Middle and Upper Rappahannock River Basin, VA, Rainfall, Stream, and Water Quality Gauging Analysis

Germanna Community College, 1000 Germanna Point Drive, Fredericksburg, VA

10 am, February 5, 2012

10:00 am Introduction

10:15 am Study Progress

10:30 am Review of Draft Report

- **-Background Information**
- **-Problems and Opportunities**
  - **-Existing Problems**
  - **-Findings from Existing Plan Reviews**
  - **-Comments Collected**
- **-Gauging Analysis**
  - **-Initial Gauge Locations Collected**
  - **-Analysis Procedures**
  - **-Results**
- **-Conclusions**

11:15 am Meeting Closing Comments, Schedule of Report Review Period

MIDDLE AND UPPER RAPPAHANNOCK RIVER BASIN, VIRGINIA RAINFALL, STREAM, AND WATER QUALITY GAUGING ANALYSIS

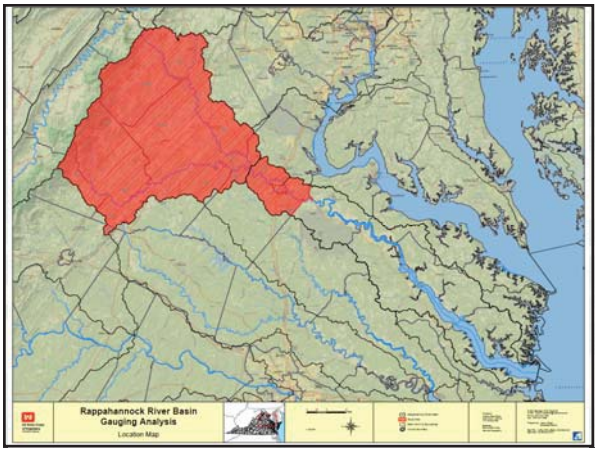
5 February 2013

Study CSA

- Cost Sharing agreement between the U.S. Army Corps of Engineers and Virginia Department of Conservation and Recreation signed on August 24, 2012.
- Through USACE Section 22 PAS Program

Study Scope

- Upper and Middle Basin: City of Fredericksburg, Stafford County, Spotsylvania County, Culpeper County, Fauquier County, Greene County, Madison County, Orange County, and Rappahannock County.
- New real-time continuous rainfall, stream, and water quality gauges



Study Coordination

- 2 Study Meetings with Stakeholders and Technical Experts
- RRB Commission Technical Committee Meetings
- Upper Rappahannock-Rapidan Regional Land Use Committee Meeting
- Review of Existing Reports and Other Information: Hazard Mitigation Plans, Water Supply Plans, TMDL Implementation Plans, and USACE Reports
- At Least One Representative from Each Locality Gave a Response for the Study

Groundwater Gauges

- The possibility of including ground water data collection needs was considered. However due to the intricacy of ground water monitoring with the limitations on the timeline and funding for the existing study, ground water monitoring could not be pursued further under this CSA.

Existing Gauges or Monitoring

- USGS
- NWS
- VDEM
- VA DEQ

Presentations at first two study meetings.

- Other Smaller Programs

USGS

Station Number	Station Name
01662800	Battle Run Near Laurel Mills
01663500	Hazel River at Rixeyville [1]
01664000	Rappahannock River at Remington [1, 2]
01665500	Rapidan River near Ruckersville
01666500	Robinson River near Locust Dale
01667500	Rapidan River near Culpepper [1, 2]
01668000	Rappahannock River near Fredericksburg [1, 2]

1. NSIP program, additional NSIP program: Dragon Swamp near Church View, Mountain Run near Culpepper, and Rapidan River near Culpepper stream gauges are currently inactive.
2. USGS Water Quality Monitoring Sites

• Federal-State Cooperative Water Program (Water Coop Program) – funding for stations on a cost-share basis.

