

CHAPTER 7.8 DEQ WATER QUALITY REGIONAL INITIATIVES

Valley Regional Office (VRO)

Shenandoah and James Rivers – Springtime Fish Disease and Mortality

Springtime fish disease and mortality events have occurred in the Shenandoah and upper James River watersheds since 2004. Relatively high rates of mortality occurred in 2004 and 2005, particularly in the Shenandoah basin. Smallmouth bass and sunfish seem to have been disproportionately impacted, although a number of other species have also been affected, including suckers and catfish. These events have continued, but have been much less severe for the last 2-3 years. During 2011 staff continued to receive occasional reports of fish with skin lesions during spring and early summer. A few reports of small numbers of dead fish were also received. Investigations by a number of researchers have not identified a single cause for these events, although many of the specimens examined were found to have a condition called furunculosis, caused by a cool-water fish pathogen known as *Aeromonas salmonicida* and characterized by skin and internal lesions. State biologists worked closely with USGS scientists for several years to compare presence of this bacterium on fish before, during, and after fish kill events at multiple sites in the Shenandoah and James River systems. No new research was conducted during 2011; efforts focused primarily on monitoring and tracking outbreaks. This approach will continue in 2012 unless outbreaks occur at severe levels.

South River Mercury

Mercury was used in a manufacturing process at the DuPont plant in Waynesboro, VA from 1929-1950. Mercury losses and resulting contamination to the river and floodplain from that process resulted in a legacy problem that continues today. In a 1984 settlement between DuPont and the State Water Control Board, a fund was established to support monitoring of water, sediments, and fish tissue in the river system for a projected 100-year period. More recently, in 2006, DEQ established a full-time position in the Valley Regional Office to focus on this serious environmental issue. Specific activities in this program area that occurred during 2011 are outlined below.

- a) **Water Sample Collection and Analysis for Mercury in the South River and South Fork Shenandoah River, Virginia.** This monitoring project focuses on water column concentrations of dissolved and total mercury in the South River and South Fork Shenandoah River. Monitoring through the 1990s rarely detected measurable amounts of mercury in water, due to analytical constraints. With the development of more sensitive techniques (“clean” metals sampling and analyses) during the 1990s, quantifiable levels are now routinely recorded. Since 2001, DEQ staff has collected total and dissolved mercury samples from multiple sites on the South River and South Fork Shenandoah River on a bimonthly frequency.
- b) **South River Science Team.** DEQ staff members continue to coordinate with members of the South River Science Team on a number of surveys and studies in which data are gathered for water, sediments, floodplain soils, and biota in and along the South River. The South River Science team is comprised of representatives from industry, academic institutions, state and federal agencies, environmental groups and independent researchers. This group meets quarterly to coordinate efforts, collaborate on future work, and communicate results. Ongoing studies address mercury source identification, fate and transport, methylation processes, and ecological processes. Information on the activities of the South River Science Team can be found at <http://www.southernriverscienceteam.org/>.
- c) **Natural Resources Damage Assessment (NRDA) for South River and South Fork Shenandoah River.** DEQ is working with other state partners (as the state trustee) and the US Fish & Wildlife Service (as federal trustee) to continue assessment of damages to aquatic and terrestrial life in and along these rivers. Studies by South River Science Team partners and

contractors will serve as the basis for damage assessment and will also help identify opportunities for restoration and mitigation. The NRDA team of technical, policy, and legal staff has been meeting several times per year as this process moves forward. Final settlement is expected within 2-3 years.

Blue Ridge Regional Office – Lynchburg (BRRO-L)

Total Maximum Daily Load (TMDL) Activities

There are currently four (4) TMDL studies being conducted or been completed by BRRO-L water staff. There are currently three (3) Implementation Plans either being conducted or have been completed in BRRO-L over the past two years. The projects are listed in detail below.

- a) **Meherrin River Basin.** The TMDL study was completed and approved by EPA on 4/12/2010 and the Virginia SWCB on 9/30/2010. The project addressed bacteria impairments in the Meherrin River as well as several tributaries including, North Meherrin River, Briery Branch, Genito Creek, and Great Creek. A public meeting was and will be held to discuss the TMDL process and the sources of bacteria unique to the Meherrin River basin.
- b) **Roanoke (Staunton) River Basin.** The PCB TMDL study covers the entire Roanoke River Basin and was done in conjunction with the DEQ Blue Ridge Regional Office in Roanoke. In 1999 & 2000, source identification work was completed in the Altavista and Brookneal areas. On-going and legacy sources of PCBs were identified through the TMDL study which was conducted over a six year period. The TMDL was approved by EPA on 4/9/2010 and the Virginia SWCB on 12/9/2010.

The results from the study were presented in unique forums by DEQ staff members. The forums were held in Brookneal, Virginia in August 2007 and Altavista, Virginia in July 2008. There were no formal presentations given. However, citizens were able to visit “information booths” manned by DEQ staff, with poster displays and handouts. The general consensus of the forum was the public had their questions answered or knew how to contact appropriate staff if they had additional questions. The most recent fish tissue and sediment sampling results were also presented at the forum. The results continued to show elevated levels of PCBs, but for the first time, the results showed elevated levels of mercury. DEQ provided information on mercury and the potential health effects along with the PCB information. The Virginia Department of Health issued an additional fish consumption advisory for mercury soon after the results were published. A final public meeting was held July 30, 2009 in Brookneal, Virginia.

- c) **Bear Garden Creek.** A TMDL study has been completed to address bacteria problems in the Bear Garden Creek watershed in Buckingham County, Virginia. A final public meeting was held in the beginning of October 2011. Public comment closes 11/4/2011 when the report will then be submitted to EPA for approval.
- d) **North Creek.** North Creek in Fork Union is scheduled for TMDL development by 2014. Biological monitoring at three sites on North Creek has been ongoing since 2007. Ambient monitoring at the three sites was conducted in 2009-2010. Source analysis is currently being completed and a draft TMDL report should be ready by summer 2012.
- e) **Slate River Watershed Implementation Plan.** The project addressed bacteria impairments in the Slate River Watershed. Tributaries include Austin Creek, Frisby Branch, North River, and Troublesome Creek. A public meeting was held to discuss the Implementation Plan process and the sources of bacteria unique to the watershed. The final report is awaiting approval from the Virginia SWCB.

- f) **Upper Banister River Implementation Plan.** The project addressed bacteria impairments in the Upper Banister River Watershed. Tributaries include Whitehorn Creek, Bearskin Creek, Cherrystone Creek, and Stinking River. A public meeting was held to discuss the Implementation Plan process and the sources of bacteria unique to the watershed. A final public meeting was held on 10/25/2011. Implementation planning in the Lower Banister River Watershed will begin in November 2011.
- g) **Ash Camp and Twittys Creek Implementation Plan.** The project addressed sediment impairments in the Ash Camp Creek and Twittys Creek Watersheds. A public meeting was held to discuss the Implementation Plan process and the sources of sediment unique to Ash Camp Creek and Twittys Creek. The final report is awaiting approval from the Virginia SWCB.

