978 by C.E. Graves, Jr. and party.

Station Description for #01674000 Mattaponi River near Bowling Green, Va.

DRAINAGE AREA.—257 square miles

GAGE.—A DCP recorder system in a 48 in corrugated steel gage house and aluminum well, 24 ft in length is located on right bank about 8 ft downstream from old highway bridge; range in stage of recorder is from 0.75 ft to 20.8 ft.

Inside staff gage consists of enameled sections from 0.60 ft to 20.32 ft attached to 2”x6” board bolted to inside of well.

Outside gage is a reference point on downstream side of old bridge, at station 21 ft from left side, elevation 20.40 ft. Intakes and flushing systems are as follows: intakes consist of 2-inch galvanized pipe equipped with valves and 2-inch flushing pipe extending into floor of house, pump and tank for flushing.

Datum of gage is 85.14 ft above mean sea level.

Elevations are as follows:

Bottom of well	0.60 ft
Top of well	17.0 ft
Lower intake	1.09 ft
Upper intake	2.19 ft
Floor	17.80 ft
Shelf	21.40 ft
Left end of bridge	17.40 ft
Right end of bridge	16.71 ft
Bottom of bridge	14.70 ft
Right bank overflow	11.51 ft
Left bank overflow	12.51 ft
Ground level	12.51 ft

Station Description for #01674000 Mattaponi River near Bowling Green, Va.

HISTORY – Installed September 1942 and operated to current date without a break in record. Prior to August 17, 1978, gage located on left band at same datum.

REFERENCE AND BENCH MARKS – R.M. No. 1: Elevation 20.40 ft is a cross, cut in the top of the concrete handrail of the concrete bridge, 12 ft from the left abutment on DSS of bridge. (Unable to locate 5/10/2006)

R.M. No. 2: Elevation 20.435 ft (revised 7/11/1946 by USGS), is a U.S.E.D. bronze tablet set in top of concrete handrail of concrete bridge near left abutment on USS of bridge (station 36 TBS-F3).

R.M. No. 3: Elevation 17.46 ft is a bolt anchored in right DS end of concrete guardrail, 1 ft above pavement surface.

R.M. No. 4: Elevation 16.621 ft is a bolt anchored in left DS side of concrete bridge rail.

CHANNEL AND CONTROL – Control at low water consists of gravel riffle on right side of island 100 ft below the gage. At medium and high stages the control is channel, the streambed of which is an island 100 ft downstream. Shifts are common. Beaver activity in stream causing shifts many years during low-flow conditions.

DISCHARGE MEASUREMENTS. – Low-water measurements are made by wading about 100 – 150 ft above or 300 ft below old bridge. Medium and high-water measurements are made from the downstream side of either bridge, and the initial point for soundings is at the left abutment. The river bottom is gravel and shifts slightly and the banks are sloping with over-hanging trees. The channel is curved both above and below the gage; however, the channel is fairly straight at the measuring section.

For medium water there are two overflow channels to be measured above ∀ 10 ft at the old bridge, but in extreme high water both approaches to the new bridge are subject to overflow. Right side overflows at 13.0 ft on Rt. 605. At stages about ∀11.5, measurements must be made on new bridge.

FLOODS –- Period of record, maximum discharge, 13,400 cfs (18.95 ft from HWM in well), June 23, 1973. Outside period of record, flood in August 1928, reached a stage of approximately 19.5 ft based on relative difference in stage between this flood and the flood of October 17, 1954,

at Milford 4 miles downstream, discharge 15,000 cfs , from rating curve extended above 8,100 cfs.

Station Description for #01674000 Mattaponi River near Bowling Green, Va.

POINT OF ZERO FLOW— Variable due to sand and gravel movement and beaver dams in the control area.

WINTER FLOW— Stage-discharge relation affected by ice during severe cold periods.

REGULATION AND DIVERSION.— Some diurnal fluctuation from Gristmill upstream on Po River.

ACCURACY— Good

COOPERATION— None

SKETCH.— See attached topographic map.

PHOTOGRAPHS – In office files.

OBSERVER.—N\A

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Station Number: 02024000

Description Updated: 05/10/04

By: S. L Wheeler

DESCRIPTION OF GAGING STATION ON: Maury River nr. Buena Vista, Va.

LOCATION.--Lat 37°45'45", long 79°23'30", Rockbridge County, on right bank 0.5 mile downstream from South River and 2.8 miles northwest of Buena Vista.

To reach station from Interstate 81, take exit BUENA VISTA, LEXINGTON RT 60. Travel East on Rt 60 (dual highway) towards Buena Vista 1.1 miles to crossover at Ben Salem wayside. Cross westbound lane. Proceed to private driveway known as Lincoln House; drive 0.6 mile along river to gage on right bank.

To reach station from Buena Vista, drive west on Highway 60 1.9 miles from city limits to Ben Salem wayside; turn right onto private driveway known as Lincoln House; drive 0.6 mile along river to gage on right bank. During extreme high water part of the section of private road between U.S. Highway 60 and gagging station is flooded, making it necessary to stop of U.S. Highway 60 at top of hill towards Lexington and walk wood line and down hill (about half a mile) to gagging station. SEE ATTACHED MAP.

ESTABLISHMENT.-- By A. R. Green on Mar. 23, 1939.

DRAINAGE AREA.--646 square miles (revised).

GAGE.--Electronic recorder (Sutron 8210 DCP) with 15-minute record interval, and National Weather Service Hydro logger, and flood warning transmitter, in a 33-foot concrete gage house located on right bank half a mile below mouth of South River. Base gage is an independent electric tape inside house. Range in stage of recorder 0.1 to 26.7 feet. Top and bottom of well in gage house are at elevations 24.7 feet and -1.0 feet. Inside staff gage consists of enameled gage sections (0.0 to 20.3 feet) fastened to 2" x 6" board embedded in concrete wall of gage house; outside staff gages consist of enameled staff gage sections (10.1 to 24.7 feet) fastened to 2"x6" board embedded in concrete wall of gage house and vertical gage (0-4.4) fastened to tree about 40' upstream. Intakes and flushing equipment are as follows: two 2-inch intakes (tops of intakes at elevations 0.3 to 2.3 feet) both equipped with 2-inch gate valves, 2-inch riser pipes to flushing tank underneath shelf, and valve stems. Flushing pump is lift type installed in house with 1 1/4-inch pipe extension in well. Datum of gage is 846.58 feet above mean sea level datum of 1929.

BENCH MARKS.--

RM #1, elevation 15.01 feet, is top of 1/2-inch machine bolt set vertically in edge of ledge rock 21.8 feet 8.5 feet upstream and 7.0 feet inshore from upstream, inshore corner of gage house.

RM #2, elevation 16.605 feet, is top of 1/2-inch machine bolt set vertically in edge of ledge rock 21.8 feet downstream and 8.5 feet inshore from downstream, inshore corner of gage house.

RM#3, elevation 15.731 feet, is chiseled square on upstream corner of lowest concrete step, 7 feet out stream from gage. Established 10-22-1991.

CONTROL.--Low-water control is a V-notched rock ledge extending diagonally across river about 100 feet below gage house overlain near left bank by gravel bar, clean and permanent. Medium and high-water control is a rock ledge overlain by some gravel and boulders located about 400 feet below gage house, clean and fairly permanent, and probably will be affected by ice formations.

DISCHARGE MEASUREMENTS.--Made from cableway located 200 feet below gage house and by wading 1/4 mile above gage. Most high-water measurements will be made from highway bridge on 10th street in Buena Vista, about 3 miles downstream. Cableway consists of 1-inch galvanized plow-steel yacht rigging rope. spa 416 feet, supported on both banks by 20-foot square steel towers and anchored to dead men consisting on concrete blocks 4'x4'x7' buried in the ground, cable looped around RR rail embedded in concrete. Cable is marked off with paint at 10-foot intervals; initial point for

soundings. Cable is all-aluminum standup car, follower brake type, for use with reel at end of car. Bed of stream is mostly ledge rock with some gravel and boulders, fairly smooth, clean and permanent. One channel up to a stage of around 10 feet when water will flow through field on left bank as separate channel up to a stage of about 15 feet. Flow smooth with high velocities and fairly straight at all stages. Channel straight for half a mile above and fairly straight for about 1500 feet below. Water swift and fairly smooth throughout broken by series of riffles during low water. Right bank wooded and deep, not subject to overflow. Left bank low and will overflow above for about 100 feet up to stage of about 10 feet, above this point water will start to flow through center of field about 200 feet from left EW at low water and at stage of about 15 feet flow will be in one channel extending 250 feet from the left edge of water at low water. Fringe of bushes and trees near left edge of river, overflow plain is cultivated land. Measuring conditions considered good.

FLOODS.--The flood on March 1936 reached a stage of approximately 22 feet based on local information that water was 1 to 1 1/2 feet deep on RR tracks. Considered the highest flood since the 1913 flood amd slightly higher than that flood. Flood of Aug. 20, 1969 reached a stage of 31.23 feet (discharge, 105,000 cfs, from slope-area measurement of peak flow).

POINT OF ZERO FLOW.--0.3 foot, Dec. 1946

WINTER FLOW.--Stage-discharge regulation is affected by ice during cold winters.

REGULATION.--None. Dam of Columbia Pulp and Paper Co. located 2 1/2 miles downstream at Buena Vista has no effect on stage-discharge relation at gage.

DIVERSIONS.--None.

ACCURACY.--Records good.

COOPERATION.--U.S. Army Engineers, Norfolk Office

JOB HAZARD ANALYSIS FOR Maury River Near Buena Vista 02024000		
PREPARED BY:	**REVIEWED BY:**	**Recommended Protective Clothing and Equipment:** Personal flotation device, orange safety vest, hip boots/waders, foul weather gear, appropriate clothing for

DATE: 03/28/02	DATE:	climatic conditions, insect repellent, sunscreen, first aid kit, cell phone, disinfectant, highway signs, and orange cones.
APPROVED BY:	TITLE (First line supervisor)	Date
APPROVED BY:	TITLE (Second line Supervisor)	Date
Sequence of Basic Steps	**Potential Accidents/ Hazards**	**Recommended Safe Job Procedures**
Driving to site	Vehicle traffic	Stay current with defensive driving recommendations. Make sure vehicle is in proper working condition. Reduce speed when weather conditions dictate. Be alert other vehicular traffic.
Arriving at site	Vehicle traffic on road or bridge	Locate safe parking area. Turn on strobe safety light on field vehicle if warranted. Watch out for other traffic. Be aware of current bridge safety plan if required. Use bridge sidewalk.
Unloading/ setting up equipment	Pinching fingers, smashing fingers or toes, and back strain	Be aware of hand/foot placement, wear protective footwear as needed, use proper lifting technique, and do not rush actions.
Making a wading Measurement	Entering the stream, floating or submerged debris, drowning, soft streambed.	Wear PFD. Use caution going down the stream bank into the water. Be careful of foot placement along bank and in stream. Be aware of any floating debris, overhanging tree branches, venomous snakes, or anything else that may pose a hazard to your body. Do not attempt the measurement if there is any doubt that you will be able to safely

		cross the stream with the equipment needed to complete the job.
Making discharge measurement from bridge	Vehicle traffic	
	Falling over bridge	Wear PFD, do not lean over bridge
	Floating or submerged debris	Retrofit all "B" reels (and modified A reels) for a break-a-way cable. Be alert to debris, have cutters ready if sounding cable needs to be cut.
Reloading equipment	Pinching fingers, smashing fingers or toes, and back strain	Be aware of hand/foot placement, wear protective footwear as needed, use proper lifting technique, do not rush actions
Returning to Office	Vehicle traffic	Stay current with defensive driving recommendations. Make sure vehicle is in proper working condition. Reduce speed when weather conditions dictate. Be alert other vehicular traffic.

SKETCH.--

PHOTOGRAPHS.--

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 05/13/80

By: D.W. Henry

Revised: T.L. Gibson, 07/19/01

Updated: J.K. Lambert 04/12/04

R.E.Lawson 05/11/05

Description of Gaging Station **#02031000 on Mechums River near White Hall, Virginia.**

LOCATION.—Lat. 38°06'09", long. 78°35'35". Albemarle County, on right bank, 20 ft downstream from bridge on State Highway 614, 1.5 miles downstream from Rocky Run, 4.9 miles upstream from confluence with Moorman's River, and 4.0 miles southeast of White Hall. Topo Map: Charlottesville West.

