2011 Report on Toxics Reduction in State Waters

The complete set of Tables, Folders with Figures, and Appendices associated with this report, as well as the text document, are available on the WebPages of the Department of Environmental Quality at http://www.deq.virginia.gov/watermonitoring/.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

JANUARY 1, 2012

This page intentionally left blank

Table of Contents

All Tables, Folders, Figures and Appendices referred to in the text are available as "Read Only" files on DEQ's WebPages (http://www.deq.virginia.gov/watermonitoring/tox.html). Data users may download them as they are and then rename them if editing or reformatting is desired. All are also available on CD together with this text. Direct your requests to Don Smith at (804) 698-4429 or Donald.Smith@deq.virginia.gov.

List of Tables

* *

List of Figures: Folders 3 through 6

The numbering of figure-containing **Folders** corresponds to the numbers of the associated **Tables 3 through 6**, which contain the complete results for the ambient monitoring of toxic materials from the past state fiscal year. The Microsoft Excel® workbooks that contain the graphs of historical toxics concentrations also include worksheets with descriptive statistical summaries of historical data arranged as follows:

(1) Historical data arranged by state fiscal year for all toxic parameters in the class;
(2) Historical data arranged by toxic parameter for years 1997 through the present.

Note: Because of restrictions for naming electronic folders and files, the names of some folders and files stored on disk may not appear exactly the same as those listed below.

Introduction to Tables and Folders - Analyte Lists and Program Codes for Tables and Folders

Folder 3 - Historical Dissolved Clean Metals - All Basins

Historical Dissolved Metals - (1) Potomac-Shenandoah Basin SFY11
Historical Dissolved Metals - (2) James Basin SFY11
Historical Dissolved Metals - (3) Rappahannock Basin SFY11
Historical Dissolved Metals - (4) Roanoke Basin SFY11
Historical Dissolved Metals - (5) Chowan-Dismal Swamp Basin SFY11
Historical Dissolved Metals - (6) Tennessee-Big Sandy Basins SFY11
Historical Dissolved Metals - (7) Chesapeake Bay and Coastal Basins SFY11
Historical Dissolved Metals - (8) York Basin SFY11
Historical Dissolved Metals - (9) New Basin SFY11

Folder 4 - Historical Total Metals - Water - All Basins

Historical Total Metals in Water Column - (1) Potomac-Shenandoah Basin SFY11
Historical Total Metals in Water Column - (2) James Basin SFY11
Historical Total Metals in Water Column - (3) Rappahannock Basin SFY11
Historical Total Metals in Water Column - (4) Roanoke Basin SFY11
Historical Total Metals in Water Column - (5) Chowan/Dismal Swamp Basin SFY11
Historical Total Metals in Water Column - (6) Tennessee - Big Sandy Basin SFY11
Historical Total Metals in Water Column - (7) Chesapeake Bay & Coastal Basins SFY11
Historical Total Metals in Water Column - (8) York Basin SFY11
Historical Total Metals in Water Column - (9) New Basin SFY11

Folder 5 - Historical Metals - Sediment - All Basins

Historical Sediment Metals - (1) Potomac-Shenandoah Basin SFY11
Historical Sediment Metals - (2) James Basin SFY11
Historical Sediment Metals - (3) Rappahannock Basin SFY11
Historical Sediment Metals - (4) Roanoke Basin SFY11
Historical Sediment Metals - (5) Chowan-Dismal Swamp Basin SFY11
Historical Sediment Metals - (6) Tennessee-Big Sandy Basin SFY11
Historical Sediment Metals - (7) Small Chesapeake Bay & Coastal Basins SFY11
Historical Sediment Metals - (8) York Basin SFY11
Historical Sediment Metals - (9) New Basin SFY11

Folder 6a - Historical Organo-Chlorine Pesticides - Sediment - All Basins

- **Historical Sediment OC Pesticides - (1) Potomac-Shenandoah SFY11**
- **Historical Sediment OC Pesticides - (2) James SFY11**
- **Historical Sediment OC Pesticides - (3) Rappahannock SFY11**
- **Historical Sediment OC Pesticides - (4) Roanoke SFY11**
- **Historical Sediment OC Pesticides - (5) Chowan SFY11**
- **Historical Sediment OC Pesticides - (6) Tennessee-Big Sandy SFY11**
- **Historical Sediment OC Pesticides - (7) Small Chesapeake & Coastal SFY11**
- **Historical Sediment OC Pesticides - (8) York SFY11**
- **Historical Sediment OC Pesticides - (9) New SFY11**