Citizen Monitoring Support

The Leesville Lake Association and the Timberlake Homeowners Association have developed monitoring strategies and received DEQ grant funding to monitor the lakes during critical periods. The Leesville Lake Association collects their data using a multi-probe sampler on loan from DEQ. The data from this monitoring program are reported each month to BRRO-L. The Timberlake Homeowners Association collects water samples to be sent to the state laboratory for analysis. These data are also sent to BRRO-L for review every month.

Coordination with US Army Corps of Engineers – John H. Kerr Reservoir & Dam

The Roanoke River, downstream of the John H. Kerr Reservoir and Dam, experiences seasonal dissolved oxygen changes due to the natural stratification of the reservoir. These natural changes often result in violations of the dissolved oxygen criteria especially below the dam. During months when the reservoir is stratified, water from below the thermocline is released through the dam to generate hydroelectric power and discharged to the river downstream.

BRRO-L staff contacted the US Army Corps of Engineers (USACOE), which owns and operates the dam, to determine what changes to their operations could occur to correct the water quality problems. The USACOE is currently retrofitting the dam and updating several of the power generating turbines with aeration capabilities. The retrofitted turbines should increase the dissolved oxygen levels enough to maintain state standards. BRRO-L staff will continue to work with the USACOE to monitor the progress of the retrofit and determine when the segment can be removed from the Impaired Waters list.

This segment of the Roanoke River has been listed on the Virginia Impaired Waters list since 1996 and was slated for TMDL development by 2010. The Roanoke River segment below the dam was listed as a Category 4B during the 2008 IR cycle and continues to show improvement from the retrofits occurring at the dam.

Biological monitoring of the Pedlar River Watershed

Citizens living in the Pedlar River watershed expressed concern over the effects of the Pedlar Reservoir dam on downstream water quality. Also of concern is a gravity-fed pipe on Little Irish Creek that directs flow from the stream into the Pedlar Reservoir. Biological monitoring in the watershed began in 2008 and continued through 2010 to determine any effects on water quality caused by the dam or the gravity pipe.

Couches Creek/Kenbridge STP

Biological monitoring on Couches Creek near Victoria will be ongoing in order to determine the effects of the Victoria STP on water quality in the stream. Monitoring began in 2008 at two sites on Couches Creek, one site just downstream of the outfall and the other several miles downstream.

Targeted Biological Monitoring

BRRO-Lynchburg Regional Biologists perform benthic macroinvertebrate and habitat assessments at a variety of sites to assess the ecological health of freshwater streams and rivers. Streams within the urban areas of BRRO-Lynchburg have been selected for water quality assessments on a rotating basis. For this assessment, two sites in Farmville and three sites in both Danville and Altavista were revisited between 2009-2010.

BRRO-Lynchburg has several Tier III streams in Amherst County which had not been previously biologically monitored. Four of these streams were monitored in 2010 in order to assess their biological condition and potentially use as reference streams for genus SCI development.

Biologists reviewed regional water quality data collected at ambient monitoring stations to identify additional biological monitoring sites. The data were analyzed to identify a range of monitoring stations with respect to nutrients and physical parameters (dissolved oxygen, pH, etc). Higher quality streams are monitored to identify potential reference sites to use in the genus-level Virginia Stream Condition Index development. Lower quality streams are monitored to assess whether the benthic communities are impaired and to identify potential stressors.

Blue Ridge Regional Office (BRRO-ROANOKE)

TMDL Activities in the BRRO-Roanoke

BRRO-Roanoke's TMDL staff assisted in the completion of Implementation Plans on the Lower Blackwater River watershed, Big Otter watershed, Back Creek, Mill Creek and Dodd Creek. DCR was the lead agency on all of the aforementioned TMDL Implementation Plans except for Back Creek. New River Highlands Resource Conservation and Development Council partnered with Maptech, Inc. to complete the Back Creek Implementation Plan.

BRRO-Roanoke TMDL staff took the lead on the Implementation Plan for the Pigg River watershed. DCR and Maptech, Inc., as well as local stakeholders like the Blue Ridge Soil and Water Conservation District, assisted with the project. A watershed tour, agricultural and residential working group meetings, and public meetings encouraged public involvement in the project. Presentations about the Pigg River Watershed Implementation Plan were given at the Franklin County Cattlemen's Association and the Roanoke River Currents Conference.

BRRO-Roanoke TMDL staff participates in the Stroubles Creek Watershed Initiative (SCWI), which spun off from the Implementation Plan Steering Committee. The SCWI continues to meet as needed to review grant proposals related to the Implementation Plan and participate in various outreach events like Blacksburg's Steppin' Out street festival and Sustainability Week. During Sustainability Week, BRRO-ROANOKE set up a "bug tub" featuring local benthic macroinvertebrates and displays with information about water quality and the Stroubles Creek TMDL. Participants include local residents, Town of Blacksburg, DEQ, DCR, Virginia Tech and leaders in local environmental education initiatives.

BRRO-Roanoke TMDL staff and the DEQ Water Quality Data Liaison coordinated the establishment of Coliscan[®] Easygel[®] monitoring networks in the Big Otter and Looney Creek watersheds. Coliscan[®]

sampling and analysis are accomplished in cooperation with the Peaks of Otter Soil and Water Conservation District in the Big Otter watershed and the Mountain Castles Soil and Water Conservation District in the Looney Creek watershed. Collectively, the groups monitored approximately 20 stations.

In 2006, the Montgomery County Public Schools received a Learn and Serve Watershed Grant. DEQ partnered with the school system and participated in two teacher's workshops and a University-Community Partnership Conference. At the workshops, BRRO-Roanoke staff presented information about local water quality monitoring efforts, equipment and TMDLs, while offering support to teachers in the form of technical assistance and equipment. This partnership will continue as new teachers are brought into the program.

Special studies related to TMDLs included water column PCB sampling in the Roanoke River and New River watersheds, diurnal dissolved oxygen studies in the Smith River and Jackson River, quantitative habitat data collection (using EPA's Relative Bed Stability method) in the Smith River and bacterial source tracking data collection in various watersheds.