From Charlottesville city limits, go west on State Route 654 to intersection with State Route 601 (2.03 miles), continue on Rt. 601 to intersection of State Route 676 (2.7 miles), continue on Rt. 676 to intersection of State Route 614 (1.0 miles) continued on Rt 614 to bridge and gage (1.3 miles). Although four different Route numbers are encountered, the drive is an uninterrupted westward journey.

From Free Union, go southeast on State Route 601 to intersection with State Route 676 at Woodsons Store (4.5 miles), turn right on Rt. 676 to intersection with State Route 614 (1.0 miles), and continue on Rt. 614 to bridge and gage (1.3 miles).

ESTABLISHMENT.—Established November 21, 1979 as a recording station by E.D. Powell and party.

DRAINAGE AREA.—95.4 square miles (measured on USGS topographic maps).

STATION DESCRIPTION #02031000 MECHUMS RIVER AT WHITE HALL - CONTINUED

GAGE. —DCP recorder system connected to a pressure transducer in a 48-inch corrugated house. House is composed of one 8-ft section anchored to concrete footing. There is approximately 200 ft of plastic tubing connecting house to stream. Orifice end encased in 2-inch metal pipe and anchored to concrete bridge pier in the stream and buried in right bank. Tubing from right bank to the house encased in ¾ inch plastic pipe buried in ground. Outside gages consist of a wire weight gage attached to downstream handrail of bridge and reference point, located on top of upstream bridge handrail post 95 ft from right bank, and a staff gage on the bridge pier, on the right bank from 3.36 to 13.52 ft. Datum of gage is 429.75 ft.

Elevations as follows:

Orifice nut, elevation	3.90 ft
Bottom of bridge steel	32.50 ft
Top bridge handrail	39.26 ft
Bridges curb	36.76 ft
Check bar	39.04 ft
R.P.	39.03 ft

HISTORY.—No other gages have been operated on this stream. Mechums river is a tributary to South Fork Rivanna River. A station has been operated on South Fork Rivanna River since August 8, 1979. Prior to September 1951, data published as Mechums River near Ivy.

REFERENCE AND BENCHMARKS. – R.M. No. 1, Elevation 36.772 ft., chiseled square on top of upstream right bank bridge wingwall.

R.M. No. 2, Elevation 38.494ft., (revised 4/22/2004), chiseled square on top of upstream left bank bridge wingwall.

R.M. No. 3 (1979), Elevation 31.57 ft, chiseled square on shoreward upstream corner of gage house footing.

B.M. 645 (1935), Elevation 645.432 ft above mean sea level (1929 datum) at church cemetery in Owensville, 20 ft north of State Highway 676, bronze tablet marked “B 155”.

STATION DESCRIPTION #02031000 MECHUMS RIVER AT WHITE HALL - CONTINUED

CHANNEL AND CONTROL. – One channel at all stages. Channel is straight for 0.2 miles upstream and 30 ft downstream. Both banks fairly open and steep with brush above gage and wooded below. Bankfull stage is 12 ft ∀.

Low and medium stage control is rock riffle 30 ft downstream of orifice. Steep left bank at bend, 300 ft below gage, becomes control at higher stages.

DISCHARGE MEASUREMENTS. – Wading measurements during low stages can be made from 50 ft above bridge to 200 ft below. Medium and high stages can be measured from either side of highway bridge although downstream side is considered more safe. Bridge marked off in 10-ft intervals with initial point at right bank and the span of bridge is 187 ft.

Discharge measuring conditions are good at all stages.

FLOODS. – Maximum of the period of record, was the flood of October 15, 1942, gage-height 30.30 ft, discharge of 20,000 cfs . The flood of September 7, 1996 reached a gage-height of 24.79 ft with a discharge of 14,200 cfs. Flood in June 1972 reached a stage of 30 ft ∀, gage datum, information from Eddie Young, Department of Highways and Transportation. Flood in September 1979 reached a stage of 24.5 ft ∀, gage datum, from high-water marks.

POINT OF ZERO FLOW.— 3.42 ft ∀ 8/22/97, 3.71ft 7/11/02, 3.67ft 8/9/02, 3.62ft 8/12/02

WINTER FLOW.— Stage affected by ice during cold winters.

REGULATION AND DIVERSION.— None.

ACCURACY.— Stage-discharge relationship should be fairly stable. Control may be subject to minor shifting.

COOPERATION.— Station established in cooperation with Rivanna Water and Sewer Authority. Real time data at USGS home page (www.va.usgs.gov).

STATION DESCRIPTION #02031000 MECHUMS RIVER AT WHITE HALL - CONTINUED

SKETCH.— See attached sketches and maps.

PHOTOGRAPHS. – None.

OBSERVER.—N\A

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Station Number: 01634000

Description Update: 3-1-2003

By: K. Dydak

DESCRIPTION OF GAGING STATION ON: North Fork Shenandoah River nr. Strasburg, Va.

LOCATION --Lat 38°58'36", long 78°20'11", Warren County, on right bank at upstream side of bridge on State Highway 55, 1.5 miles southeast of Strasburg, 2.2 miles upstream from Cedar Creek, 4.5 miles above Passage Creek, and 10 miles upstream from confluence with South Fork of Shenandoah River.

To reach station from Strasburg or Riverton, take State Highway 55 from either town to bridge across North Fork of Shenandoah River and gaging station.

ESTABLISHMENT --By J. J. Dirzulaitis and Karl Jetter on Mar. 6, 1925.

DRAINAGE AREA --768 square miles (revised.)

GAGE — A CR10x digital recorder with 15-minute data interval, with phone modem in a concrete gage house. Gage also has transmitter operated by National Weather Service,

Prior to Sept. 21, 1930, a chain gage on downstream side of old highway bridge was used as the gage.

Water-stage recorder in concrete gage house was used Sept. 21 1930 to Mar. 1936. Temporary staff gage on middle pier used Apr. 27 to Jul. 22.

A new 39-foot tall concrete gage house with water-stage recorder was put in operation on July 28, 1936. Top and bottom of well in gage house are 31.0 and 0.4 feet respectively. Inside staff gage consists of enameled gage sections (0.5 - 20.3 feet) fastened to 2" x 6" board embedded in concrete wall of gage house. Intakes and flushing equipment are as follows: two 2-inch intakes (top of intakes at elevations 1.6 and 5.0 feet) both equipped with 2-inch gate valves and valve stems and 2-inch riser pipes fitted with flush tank at top to facilitate flushing with pitcher pump.

REFERENCE MARKS.--

RMs 0.5-1 were destroyed by flood of March 1936.

RM #5 elevation 11.01 feet, is threaded end of machine bolt set in downstream end of pier on right shore, destroyed 1992.

RM #6 elevation 19.04 feet, is threaded end of machine bold set in instream face of right abutment several feet downstream from center of face and 6 feet above ground.

RM #7 elevation 15.682 feet, is RR spike driven in 12-in. ash tree, 60 feet inshore on the right bank (instream side), 120 feet upstream of gage. Not located in 2002.

RM #8 elevation 8.082 feet, is RR spike driven in 36-in. sycamore tree on the right bank (outstream side), 112 feet upstream of gage. Not located in 2002.

RM #9 elevation 10.922 feet, is RR spike driven in 12-in. ash tree, 215 feet upstream of gage and

10 feet inshore on right bank. Spike is on the outstream side. Not located in 2002.

RM #10 elevation 11.61 feet, is top of VDOT marker, upstream of old abutment in the road bed, in line with the face of the abutment, 25 feet upstream of wingwall, and one foot below land surface.

RM #11 elevation 16.217 feet, is top of 4-in. steel gatepost, 40 feet upstream and in line with streamward edge of gagehouse (added 10/01/2002)

CONTROL --Control is rock ledge located 150 feet downstream from highway bridge, permanent, and subject only to small shifts when some gravel is deposited. Control generally clean but during the summer of some years there is some vegetation on the control. Control will not be affected by ice except during extremely cold winters.

DISCHARGE MEASUREMENTS – High flow measurements may be made from upstream side of bridge. Wading measurements can be made 60 feet above gage to 200 feet below bridge. Bridge marked off in 10-foot sections on upstream side. Character of bed of stream from 700 feet above and about 800 feet below is an outcrop of ledge rock with gravel and some sand, probably permanent. Moss and grass grows between ledges of rock. One channel at all stages broken by mid-stream piers; depths about equal to gage height, flow smooth, velocities moderate, and no angle at measuring section. Channel above the gage straight for 700 feet, and straight for 1,200 feet below gage, water smooth and velocities moderate. Both banks will overflow at high stages and wooded along edge of water, but cultivated farther back. There is a high cliff on right bank about 150 feet from right abutment, left bank low and cultivated field extends about a quarter of a mile back of left abutment. Excellent records should be obtained at this station.

FLOODS --Maximum discharge, 100,000 second-feet Oct. 16, 1942 (gage height, 31.2 feet, from high-water mark in gage well) from rating curve extended above 46,000 second-feet by logarithmic plotting.

POINT OF ZERO FLOW --Determined to be at gage height 0.68 feet ± 0.1 foot on March 7, 1925.

WINTER FLOW --Stage-discharge relation is affected by ice during extremely cold winters.

REGULATION --Large diurnal fluctuation at low and medium flow caused by a hydroelectric plant at

Edinburgh, and from other unknown sources.

DIVERSIONS --None.

ACCURACY --Good.

COOPERATION --U.S. Army Engineers, Baltimore District.

SKETCH --

PHOTOGRAPHS —

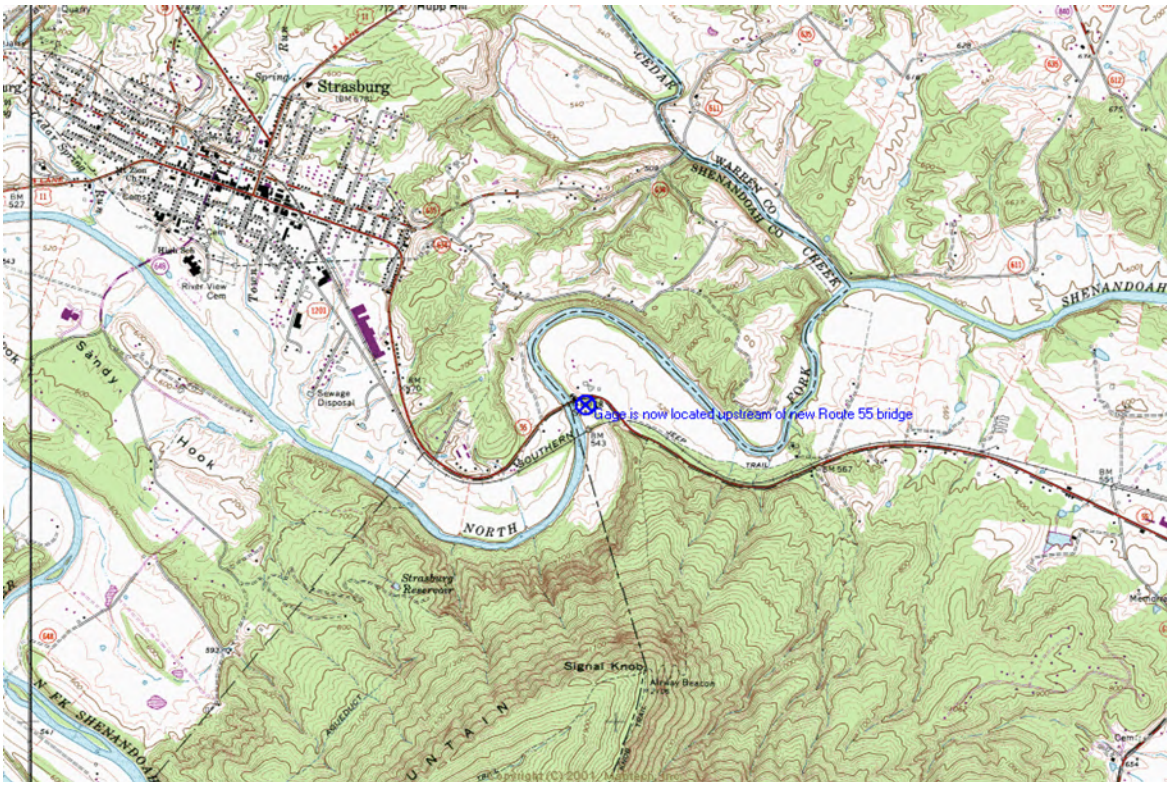
JOB HAZARD ANALYSIS FOR STATION 01634000

NF SHENANDOAH RIVER AT STRASBURG

PREPARED BY: DATE: 4/12/2002	REVIEWED BY: DATE:	Recommended Protective Clothing and Equipment: Personal flotation device, orange safety vest, hip boots/waders, foul weather gear, appropriate clothing for climatic conditions, insect repellent, sunscreen, first aid kit, cell phone, disinfectant, highway signs, and orange cones.
APPROVED BY:	**TITLE (First line supervisor)**	**Date**
APPROVED BY:	**TITLE (Second line Supervisor)**	**Date**

Sequence of Basic Steps	**Potential Accidents/ Hazards**	**Recommended Safe Job Procedures**
	Vehicle traffic	Stay current with defensive driving recommendations. Make sure vehicle is in proper working condition. Reduce speed when weather conditions dictate. Be alert other vehicular traffic.
Arriving at site	Vehicle traffic on road or bridge	Safe parking on the right-downstream shoulder of Route 55 West at bridge. Turn on strobe safety light on field vehicle if warranted. For a high-water discharge measurement or qw sampling, park on the left-upstream shoulder on the bridge. Watch out for other traffic. **Moderate** traffic here. Be aware of current bridge safety plan if required.
Unloading/ setting up equipment	Pinching fingers, smashing fingers or toes, and back strain	Be aware of hand/foot placement, wear protective footwear as needed, use proper lifting techniques, and do not rush actions.