Folder 6b - Historical Organo-Phosphorus Pesticides - Sediment - All Basins

- **Historical Sediment OP Pesticides-1 - (1) Potomac-Shenandoah SFY11**
- **Historical Sediment OP Pesticides-2 - (1) Potomac-Shenandoah SFY11**
- **Historical Sediment OP Pesticides-1 - (2) James SFY11**
- **Historical Sediment OP Pesticides-2 - (2) James SFY11**
- **Historical Sediment OP Pesticides-1 - (3) Rappahannock SFY11**
- **Historical Sediment OP Pesticides-2 - (3) Rappahannock SFY11**
- **Historical Sediment OP Pesticides-1 - (4) Roanoke SFY11**
- **Historical Sediment OP Pesticides-2 - (4) Roanoke SFY11**
- **Historical Sediment OP Pesticides-1 - (5) Chowan SFY11**
- **Historical Sediment OP Pesticides-2 - (5) Chowan SFY11**
- **Historical Sediment OP Pesticides-1 - (6) Tennessee-Big Sandy SFY11**
- **Historical Sediment OP Pesticides-2 - (6) Tennessee-Big Sandy SFY11**
- **Historical Sediment OP Pesticides-1 - (7) Small Chesapeake & Coastal SFY11**
- **Historical Sediment OP Pesticides-2 - (7) Small Chesapeake & Coastal SFY11**
- **Historical Sediment OP Pesticides-1 - (8) York SFY11**
- **Historical Sediment OP Pesticides-2 - (8) York SFY11**
- **Historical Sediment OP Pesticides-1 - (9) New SFY11**
- **Historical Sediment OP Pesticides-2 - (9) New SFY11**

Folder 6c – Historical Herbicides – Sediment – All Basins

- **Historical Sediment Herbicides - (1) Potomac-Shenandoah SFY11**
- **Historical Sediment Herbicides - (2) James SFY11**
- **Historical Sediment Herbicides - (3) Rappahannock SFY11**
- **Historical Sediment Herbicides - (4) Roanoke SFY11**
- **Historical Sediment Herbicides - (5) Chowan SFY11**
- **Historical Sediment Herbicides - (6) Tennessee-Big Sandy SFY11**
- **Historical Sediment Herbicides - (7) Small Chesapeake & Coastal SFY11**
- **Historical Sediment Herbicides - (8) York SFY11**
- **Historical Sediment Herbicides - (9) New SFY11**

Folder 6d – Historical PAHs - Sediment – All Basins

- **Historical Sediment PAHs - (1) Potomac-Shenandoah SFY11**
- **Historical Sediment PAHs - (2) James SFY11**
- **Historical Sediment PAHs - (3) Rappahannock SFY11**
- **Historical Sediment PAHs - (4) Roanoke SFY11**
- **Historical Sediment PAHs - (5) Chowan SFY11**
- **Historical Sediment PAHs - (6) Tennessee-Big Sandy SFY11**
- **Historical Sediment PAHs - (7) Small Chesapeake-Coastal SFY11**
- **Historical Sediment PAHs - (8) York SFY10**
- **Historical Sediment PAHs - (9) New Sediment SFY11**

Folder 6e Historical Semi-volatiles - Sediment – All Basins

- **Historical Sediment Semi-volatiles - (1) Potomac-Shenandoah SFY11**
- **Historical Sediment Semi-volatiles - (2) James SFY11**
- **Historical Sediment Semi-volatiles - (3) Rappahannock SFY11**
- **Historical Sediment Semi-volatiles - (4) Roanoke SFY11**
- **Historical Sediment Semi-volatiles - (5) Chowan SFY11**
- **Historical Sediment Semi-volatiles - (6) Tennessee-Big Sandy SFY11**
- **Historical Sediment Semi-volatiles - (7) Small Chesapeake-Coastal SFY11**
- **Historical Sediment Semi-volatiles - (8) York SFY11**
- **Historical Sediment Semi-volatiles - (9) New SFY11**