BRRO-Roanoke Community Involvement

The BRRO-Roanoke Water Monitoring Group (monitoring, TMDL, and assessment staff) participated in numerous outreach events during 2005-2010. Staff taught area students and teachers about biological monitoring at events such as the Clean Valley Council's Earth Summit, Stream School, Fall Waterways Cleanup, Downtown Learning Center's Summer Enrichment Program, Smith Mountain Lake State Park's Junior Rangers program, Bedford Elementary "Camp Bees" day camp, and Roanoke area Cub Scouts at "Bug Scouts" day camps. The group had displays at the Blacksburg Watershed Open House, Blacksburg's Downtown "Steppin Out" Festival, Mountain Waters Celebration at Lake Moomaw, Philpott Reservoir Environmental Expo, and a Catawba LandCare Organizational meeting informing citizens about TMDLs, water monitoring, and assessments. Staff also made presentations on water pollution, monitoring, and restoration to the Franklin County Master Gardeners organization, Roanoke River Currents Conference, Southern Rivers Grant Project leaders in Radford, and participated in two teacher's workshops for Montgomery County science teachers. 2008 marked the inaugural year for the Christiansburg High School Environmental Expo. DEQ hosts a booth annually at the event with information about water quality monitoring, biomonitoring and watershed stewardship.

- a) **LandCare.** BRRO-Roanoke staff attended a meeting in the Catawba Valley near Blacksburg Sunday July 22, 2007, sponsored by Catawba LandCare. This group started February 2007, when a small group of neighbors from the Catawba and North Fork Valleys came together to hear about LandCare; what it is, and the concepts behind it. These neighbors came away from that meeting convinced that LandCare should indeed be introduced along the length and breadth of the Catawba Creek and North Fork watersheds including their tributaries. By adopting the LandCare concept, it would enable all stakeholders to take part in the effort to preserve the landscape of Catawba Creek and North Fork Valleys, while at the same time, strengthening its' communities. As a result of that meeting, Catawba LandCare emerged, with the mission of providing education and outreach to the community, encouraging a healthy and sustainable environment in the Catawba Creek and North Fork watersheds, and promoting open space across the Roanoke and Montgomery County boundaries. BRRO-Roanoke TMDL staff set up a DEQ and TMDL display and spoke briefly about DEQ and the TMDL activities in the watersheds. BRRO-Roanoke staff also attended the three-day National LandCare Workshop in Blacksburg.
- b) **Green Infrastructure.** Green Infrastructure is an "interconnected network of land and water that contributes to the health, economic well being and quality of life for communities and people." It is designed to bring together diverse organizations and agencies involved in resource protection, economic development, infrastructure, heritage, recreation, and land management. The initiative is growing in the New River Valley and BRRO-Roanoke staff are active as part of the Advisory Committee.

- c) **Girl Scouts.** BRRO-Roanoke Water Permitting, Waste and TMDL staff partnered with the Western Virginia Water Authority and worked with local Girl Scout troops to educate them about environmental issues. The girls learned about aquatic insects, water quality monitoring, watersheds and landfills. They collected water quality data including pH, dissolved oxygen, and turbidity from Carvins Cove Reservoir. Troops also toured the water treatment plant in Roanoke. The WVWA and DEQ have partnered to put together this event for two years in a row and hope to make the workshop an annual event.

- d) **William Byrd High School.** In spring 2008, BRRO-Roanoke staff taught students and teachers in the Learn and Serve program's Biology class about stream ecology and water quality monitoring during a field trip to Wolf Creek including hands-on biological monitoring and stream habitat assessments. Through this partnership, BRRO-Roanoke staff coordinated the McDonald's Mill Outdoor Watershed Education Lab on the North Fork of the Roanoke River in fall 2008. Approximately 70 Ecology students and teachers learned about water monitoring through hands-on chemical and biological sampling with VDEQ staff and Virginia Save our Streams and Clean Valley Council volunteers. A stream restoration and riparian buffer tour was conducted by VDGIF biologists and an introduction to conservation easements and preservation of land to benefit wildlife and water quality was provided by Catawba LandCare staff and the Mill's landowner. The success of the event has led to the invitation to all area high schools to use this farm and Virginia Tech's Catawba Farm for future hands-on experience in an outdoor classroom setting.

PCB Source Investigations in the New River VDH Fish Consumption Advisory Area (2002 – 2004)

From 2002 – 2004, an intense search for PCB sources was conducted in the New River watershed from Claytor Lake Dam to the Virginia-West Virginia State line near Glen Lyn. The investigation involved extensive review of VA DEQ agency records, interviews of local officials, citizens, industry representatives, and information provided by the New River PCB Source Study Citizen's Committee. Based on these interviews and follow-up onsite inspections, DEQ teams sampled soil and sediment from multiple areas in the New River Valley in the fall of 2003. The investigation incorporated approximately 50 sites of sediment and soil samples.

James River Fishkill Monitoring

During the spring and summer periods of 2007 – 2009, BRRO-Roanoke staff has assisted with the investigation of fish kills of unknown causes in the upper James River system. Predominantly smallmouth bass and sunfish are the affected species and have been observed with skin lesions and other health problems during the spring and early summer. During 2007 staff monitored and confirmed citizen reports of distressed and dead fish in the James River, monitored environmental conditions and assisted VDGIF biologists with fish collection for health analyses by USGS and university scientists. In 2008, staff continued to track citizen reports and collected multiple parameters (physical/environmental conditions, metals, organics, nutrients, and pesticides) on the James River and a reference site on the New River, as well as assisted with the collection of fish during pre-kill, within kill, and post-kill periods on both rivers. During spring and summer 2009, staff collected weekly bacteria samples for *Aeromonas salmonicida* at ten stations on the upper James River and several tributaries. Staff also assisted with fish collection on the James River and tributaries and deployed temperature loggers at multiple locations to monitor daily water temperatures.

Mudlick Creek Stream Restoration Project

BRRO-Roanoke water monitoring and VWP staff assisted Roanoke County with a stream restoration project at Garst Mill Park from 2007 to 2009. Pre-restoration activity included monitoring the benthic macroinvertebrate community, monitoring turbidity during storm events, and measuring stream bank erosion in several sections of Mudlick Creek. Staff also provided technical guidance with restoration design plans for County officials, DCR staff, and consultants that produced the design and supervised the project. Staff attended informational meetings held at the park to inform citizens of the project and its benefits to water quality. Post-restoration monitoring will include assisting the county with biological monitoring bank erosion surveys.