Making discharge measurement from bridge	Vehicle traffic	**Bridge Site type is SE.** 'Road Work Ahead' and 'Shoulder Closed' signs should be placed along right shoulder of Route 55 East. Park on bridge next to road, facing east. Place cones behind truck and along bridge according to bridge safety plan.
	Falling over bridge	Wear PFD, do not lean over bridge
Bridge measurement (cont)	Floating or submerged debris	Be alert to debris, have cutters ready if sounding cable needs to be cut.
Making wading discharge measurement	Entering the stream, floating or submerged debris.	Wear PFD. There is a cattle fence that is occasionally charged, between the dirt road at the base of the gage and the outside staff. Use caution going down stream bank into water. Be careful of foot placement along bank and in stream. Bedrock streambed is slippery. Beware of any floating debris. **Do not** attempt the measurement if conditions are such that you cannot safely enter and exit the stream.
Reloading equipment	Pinching fingers, smashing fingers or toes, and back strain	Be aware of hand/foot placement, wear protective footwear as needed, use proper lifting technique, do not rush actions



North Fork Shenandoah gage location

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 05/13/80

By: D.W. Henry

Revised: R.E.Lawson 5/9/2006

Description of Gaging Station **#02027500 on Piney River at Piney River, Virginia.**

LOCATION.—Lat. 37°42'08", long. 79°01'40". Nelson County, on left bank at upstream side of bridge on State highway 151, 0.2 miles southwest of Piney River post office, 1.7 miles downstream from Indian Creek, and 2.5 miles southeast of Lowesville.

To reach the gage from Lovingston, drive approximately 4 miles to route 56, turn right onto Route 56, travel approximately 5 miles and turn left onto Route 151, to Piney River, continue .2 miles southeast of Piney River Post Office to the gage.

ESTABLISHMENT.—Gage established by R.E. Curtis, July 18, 1949. See history. Gage relocated to upstream side of bridge, left bank, Sept. 21, 1973, by R.W. Buck and party.

DRAINAGE AREA. — 47.6 square miles.

GAGE. —DCP system in 48 in. aluminum pipe well and house.

Intakes are in 2-inch galvanized pipe, both with flushing systems. Lower intake has siphon for low flow. Elevation of lower intake is 1.94 ft gage datum (revised) and is 55 ft long. Elevation of upper intake is 3.11 ft gage datum (revised) and is 50 ft long.

Enameled staff gage in well and integral float-tape for inside reference. Range of staff gage is 1.00 ft to 23.72 ft gage datum.

Outside gage is wire-weight type and is located on handrail on upstream side of bridge. Datum of gage is 631.58 ft, National Geodetic Vertical Datum of 1929(revised from 633.58 ft).

Elevations as follows:	**REVISED**
IG RP	25.78ft.
Top Lower intake	1.94 ft.
Top Upper intake	3.11 ft.
Bottom of Well	1.00 ft
Shelter floor	22.26 ft
Instrument shelf	25.78 ft
Check bar	22.27 ft (gage datum)

HISTORY.—Prior to May 27, 1969, water-stage recorder, and Nov. 4, 1969 to Feb. 26, 1970, non-recording gage at site 20 ft downstream from former highway bridge at same datum. Feb. 26, 1970, to Sept. 20, 1973, on right bank 20 ft upstream from bridge at same datum. Datum of gage changed from 633.58 to 631.58, in 1999 to lower plates, to keep from having negative gage heights.

REFERENCE AND BENCHMARKS. – R.M. No. 1: Elevation 21.73 ft., chiseled square on right downstream wingwall 45 in. downstream from end of wingwall at bridge.

R.M. No. 2: Elevation 21.72 ft., chiseled square on right upstream wingwall 42 inches downstream from end of wingwall at bridge.

R.M. No. 3: Elevation 18.78 ft., is head of ½" bolt set in concrete post due east of the gage house on the left bank, upstream side of the road at the top of the fill, adjacent to the left bridge abutment.

R.P. Elevation: 23.43 ft., is a chiseled "V" bottom of chamfer, top of the handrail, upstream side of the bridge at the station 52.

Check Bar Elevation: 22.27 ft., located on the upstream side of Rt. 151 bridge

CHANNEL AND CONTROL. – One channel at all stages. Channel is fairly straight for 400 ft upstream and 200 ft downstream. Both banks are brush and tree covered with gradual slopes. Streambed is mostly gravel with some larger rock and occasional rock outcrops.

Low and medium-water control consists of rock and gravel just below gage. The channel will be the control in higher water.

DISCHARGE MEASUREMENTS. – Wading measurements can be made 50-150 ft below the gage. High-water measurements made from the upstream side of bridge. The bridge is a 100ft long and marked off at 5-ft intervals on up and downstream sides. Larger sounding weights should be used at medium and higher stages because of rapid velocities.

Discharge measuring conditions are good at all stages.

FLOODS. – Flood of August 20, 1969 reached a stage of 13.8 ft, (from floodmarks). Discharge 38,000 cfs on basis of slope-area measurement of peak flow. June 1949 reached a stage of 9.9 ft (from floodmarks). Flood of September 6, 1996 reached a stage of 12.85 ft., 27,400 cfs. All stages relate to old datum before 1999.

POINT OF ZERO FLOW.— 1.26ft Aug. 14, 2002. 1.28 ft Sept. 11, 2002.

WINTER FLOW.—Stage-discharge relation may be affected by ice during severe winters.

REGULATION AND DIVERSION.— Periodic dewatering of quarries upstream adds small amount of inflow.

ACCURACY.— Stage-discharge relation should be permanent. Records of stage are good and measuring conditions are good. Extreme low water and ice affected records are fair.

COOPERATION.— Real time data at USGS home page (www.va.usgs.gov.)

SKETCH AND MAPS. Attached

PHOTOGRAPHS. – N/A

OBSERVER.—N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 04/21/72

By: E.D. Powell

Revised: M.S. Alling 06/17/85

R.E.Lawson 05/19/05

Description of Gaging Station **#01673800 on Po River near Spotsylvania, Virginia.**

LOCATION: Lat 38°10'17", long 77°35'42", Spotsylvania County, on right bank at USS of bridge on State Highway 208, 1.6 miles downstream from Gladys Run, and 4.9 miles upstream from US Highway 1. Gage can be reached from Spotsylvania by driving 2.0 miles south on Route 208.

ESTABLISHMENT: Established Sept. 24, 1962 by C.A. Shepherd and H.R. Meeks. Prior to Sept. 30, 1964 a non-recording gage at same site and datum.

DRAINAGE AREA: 344 square miles.

GAGE: A DCP recorder system in 48" aluminum pipe well and house, consisting of two 6 ft and two 8 ft sections. Inside gage is enameled sections 0.0 to 23.72 ft screwed to 2"x6" treated pine timber bolted to well. The two intakes are flushed by lift-type pump with tank, and 2-inch risers. Stages can be recorded from 0.00 to 24.35 ft. R.P. located on upstream side of bridge at station 75. Elevation = 31.53 ft.

Datum of gage is 183.76 ft above mean sea level.

Elevations are as follows:

Bottom of well	0.00 ft
Lower intake	1.06 ft
Upper intake	1.65 ft
Floor	21.21 ft
Shelf	24.74 ft
Bridge Low Steel Left Bank	24.32 ft
Bridge Low Steel Right Bank	21.07 ft

HISTORY: Prior to September 30, 1964, nonrecording gage at same site and datum.

REFERENCE AND BENCHMARKS: R.M.'s 1-4 destroyed with bridge replacement.

R.M. 5: Elevation 24.28 ft, Chiseled square located on left upstream side of bridge seat painted orange.

R.M. 6: Elevation 20.745 ft, Chiseled square located on right upstream side of bridge seat painted orange.

REFERENCE AND BENCHMARKS CONTINUED:

R.M. 7: Elevation 30.11 ft, Chiseled square located on right upstream side of bridge abutment painted orange.

R.P. Elevation 31.53 ft. Chiseled "V" on upstream side of bridge at station 75 painted orange.

VDOT BM: Elevation 207.557 ft msl and 23.797 ft gage datum. Railroad spike painted orange in base of sycamore tree on left bank upstream side of bridge located 170 ft north of gage and 125 ft west of center line of new road.

CHANNEL AND CONTROL: Low-water control is rock and gravel riffle 200 ft below gage. Medium water will probably be controlled by channel and high water will probably be controlled by the bridge opening. Left bank and right bank has gradual slope below bridge with overflow on right side in field below bridge at about 10-ft stage. Channel fairly straight for 300 ft above bridge and curves to right at bridge and then straight for about 200 ft. Channel consists of rock and gravel and some aquatic growth below bridge. Subject to small shifts at low stage.

DISCHARGE MEASUREMENTS: Wading measurements are made about 400 ft below bridge. High stages can be measured from Highway Bridge, which is marked off in 5-ft sections with initial point of sounding at right end of upstream guardrail. Slight horizontal angles may be present.

FLOODS: Maximum for period of record, 10,900 cfs, June 22, 1972, gage height, 19.03 ft. Information provided by Mr. Hotchel, former observer, indicates that the highest stage in remembrance occurred in 1933 or 1934 and was about 23.5 ft.

POINT OF ZERO FLOW: 1.01 ft, Oct. 5, 1983.

WINTER FLOW: Affected by ice during severe winters.

REGULATION AND DIVERSION: None.

ACCURACY: Records good.

COOPERATION: None.

SKETCH: See attached Topographic map.

PHOTOGRAPHS: In office file.

OBSERVER: N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 05/09/69

By: P.N. Schackelford

Revised: D.W. Henry, 05/01/91

R.E. Lawson, 04/14/00

J.K. Lambert, 04/12/04

M.L. Hutchison 03/23/05

Description of Gaging Station **#01665500 on Rapidan River near Ruckersville, Virginia.**

LOCATION.-- Lat 38°16'48", long 78°20'27", on left bank 10 ft below bridge on US Highway 29, 0.2 miles downstream from Elk Run, 1.7 miles upstream from White Run, 2.1 miles downstream from South River, 3.6 miles northeast of Ruckersville, at mile 63.5.

ESTABLISHMENT.—Established September 5, 1942 by R.H. Tice. See history.

DRAINAGE AREA.—114 square miles.

GAGE. -- DCP Satlink system with 15 minute readings, connected to a pressure transducer in 48-inch aluminum house. Outside gage is type "A" wire-weight mounted on the downstream side of the northbound bridge. Wire-weight gage is integral with recorder. Length of orifice line is 150 ft.

Datum of gage is 439.44 ft above mean sea level, datum of 1929, Culpeper supplementary adjustment of 1943.

Elevations are as follows:

Floor	27.2 ft
Instrument shelf	32.0 ft
Top of house (inside)	35.6 ft
Wire-weight Check Bar	32.17 ft reset 4/16/01

HISTORY. -- Gages have been operating on Robinson River near Locust Dale since July 1943 and on the Rapidan River near Culpeper since November 1930. A break in record occurred on June 27, 1995, due to the loss of the old concrete gage during the maximum for period of record flood. Gage established Oct. 1, 1998

REFERENCE AND BENCHMARKS. -- R.M. Nos. 1 – 5, 7; destroyed.