•Stream Gauges
  •Collect Stage Data and have developed Rating Curves

•Water Quality Monitoring
  •12 monthly samples and 8 targeted storm samples taken to compute nutrient and sediment loads and determine long-term trends at each location

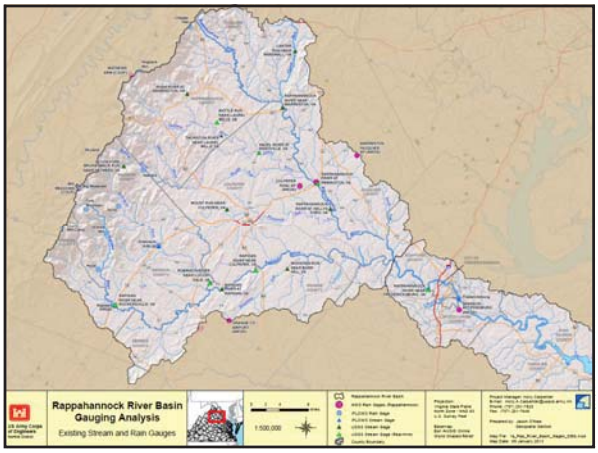
•QA/QC Requirements

NWS

- Rain Gauges
  - AWOS – Automated Weather Observing Systems
  - COOP – manually or automated data collected by volunteers

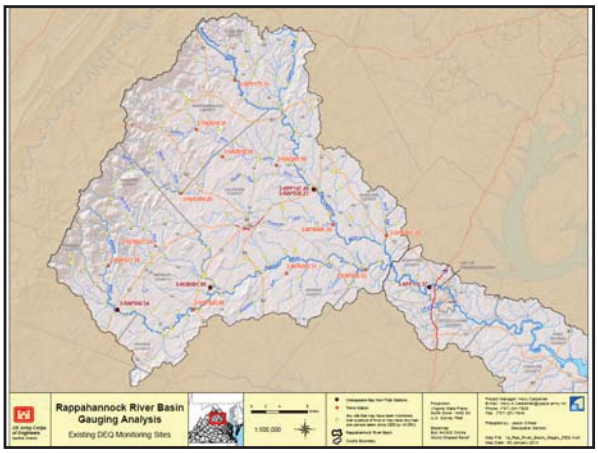
VDEM

- IFLOWS Rain and Stream Gauges for emergency management
- Stage recorded
- QA/QC specific for IFLOWS



VA DEQ

- Largest source of water quality data produced from monitoring
- Trend and Non-Tidal stations are long-term
- Sites since 2000 shown on map



Other Programs

- The Virginia Water Monitoring Council (VWMC)
- EPA National Aquatic Resource Survey (NARS) and EPA STORET DATA Warehouse
- National Park Service (NPS)
- Virginia Department of Health (VDH)
- VIMS Virginia Estuarine and Coastal Observing System (VECOS)
- Virginia Save Our Streams (VA SOS) Program – citizen monitoring

Background Information

- Dams
- 303d Impaired Stream Locations
- VPEDS Permits
- Local Hazard Mitigation Plans
- TMDL IP Plans
- Local Water Supply Plans

Dams

- Dam Watch by USEngineering Solutions
  - Real-time gauges and analysis of data to provide warnings to emergency management officials when needed.
- Gauges for impoundments not considered
- Impoundments considered in gauge placement as they regulated flow

Local Hazard Mitigation Plans

George Washington Regional Commission Hazard Mitigation Plan, March 2012 (Covers the Middle Basin)

- Page 318 - GWRC Mitigation Strategies – Flood Gauge Installed on Rappahannock River by the City of Fredericksburg – It is recommended to establish an early warning system, such as river gauging and flood warning systems, for jurisdictions in the GWRC region that can provide event-distinct information to citizens and businesses.

Rappahannock-Rapidan Multi-Jurisdictional Hazard Mitigation Plan, 2012 Update (Covers most of the Upper Rappahannock River Basin)

- Appendix A: Page 2 – Region Wide Project 13, improved water monitoring capabilities along major rivers in the region (including additional monitor stations and improved data tracking capabilities)
- Appendix C: Page 29 – IFLOWs rain gauge to be used for early warning systems.

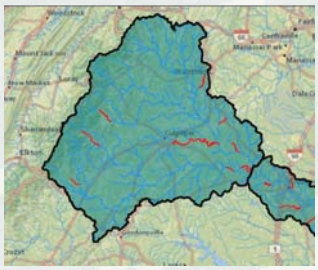
VPDES Permits

- Permits for P.S. discharges
- Includes in permits monitoring requirements which can not be replace by gauges
- *VSMP – Virginia Stormwater Management Program Permit

303d Impaired Streams

- List of TMDL Priorities
- Updated April 1st on even numbered years (submitted from VA DEQ to EPA)
- Require development of TMDLs and TMDL IP plans

303d Impaired Streams Map



TMDL IP Plans

- TMDL IP mitigation strategies are widely implemented in impaired basins
- Locations without long term monitoring are suggested for long term monitoring in this analysis
- WQ modeling data requirements