Southwest Regional Office (SWRO)

Stonega Straight Pipe

A special study was conducted to determine if a straight pipe being used by 18 homes in Stonega, VA was detrimental to aquatic life in Callahan Creek. The study was a joint cooperative project with DEQ providing field data, U.S. Fish and Wildlife providing analytical costs, chemistry and bioassays, and the Town of Big Stone Gap providing BOD analysis. The project sampling occurred from September 11, 2011 to September 19, 2011. Monitoring data that was collected included benthic, chemical, bioassay, and flow samples from various locations along the project site. Stream flow measurements were conducted by DEQ and were compared to meter readings from residents that discharge to the common straight pipe. Three sites were selected for benthic sampling, including above and below the straight pipe. Field parameter data was collected at least once per day during the project since conductivity is an important current issue for mining watersheds. Chemical and bioassay analysis were conducted by Coastal Bioanalysts, Inc. The Chronic 3-Brood Static Renewal Survival and Reproduction Test was carried out using *Ceriodaphnia dubia*, with the bioassays to include a dilution series. The Chronic 7-Day Static Renewal Survival and Growth Test was conducted using *Pimephales promelas*, and an additional chronic test was implemented using *Hyallela azteca*. The water samples used for these tests were collected using automatic sampling equipment provided by DEQ. These machines were placed at three locations: upstream at the control, downstream below the effluent, and at the common discharge pipe. The chronic toxicity results concluded that there was a significant impairment at the common discharge pipe and a slight impairment below the effluent compared to upstream samples. The Biological Oxygen Demand data concluded that the effluent site had a BOD of only 20 mg/L, a common regulation limit for sewage treatment plants. E. coli measurements were also surprisingly low at the effluent. A combination of flow, BOD, E. coli data, and toxicity results indicate the samples were diluted. After comparing flow measurements gathered by DEQ and water usage data from the Town of Appalachia, we concluded there was approximately 6,728 gallons of water per day being discharged from the straight pipe from an unknown source, possibly groundwater infiltration into the pipe.

Sewerage Extensions in Unsewered Areas

- a) **Tazewell County.** Baptist Valley in Tazewell County (Approximately 75,000 feet of 8-10 inch pipe, 390 manholes, 3 pump stations, 5,000 feet of 2-4 inch force main and related appurtenances to serve Rt 631 to the Divides, Route 635, and Route 16 to Mundytown Road). Approximately 700 potential customers can be served.
- b) **Richlands-Birmingham Area.** (Approximately 28,300 feet of 6-8 inch pipe, 5,100 feet of 2-6 inch force main, 175 manholes, and 2 pump stations to serve an annexed area south of Richlands including parts of Kent's Ridge Road to Daw Road, Daw Road, Birmingham Road, Deel Road, etc.)
- c) **Wise County.** Stephens/Guest River Interceptor (Approximately 22,000 feet of 8-24 inch pipe, 100 manholes, and related appurtenances from Esserville upstream to the Stephens Community along Guest River, Rocky Fork and Sepulcher Creek).

- d) **Dickenson County.** Longs Fork Collection System (Approximately 10,500 feet of 8-inch pipe, 3,100 feet of 4-inch force main, 81 manholes, 1 pump station and one pump station upgrade serving approximately 100 customers (including eliminated Longs Fork Elementary WWTP) along Route 72 between Route 83 and Longs Fork Elementary School).

Northern Regional Office (NRO)

Biological Monitoring

Probabilistic Biomonitoring and Chemical Monitoring Program in Virginia Non-Tidal Streams

NRO has participated in the DEQ's Probabilistic Monitoring Program since its inception in the spring of 2000. This program consists of three sampling components: a thorough examination of the benthic macroinvertebrate community utilizing the EPA's Rapid Bioassessment Protocols, sampling a full suite of chemical parameters in water and sediment, and a physical habitat evaluation at each station. The stations are biologically sampled twice a year. Chemical sampling is performed each spring and fall in conjunction with biological monitoring. The physical habitat evaluation is conducted each fall when the biological monitoring is performed. In 2009, NRO sampled eight probabilistic stations in the spring and fall for a total of 16 sampling events. The 2010 Probabilistic Monitoring Program concluded with a total of six stations sampled once in the spring and fall for a total of 12 sampling events.

Special Studies

Continuous Monitoring in the Tidal Potomac

In 2007, NRO initiated continuous monitoring in the tidal embayment of Pohick Creek. The monitoring period for this area was conducted from April to October. Data for all of the long-term water quality monitoring deployments were collected using YSI Model 6600 EDS multi-meters. These instruments were configured to measure and store water temperature, pH, dissolved oxygen, turbidity, and chlorophyll measurements in fifteen-minute increments. In addition to the continuous monitoring with the YSI sondes, water column grab sampling, light attenuation, and Secchi depth measurements were performed at each of the stations where the continuous monitors were deployed. Continuous monitoring data was collected at the Pohick Bay Station in 2007, 2008 and 2009.

Special Study and Citizen Requested Monitoring

In 2009 and 2010 the Northern Region of DEQ collected special study ambient monitoring data for the following streams: Camp Creek and Wheeler Creek. In addition, ambient data was also collected in 2009 and 2010 to honor the requests of citizens in the Little Pimmit Run watershed.

Total Maximum Daily Load Monitoring

In 2009 and 2010 the Northern Region of DEQ devoted a significant amount of their monitoring efforts to collecting data for the Total Maximum Daily Load (TMDL) Program. Monitoring was conducted for the purpose of TMDL development, TMDL Implementation Plan Development, and TMDL Implementation Plan Follow-Up.

TMDL Development

Monitoring to support bacteria TMDL development was conducted on the following streams in 2010: Sugarland Run, Mine Run, Pimmit Run, Powells Creek, Little Creek, Chopawamsic Creek (includes Final 2012

the North, Middle and South Forks), Quantico Creek, South Fork Quantico Creek, an Unnamed Tributary to the Potomac River, Aquia Creek, Austin Run, Accokeek Creek, Potomac Run, and Potomac Creek.

Monitoring to support the development of several benthic TMDLs also occurred in 2010. Ambient and metals sampling was performed on South Fork Catoctin Creek, Holmes Run, and Tripps Run. In 2010 storm sampling was performed on South Fork of Catoctin Creek that included total and dissolved metals.

Implementation Plan Development and Follow-Up Monitoring

In 2009 and 2010 the Northern Region of DEQ collected ambient monitoring data for TMDL follow-up monitoring for the implantation plan development for the following streams: Thumb Run (includes the East and West Branches), Carter Run, Great Run, and Deep Run. Ambient monitoring was also conducted on Goldmine Creek in 2009 to support the upcoming development of the Implementation Plan for tributaries to Lake Anna.

Total Maximum Daily Load Studies

In 2009 and 2010 two TMDL reports covering 4 impaired segments, were completed in NRO and approved by the U.S. EPA. A Bacteria TMDL for the tidal portion of Four Mile Run (Arlington County and the City of Alexandria) was approved by EPA on June 14, 2010. Bacteria TMDLs were also completed for Holmes Run, Cameron Run, and Hunting Creek (Arlington County, City of Alexandria, City of Falls Church, and Fairfax County). These TMDLs were approved by EPA on November 10, 2010.