R.M. No. 6, Elevation 33.51 ft, chiseled square, painted orange, top of instream corner of north bound Rt. 29 bridge wingwall, downstream left bank.

R.M. No. 8, Elevation 33.55 ft, chiseled square, painted orange, top of instream corner of north bound Rt. 29 bridge wingwall, up stream left bank.

R.M. No. 9, Elevation 21.10 ft, bridge bolt painted orange cemented in 3” pvc pipe 10ft east and 3 ft north of center line of gage.

CHANNEL AND CONTROL. -- At the control the channel bed is of solid rock and boulders and probably permanent. The left bank is rock and rises sharply. Right bank is of soil and sand, and overflows during high water. One channel is at all stages. The low and medium water control is a cobble and bedrock riffle 200 feet below the gage. It is permanent but subject to minor shifts. Channel control exists at high stages with the old Rt. 29 highway approach fills acting as the highway control 300 ft below gage.

DISCHARGE MEASUREMENTS. -- Low and medium water wading measurements are made downstream 400 – 1000 ft below gage. High-water measurements are made from upstream side of south bound bridge marked off every 5 ft with two stripes at 50 ft intervals

and three at 100 ft intervals. Cross section is 350 ft wide with zero starting on left bank. High-water measurements are also made on the downstream side of north bound bridge marked off every 10 ft with two stripes at 50 ft intervals and three at 100 ft intervals. Cross section is also 350 ft wide with zero starting on the left bank. The main channel is approximately 80 ft wide with extreme velocities. One may have to take surface readings above 8 – 10 ft. Measurements should be good.

FLOODS. -- Flood of June 27, 1995, reached a gage height of 31.3 ft, discharge 106,000 cfs (slope area measurement). Flood of October 15, 1942, reached a gage height of 20.8 ft, discharge 25,000 cfs.

POINT OF ZERO FLOW. -- On August 5, 1946, 0.1 ∀ 0.1 ft, July 8, 1982, -0.5 ∀ .5 ft. 0.70 ∀ .1 ft, August 9, 1999. Oct. 11, 2001 1.07ft. August 23,2002 1.00ft

WINTER FLOW. -- Some ice effect during cold winters.

REGULATION AND DIVERSION. -- Diversion 0.4 miles upstream since 1973 by Rapidan Service Authority for municipal supply of Greene County and town of Stanardsville has averaged less than 1.0 cfs.

ACCURACY. -- Good.

COOPERATION -- Real time data at USGS home page (http://waterdata.usgs.gov)

SKETCH AND MAPS. -- Attached.

PHOTOGRAPHS. -- N\A

OBSERVER. -- N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 05/09/69

By: P.N. Schackelford

Revised: D.W. Henry, 05/01/91

D.W. Henry, 04/12/00

Updated" J. K. Lambert 4/12/04

Description of Gaging Station **#01667500 on Rapidan River near Culpeper, Virginia.**

LOCATION.-- Lat 38°21'01", long 77°58'31", on left bank 0.7 miles upstream from Cedar Run and bridge on US Highway 522, 8.5 miles south of Culpeper, Culpeper County, and at miles 29.6.

To reach station from Orange, drive 9 miles on State Highway 20 toward Fredericksburg, turn left on US Highway 522 just beyond Unionville, drive north toward Culpeper about 9 miles, turn left on State Highway 647 just beyond concrete bridge over Rapidan River, drive half a mile to intersection with State Highway 655, turn left and drive half a mile to gage at abandoned bridge site.

Station can also be reached by leaving Culpeper on US Highway 522 and driving south 9 miles to intersection with State Highway 647, 1,000 ft north of bridge over Rapidan River, turn right and proceed to gage as above. See sketch for short cut from Robinson River near Locust Dale.

ESTABLISHMENT.—Established November 16, 1930 by J.J. Dirzulaitis and T.F. Hanly.

DRAINAGE AREA.—472 square miles (revised).

GAGE.—DCP Satlink system in a 36 ft concrete gage house located on left bank about 40 ft upstream from old bridge site. Range in stage of recorder –0.1 to 29.2 ft.

Inside staff gage consists of enamel gage sections 0.0 ft to 10.1 ft fastened to a 2"x6" board embedded in the wall of the gage house. Outside check gages consist of enameled staff section (1.0 – 4.62 ft) fastened to 2"x6" board and steel bolted to the concrete pier at the intake, and enameled staff gage sections (10.4 – 27.1 ft) fastened to 2"x12" board embedded in concrete wall of gage house.

There are two 2-inch intakes (top of intakes at elevation 0.1 and 3.4 ft), equipped with 2-inch gate valves and valve stems and 2-inch riser pipes with flush tank at top to facilitate flushing deep well pump. Lower intake with static tube extension.

Weather Bureau type staff gage attached to downstream, shore corner of gage house, 18.1 – 31.0 ft. The gage cannot be reached when the stage is above roughly 13 ft. National Weather Service gage height transmitter at gage. Gage height posted at MARFC web site and at phone (540) 825-0969.

Datum of gage is 241.36 ft above mean sea level, datum of 1929, Culpeper supplementary adjustment of 1943.

GAGE - Continued

Elevations are as follows:

Bottom of well	-0.4 ft
Top of well	27.0 ft
IG RP	29.61 ft

HISTORY.—Fisher Porter digital recorder replaced with CR10-X data logger with 15 minute readings on 3/28/01.

REFERENCE AND BENCHMARKS. – R.M. 1, Elevation 2.61 ft, is a chiseled quarter circle on upstream and instream corner of base of left, upstream cylindrical pier.

R.M. No. 2, non-existent, see 7/27/48 notes located at USGS, Richmond, Va.

R.M. No. 3, Elevation 8.535 ft, is a chiseled triangle on inshore edge of second circular ledge at top of left, downstream pier, 43 ft downstream and in line with instream side of gage house.

R.M. No. 4, Elevation 12.42 ft, is ½" bolt located in the upstream shoreward corner of gage house.

CHANNEL AND CONTROL. – Control is a rocky ledge about 50 ft below gage. Control is clean, fairly permanent, and not affected by ice except during cold winters.

DISCHARGE MEASUREMENTS. – The measuring section for medium and high-water is upstream side of concrete bridge on US Highway 522, 0.7 miles downstream from gage. Initial point for soundings is the end of the concrete guardrail, left bank. Bridge marked with paint at 10-ft intervals 400 ft wide. Wading measurements may be made in the vicinity of gage or 400 – 1000 ft downstream. Bed of stream composed mostly of clean, shifting sand. One channel at all stages broken by two piers. Flow smooth with moderate velocities. Channel straight for 300 ft above and 500 ft below. Both banks above and below cultivated and subject to overflow at a stage of about 12 ft; however, due to highway fill, all flow will pass under bridge except at extremely high stages. Measurements in general should be good.

FLOODS. – Maximum discharge, 59,300 cfs, June 28, 1995, gage height 30.40 ft. Flood of Oct. 16, 1942 was 58,000 cfs, gage height 30.3 ft. Flood of Apr. 26, 1937, reached a stage of 28.03 ft, discharge 49,400 cfs, from recorder graph. R.S. Somerville, the farmer living near the gage, stated that this flood was 6 ft above 1889 flood, 4 ½ ft above 1893 flood, and 3 ft above 1901 flood, based on memory marks on an old tree near his house, marks now obscure.

POINT OF ZERO FLOW.— Determined to be at gage height 0.0 ft ∀ 0.1 ft on Aug. 30, 1943 and –0.52 ft ∀0.1 on August 9, 1999. –0.43 ± .10 August 26,2002

WINTER FLOW.— Stage-discharge relation is affected by ice during cold winters.

REGULATION AND DIVERSION.— Low-water flow regulated by operation of mill at Rapidan in prior years. Agricultural irrigation at times.

ACCURACY.— Records are generally good.

COOPERATION.— NWS# 540-825-0969. Real time data at USGS home page (http://waterdata.usgs.gov)

SKETCH AND MAPS.— See attached.

PHOTOGRAPHS. – N\A

OBSERVER/ LANDOWNERS. Current Landowners, John and Cindy Grano Ph. 540-825-9586. Farm manager, Walker Somerville. Land owner across road E.V. Baker.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Station Number: 01664000

Description Updated: 4-8-2004

By: K.M. Dydak

DESCRIPTION OF GAGING STATION ON: Rappahannock River at Remington, Va.

LOCATION.--Lat 38°31'50", long 77°48'50", Fauquier County, Hydrologic Unit 02080103, on left bank 80 feet upstream from bridge on alternate U.S. Highway 29, at Remington, 0.3 mile upstream from Tinpot Run, 0.4 mile downstream from Ruffans Run, 2.5 miles downstream from Hazel River, at mile 35.2.

To reach station from intersection of U.S. Highway 17 and 28 near Bealeton, turn left from 17N onto 28 and drive 2.3 miles to U.S. Route 15/29. Turn left onto southbound 15/29. Follow 0.3 miles and turn left onto

Bus. 15/29 S. Follow 2.1 miles through town of Remington, to gage on right.

Gage is 85 miles from the Virginia District office.

DRAINAGE AREA. --620 square miles.

ESTABLISHMENT. --Wire-weight Oct. 29, 1942, by C. A. Shepherd, P. N. Shackelford, and M. S. Berry. Continuous recorder Nov. 21, 1951, by W. G. Bonham.

GAGE. –Sutron 8210 EDL with GOES radio transmitter with 15-minute record interval, and a transmitter operated by the National Weather Service, in a 6-foot square concrete house and well 42 feet high. Inside staff gage is enameled sections 0.25 to 32.90 feet attached to 2" x 6" timber bedpiece bolted to well, is standard reference gage. The outside gage is a wire-weight gage on downstream side of the bridge, check bar elevation is 33.04 feet. The intakes are 2" galvanized pipe. The bottom intake is 36 feet long and is equipped with a 2" riser for flushing. The top intake is 30 feet long and is equipped with a 2" riser for flushing. Water for flushing is lifted to a flushing tank by a deep well cylinder pump.

Elevation of gage features are as follows:

Bottom of well	-0.3 foot
Bottom intake	1.60 feet
Top intake	3.40 feet
Bottom well door	16.0 feet
House floor	34.0 feet
Instrument shelf	37.5 feet
Top of house	42.0 feet

Datum of gage is 252.53 feet National Geodetic Vertical Datum of 1929, Culpeper supplementary adjustment of 1943.

HISTORY. -A gaging station was operated on Rappahannock River at Kellys Ford, Va. about 4 miles downstream from Remington from February 1925 to December 1951.

REFERENCE AND BENCH MARKS. --

RM #2, elevation 19.305 feet, is chiseled square on flat ledge of large rock 18 feet inshore from downstream pier on left bank.

RM #3, elevation 17.506 feet, is head of 3/8" diameter bolt set horizontal in streamward face of well, downstream edge, 1 ft above cleanout sill.

CHANNEL AND CONTROL. --Main channel at gage is about 150 feet wide. Right bank is flat and subject to overflow at a gage height of about 8 feet. Left bank rises sharply to a gage height of about 12 feet, after which it is flat for about forty feet and then rises sharply to a gage height of about 32 feet. Channel is straight for about 800 feet below gage. Trees along both banks above and below gage. The upstream channel is a long sweeping bend in the river. Shifting is negligible based on discharge measurements. One channel at all stages. The control is a rock ledge about 400 feet downstream from gage for stages up to about gage height of 5 feet. Control is clear and permanent. High water control is channel. Railroad bridge about 350 feet wide with 3 supporting piers located about 450 feet downstream from gage may have some controlling effect for extremely high stages. Since establishment of the recording gage in November 1951, the highway bridge opening and approach probably acts as the control at high stages.

DISCHARGE MEASUREMENTS. --Wading measurements are made 1,600 feet below gage. To reach wading section walk on left bank, wade just above Tinpot Run. Maximum wading stage is about 3.6 feet. High-water measurements are made from upstream side of southbound US Rt 29 bridge, located 2,000 feet above gage. Initial point is edge of left concrete abutments. Bridge is marked with paint at 10-foot intervals.

FLOODS. -1942-80: Maximum discharge, 90,000 cfs Oct. 16, 1942 (gage height, 30.0 feet). Maximum flood since at least 1828, that of Oct. 16, 1942.

POINT OF ZERO FLOW.--1.7 ± 0.1 foot Oct. 24, 1951. Permanent with minor shifts.

WINTER FLOW.--Stage-discharge relation is effected by ice during very cold winters.