Water Supply Plans

Fauquier County Regional Water Supply Plan

- Page 23 – develop and maintain a more extensive monitoring program
- Page 68 – sites desired to be analyzed for water quality data have a limited number of samples and can not be extrapolated

The Water Supply Plan for Rappahannock County and the Town of Washington

- Page 45 – existing stream flow gauges are critical to water supply analysis and should be maintained
- Page 46 – rain events vary widely across the county, indicates additional rain gauges are needed
- Page 86 – more locally focused monitoring needed, including the headwaters
- Page 87 – monitoring in headwater and additional continuous meteorological monitoring station is needed

Comments from Coordination

1. Comments from ALL Local Government Officials in the Study Area

2. Comments from Agencies
- National Weather Service (NWS)
- United States Geological Survey (USGS)
- National Weather Service (NWS)
- Virginia Department of Emergency Management (VDEM)
- Virginia Department of Environmental Quality (VA DEQ)
- Virginia Department of Conservation and Recreation (VA DCR)
- Virginia Department of Game and Inland Fisheries (DGIF)
- Virginia Department of Health (VDH)
- Virginia Farm Bureau Federation
- Virginia Department of Transportation (VDOT)

3. Comments from Local Groups
- Rappahannock River Basin Technical Committee
- Rappahannock-Rapidan Regional Commission Land Use and Environmental Committee
- Culpeper Soil and Water Conservation District
- John Marshal Soil and Water Conservation District
- Time Bondelid Consulting Engineer
- Caroline County (Outside of Study Area)

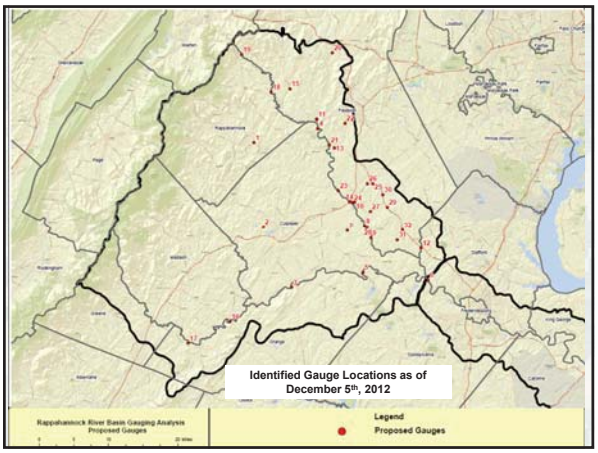
Identified Gauge Locations

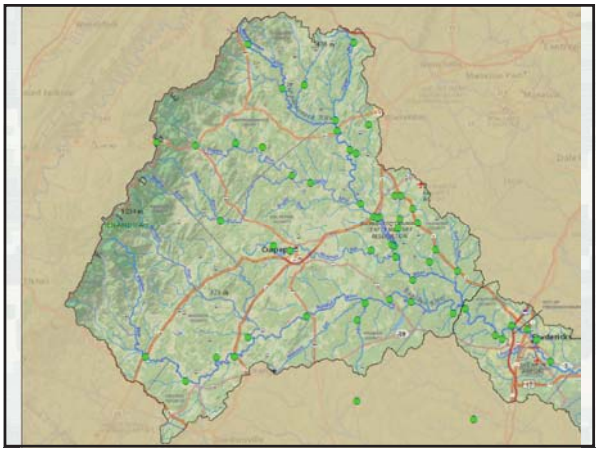
- Compiled from:
  - Meetings
  - Phone calls
  - Emails
  - Existing reports
- 57 Locations Identified:
  - Rain Only - 6
  - Rain and Stream - 8
  - Rain and Water Quality - 3
  - Rain and Stream and Water Quality - 5
  - Stream and Water Quality - 4
  - Water Quality Only - 31