Bacteria TMDLs for Sugarland Run, Mine Run, and Pimmit Run are currently underway and will be completed in early 2012. In addition, bacteria TMDLs for Powells Creek, Quantico Creek, South Fork Quantico Creek, North Branch Chopawamsic Creek, Austin Run, and Unnamed Tributary to the Potomac River, Accokeek Creek, Potomac Creek, and Potomac Run are also scheduled to be completed in early 2012.

During 2009 and 2010 EPA worked to complete a storm water flow TMDL for the benthic impairments on Accotink Creek (City of Fairfax, Fairfax County). EPA was the lead agency for completing the Accotink Creek benthic TMDL, which was completed in 2011.

TMDL Implementation Plan Development

In addition to developing TMDLs necessary to meet the requirements of the Consent Decree Schedule, NRO assisted the Department of Conservation and Recreation (DCR) with the development of several bacteria TMDL implementation plans in the following watersheds: (1) Marsh Run Watershed (Marsh Run, Browns Run, Craig Run; located in Fauquier County); (2) Robinson River Watershed (Robinson River and Little Dark Run; located in Madison and Culpeper Counties); and (3) Tributaries to Lake Anna (Pamunkey Creek, Terrys Run, Plentiful Creek, Beaver Creek, Mountain Run, and Goldmine Creek; located in Louisa, Spotsylvania, and Orange Counties). The implementation process involved intense coordination between state and federal agencies, local governments, and citizen groups. In the implementation plan process major emphasis was placed on discussing best management practices (BMPs), locations of control measures, education, technical assistance, monitoring, and funding. The Marsh Run watershed Implementation Plans were completed in 2010 and the Robinson River Watershed and Lake Anna Tributaries Implementation Plans started in 2010 and were finished in 2011.

Virginia Water Facilities Revolving Loan Fund Projects

Since 1987, the Virginia Water Facilities Revolving Loan Fund has been providing low interest

loan funding for water quality improvement projects throughout the Commonwealth. Funds are currently provided to local governments, public service authorities, agricultural producers, partnerships, and corporations for a variety of project types. Loan repayments are circulated back into the Fund to create a dedicated source of revenue available for future clean water projects. One notable example of these projects is described below.

Arlington Water Pollution Control Facility

The Fund has loaned \$167 million to a six-year, \$500 million project designed to upgrade the facility, which will result in the following water quality improvements: expanding the existing 30 million-gallon per day (MGD) to 40 MGD capacity, provide a cost-effective way to treat flows to the facility during storm events (which will address bypasses to Four Mile Run, a tributary to the Potomac River and the Chesapeake Bay), and increase the removal of total nitrogen and total phosphorus.

Upgrades completed to the facility during 2009 and 2010 include:

1. Completed construction of two equalization tanks in February 2009, resulting in the buffering of storm water flow and reduced bypasses to Four Mile Run.
2. Completed upgrade of the secondary treatment system and clarifiers in March 2009 resulting in increased nutrient removal.
3. Completed upgrade of the disinfection system in November 2009.
4. Replaced the electrical distribution center in November 2009.

Piedmont Regional Office (PRO)

Dragon Swamp Mercury Source Assessment

Portions of Dragon Run/Dragon Swamp and the Piankatank River were initially placed under a VDH fish consumption advisory in 2003 due to mercury exceedences in largemouth bass, which was discovered during fish tissue monitoring by the DEQ in 2000. After further monitoring by the DEQ, the advisory was expanded in July 2005 to include the entire length of Dragon Run/Dragon Swamp and the Piankatank River down to Deep Point Boat Landing. The fish consumption advisory recommends that adults eat no more than two meals/month of largemouth bass and that high risk individuals—such as women who are pregnant or may become pregnant, nursing mothers, and young children—do not eat any fish contaminated with mercury. High levels of mercury in the bloodstream of unborn babies and young children may harm the developing nervous system.

To determine the source of the mercury, the DEQ Piedmont Regional Office performed a source assessment study from 2004 through 2006. The study involved monitoring mercury levels in water and sediment at 13 locations throughout the Dragon Swamp watershed to examine patterns of mercury distribution.

In the second year of the study, all 13 locations were monitored on the same day to determine if any statistically valid differences in water mercury concentrations exist between the stations. All locations were sampled five times in 2006 and, based on an ANOVA analysis, no stations were more contaminated than the rest of the watershed (i.e. no “hotspots”). Most samples were below the laboratory detection level of 1.5 parts per trillion (ppt). The highest value measured (10.6 ppt) was well below the EPA human health standard for public drinking water supplies (50 ppt) and less than 1/70th the chronic Aquatic Life standard of 770 ppt.

The study demonstrated that the mercury contamination is entering this system primarily from atmospheric deposition. Levels of total mercury were evenly distributed throughout the watershed. If local “hotspots” or areas of comparatively elevated levels of total mercury had been found, it would have indicated local ground-based sources of mercury entering the system.

Atmospheric Deposition of Mercury at Harcum, VA 2004-2007

In response to concerns relating to the 2003 Virginia Department of Health (VDH) fish consumption advisory for mercury in the Dragon Run/Dragon Swamp/Piankatank River watershed, the DEQ Piedmont Regional Office entered into a collaborative effort with Dr. William Reay of the Virginia Institute of Marine Science (VIMS) and the DEQ Coastal Zone Management Program to establish and maintain a National Atmospheric Mercury Deposition Network (MDN) station to monitor weekly inputs and loadings of mercury into the watershed. The station was constructed on Dr. Reay’s property in Harcum, VA and he maintained it and performed the weekly monitoring tasks. This summary covers from December 2004 through June 2007. Oversight of the station was transferred to Central Office Air Monitoring in 2008.

Dr. Reay collected ninety-four (94) weekly samples of rainfall at the Harcum station during this study. There were 25 other weeks in the period where there was no precipitation to sample. A MDN laboratory in Illinois analyzed the samples for total mercury (Hg). The mean Hg concentration for the period was 9.1 ng/l and the mean deposition load, which combines rainfall with Hg concentration, was 185 ng/m². The concentrations and loads varied widely from a minimum concentration of 0.92 ng/l and load of 3.91 ng/m² to a maximum concentration of 40.4 ng/l and load of 1697 ng/m². There appeared to be a pattern of seasonality in the Harcum data; monthly totals generally showed highest deposition loads in the summer and lowest loads in the winter. This pattern also appeared in the other two station datasets from Virginia, which are located in Culpeper and in Shenandoah National Park. Harcum data was also compared with data from stations in Acadia National Park in Maine and Everglades National Park in Florida. The lowest Hg concentrations and loads generally appeared in the upper Northeastern USA as evidenced by mean Hg at Acadia, ME of 6.8 ng/l. Mid-Atlantic concentrations and loads were mid-range as shown by Harcum at 9.1 ng/l. The far Southeastern USA had the highest concentrations and loads, reflected by the Everglades mean Hg of 14.1 ng/l.