REGULATION AND DIVERSION.--Low flow partly regulated by mills above station. No diversion.

ACCURACY.--Stage-discharge relationship is fairly permanent. Measuring conditions are generally good. Records are generally considered good.

COOPERATION.--U.S. Army Corps of Engineers, Norfolk, Va.

PHOTOGRAPHS.--See files.

WATER QUALITY

PERIOD OF RECORD.--Daily record April 1951 to current year.

EQUIPMENT AND SAMPLING.--

REMARKS.--

JOB HAZARD ANALYSIS FOR STATION 01664000

RAPPAHANNOCK RIVER AT REMINGTON, VA

PREPARED BY: DATE: 4/12/2002	REVIEWED BY: DATE:	Recommended Protective Clothing and Equipment: Personal flotation device, orange safety vest, hip boots/waders, foul weather gear, appropriate clothing for climatic conditions, insect repellent, sunscreen, first aid kit, cell phone, disinfectant, highway signs, and orange cones.
APPROVED BY:	TITLE (First line supervisor)	Date
APPROVED BY:	TITLE (Second line Supervisor)	Date

Sequence of Basic Steps	**Potential Accidents/ Hazards**	**Recommended Safe Job Procedures**
Driving to site	Vehicle traffic	Stay current with defensive driving recommendations. Make sure vehicle is in proper working condition. Reduce speed when weather conditions dictate. Be alert to other vehicular traffic.
Arriving at site	Vehicle traffic on road or bridge	Safe parking for a wading measurement is on the left upstream bank adjacent to the gage. The high water discharge measurement is from the upstream side of southbound 29, and requires that you park on the bridge shoulder. Turn on strobe safety light on field vehicle. Watch out for other traffic, traffic is **heavy** on 29. Be aware of current bridge safety plan as required.
Unloading/ setting up equipment	Pinching fingers, smashing fingers or toes, and back strain	Be aware of hand/foot placement, wear protective footwear as needed, use proper lifting technique, do not rush actions.

Making discharge measurement from bridge	Vehicle traffic	**Bridge Site type is SE.** 'Road Work Ahead' and 'Shoulder Closed' signs should be placed along right shoulder of road. Park on bridge facing south. Place cones behind truck and along bridge according to bridge safety plan.
	Falling over bridge	Wear PFD, do not lean over bridge
Bridge measurement (cont)	Floating or submerged debris	Be alert to debris, have cutters ready if sounding cable needs to be cut.
Making wading discharge measurement	Entering the stream, floating or submerged debris, drowning, soft streambed	Wear PFD. The wading section at Remington is either on the control, just upstream of the railroad bridge one-quarter mile downstream of the gage, or farther downstream (just above Tinpot Run on the left bank). Use caution descending the rocky path from the road, and going down stream bank into water. Be careful of foot placement along bank and in stream. Beware of any floating debris, overhanging tree branches, etc. **Do not** attempt the measurement if conditions are such that you cannot safely enter and exit the stream.
Reloading equipment	Pinching fingers, smashing fingers or toes, and back strain	Be aware of hand/foot placement, wear protective footwear as needed, use proper lifting technique, do not rush actions
Returning to Office	Vehicle traffic	Stay current with defensive driving recommendations. Make sure vehicle is in proper working condition. Reduce speed when weather conditions dictate. Be alert other vehicular traffic.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 05/13/69

By: P.N. Schackelford

Revised: D.W. Henry, 05/02/91

Updated: J. K. Lambert 4/12/04

Description of Gaging Station **# 01666500 Robinson River Near Locust Dale, Virgina.**

LOCATION.-- Lat 38°19'30", long 78°05'45", on right bank 100 ft upstream from bridge on State Highway 614, 1.1 miles upstream from Great Run, 1.7 miles upstream from mouth and 2.0 miles southeast of Locust Dale, Madison County, and 3.4 miles downstream from Crooked Run.

Station reached by driving north on US Highway 15 to Locust Dale, turn right on State Highway 614 and go 2.0 miles to bridge and station.

ESTABLISHMENT.—Established July 29, 1943, by J.S. Cragwall, Jr.

DRAINAGE AREA.—179 square miles (revised).

GAGE.— DCP recorder system in 5 ft concrete well.

Inside staff gage, enamel sections 0.0 to 19.5 ft attached to 2"x6" timber bed piece on streamward side of well, is a standard reference gage.

The outside gage is enamel sections, 11.4 to 23.7 ft, attached to the inshore, upstream corner of the gage house. The intakes are of 2" pipe. Ten foot of 1½ -inch plastic pipe as siphon tube in

lower intake and 1-inch plastic pipe as siphon tube inside upper intake enables upper intake to work to about 1.5 foot. The bottom intake is 22 ft long and equipped with 2" riser for flushing. Water for flushing is lifted by a deep well cylinder pump.

Datum of gage is 283.70 ft above mean sea level, datum of 1929, Culpeper supplementary adjustment of 1943.

Elevations are as follows:

IG RP	26.89ft
Bottom of well	-0.8 ft
Bottom of intake (flow line)	1.0 ft
Top of intake (flow line)	3.0 ft
Bottom of well door	12.2 ft
House floor	23.5 ft
Instrument shelf	26.5 ft
Top of house	30.0 ft
RP	24.355ft

HISTORY.—Gaging station has been in operation on Rapidan River near Culpeper, Va. since November 16, 1930, and Rapidan River near Ruckersville, Va., since Sept. 5, 1942.

REFERENCE AND BENCH MARKS. – R.M. No. 3, Elevation 13.258 ft, top of nut on bolt that is set in landward side of well, downstream side of clean out door and about 2 ft above ground.

REFERENCE AND BENCH MARKS - Continued

R.M. No. 4, Elevation 15.523 ft, (temporary) nail in streamward side of 24" oak tree (1' from base) located 13 ft upstream and 30 ft inshore from upstream, inshore corner of gage house. Same tree that R.M. No. 1 was located on (grown over).

R.M. No. 5, Elevation 22.023 ft, chiseled square on upstream, in stream corner of right upstream concrete bridge abutment. Established 02/16/84.

R.M. No. 6, Elevation 19.435 ft, chiseled square on upstream, shoreward corner of left upstream concrete bridge abutment. Established 02/16/84.

R.P. elevation 24.355ft chiseled v on upstream side of bridge.

CHANNEL AND CONTROL. – Low control is located 100 ft downstream from gage at low stages and is rock ledge. At higher stages an island, 1,400 ft downstream, becomes the point of control as the low control will be submerged. Low-water control is clean, permanent, not subject to vegetation growth, but probably liable to ice formation in extremely cold weather. The island is sand and gravel deposit covered with small trees and brush. High-water control is channel with bankfull at 12 ft ∀. Left bank overflow passes over highway at about 16 ft stage. Highway bridge, just downstream of low control is subject to collecting debris, thus causing numerous negative shifts to rating.

DISCHARGE MEASUREMENTS. – Low water measurements are made by wading 200 – 1000 ft above gage. Medium and high-water measuring section is downstream side of highway bridge. Initial point is at edge of left abutment. Bridge is marked with paint stripe at 5 ft intervals.

FLOODS. – Flood of October 15, 1942, reached a gage height of 23.9 ft, discharge about 44,000 cfs based on a paint mark placed on bridge truss by a Mr. Mahames who lives in house on left bank, and in sight of bridge. June 22, 1972, gage height, 20.92 ft (discharge 24,500 cfs). June 27, 1995 gage height 22.93ft discharge 25,400cfs. Sept. 6, 1996 gage height 23.92ft discharge 22,100cfs.

POINT OF ZERO FLOW.— Determined July 16, 1943, to be 0.3 ft by sounding on left channel control. Oct. 4, 1990 zero = .04 ft ∀.10 ft. Minimum 1.2 cfs, Sept. 7, 13, 1954; minimum daily 1.8 cfs, Sept. 13, 27, 1954. August 9, 1999 .82ft. August 26,2002 0.64ft.

WINTER FLOW.— Stage-discharge relation affected by ice in extremely cold weather.

REGULATION AND DIVERSION.— Low flow regulated by power plant about 11 miles above station and at Banco Mills about 14 miles above station in prior years.

ACCURACY.— Good.

COOPERATION.— Real time data at USGS home page (http://waterdata.usgs.gov)

SKETCH AND MAPS.— See attached topo map.

PHOTOGRAPHS. – See attached photograph.

OBSERVER.—N\A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 05/12/60

By: P.N. Shackelford

Revised: D.W. Henry, 05/25/89

D. A. Nissen 03/23/05

Description of Gaging Station **#01628500 South Fork Shenandoah River near Lynwood, Virginia**

LOCATION.-- Lat 38°19'21", long 78°45'18", Rockingham County, on left bank 1.2 miles northeast of Lynwood and 3.3 miles downstream from confluence of North and South Rivers.

To reach station from Grottoes, drive 3 miles north on US Highway 340 to State Highway 708, turn left and drive 1.6 miles, past river to intersection with State Highway 655, turn right and drive 0.4 miles to farm entrance on the right.

To reach station from Elkton, drive south on US Highway 340 for 12 miles to intersection with State Highway 708 turn right and drive 1.6 miles, past river to intersection with State Highway 655, turn right and drive 0.4 miles to farm entrance on the right.

See attached sketch and maps for farm route to gage house and routes to gage from other locations. (Maple Lane Farm – Tom Kegley).

ESTABLISHMENT.—Established Sept. 14, 1930 by J.J. Dirzulaitis.

DRAINAGE AREA.—1,084 square miles.

GAGE. —DCP recorder system 15 minute readings installed August 2004 in a 36 ft concrete gage house on left bank. National Weather Service operates B.D.T. and rain gage at gage. For readings phone:

Leo Harrison	(301) 763-8271
Eleanor Merkle	(301) 899-3155
Drainage Area Recording	(202) 899-7378

Range of stage is 0.6 ft to 31-ft ±. Inside staff gage with enameled sections (.40 to 20.30 ft) is fastened to a 2"x6" board secured to the inside wall of well. A steel tape with an 8-inch float activates the recorder set to the inside staff gage (base gage) with integral tape pointer gage. Maximum and minimum indicator clips are attached to this steal tape. Reference point established on shelf at elevation 31.82-ft for inside gage height check. Outside slope gage graduated to tenths of a foot secured to concrete pier at water's edge and upstream side of gage house.

Intakes and flushing equipment are as follows: two 2-inch intakes (elevations 1.1 and 4.6 ft), equipped with 2-inch gage valves, 2-inch riser pipes to flushing tank under house shelf, and valve stems. Flushing pump is lift type with 1 ¼" pipe extension in well.

Datum of gage is 1,013.17 ft above National Geodetic Vertical Datum of 1929.

GAGE. —Continued

Elevations are as follows:

IGRP	31.82 ft
Top of well	31.0 ft
Upper intake	4.6 ft
Lower intake	1.1 ft
Bottom of well	0.4 ft

HISTORY — The present recording gage was started in use September 1930. The datum and location has remained the same for the period of record.

At a site 42.3 miles downstream, S.F. Shenandoah River near Luray (01629500) has been operated as a continuous recording gage since June 1979 and previously from October 1938 to September 1951. The sum of records for upstream recording stations, North River near Burketown (01622000), and South River at Harriston (01627500) approximate flow at Lynwood

REFERENCE AND BENCHMARKS – R.M. No. 1, Elevation 14.61 ft, top of bolt cemented in landing of old steps, at the inshore, downstream corner.

R.M. No.5, Elevation 25.42ft Top of bolt set in concrete pier 79.5ft shoreward of upstream shoreward side of gage just inside of cedar thicket at ground level.

R.M. No 7, Elevation 21.255ft Chiseled square on limestone out crop painted orange 38ft downstream and 63ft shoreward of downstream shoreward corner of gage house, also 75ft downstream and shoreward on the hypotenuse of the above triangle.

R.M. No 8, Elevation 20.89ft Chiseled square on limestone outcrop painted orange 35ft downstream and 64ft shoreward of downstream shoreward corner of gage house. Also 73ft downstream and shoreward on the hypotenuse of the triangle and 3 ft upstream of R.M. No. 7

CHANNEL AND CONTROL. – One channel at all times with flow smooth and moderate. Gage is located in a slight bend in the river. Stream bed is a series of rock ledges, running widthwise across gage pool with some sand. Control is a rock ledge approximately 600 ft ∀ downstream from gage. Probably permanent, although subject to having an accumulation of algae and aquatic growth during low summer flows. Both banks are subject to overflow during high stages with the left bank being clear pasture land and right bank being lined with trees.