Example Identified Gauge Locations

Table 4.1 Identified Locations

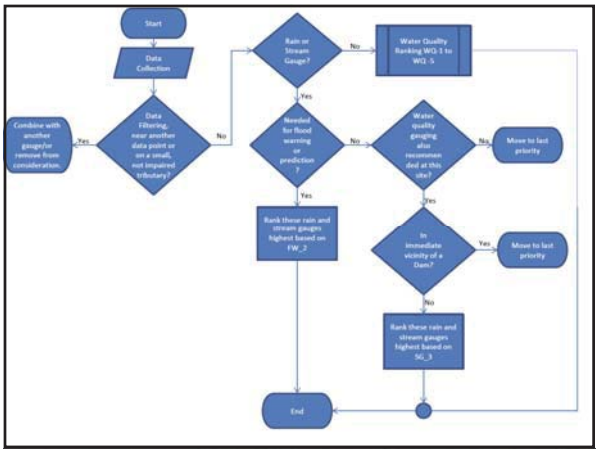
Id	Issue	Location Description	Type	Source of Information
1	Need real time rain gauge for flooding predictions.	at stream gauge, battle run near Laurel Mills, VA	New Rain Gauge	VDEM, Sept 18 Meeting
2	Real time stream and rain gauges to predict flooding in the Mountain Run Area, NWS documents reports of flooding on Oct 2, 2012.	at historic stream gauge Mountain Run near Culpeper, VA	New Rain Gauge, New Stream Gauge	NWS, Sept 18 Meeting and Nov 15 Meeting
3	Real time rain gauge for flooding predictions.	at stream gauge Rapidan River near Culpeper, VA	New Rain Gauge, Water Quality Gauge	VDEM, Sept 18 Meeting
4	Real time stream and rain gauges to predict flooding, also water quality monitoring mainly to build baseline data from an agricultural and forestry portion of the watershed.	Rappahannock River at Route 211 Bridge, at historic stream gauge Rappahannock River near Warrenton, VA	New Rain Gauge, New Stream Gauge, Water Quality	Sept 18 Meeting and Fauquier, J.M. SWCD
5	Extreme need for rain gauge east of Ruckersville in the RRB, real time stream and rain gauges to predict flooding.	Locust Grove, Route 3, Germanna Hwy, crossing of Rapidan River	New Rain Gauge, New Stream Gauge, Water Quality	VDEM, NWS, Sept 18 Meeting and Nov 15 Meeting
7	Real time stream and rain gauges to predict flooding.	confluence of Mountain Run and Flat Run	New Rain Gauge, New Stream Gauge	VDEM, Sept 18 Meeting
6	Real time stream and rain gauges to predict flooding.	upriver from Fredericksburg, below the confluence of Rappahannock and Rapidan River, VDEM priority for additional stream gauge	New Rain Gauge, New Stream Gauge	VDEM, NWS, Sept 18 Meeting and Nov 15 Meeting

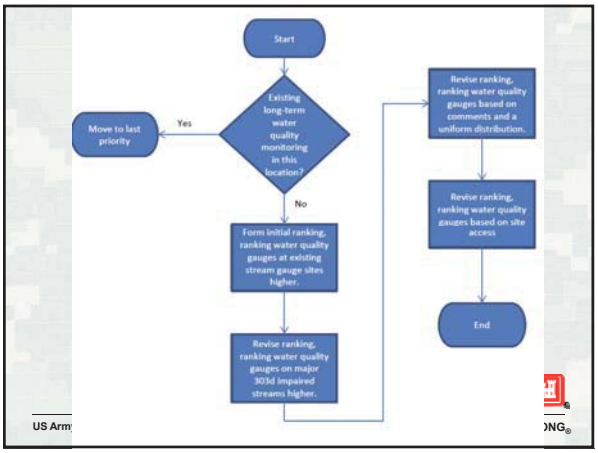


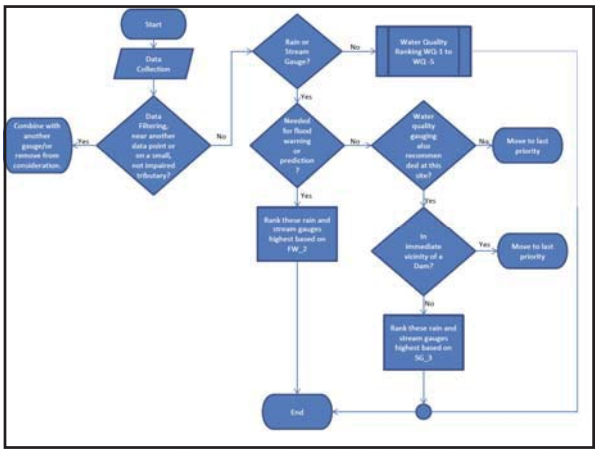


Analysis

- Data filtering – reduced to 24 sites
- First priority – rain and stream gauges for flood warning
- Then ranked other rain and stream gauges
- Remaining WQ gauges







Analysis Results

- 13 new rain gauges
- 7 new stream gauges
- 19 new water quality gauges (which would require an additional 11 stream gauges)