The Harcum, VA station VA98 mercury dataset may be found at <http://nadp.sws.uiuc.edu/sites/siteinfo.asp?id=VA98&net=MDN>. The study summary may be obtained from Mark Alling of Virginia DEQ by emailing Mark.Alling@deq.virginia.gov.

Tyson Foods, Inc. Glen Allen Ammonia Study

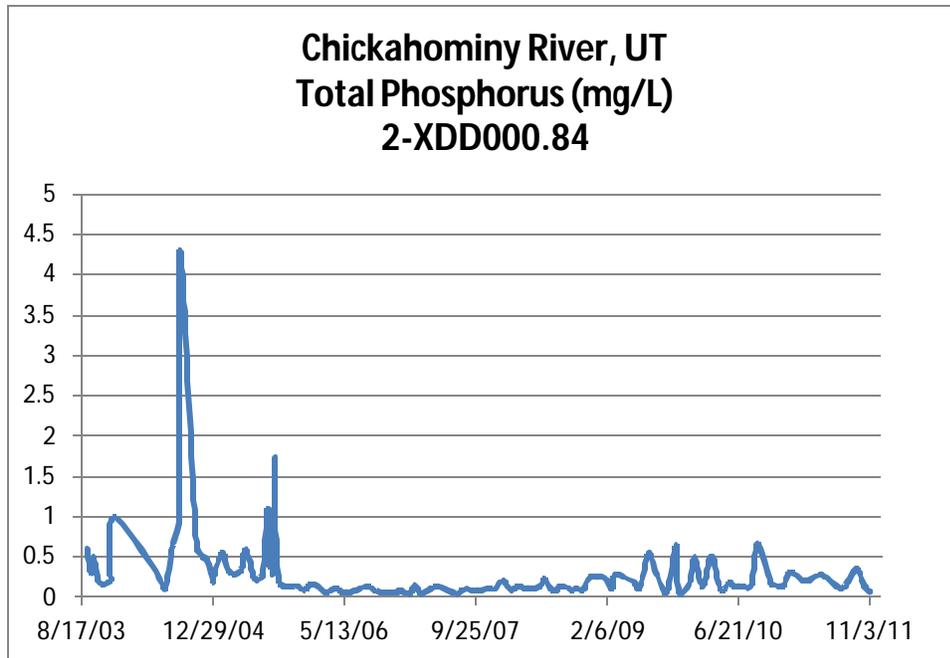
Data analysis in summer 2005 determined that ammonia levels were elevated in an unnamed tributary of the Chickahominy River below the permitted discharge from Tyson Foods. The ammonia levels exceeded the allowable chronic 30-day average water quality standard, however the data was limited to instantaneous grab samples, so comparison to the chronic standard was not possible.

PRO staff subsequently performed a study in July-August 2005 to determine if ammonia levels exceeded chronic water quality standards in the stream. Samples were taken at seven locations on the tributary, including upstream and downstream of the discharge, in a downstream pond, and downstream of the pond. Samples were taken daily Monday-Thursday to allow better comparison to the 30-day average standard. During this month-long study, acute and chronic ammonia violations, pH violations, and maximum temperature violations were noted at various locations. In addition, two separate fish kills were documented during the study; one of the fish kills coincided with an unanticipated wastewater treatment plant bypass that caused exceedences of permit limits for total phosphorus and total suspended solids in the Tyson effluent.

Tyson Foods has since upgraded their wastewater treatment plant and have significantly reduced the

amount of total phosphorus in their effluent. Total phosphorus data from the unnamed tributary (UT) below the facility is shown in Figure 7.8-1.

Figure 7.8-1 UT Chickahominy River Total Phosphorus 2003 – 2011.



Harmful Algal Bloom Response and Monitoring Program

The DEQ investigates fish kills to determine whether they are caused by algal blooms, and, if so, to determine whether harmful algal blooms (HAB) are present. Many fish kills are juvenile menhaden kills which are typically attributed to low dissolved oxygen and stranding overnight at low tide. In most instances no lesions are observed on these fish, HAB counts are low, and DNA probe results are negative. However, fish kills are often caused by both toxic and non-toxic algal blooms. In its early stages, the blooms elevate dissolved oxygen (DO) and pH but, as the bloom dies, DO can drop to hypoxic levels resulting in fish and crab kills. In addition, some HAB species can cause lesions on fish and have been tied to health effects in fisherman.

During HAB investigations, DEQ collects dissolved oxygen, pH, temperature, and a full range of water quality analyses - including dissolved, particulate and total phosphorus and nitrogen, chlorophyll a, biochemical oxygen demand, total suspended solids, and total organic carbon. Algae samples are collected by the DEQ and are sent to Old Dominion University for identification and HAB algal cell counts, and are sent to the Virginia Institute of Marine Science (VIMS) for DNA probe identification.

Specific investigations:

2005. In 2005, PRO staff investigated nine incidents, including two juvenile menhaden kills, a filamentous blue-green algae bloom near Hopewell, and several dinoflagellate red tide blooms.

On September 29th – October 9th, PRO monitored a blue-green *Anabaena* bloom in the James River near Scottsville, which is approximately 65 miles upstream from the City of Richmond. There was concern about possible taste and odor problems in Richmond's drinking water supply if the bloom reached the intake. However, tropical storm Tammy flushed the bloom past the city on October 9th. No fish kill was reported.

2006. On April 1, 2006, PRO responded to a report of skin rashes and lesions from water exposure in the Potomac River near Colonial Beach. Old Dominion University identified low levels of diatoms and no toxic dinoflagellates. The rashes and lesions were reported to the Virginia Department of Health. A possible red tide bloom was noted 10 miles upstream.

2007. A *Karlodinium* dinoflagellate HAB in the Potomac River lasted approximately 8 weeks during June through August 2007. At its peak, the bloom extended from Upper Machodoc Creek, which is located upstream of Colonial Beach, down to Sandy Point, which is 30 miles below Colonial Beach. Locations of the densest areas of the bloom varied up and down the river, but most often occurred from the municipal pier in Colonial Beach to below the mouth of Mattox Creek. In later stages of the bloom, it also entered Monroe Bay behind Colonial Beach. On July 11, the bloom resulted in a major fish kill of 300,000 menhaden, white perch, croaker, and other species in Mattox Creek.