List of Appendices

Glossary of Acronyms, Abbreviations and Technical Terms

Ambient Monitoring	The monitoring of physical and chemical characteristics within the Commonwealth's rivers, streams, lakes and estuaries. Ambient monitoring and assessment characterize ecological stressors and evaluate their potential impact on aquatic organisms and other wildlife, and on human health and recreational use of Virginia's waters.
AMD	Acid Mine Drainage
Aroclor	Aroclors ® - technical mixtures of PCBs made by Monsanto during the period of the 1930s through 1977.
ALU	Aquatic Life Designated Use
B4B	Businesses for the Bay Program
BDE	Bromated diphenyl ether
B-IBI	Benthic Index of Biotic Integrity
BTU	British Thermal Unit - the amount of energy required to increase the temperature of 1 pound of water by 1 degree Fahrenheit, at normal atmospheric pressure.
CBP	Chesapeake Bay Program
CEDS	Comprehensive Environmental Data System
CIMS	CBP Information Management System
Compliance Monitoring	The monitoring of in-pipe concentrations of permitted discharges, which is one element in the prevention of contamination by toxics. Compliance monitoring evaluates whether or not the concentrations of potential pollutants in industrial, municipal or other permitted discharges are within the allowable limits specified in their permits.
CPMI	Coastal Plain Macroinvertebrate Index – used to evaluate the health of freshwater benthic communities in the Coastal Plain Region of Virginia
CVs	Consensus-Based Sediment Quality Guidelines – Critical values for contaminants in freshwater sediment (replace freshwater use of previously utilized ER-L and ER-M values intended for assessment of estuarine and marine sediments; MacDonald et al. 2000). See also PEC, below.
CWA	Federal Clean Water Act (1983) that first described the scope and purpose of water quality standards and defined the authority and responsibility of the U.S. EPA and the various states in relation to the requirements for, submission of, and establishment of such standards.
DCLS	Division of Consolidated Laboratory Services
DEQ	Department of Environmental Quality
DMR	Discharge Monitoring Report
EDAS	Ecological Data Application System (database)
EEC	Extreme Effects Concentration – the concentration of a contaminant above which adverse effects to sediment-dwelling organisms frequently or always occur
ELG	Effluent Limitation Guidelines
EMS	Environmental Management System
ER-L	Effects Range-Low
ER-M	Effects Range-Moderate
EPA	Environmental Protection Agency
FY	Fiscal year
FWS	Fish and Wildlife Service, Department of the Interior
IBI	Index of Biological Integrity
ICPRB	Interstate Commission for the Potomac River Basin
IR	"Integrated Report" – abbreviation for the 305(b)/303(d) Water Quality Integrated Assessment Report

IRIS Integrated Risk Information System - a database of human health effects that may result from exposure to various substances found in the environment. IRIS is provided online by EPA and its Office of Research and Development, National Center for Environmental Assessment. (http://cfpub.epa.gov/ncea/iris/index.cfm)

MEC Midrange Effect Concentration – the concentration of a contaminant above which adverse effects to sediment-dwelling organisms frequently occur

MGD Millions of Gallons per Day

Microgram (µg or ug) One millionth of a gram.

MonPlan Annual Water Quality Monitoring Plan

MY Monitoring Year

Nanogram (ng) One billionth of a gram

NARS National Aquatic Resources Survey

NCCA National Coastal Condition Assessment

NOAA National Oceanic and Atmospheric Administration

NPEP National Partnership for Environmental Priorities

NPS Non-Point Source (pollution)

OC-Pesticides or OCP Organo-chlorinated Pesticide

OEE Office of Environmental Education

OP-Pesticides or OPP Organo-phosphorylated Pesticide

OPP or OP2 Office of Pollution Prevention

PAH Polycyclic Aromatic Hydrocarbon

PBTs Persistent Bioaccumulative Toxics – Toxic substances that accumulate (bio-concentrate) and persist in the tissues of living organisms.

PCB Polychlorinated biphenyl

PEC Consensus-based *Probable Effects Concentrations* for chemical contaminants in freshwater sediments (MacDonald et al. 2000). See also CV, above.

Picogram (pg) One trillionth of a gram

PMP Pollutant Minimalization Plan - An iterative plan with a programmed schedule and final goal for the reduction (minimalization) of toxic discharge (e.g. in particular PCBs) from a permitted point source. It supplants the necessity of establishing a reduced, fixed numerical limit which may be impossible to attain for a permitted discharge.