US Army Corps of Engineers – Norfolk District BUILDING STRONG®

Analysis Results

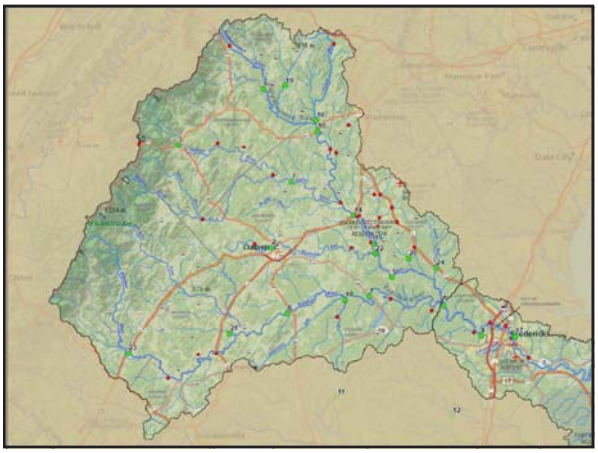
Priority	Id	Issue	Location Description	Type	Source of Information
1	5	Extreme need for rain gauge east of Ruckersville in the RRB, real time stream and rain gauges to predict flooding.	Locust Grove, Route 3, Germanna Hwy, crossing of Rapidan River	New Rain Gauge, New Stream Gauge, Water Quality	VDEM, NWS, Sept 18 Meeting, Nov 15 Meeting, and Orange County
2	33	Stream gauge downstream of Lake Pelham Dam. real time stream and rain gauges to predict flooding in the Mountain Run Area, NWS documents reports of flooding on Oct 2, 2012.	Downstream of Lake Pelham Dam.	New Rain Gauge, New Stream Gauge	VDEM, Town of Culpepper, NWS, Sept 18 Meeting and Nov 15 Meeting
3	46	Need for rainfall and stream flow information on South Fork of the Thorton, Sperryville, several homes in business, some in 1 % annual chance flood plain.	South fork of Thorton River, at Rt 522 Bridge, Sperryville	New Rain Gauge, New Stream Gauge	Rappahannock County
4	38	Need for water quality information for Rappahannock River at Fredericksburg, only previous continuous water quality gauge was located here, but has been washed out by a storm. City of Fredericksburg would like to capture water quality runoff from the City.	5 miles upstream of I-95, near Motts Run, to be installed at the intake structure for the City of Fredericksburg	New Rain Gauge, Water Quality Gauge	USGS, City of Fredericksburg, VDEM
5	52	Need for rainfall and stream flow information for flood warning.	At Rappahannock River Kemper's Ford or Richardsville	New Rain Gauge, New Stream Gauge, Water Quality	NWS, VDEM
6	18	Need for stream flow information from Jordan River, at Crest Hill Road or below , Baseline data needed from a mainly agricultural and forestry portion of the watershed.	Rappahannock River, confluence of Jordan and Rappahannock Rivers, Rt 647 Crest Hill Road Bridge	New Stream Gauge, Water Quality Gauge	NWS, Fauquier, J.M. SWCD, Tim Bodelid Consulting Engineer
7	34	Need for rainfall and water quality data.	Bottom of Hazel River Watershed	New Rain Gauge, Water Quality Gauge	Culpepper County, VDEM Sept 18 Meeting
8	1	Need for rainfall and water quality data.	at stream gauge Rapidan River near Culpeper, VA	New Rain Gauge, Water Quality Gauge	VDEM, Sept 18 Meeting

Analysis Results

Priority	Id	Issue	Location Description	Type	Source of Information
9	6	Need for rainfall and stream flow information for flood warning.	upriver from Fredericksburg, below the confluence of Rappahannock and Rapidan River, VDEM priority for additional stream gauge	New Rain Gauge, New Stream Gauge, Water Quality	VDEM, NWS, Sept 18 Meeting and Nov 15 Meeting
10	4	Need for real time rain fall, stream flow for flood warning, also water quality monitoring mainly to build baseline data from an agricultural and forestry portion of the watershed.	Rappahannock River at Route 211 Bridge, at historic stream gauge Rappahannock River near Warrenton, VA	New Rain Gauge, New Stream Gauge, Water Quality	Sept 18 Meeting and Fauquier, J.M. SWCD
11	55	Need for rainfall data (outside of basin, but rain information could provide warnings to basin area).	Po River USGS Gauge	New Rain Gauge	VDEM
12	56	Need for rainfall data (outside of basin, but rain information could provide warnings to basin area).	Partlow USGS Gauge	New Rain Gauge	VDEM
13	57	Need for rainfall data (outside of basin, but rain information could provide warnings to basin area).	North Ana River, or close to this area	New Rain Gauge	VDEM
14	14	Need for rainfall and water quality information, upstream of Remington stormwater discharge and WWTP discharge.	Major Outfall, at DEQ Non-tidal station, 3-RTP 147.49, 3-RAP030.21, and USGS Remington Stream Gauge	New Rain Gauge, Water Quality Gauge	Nov 15 Meeting and Fauquier, J.M. SWCD
15	28	Background data for a largely agricultural watershed. Bottom of watershed for Marsh Run, 303d impaired, which has no long term monitoring.	Marsh Run at Route 651 (Germanna Bridge Quad) bridge	Water Quality Gauge	Fauquier, J.M. SWCD
16	11	Need for water quality data.	Carters Run at Route 688	Water Quality Gauge	Nov 15 Meeting and Fauquier, J.M. SWCD