2008. An algae bloom occurred on Mattox Creek in Westmoreland County on 7/28/2008, with dissolved oxygen (DO) supersaturation of 179% and total phosphorus of 0.17 mg/l. No dead fish were observed. A fish kill of many juvenile menhaden occurred in the headwaters of Horn Harbor, possibly due to low DO stranding.

A very large *Microcystis* HAB occurred on the Potomac River from Mattawoman Creek downstream 15 miles to Fairview Beach on 8/8-13/2008, with up to 1.1 million cells/ml and microcystin toxin up to 247 ug/l. The recommended EPA microtoxin water quality criterion is 10 ug/l.

2009. A Colonial Beach/Potomac River fish kill of croaker, perch, and menhaden was reported by VIMS on July 1, 2009. PRO counted 118 gizzard shad, white perch, catfish, striped bass, American eels and one blue crab. No HAB was visible although pH was elevated to pH 8.5 SU.

On August 20, 2009, a large fish kill of juvenile menhaden occurred at the New Point Comfort Camp Marina. The fish kill was estimated to be from 500,000 – 1 million fish and was caused by low DO stranding.

2010. An algae bloom occurred on the Ware and East Rivers on May 5, 2010 which contained 100,000 cells/ml of the dinoflagellate *Karlodinium veneficum*, which can produce a toxin that can kill fish, but is harmless to humans. However no dead fish were noted. The water color was pink and the maximum pH was 8.7 S.U. *Karlodinium* was found at four sample sites in the mainstem Ware River and upstream coves of Fox Mill Run and Beaverdam Creek through May 10 at up to 950 cells /ml.

An algae bloom was reported by the Chesapeake Bay Foundation on May 21, 2010 in Aimes Creek of the Lower Machodoc Creek off the Potomac River which contained up to 10,000 cells/ml of *Karlodinium*, a common late winter bloom producer. DEQ investigated on Monday May 24 and found no traces of the bloom.

VIMS reported a bloom of *Akashiwo sanguine* in the lower York River on June 28, 2010.

A fish kill of 250,000 juvenile menhaden occurred in Barn Creek in Milford Haven starting July 3, 2010, accompanied by very green water color. The dissolved oxygen level ranged from 0.0 to 2.1 mg/l in the upper half of Barn Creek. This appeared to be a low tide low dissolved oxygen stranding event, but accompanied by an algae bloom.

An algae bloom of 640 cells/ml *Gymnodinium* occurred in Hampton Hall Creek on July 15, 2010. Dissolved oxygen was at 128% saturation and pH was 8.2 S.U. No fish kill was observed.

An algae bloom dominated by *Cochlodinium* and *Scrippsiella*, which included low levels of *Alexandrium monilatum* occurred in Sarah Creek on July 28, 2010. Reddish brown discolored water was observed, but no fish kill. This bloom grew to involve the lower York River by July 31, 2010 and parts of the lower Chesapeake Bay to the Chesapeake Bay Bridge Tunnel by August 10, associated with a fish kill.

There was a report of 1000's of dead juvenile menhaden in tidal Oyster Creek in the Rappahannock River on August 1, 2010 with no mention of an algae bloom.

An unusual stinging nettle kill occurred on Blackwater Creek in North River on August 9, 2010. The water color was green and dissolved oxygen was depressed at 4.9 mg/l.

A series of juvenile menhaden fish kills occurred from August 16 - September 15, 2010 involving the HAB species *Chattonella* at up to 620 cells/ml in Cobbs Creek (4 distinct kills, one at 174,000 dead fish), Antipoison Creek (153,760 dead fish on September 3 - 8 with low dissolved oxygen at 0.8 mg/l and very high chlorophyll-a at 256 mg/kg.), Queen Creek (September 4 with 10,000 dead fish), Barn Creek (August 28) and Dancers Creek (1000s of dead fish). *Chattonella* can produce a brevetoxin related to shellfish poisoning.

There was a bloom of blue green algae *Oscillatoria* and *Aphanizomenon* in the tidal Appomattox River near the Virginia American water intakes on September 11, 2010. The concentrations were at 51 mg/kg chlorophyll a. The drinking water plant reported taste and odor problems related to these algae. No dead fish were observed.

There was a report of 1,000 dead fish in tidal Wilton Creek in the Piankatank River on September 26, 2010 with no mention of an algae bloom.

2011. An algae bloom occurred on Totuskey Creek on March 4, 2011 which contained 27,750 cells/ml of the dinoflagellate *Heterocapsa rotundata*, a common late winter bloom producer. No adverse impacts were noted.

An algae bloom occurred on the Rappahannock River in late May, 2011 which contained large concentrations of the dinoflagellates *Heterocapsa rotundata*, *Gyrodinium*, *Prorocentrum* and *Karlodinium*. No adverse impacts were noted.

An algae bloom occurred on Byrd Lake in the City of Richmond on July 7, 2011, which had an associated small fish kill. Live fish were also observed. There was a pH water quality standard violation during the bloom at pH 9.5 S.U. The fish kill was probably caused by high water temperatures, high pH and possible low dissolved oxygen at night during the bloom.

A juvenile menhaden fish kill occurred in Put-in Creek in Mathews County on July 7, 2011. Low salinity was observed in this tidal headwaters location due to heavy rains. Dissolved oxygen was also low at 4.5 mg/l. There was no algae bloom present.

On July 21, DEQ received an unconfirmed report of a red tide algae bloom with dead fish off Colonial Beach and Westmoreland State Park on July 9, 2011. These locations were checked on July 21, 2011, at which time DEQ observed an algae bloom on the Potomac River at Colonial Beach which contained 4,670 cells/ml of the dinoflagellate *Gyrodinium instriatum*, which causes brown water color. Dissolved oxygen was supersaturated with pH 9.0. No adverse impacts were noted.

DEQ received two reports of fish kills in a private pond below a poultry processing plant on July 20 and October 6, 2011. The July bloom resulted in a fish kill of 5,183 juvenile largemouth bass and sunfish.

The October bloom resulted in a fish kill of 1,868 sunfish, largemouth bass, channel catfish and crappie of all sizes. The pond contained large concentrations of the blue green algae *Microcystis* on each occasion. At these levels the algae can produce microtoxin, which was confirmed during the October bloom event. Old Dominion University stated that microtoxin was the probable cause of the October 6 fish kill.

Coastal 2000 Initiative - Water Quality, Biomonitoring and Sediment Toxicity of Virginia Estuaries

PRO and TRO have sampled randomly-selected probabilistic estuarine stations on the western and eastern Chesapeake Bay shores and the Atlantic Ocean side of the Eastern Shore from summer 2001 to present. Probabilistic studies answer questions such as "What percentage of Virginia estuaries have low dissolved oxygen?" Sampling crews obtain filtered chlorophyll a and nutrients, particulate nutrients, total suspended solids, benthic infauna, sediment metals, organics, particle size, and toxicity samples, light attenuation data, and depth profiles for DO, temperature, pH, conductivity and salinity. Each station is sampled once. Field duplicate samples are collected at one station per run, to cover 10 percent of samples for each parameter. Hydrolabs are pre- and post-calibrated and maintained according to agency SOPs. The results of the study are incorporated into the 305(b) assessment.