POTW Publicly Owned Treatment Works

P2 or PP Pollution Prevention Program

ProbMon Probabilistic Monitoring Program

QAPP Quality Assurance Program and Project Plan

RBP Rapid Bioassessment Protocol

SFY State Fiscal Year (July 1 – June 30)

SIC Standard Industrial Classification

SOP Standard Operating Procedure

SPMD Semi-Permeable Membrane Device

STORET EPA's legacy national ecological database (short for data 'STOrage and RETrieval' system)

SV Screening Value

TBT Tributyltin

TEC Threshold Effect Concentration – the concentration of a contaminant below which adverse effects to sediment-dwelling organisms are unlikely to occur

TMDL Total Maximum Daily Load study

TMP Toxics Management Program

TMR Toxics Management Regulation

TOC Toxics of Concern

TRE Toxics Reduction Evaluation

TRI	Toxic Release Inventory - The Toxics Release Inventory documents the total quantities of EPA-listed toxic compounds that are released annually (to the waters, the air and the land) by permitted facilities within the Commonwealth. Changes in the quantities of toxics released are indicative of the effectiveness of pollution prevention programs, but are not an adequate or representative measure of environmental impact or impairment.
TRISW	Toxics Reduction in State Waters (report)
TSV	Tissue Screening Value – risk-based screening values used by DEQ and VDH for evaluating fish-tissues for human consumption
USGS	United States Geological Survey, Department of the Interior
VISE	Virginia Information Source for Energy (Website)
VDH	Virginia Department of Health
VEEP	Virginia Environmental Excellence Program
VERC	Virginia Emergency Response Council
VH2E	Virginia Hospitals for a Healthy Environment
VIMS	Virginia Institute of Marine Science
VMN	Virginia Mentoring Network
VPDES	Virginia Pollutant Discharge Elimination System
VPI	Virginia Polytechnic Institute and State University
VSCI	Virginia Stream Condition Index – used to evaluate the health of freshwater benthic communities in the Piedmont and Mountain Regions of Virginia.
WET	Whole Effluent Toxicity
WQBEL	Water Quality Based Effluent Limitation
WQM	Water Quality Monitoring
WQMA	Office of Water Quality Monitoring and Assessment
WQS	Water Quality Standard(s)
WQX	Water Quality Exchange – EPA's new generation water quality information storage database, which has replaced the legacy STORET database.
WTPs	Water Treatment Plants
WWTPs	Wastewater Treatment Plants

Executive Summary

The Virginia Department of Environmental Quality (DEQ) is submitting this annual Toxics Reduction in State Waters (TRISW) Report to the Governor and the Chairs of the House Agriculture, Chesapeake and Natural Resources Committee and the Senate Agriculture, Conservation and Natural Resources Committee pursuant to Virginia Code § 62.1-44.17:3.

The primary objective of the TRISW Report is to document the Commonwealth's progress toward reducing toxics in state waters and improving water quality. This commitment includes three principal types of activities: (1) the prevention of contamination of the Commonwealth's waters by toxics, (2) the continued monitoring of those waters for the presence of toxics and (3) the implementation of remedial measures to reduce and/or eliminate toxics found in the Commonwealth's waters.

Prevention

Permitting: Compliance monitoring, the monitoring of in-pipe concentrations of permitted discharges, is one essential element of the prevention of contamination by toxics of the Commonwealth's waters. During State Fiscal Year 2011 (SFY11; 07/01/10-06/30/11), DEQ's Toxics Management Program (TMP) included 304 reporting facilities with 609 outfalls that had active permit-defined toxics limits in their effluents, as recorded in DEQ's Comprehensive Environmental Data System (CEDS) database. Approximately 1.91% of 4,244 individual parameter records exceeded the permitted average concentration and 1.47% of 6,345 exceeded their maximum permitted concentrations; almost all were incidental elevations of total or dissolved metals in discharges from municipal wastewater treatment plants.