DISCHARGE MEASUREMENTS. – Wading measurements can be made up to a gage height of 3.44 ft ± at points 1,500 – 1,700 ft upstream of gage. Caution has to be exercised as footing on ledge rock is not the best in mid-stream. Also wading measurements can be made .9 mi. above gage, 200ft downstream from Rt. 708 bridge during low flow. Medium and high water can be measured from cable located 200 ft upstream from the gage. Cable way consists of 1 1/8" tramway cable, span 800 ft, supported at both ends by standard 30-ft steel towers equipped with steel ladders and landing platforms.

Cable is anchored to a 4'x4'x7' reinforced concrete block buried in ground on the right bank (6 cubic yards added May 9, 1956) and 4'x3 ½'x6' reinforced concrete block buried in the concrete. Cable is marked off with paint strips every 10 ft. Cable car is stand-up metal follower brake type with end mounting for sounding reel.

High water measurements can also be made from Rt. 708 bridge located 1.06 miles upstream of gage. Water starts to overflow bridge approach along the right bank at gage height of 17 ft±.

DISCHARGE MEASUREMENTS. –Continued

Flow is fast and depths in mid-channel are somewhat deep. Angles are also encountered although carefully made measurements plot well after storage adjustments at high stages. Lower

Levis Run enters the river between bridge and gage on the Right Bank, but its flow is negligible at high stages.

FLOODS. – Maximum stage since at least 1870, September 7, 1996 gage height of 30.84 ft from flood marks with a maximum discharge of 107,000 cfs.

Oct. 15, 1942	27.20 ft	80,000 cfs
Mar. 18, 1936	26.57 ft	77,000 cfs
June 18, 1949	23.60 ft	53,600 cfs
June 22, 1972	23.45 ft	50,700 cfs
Nov. 05, 1985	29.46 ft	95,100 cfs

POINT OF ZERO FLOWS. — 0.78ft on Sept. 19, 2002. Minimum flow, 32 cfs, Sept. 20, 1932, gage height 1.63 ft, minimum daily 93 cfs, Sept. 21, 29, 1930. Diurnal fluctuation at low flow prior to 1960 caused by mill at Lynwood. Oct. 13, 1998 0.68, Dec. 7, 1998 .71

WINTER FLOW. — Stage-discharge relation is affected by ice during extremely cold winters.

REGULATION AND DIVERSION. None since 1960.

ACCURACY. — Records good at all stages.

COOPERATION — NWS #540-249-4676, IFLOWS (www.afws.net) Real time data at USGS home page (va.water.usgs.gov)

SKETCH AND MAPS — Attached

PHOTOGRAPHS. – See attached photograph.

OBSERVER.—N\A

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Station Number: 01631000

Description Updated: 2/27/03

By: S.L.Wheeler

DESCRIPTION OF GAGING STATION ON: South Fork Shenandoah River at Front Royal, VA.

LOCATION.-- Lat 38°54'50", long 78°12'40", on left bank 0.7 mile downstream from bridge on State Highway 619 1.0 mile west of Front Royal, Warren County, and 3.5 miles upstream from confluence with North Fork of Shenandoah river.

To reach station from Front Royal drive southwest from Main Street on State Highway 340 to intersection with State Highway 619, turn right and continue across the bridge, turn right on RT 679 and proceed 0.7 mile to gage.

ESTABLISHMENT. --By J. J. Dirzulaitis and H. C. Eagle on Sept. 21, 1930; a non-recording station was operated at site one mile upstream from June 1899 to July 1906.

DRAINAGE AREA. --1,642 square miles (revised)

GAGE. --CR10X data logger and shaft encoder, replaced with Sutron 8210 w/satlink on June 19,2002 @1115 and transmitter operated by U. S. Weather Service, in a 46-foot concrete gage house on left bank 20 feet below the old highway bridge (now

removed); present recorder range in stage from -1.5 to 37.9 feet. Top and bottom of well in gage house are at gage heights 36.5 and -1.5 feet respectively. Inside staff gage consists of enameled gage sections (0.0 - -13.5 ft) fastened to 2"x 6" board anchored in concrete wall of gage house; outside gage consists of enameled sections fastened to old bridge pier and to gage house. Intakes and flushing equipment are as follows: Two 2-inch intakes (top of intakes at elevations -0.6 and 4.7 feet) both equipped with 2-inch gate valves and valve stems and 2-inch riser pipes to flushing tank underneath shelf. Flushing pump is lift type with 1 1/4-inch pipe extension in well.

HISTORY. --

REFERENCE MARKS. --

RM #1, 2, and 3 are destroyed.

RM #4, elevation 472.190 feet is a chiseled square in concrete boat landing extending into the river from the right bank. (Gage datum = 2.81 ft.).

RM #5, elevation 472.977 feet, is a chiseled square in the concrete footing for the former bridge and is on the left bank at the water edge next to the outside staff. (Gage datum = 3.597 ft.).

RM #6, elevation 478.669 feet, is a nut on the lowest bracket holding the gage house ladder and is painted orange. (Gage datum = 9.289 ft.).

RM #7 is a lag bolt in a 24-inch sycamore tree, 40 feet inshore and 20 feet upstream of gage (Gage datum = 10.555 ft.).

DATUM OF GAGE.--469.38 feet above mean sea level, datum of 1929, as determined by closed line of levels (error of -0.005 foot) by U. S. Geological Survey, Water Resources Branch, on Dec. 29, 1936, from the following bench mark of the Norfolk & Western Railway. Front Royal, on E. side of S. abutment of bridge No. 657, 10 feet right of station 9362 + 83.4; chiseled marked (N. & W. R.R. B. M.). Elevation is

479.89 feet. U.S.E.D. Bronze Tablet No. 336 was checked in the level run and found to be at elevation 492.01 feet above mean sea level, datum of 1929.

CONTROL. --Control is a rock ledge about 200 feet below, not affected by ice except during cold winters. Large backwater effect is created by aquatic growth in summer and fall.

DISCHARGE MEASUREMENTS. --Made from upstream side of RT 619 bridge, 0.7 mile above gage. Bed of stream composed of ledges of rock with some sand and gravel between, clean, and permanent.

One channel at all stages, flow smooth with moderate velocities. Channel below straight for half a mile, flow smooth with series of riffles.

Wading measurements can be made anywhere between the gage and control. Channel above straight for 100 feet, flow smooth with moderate velocities. There are various angles at measuring section. Measurements should be good, except for periods of year when aquatic vegetation takes over the water column.

Right bank is low, fringed with trees, cultivated and subject to overflow.

When the N. F. Shenandoah River is at extreme high stage, there is a backwater effect at the gage.

FLOODS. --Maximum during period of record 34.8 feet Oct. 16, 1942, from flood mark on gage well.

POINT OF ZERO FLOW. ---0.21 + 0.1 Oct. 7, 1943 H.M.T.

WINTER FLOW. --Stage-discharge relation is affected by ice during cold winters.

REGULATION. --Flow at low and medium stages is regulated by operation of power plants above station.

DIVERSIONS. --None.

ACCURACY. --Records are good.

COOPERATION. --U. S. Army Corps of Engineers, Baltimore District.

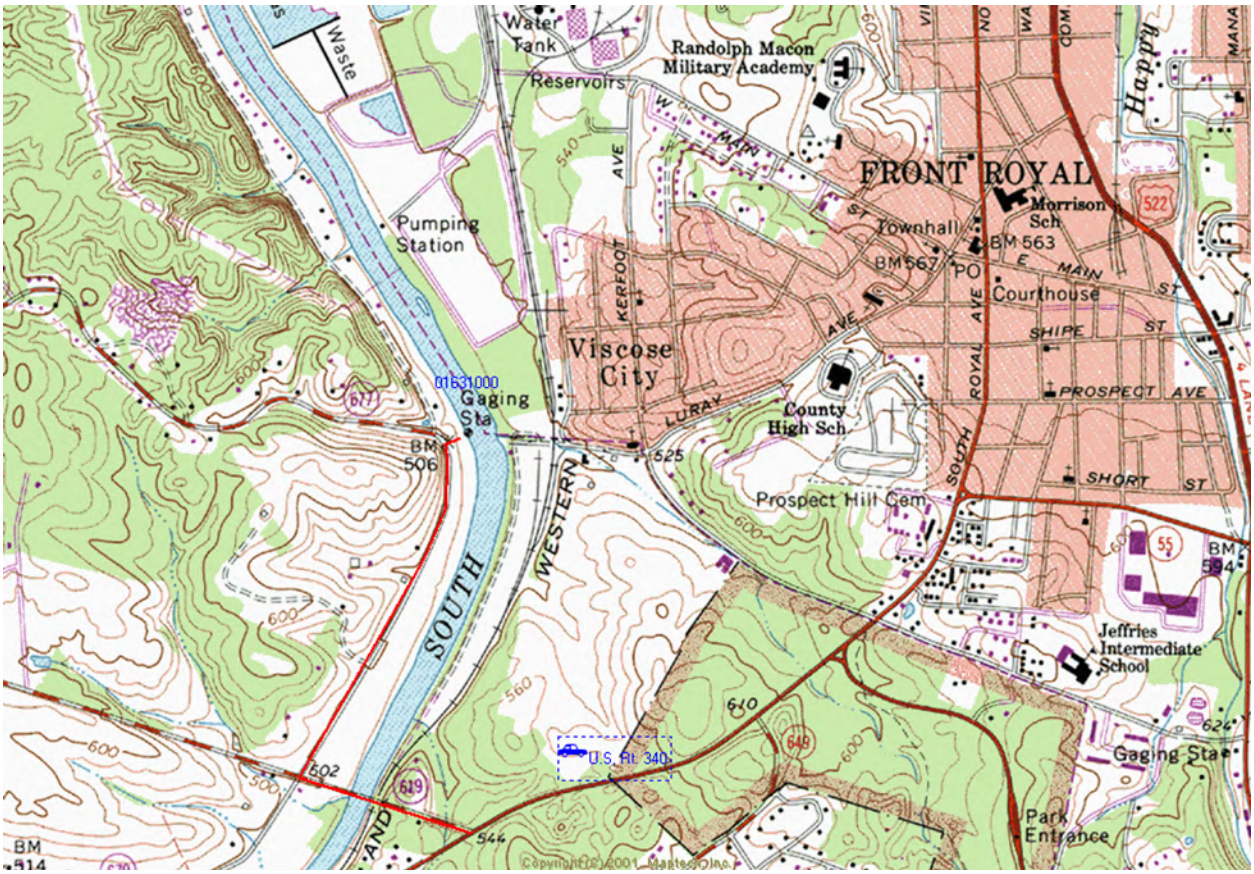
SKETCH. --

PHOTOGRAPHS. –

JOB HAZARD ANALYSIS FOR STATION 01631000 SF SHENANDOAH RIVER AT FRONT ROYAL, VA		
PREPARED BY: **DATE:** 4/12/2002	**REVIEWED BY:** **DATE:**	**Recommended Protective Clothing and Equipment:** Personal flotation device, orange safety vest, hip boots/waders, foul weather gear, appropriate clothing for climatic conditions, insect repellent, sunscreen, first aid kit, cell phone, disinfectant, highway signs, and orange cones.
APPROVED BY:	**TITLE (First line supervisor)**	**Date**
APPROVED BY:	**TITLE (Second line Supervisor)**	**Date**

Sequence of Basic Steps	**Potential Accidents/ Hazards**	**Recommended Safe Job Procedures**
Driving to site	Vehicle traffic	Stay current with defensive driving recommendations. Make sure vehicle is in proper working condition. Reduce speed when weather conditions dictate. Be alert other vehicular traffic.