Analysis Results

Priority	Id	Issue	Location Description	Type	Source of Information
17	48	Need for water quality data.	At bottom of Clairborne Run watershed.	Water Quality Gauge	Stafford County
18	40	Need for water quality data for 303(d) stream with TMDL that drains a large portion of Orange County.	At the bottom of Mountain Run watershed, drains in Rapidan, in Orange County.	Water Quality Gauge	Culpepper SWCD, Orange County
19	15	Need for water quality data.	Thumb Run at Route 688, Leeds Manor Rd	Water Quality Gauge	Nov 15 Meeting and Fauquier, J.M. SWCD
20	31	Background data from a largely agricultural watershed.	Sumerduck Run at Route 651 Bridge	Water Quality Gauge	Fauquier, J.M. SWCD
21	42	Need for water quality data for Robinson River at route 614. Robinson river is a major tributary of the Rapidan. Robinson river is undergoing a TMDL effort.	Robinson River at Route 614	Water Quality Gauge	Culpepper SWCD, Orange County
22	9	Need for water quality data.	on Mountain Run before confluence with Rappahannock River or at confluence	Water Quality Gauge	Sept 18 Meeting and Fauquier, J.M. SWCD
23	41	Stream flow and water quality data, to support water intake site for Rapidan Service Authority and support TMDL IP for 303d portions of Rapidan.	Rapidan River at Route 29	Water Quality Gauge	Culpepper SWCD
24	12	Need for water quality data.	Deep Run at Route 17	Water Quality Gauge	Nov 15 Meeting and Fauquier, J.M. SWCD



Typical Gauge Cost

- **Chowan River Basin**
  - **$75 k to upgrade 4 rain gauges to real time, minimal annual O&M**
  - **$160 k to install 7 new stream gauges, O&M estimated $96,800**
- **Program funding and cost share percentages are limited and vary**

Typical Gauge Cost

Item	Type	Cost ($1000)	Agency
Stream Gauge	Installation	$17	USGS
	O&M	$15	USGS
	O&M with monitoring	$35	USGS
Water Quality Gauge	Installation	$35	USGS
	O&M with monitoring	$50-$60	USGS
Stream and Rain Gauge at one site	Installation	$20	VDEM

Funding Opportunities

Program	Agency	Type of Gauge/Comments
Chesapeake Bay Program Grant Funds	EPA (CWA)	Water Quality, installation (funding through this program in the near future is unlikely since funds for improving the stream gauge network and existing water quality monitoring have been recently provided), cost share
Water Quality Improvement Act	EPA (CWA)	Water Quality, installation
Hazard Mitigation Grant Program (HMGP)	FEMA	Rain, Stream Gauges (flood mitigation), installation
Pre-Disaster Mitigation Grant Program (PDM)	FEMA	Rain, Stream Gauges (flood mitigation), installation
Water Coop Program	USGS	All, installation and O&M, cost-share, limited funding each year
COOP	NWS	Rain, installation and O&M
IFLOWS Program	VDEM	Rain, Stream Gauges (flood mitigation), installation and O&M
Section 319 Base Funds	EPA (CWA)	Water Quality, up to 20% of base funding for the program may be used for planning and assessment activities to solve non-point source problems
Chesapeake Bay Stewardship Fund	National Fish and Wildlife Foundation (NFWF)	Water Quality - planning, research and monitoring listed as a key strategy

Report Review

Date	Action
February 11, 2013	Draft Report Distributed for Review
March 4 and 5th	VLWA Conference
March 11, 2013	Comments Due
March 20th, 2013	RRBC Commission
March 22nd, 2013	Final Report Distributed

Questions?