Pollution Prevention: The 2011 Pollution Prevention Annual Report is available on the DEQ WebPages at http://www.deq.virginia.gov/p2/homepage.html. Among the highlights of Pollution Prevention successes affecting reduction of toxics in state waters in the past year are the following:

- At the end of 2011, there were approximately 450 approved or pending facilities in the Virginia Environmental Excellence Program (VEEP).
- Virginia still provides performance-based permit fee discounts (from 2 to 20%) for "going beyond compliance." In 2011, over $126,000 in fee discounts were distributed among VEEP facilities that implemented and carried out their Environmental Management System (EMS) plans.
- A review of VEEP annual performance for 2011 reported a reduction of 89 tons in the use of hazardous materials and a decrease of almost 101,593 tons in the generation of hazardous wastes.
- Total water use was reduced by more than 1.034 billion gallons during the past two years, and the reduction of energy consumption continues to be a priority. Releases to the atmosphere were also significantly reduced: emission of volatile organic compounds was reduced by 547 tons. This is important for water quality protection as these air emissions may eventually enter surface waters through direct wet and dry air deposition or surface water runoff. DEQ's Office of Pollution Prevention's partnership with the Virginia Automotive Recyclers Association (VARA) yielded a pilot project to remove mercury tilt switches in automobiles as part of the dismantling and salvage process. Several years ago, the Office of Pollution Prevention sponsored the distribution of pre-paid collection kits with instructions for removing the switches and precautions for safe handling and shipping. VARA promoted the pilot to its membership, and more than thirty facilities participated in the program. VARA also coordinated the pilot program with the National Partnership for Environmental Priorities, pledging to remove 1,500 switches (the equivalent of almost five pounds of mercury). The success of the pilot program resulted in legislation adopted by the 2006 Virginia General Assembly which requires removal of mercury convenience switches from end-of-life motor vehicles prior to demolition. DEQ has worked with VARA, the Virginia Department of Motor Vehicles, the scrap

industry, steel manufacturers, and the automotive industry to implement the program. End of Life Vehicle Solutions (ELVS), an organization created by automotive manufacturers, has distributed collection buckets for mercury switches throughout the Commonwealth. To date, nearly 67,000 switches have been collected in Virginia, equating to more than 150 pounds of mercury. (Refer to DEQ's Mercury Reduction Webpage - http://www.deq.virginia.gov/p2/mercury/homepage.html.)

- Virginia's National Partnership for Environmental Priorities (NPEP – voluntary reduction of priority chemicals in products and wastes) was discontinued in 2011, but DEQ's Office of Pollution Prevention continues to promote its outreach efforts while the program(s) to replace NPEP are under development.

Environmental Education: Across the state, twelve regional teams continue to bring together local conservation organizations and education agencies to implement stewardship projects, provide field experiences for students and educate citizens about local issues. Virginia Naturally's monthly electronic newsletter provides over 2,100 educators and litter and recycling program managers across Virginia with information on special features (conferences, etc.), funding and awards deadlines, upcoming events, partner updates and resources. Non-competitive litter prevention and recycling grants ($1,742,782 in 2011) were provided to 308 local governments. The Environmental Educators Leadership Program and numerous Stewardship Training Workshops have provided training for hundreds of educators statewide (http://www.vanaturally.com/).

Toxics Release Inventory (TRI): The Toxics Release Inventory documents the total quantities of EPA-listed toxic compounds that are released annually to waters, air and the land by permitted facilities within the Commonwealth. Changes in the quantities of toxics released are indicative of the effectiveness of pollution prevention programs, but are not an adequate or representative measure of environmental impact or impairment.

The TRI Report is available on the DEQ Website at: http://www.deq.virginia.gov/sara3. It summarizes data from calendar year 2009, during which 421 facilities filed 1,556 individual reports. Statewide toxic releases to the water totaled approximately 18.2 million pounds or 38.2% of the total onsite releases to all media during 2009. This quantity represents a 10.3% decrease from the 20.3 million pounds released to the water in 2008. Nitrate compounds (17.9 million pounds) represented 98.7% of the top ten TRI chemicals released to water. Nitrates, however, are of more concern for their effects as nutrients rather than as toxics. Toxics criteria for dissolved nitrates in drinking water were not exceeded in the Commonwealth during SFY 2011.

Monitoring

Water Quality Monitoring Programs: Ambient water quality monitoring consists of the measurement of physical and chemical characteristics within the Commonwealth's streams, rivers, lakes, reservoirs and estuaries. Ambient monitoring and assessment characterizes ecological stressors and evaluates their potential impact on aquatic organisms and other wildlife, and on human health and recreational use of Virginia's waters.

Periodic updates and revisions of the agency's WQM Strategy are necessary as part of the continual planning process within DEQ's Water Quality Monitoring and Assessment (WQMA) Program. By 2008, the monitoring program had fully implemented two major changes in the 2007 WQMA Strategy that affected toxics monitoring and assessment; the adaptation of the monitoring program to the newly delineated sub-watersheds of the National Watershed Boundary Dataset (NWBD) and the realignment of the monitoring year to correspond with the calendar year rather than the state fiscal year. Between 2002 and 2010, more than 98% of the Commonwealth's 1247 small watersheds were monitored.