Arriving at site	Vehicle traffic on road or bridge	Safe parking is available on the gravel shoulder on the right-upstream bank of Route 619 east, at the bridge. Turn on strobe safety light on field vehicle. Traffic is **moderate** here. Watch out for other traffic. Be aware of current bridge safety plan if required.
Unloading/ setting up equipment	Pinching fingers, smashing fingers or toes, and back strain	Be aware of hand/foot placement, wear protective footwear as needed, use proper lifting technique, do not rush actions.
Making discharge measurement from bridge	Vehicle traffic	**Bridge site type is TS2 if using a four-wheel boom, site type SE at all other times.** 'One Lane Bridge Ahead' and 'Flagger 500 FT' signs should be placed facing traffic in both directions. A flagging crew is mandatory if using a four-wheel boom. During routine discharge measurements or qw sampling, arrange signs, cones, and crew according to the bridge safety plan.
	Falling over bridge	Wear PFD and do not lean over bridge.
	Floating or submerged debris	Be alert to debris, have cutters ready if sounding cable needs to be cut.
Making wading discharge measurements		
	Entering the stream, floating or submerged debris, drowning, soft streambed	Wear PFD. Use caution going down stream bank into water. Be careful of foot placement along bank and in stream. Bedrock is **slippery** throughout the year. Be aware of any floating debris. **Do not** attempt the measurement if conditions are such that you cannot safely enter and exit the stream.
Reloading equipment	Pinching fingers, smashing fingers or toes, and back strain	Be aware of hand/foot placement, wear protective footwear as needed, use proper lifting technique, do not rush actions
Returning to Office	Vehicle traffic	Stay current with defensive driving recommendations. Make sure vehicle is in proper working condition. Reduce speed when weather conditions dictate. Be alert other vehicular traffic.



South Fork Shenandoah Gage Location 1

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER RESOURCES PLANNING

SURFACE WATER INVESTIGATIONS

Description Prepared: 05/13/69

By: P.N. Shackelford

Revised: D.W. Henry, 05/01/89

Updated: J. K. Lambert 4/12/04
D.A. Nissen 03/23/05

Description of Gagging Station **#01626000 on South River near Waynesboro, Virginia**

LOCATION -- Lat. 38°03'27", long 78°54'30", on right bank 80 ft downstream from bridge on State Highway 664, 1.3 miles southwest of Waynesboro post office, and 2.4 miles downstream from Back Creek.

To reach gage from I-64, take the Lyndhurst/Waynesboro exit (Rt. 624) at the western bottom of Afton Mt. Drive north on Rt. 624 (Delphine Ave.) for 0.5 miles to first street on the left inside of Waynesboro City limits. Turn left (northwest) and drive 0.4 miles to dead end intersection with Rt. 664 (Lyndhurst Rd.). Turn left (west) and drive 0.4 miles to bridge and gage.

A small subdivision along the right downstream bank was developed in the late 1980's. The land owner adjacent to the gage site is C.T. Kennedy, 100 Brook Ct. 22980, (540) 942-5729.

ESTABLISHMENT.—Established Oct. 1, 1952 by E.M. Miller.

DRAINAGE AREA.—127 square miles, of which 41 square miles are above flood-detention structures.

GAGE. — DCP recorder system 15 minute readings installed July 2004 in a 48-inch diameter corrugated metal pipe well and house, 26 ft high. A steel tape with an 8-inch float activates the recorder set to the inside staff gage (base gage) with integral tape pointer gage. Maximum and minimum indicator clips are attached to this steal tape. Reference point established on shelf at elevation 22.76-ft for inside gage height check. Inside staff gage, enamel sections (0.0 to 22.6 ft) attached to 2"x6" boards attached to well. Outside gage is wire-weight gage, bolted to downstream side of the highway bridge. Check-bar (28.71 ft.) to check inside gage reading set to gage datum.

The gage is equipped with two 2-inch galvanized pipe intakes. The bottom intake is 30-inch in length with 2-inch gage valve and riser pipe to flushing tank. Lift-type flushing pump with pipe extension into well with deep well cylinder.

The top intake is 26 ft in length with no flushing arrangement.

Datum of gage is 1,296.20 ft above National Geodetic Vertical Datum of 1929. Flood monument erected on left bank directly across river from gage on June 2, 1975. Range in stage (8 – 28 ft, gage datum).

Elevations are as follows:

Bottom of well	.2 ft
Bottom intake (flow line)	1.0 ft
Top intake (flow line)	2.0 ft
House floor	19.9 ft
IG RP	22.78ft
Instrument Shelf	22.8 ft
Check Bar	28.71 ft

HISTORY —Stage-discharge relation and twice daily reading at present site were collected during the period 1942 – 1952, but: NOT PUBLISHED. The present recording gage was started October 1952. The datum and location has remained the same for the period of record.

Other gages operated on South River are: 01627500 – South River near Harrison (1968 to current), 01626850 – South River near Dooms (1974-95)

REFERENCE AND BENCHMARKS. – R.M. No. 4, Elevation 15.57 ft, nail driven horizontally in shoreward side of 18-inch locust tree, 5-ft above ground, 20 ft downstream of gage.

R.M. No. 5, Elevation 13.86 ft, chiseled "V" in top of streamward side of metal sewer casing, 10 ft downstream of gage.

R.M. No. 6, Elevation 26.69 ft, chiseled square on top of bridge seat, downstream right bank.

R.M. No. 7, Elevation 30.01 ft, chiseled square on top of wing wall, upstream Right Bank.

CHANNEL AND CONTROL – One channel at all stages. Streambed is composed of rock outcrops with sand and gravel deposits. Channel is straight for 300 ft above and 800 ft below gage. Right bank rises sharply and does not overflow, busy and tree-lined. Left bank is lower and starts to overflow at gage heights of 4 – 4.5 ft. The left bank is smooth lawns except for a few trees along the river's edge.

Control is a bedrock outcrop 100 ft below gage. Control is permanent but subject to slight shifts due to deposit of sand and gravel at times and often algae and leaves.

DISCHARGE MEASUREMENTS. – Low water wading measurements can be made under the downstream edge of bridge up to a gage height of 3.6 ft. Another good wading section is upstream of island about 450 ft upstream of gage or midway on island a good section is where the black walnut tree is located on the left bank about 200 ft upstream of gage. Medium and high-water measurements are made from the downstream side of the highway bridge using sounding weights, 30-C hand line will measure up to a gage height of about 5.2 ft. Total width of bridge opening is 164 ft with 5 ft intervals marked off on the downstream handrail beginning at the left abutment. No angles at the downstream section. All measurements should be good.

Minimum flow- instantaneous, 7.0 cfs, July 18, 1966; Daily 16 cfs 2002

FLOODS. –	Nov. 4, 1985	15.30 ft	17,500 cfs
	Aug. 20, 1969	15.27 ft	17,400 cfs
	Oct. 1942	14.3 ft	14.500 cfs
	June 21, 1972	14.25 ft	14,400 cfs
	August 18, 1955	13.95 ft	13,500 cfs

POINT OF ZERO FLOW.— 1.9ft Sept. 5, 1997. 1.76ft June 14, 2002

WINTER FLOW.— Stage-discharge relation is affected by ice during extreme cold.

REGULATION AND DIVERSION.— About 1.8 cfs from Coles Run Reservoir, capacity 80,000,000 gallons, Augusta County Service Authority for industrial and municipal use, at a point 13.8 miles upstream of station.

ACCURACY.— Records should be good.

COOPERATION.— NWS phone No. 540-943-7605. IFLOWS (www.afws.net) Real time data at USGS (va.water.usgs.gov.) City of Waynesboro – Beth Lohman 540-942-6629

SKETCH AND MAPS.— Attached

PHOTOGRAPHS. – See attached photograph.

OBSERVER.—N\A

Station Description View

02024752 JAMES RIVER AT BLUE RIDGE PKWY NR BIG ISLAND, VA

Responsible Office
U.S. Geological Survey
VA Department of Environmental Quality

Most recent revision: 6/30/2011
Revised by: jrguyer

LOCATION.--Lat 37°33'19", long 79°22'03" referenced to North American Datum of 1927, Amherst County, VA, Hydrologic Unit 02080203, on downstream side of Blue Ridge Parkway bridge, 150 ft from left bank, 1.5 mi northwest of Big Island, and 7.9 mi southeast of Glasgow.

DRAINAGE AREA.--3,076 mi^2.

ESTABLISHMENT AND HISTORY.--

GAGE.--Sutron Satlink DCP with 15-minute record interval connected to a pressure transducer in a .....

Datum of gage is 600.80 ft NGVD of 1929.

DCP transmission parameters:

```
DCP ID:      17F4F440
Channel:     153 (Random 127)
TX Time:     00:58:30
TX Interval: 01:00:00
TX Window:   00:00:10
```

CONTROL.--

DISCHARGE MEASUREMENTS.--

FLOODS.--

POINT OR GAGE HEIGHT OF ZERO FLOW.--

WINTER FLOW.--

REGULATION AND DIVERSIONS.--

REFERENCE MARKS.--

DATE OF LAST LEVELS.--
Last run: UNKNOWN; Frequency: UNKNOWN; Status: OPEN

Station Description View

02034000 RIVANNA RIVER AT PALMYRA, VA

Responsible Office
U.S. Geological Survey
VA Department of Environmental Quality

Most recent revision: 8/1/2006
Revised by: S.L. Wheeler

LOCATION.--Lat 37°51'28", long 78°15'58" referenced to North American Datum of 1927, Fluvanna County, VA, Hydrologic Unit 02080204, on left bank 300 ft upstream from bridge on U.S. Highway 15 at Palmyra, 0.5 mi upstream from Cunningham Creek, and 15 mi upstream from mouth.

ROAD LOG.--To reach gage from Charlottesville, take Route 20 to Route 53, turn left on Route 53 and stay on Route 53 until Route 15, turn left on Route 15, and cross the bridge to the gage.

DRAINAGE AREA.--663 mi^2.

ESTABLISHMENT AND HISTORY.--Established May 11, 1934 by T.F. Hanly. Prior to October 24, 1942 the gage was located 200 ft downstream at the same datum. October 24, 1942 to December 18, 1947 a non-recording gage was located 10 ft downstream at the same datum.

GAGE.--Sutron Satlink DCP with 15-minute record interval connected to a shaft encoder and float system, and National Weather Service gage-height telemeter equipment (804-457-4561), in a 49-ft concrete house. Range in stage 0.0 to 44.5 ft. Intakes and flushing equipment are as follows: two 3-inch intakes (both intakes have static tubes), equipped with 2-inch gate valves and valve stems and 2-inch riser pipes to flushing tank underneath shelf. Flushing pump is lift-type with 1 1/4 inch pipe extension in well.

Inside staff gage consists of enameled staff gage sections, 0.0 to 23.7 ft fastened to 2"x6" board embedded in concrete wall of gage house.

Outside check gages consist of wire-weight gage (Check bar elevation: 44.45 ft) on upstream side of highway bridge, and enameled staff gage sections 17.0 to 40.7 fastened to 2"x6" board bolted and cinch-anchored to upstream, instream corner of gage house.

Datum of gage is 210.39 ft NGVD of 1929, Culpeper supplementary adjustment of 1943.

Well Elevations:

Lower intake	1.2 ft
Upper intake	2.5 ft
Bottom of well	0.0 ft
Top of well	42.0 ft
Check bar elevation	44.45 ft

DCP transmission parameters:

DCP ID:	DDC92521E
TX Channel:	149 (Random 115)
TX Time:	00:52:20
TX Interval:	01:00:00
TX Window:	00:00:10

CONTROL.--Control located about 50 feet below gage consists of footing and mud silts to old dam, and is subject to shifts. One channel at all stages. Small stream enters from below the gage and just above the control. Channel is straight above gage for 250 ft and straight below for 250 ft. Flow is smooth. Some angle on one side at all stages. Both banks wooded above and below, subject to overflow for short distances.

DISCHARGE MEASUREMENTS.--High-water measurements made from upstream side of Highway Bridge; bridge marked off in 10 ft sections, initial point for soundings is right end of upstream guard rail. Wading measurements are generally made in vicinity of control. Bed of river composed of sand, which shifts often. Measurements are good.

FLOODS.--
Flood of Sept. 16, 1942; gage height, 36.50 ft; discharge, 78,000 cfs.
Flood of Aug. 20, 1969; gage height, 39.85 ft; discharge, 86,000 cfs.

POINT OR GAGE HEIGHT OF ZERO FLOW.--
1.08 ft: Aug. 10, 1999

WINTER FLOW.--Stage-discharge relation is affected by ice during cold winters.

REGULATION AND DIVERSIONS.--N/A

ACCURACY.--Records are generally good.

REFERENCE MARKS.--
R.M. Nos.1, 2 and 4 unable to locate or destroyed.

R.M. No. 3, Elevation 41.49 ft., is a chiseled square in the left end of the upstream concrete wheel guard of the highway bridge.

R.M. No. 5, Elevation 10.37 ft, is threaded end of 1/2 inch bolt anchored with cinch anchors in upstream pier 9 feet downstream and 30 feet instream from gage house.