Probabilistic Biomonitoring and Chemical Monitoring Program in Virginia Non-Tidal Streams

In 2001, DEQ initiated the Probabilistic Monitoring (ProbMon) study. The goal of ProbMon is to provide accurate statewide and regional assessments of the conditions of Virginia's non-tidal freshwater streams by sampling randomly selected sites. A total of 50 streams ranging in size from first order to sixth order are sampled statewide annually. PRO samples approximately 10-15 probabilistic stations in the Piedmont and Coastal Plain ecoregions each year. The Regional Biologists gather representative samples of benthic macroinvertebrates, perform comprehensive habitat assessments, and obtain DO, temperature, pH, and conductivity data during both the spring and fall at each assigned ProbMon station. In addition, spring monitoring activities include collection of water samples that are analyzed for nutrients, Total Organic Carbon (TOC), chlorophyll a, fecal coliform bacteria and water column metals. In the fall, nutrient and periphyton samples are collected, and stream physical habitat measurements are taken. Using ProbMon data from 2001-2004, a Virginia Stream Condition Index has been developed and validated. Results from the initial five-year study have been summarized and are available for review at <http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/ProbabilisticMonitoring.aspx>. Over 600 locations have been sampled by 2010.

James River PCB Water Column Study

Due to the presence of PCBs, the VDH has issued a fish consumption advisory for the James River from the I-95 Bridge in Richmond downstream to the Hampton Roads Bridge Tunnel and the tidal portion of the following tributaries: Appomattox River up to Lake Chesdin Dam, Bailey Creek up to Rt. 630, Poythress Run, Bailey Bay, and the Chickahominy River up to Walkers Dam. The advisory recommends that adults do not eat gizzard shad, carp, or blue- and flathead catfish >32 inches long. It also recommends that adults eat no more than two meals/month of blue and flathead catfish <32 inches long, channel catfish, white catfish, largemouth bass, bluegill sunfish, American eel, quillback carpsucker, smallmouth bass, creek chub, yellow bullhead catfish, white perch, striped bass, bluefish, croaker, spot, blueback herring, and hickory shad.

In preparation for the 2014 James River PCB TMDL, DEQ has initiated a study of PCBs in ambient water in the James River using a high resolution/low detection method (EPA Method 1668A). During April - June 2011, one-time samples were collected at three stations between Hopewell and the Chickahominy River. In addition, monthly samples were collected at the James River near Jordan Point (Rt. 156 bridge station (2-JMS074.44)) starting in April 2011.

The data will be used to support development of a model for the James River TMDL.

Biosolids Application Study

DEQ staff has received questions from citizens, municipalities, environmental groups and others about fecal coliform bacteria levels in biosolids that are applied to agricultural fields and forests. Until now the only answer staff could give is that Class B biosolids are required to have less than 2 million MPN (colonies) per gram. The state laboratory (DCLS) does not have an approved method to measure the amount of bacteria in biosolids, so DEQ had no way to scientifically respond to this question. The purpose of this study is to gather information about the potential of bacteria to run off from biosolids application sites, which is actually a more valuable piece of information than how much is contained in the biosolids.

Water quality monitoring is being conducted at up to 50 stations on farm fields and forests in the Piedmont and Coastal Plain regions of PRO. DEQ staff is collecting E. coli water quality samples from standing water on farm fields and forests following storm events of sufficient rainfall. Sampling discreet standing water pools minimizes the chance of contamination by avian or wild/domesticated mammalian waste by limiting the drainage area for each sample. Samples are being collected from sites where biosolids have been applied within the previous 8 days. Attempts are being made to sample applications of both lime stabilized and digested biosolids. Data is being collected from February 2010 – June 2012; a final evaluation will be conducted in late 2012.

James River and Gillie Creek E. coli Study

Gillie Creek and the tidal James River are among the waterbodies impaired for the primary contact recreation use due to E. coli bacteria. The TMDL has been developed and has been approved by the EPA and Implementation Planning is nearing completion. Both Gillie Creek and the tidal James River receive Combined Sewer Overflows (CSOs) during and immediately following rainfall events. The City of Richmond has made excellent progress for the last 20 years in reducing the bacteria loads from CSO events by implementing improvements outlined in the CSO Long Term Control Plan (LTCP). The City of Richmond began weekly sampling at a number of sites on the tidal James River from the fall line to the mouth of the Appomattox River in 2010. Their purpose was to evaluate E. coli in this segment by the geometric mean water quality standard of 126 cfu/100mL rather than by the instantaneous standard. The City of Richmond study did not include sampling near the mouth of Gillie Creek.

As resources allow, the DEQ is sampling weekly at nine stations interspersed between the City of Richmond stations, including a station immediately below the mouth of Gillie Creek and one station in Gillie Creek. The goal of this study is for DEQ to collect E. coli weekly which will allow this segment to be assessed using the geometric mean water quality standard. Samples are collected on the same date each week to preclude non-random sampling for storm events. E. coli will be sampled on as many weekly events as possible from October 2010 to December 2011.

Tidewater Regional Office (TRO)

Low level PCB sampling in the Elizabeth River

The Elizabeth River and its tributaries have VDH fish consumption advisories for PCBs, and thus are impaired for PCBs. Ambient water samples were collected from locations throughout the watershed during spring and early summer 2009 and spring 2010. Samples were collected during “dry” weather and “wet” weather conditions. Monthly sampling at a single station in the mainstem of the river began in April 2011 to continue for one year. A low level analytical procedure using high resolution GC/high resolution mass spectrometry capable of part per quadrillion detection levels was used to analyze the samples. The

results will be used to support development of a TMDL for the watershed.

Harmful Algal Blooms/Pfiesteria Monitoring

The Department of Environmental Quality and the Department of Health, including the Division of Shellfish Sanitation, work together to respond to potentially harmful algal blooms (HABs, including Pfiesteria). Samples from algal blooms and fish kill sites are sent to Old Dominion University and the Virginia Institute of Marine Science for a detailed evaluation for potential harmful algae species. Additional information can be found at: <http://www.vdh.virginia.gov/Epidemiology/DEE/Waterborne/HABS/>

Coastal 2000 Initiative

The Tidewater Regional Office has been involved with the Coastal 2000 Program. Data has been collected from 2001 through 2011. For additional information contact the project manager, Don Smith at donald.smith@deq.virginia.gov