R.M. No. 6, Elevation 32.31 ft. is a lag screw located in a power pole 70 ft. upstream from edge of road, (Rt. 15) 100ft. shoreward from stream

Wire-weight check Bar: Elevation 44.45 (Reset 04/26/01)

LAND OWNERSHIP.--None/landowner at parking site is Ms. Judy Michaels. (434-589-5572)

DATE OF LAST LEVELS.--
Last run: UNKNOWN; Frequency: UNKNOWN; Status: OPEN

APPENDIX C: ENTERING QA/QC INFORMATION INTO WQM

Revised 03/28/2022

QA/QC CHECKLIST FOR WQM

The *WQMSOP Appendix D* contains screenshots of the process for establishing QA/QC runs in CEDS.

Note: If problems occur during data entry use the call list on the next page to attempt to identify the cause and find a solution.

1. In Run Schedule create a QA/QC run with the required QA samples.
    a. Duplicates: containers numbers 11-19. Blank/Dup designation should be S2.
    b. Equipment blanks: container numbers 21-29. Blank/Dup designation of EB.

If the QA/QC run already exists, search for the run and click on the Edit Items button and change the station ID to the station where the QA/QC samples will be collected, and the station order to match the station order in the regular run and Save.

2. Search for the Routine Run ID (e.g. NCBNTTA1).
3. Click on Schedule Run button and enter date the Run will be collected.
    a. Change Blank/Dup designation for the station where duplicates will be collected from R to S1 for containers 1-9 (the Blank/Dup designations may also be changed in the Field data screen).
4. Under the station where the QAQC will be collected click on the Merge QA/QC Run button.
    b. In the pop-up enter the name of the QAQC run to be merged and save.
5. In Field Data Screen enter sample time and field data.
    a. If you have not already done so, click on the Samples button, the Edit button for each container collected and change Blank/Dup from R to S1 for containers 1-9 at the station chosen for QA/QC.

Note: Ensure that the container numbers for QA samples follow the guidelines from the below table from *WQMSOP Section 2.4.1.*

Example: A station requires TNUTL and IONTR samples along with replicates and equipment blanks. The following table illustrates acceptable values for sample tags.

	Replicates		**Blanks**
Blank/Dups field:	S1	S2	EB
TNUTL **container #**	1	11	21
IONTR **container #**	2	12	22

CALL LIST FOR SAMPLE RELATED ISSUES

Updated April 2024

This is a list of persons, listed in order of priority, to call for help to the listed problems.

EMERGENCY LABORATORY SERVICES (all area code 804)

- After Hours Emergency Services Officer
  - 804-335-4617 (cell phone)
- Shane Wyatt – DCLS Director, Laboratory Operations & DEQ Coordinator
  - 804-648-4480x152
  - 371-7973 (fax)
  - shane.wyatt@dgs.virginia.gov

ROUTINE SAMPLE DELIVERY PROBLEMS

Cindy Johnson	804-659-2653	804-334-7590 (C)	
Roger Stewart	804-659-1384	804-370-8043 (C)	
Tish Robertson	804-659-1295		
Meighan Wisswell	571-866-6494		
Terri Harper-DCLS	804-648-4480 ext. 140		FAX 804-786-4270
Elaine Mason-DCLS	804-648-4480 ext. 138		

PROBLEMS SPECIFIC TO DATA TRANSFER

Cindy Johnson	804-659-2653*	804-334-7590 (C)	
Roger Stewart	804-659-1384*	804-370-8043 (C)	
Tish Robertson	804-659-1295*	804-212-2253 (H)	
Meighan Wisswell	571-866-6494*		
DEQ Help Desk	804-698-4100		
D. Scott Wagner	804-698-4548 takes care of FTP site.		

* Can perform manual download of WQM data to ship to DCLS.

SAMPLE COLLECTION INFORMATION & SCHEDULING WITH DCLS

These numbers are provided for non-routine sample collection and scheduling. Please make certain when scheduling bacteria samples that you confirm that one of the following persons know when and how many samples will be arriving and what services will be requested.

Cindy Johnson- DCLS liaison & Bay Program monitoring coordinator

- Cindy.johnson@deq.virginia.gov
- 804-659-2653 (O)
- 804-334-7590 (C)

Shane Wyatt – Director, Laboratory Operations & DEQ Coordinator

- shane.wyatt@dgs.virginia.gov
- 804-648-4480 x152

Bailey Davis - Inorganic Chemistry and Water Microbiology Group Manager
(Bacteria sample scheduling only)

- Bailey.davis@dgs.virginia.gov
- 804-648-4480 x320 mailto:

ORDERING SAMPLE KITS AND CONTAINERS

Terri Harper, SSS Group Manager

- 804-648-4480 ext. 140
- FAX 804-786-4270

Mattie Jones, DCLS Customer Service Support Technician

- 804-648-4480 ext. 104

ORDERING CLEAN METALS KITS

David Gulick

- David.gulick@dgs.virginia.gov
- 804-648-4480 x 354

COURIER SERVICE

Terri Harper, SSS Group Manager

- 804-648-4480 ext. 140
- FAX 804-786-4270

PRIORITY CODES

Every priority code other than the standard 7 (the usual turnaround time (TAT), as listed in the catalog of services) has a cost multiplier associated with it.

Code 7 – standard TAT, listed price

Code 6 – Chain of custody, standard TAT, listed price

Code 5 – ½ standard TAT, 1.5 X listed price

Code 4 – 7 day TAT, 2 X listed price

Code 2 – Chain of Custody for samples that will likely be used for litigation, standard TAT 1.1 X listed price.

Code 1 – Emergency sample. Pricing will be determined after completion of analysis. Since this requires lab employees to work around the clock to complete the analysis, these samples must be approved by a RD or agency director.

Bear in mind that timed analysis (BOD_5) cannot be run any faster and samples requiring immediate analysis (bacteria) will be done immediately anyway.

DIRECTIONS TO DCLS

DCLS is located at

600 North 5th Street

Richmond, VA 23219

NOTE: Temporary parking is available for sample delivery at the DCLS loading dock/sample receiving at 600 North 4th Street or on 4th Street adjacent to the loading dock.

When delivering samples, contact the security guard. If the overhead doors to the loading dock are closed, go to door on the side of the overhead doors and use the intercom to contact the security guard. If the overhead doors to the loading dock are open, you will find the security guard behind the glass window of the loading dock office. The security guard will assist you checking the samples into the lab.

From West of Richmond:

1: Start out going East on I-64 E.

2: Take the I-64 E exit- exit 75- toward WILLIAMSBURG/NORFOLK.

0.17 miles

3: Take the 3RD STREET ramp toward COLISEUM/DOWNTOWN.

0.09 miles

4: Stay straight to go onto N 3RD ST.

0.13 miles

5: Turn LEFT onto E LEIGH ST.

0.06 miles

6: Turn LEFT onto N 4TH ST.

0.04 miles

Sample receiving is in the middle of the block on the right.

From South of Richmond:

1: Start out going North on I-95 N.

2: Take the CHAMBERLAYNE AVE exit- exit number 76A. 0.16 miles

3: Turn LEFT onto CHAMBERLAYNE AVE/CHAMBERLAYNE PKWY. 0.20 miles

4: Turn SLIGHT LEFT onto W LEIGH ST. 0.30 miles

5: Turn LEFT onto N 4TH ST. 0.04 miles

Sample receiving is in the middle of the block on the right.

From East of Richmond:

1: Start out going West on I-64 W toward RICHMOND.

2: Take the I-95 S/5TH STREET exit- exit number 190- on the left toward PETERSBURG/DOWNTOWN/COLISEUM. 0.29 miles

3: Stay straight to go onto N 5TH ST. 0.12 miles

4: Turn RIGHT onto E JACKSON ST. 0.12 miles

5: Turn LEFT onto N 3RD ST. 0.07 miles

6: Turn LEFT onto E LEIGH ST. 0.06 miles

7: Turn LEFT onto N 4TH ST. 0.04 miles

Sample receiving is in the middle of the block on the right.

From North of Richmond:

1: Start out going South on I-95 S toward RICHMOND.

2: Take the I-64 E exit- exit number 75- toward WILLIAMSBURG/NORFOLK. 0.17 miles

3: Take the 3RD STREET ramp toward COLISEUM/DOWNTOWN. 0.09 miles

4: Stay straight to go onto N 3RD ST. 0.13 miles

5: Turn LEFT onto E LEIGH ST. 0.06 miles

6: Turn LEFT onto N 4TH ST. 0.04 miles

Sample receiving is in the middle of the block on the right.

APPENDIX D: CBP NON-TIDAL NETWORK PARAMETER LIST & RECOMMENDED PARAMETER GROUP CODES

Revised 03/28/2022

REQUIRED PARAMETERS FOR CBP NON-TIDAL SITES (EXCLUDING RIM SITES)

Field Parameters:

- WATER TEMP °C
- FIELD SPECIFIC CONDUCTANCE (UMHOS/CM AT 25 °C)
- FIELD DISSOLVED OXYGEN, PROBE (MG/L)
- FIELD PH (SU)
- GAGE HEIGHT (FT)

Analytical Parameters:

Storet code	Parameter name
00530	Total suspended solids (mg/L)
00540	Fixed suspended solids (mg/L)
00600	Nitrogen, total (mg/L as N)
00610	Ammonia, total (mg/L as N)
00630	Nitrite + Nitrate, total (mg/L)
OPWLF	O-phosphate, dissolved lab filtered (mg/L as P)
00665	Phosphorus, total (mg/L as P)
31616	Fecal coliforms (cfu/100mL)
31648	*E. coli* (cfu/100mL)
00625	Total kjeldahl nitrogen (TKN) (mg/L as N)
SSC-FINE	Suspended sediment concentration ≤ 62 µm (SSC_Fine, mg/L)
SSC-COARSE	Suspended sediment concentration ≥ 62µm (SSC_Sand, mg/L)
SSC-TOTAL	Suspended sediment concentration, total (SSC_Total, mg/L)

Recommended containers and required volumes/preservatives:

Parameter	Container/Volume	Preservation
BAYT3-2	1 gallon cubitainer	Preserve at 4 ^{o}C
TPLL	150 mL plastic bottle (HDPE)	sulfuric acid to pH < 2 and preserve at 4 ^{o}C
TNUTL	250mL HDPE bottle	H_2SO_4 to preserve to pH < 2
SSC-C2	1 quart cubitainer filled halfway (500mL)	Preserve at 4 °C
FCMFECQENT	125 mL plastic bottle with 100mL line containing sodium thiosulfate (when applicable)	Preserve at 4 °C
ECQT10	125mL plastic bottle with 100mL line	Preserve at 4 °C
CNTF-4	250mL HDPE plastic bottle	Preserve at 4 °C
DOCFF	40mL vials with Teflon-faced silicone septa	Preserve at 4 °C
FCHLR	GF/F glass fiber filter pad (47 mm)	Preserve at 4 °C
BAYR2	1 gallon cubitainer	Preserve at 4 °C

APPENDIX E: PROCEDURE FOR RANDOMLY SELECTING A STATION FOR EQUIPMENT BLANK AND DUPLICATE QC SAMPLING

Revised 03/12/2019

PROCEDURE FOR RANDOMLY SELECTING A STATION FOR EQUIPMENT BLANK AND DUPLICATE QC SAMPLING

Frequency:

- One equipment blank is required per station per year for all stations.
- Two duplicates are required per year for every primary station (one from USGS and one from DEQ).
- One duplicate per year is required for secondary stations.

In order to meet recommended guidelines from the Chesapeake Bay Program, the random process described below should be conducted twice (once for equipment blanks and once for duplicates).

It is permissible for EBs and duplicates to be collected during the same sampling event if the same month is randomly selected during both drawings.

1. Create a marker for each station. Note on the marker whether it is a primary (P) or secondary (S) station.
2. Place markers in a bag.
3. For regions that will be collecting fewer than twelve EBs or duplicates per year (based on number of stations in the region): randomly withdraw markers from the bag, making note of the order that they are withdrawn.
4. Create markers for each month of the water year and place in bag. Randomly withdraw month markers and match them up with the list of previous randomly selected stations. This will determine the month in which the EBs or duplicates will be collected.
5. For regions that will be collecting twelve or more duplicates or EBs a year: randomly withdraw station markers, making note of the order that they are withdrawn as this will correspond with the order that they are distributed throughout the water year.
    a. Match the first station selected with the first month of the water year (October). Sequentially move down the list until you have assigned a station to the last month of the water year (September). For the remaining stations (i.e. the 13th, 14th, 15th duplicate and so on), place one marker for each month of the water year in a bag

and randomly select the month that the duplicate will be selected. Do not replace the marker once it has been selected.