Summer (Jun-Sep) of 2010 was the eleventh year of DEQ's Estuarine Probabilistic Monitoring (ProbMon) Program and the spring and fall of 2011 comprised the eleventh year of its Freshwater ProbMon Program. Because of resource limitations, the sampling and analysis for sediment organic contaminants was suspended at freshwater ProbMon sites in SFY07. Sediment chemistry (metals and organics) sampling and toxicity testing were continued at estuarine ProbMon sites during the 2010 field season (SFY11) with resources provided by National Aquatic Resources Survey, National Coastal Condition Assessment (NARS/NCCA) and a probabilistic survey-targeted supplement to the federal §106 grant. A near-shore oceanic survey was also carried out during August of 2010 with resources and logistical support provided by EPA National Headquarters and EPA Region 3. In this case, near-shore includes oceanic waters from continental barrier beaches out to the three-nautical-mile state territorial limit. Sediment chemistry and sediment toxicity analyses of these samples were carried out by EPA nationally-contracted laboratories.

In the 2010 305(b)/303(d) Water Quality Integrated Assessment Report, sediment chemistry, sediment toxicity and benthic taxonomic results from DEQ's Estuarine Probabilistic Monitoring Program were used for a toxics-related "Weight-of-Evidence" assessment of aquatic life use at 300 estuarine sites. These results, primarily from minor tidal tributaries, complement those from the Chesapeake Bay Program's benthic probabilistic monitoring program, which emphasizes the extensive mainstem areas of major tidal tributaries and the Bay mainstem. More recent ProbMon results from 2009 and 2010 (an additional 72 estuarine and 50 near-shore oceanic sites) are being incorporated into the 2012 Integrated Report. An additional line of chemical evidence, based on the solubility of polycyclic aromatic hydrocarbons (PAHs) present in the sediment, has now been added to the weight of evidence assessment procedure. The analytical data from the 2010 Estuarine ProbMon Program and Near-Shore special study are included in the tables and folders of this TRISW Report.

DEQ's Fish Tissue and Sediment Monitoring Program (http://www.deq.virginia.gov/fishtissue/) has been suspended since 2009 because of budget limitations. At present, there are tentative plans to resume this program in 2012, dependent upon funding. However, fish samples for ecological risk assessments were collected at 22 estuarine sites from June - September 2010 as part of the NARS/NCCA Program. The results of those samples are expected to be available for the 2012 TRISW Report (Jan 2013).

Extensive monitoring of toxics for more than three decades has revealed that the distribution and concentration of contaminants vary greatly among sediment samples, whether they are nearby duplicates collected on the same day or sequential samples collected at the same site over various time spans. No definitive long-term trends have been detected to document consistent changes in sediment contamination. The probabilistic monitoring of toxics during the past eight years has demonstrated that statewide, concentrations of dissolved trace metals and organics in ambient waters are generally representative of global background levels, except near confirmed or suspected point sources. Periodic reports on the probabilistic results provide a baseline for future comparisons. Recent developments of more efficient sampling designs, sampling technologies and analytical methods offer promise of more effective documentation of short-term changes and mid-term trends in toxics in the near future.

Assessment and Remediation

Assessment: The most recent (2010) 305(b)/303(d) Water Quality Integrated Report identified 12,101 miles of impaired streams and rivers, 96,651 acres of impaired lakes, and 2,157 square miles of impaired estuaries. Of those impaired by toxics, over 99% were listed for fish consumption advisories, primarily for PCBs (31.0% of toxics-impaired rivers, 56.1% of lakes, and 98.4% of estuaries) or mercury (61.4% of rivers, 42.3% of lakes, and 1.0% of estuaries). These figures will be updated with the completion of the 2012 Integrated Report. Because the number of segments united into each Total Maximum Daily Load

(TMDL) varies with the hydrography and the extent of the impairment, the exact number and schedule of toxics-related TMDLs to be developed and implemented is not certain. DEQ's PCB Strategy (2005) establishes priorities for TMDL development and discusses various options for remediation. Analyses for the 2012 Integrated Report began in 2011, and any new PCB-impaired segments will be integrated into the Strategy.

Remediation / Reduction: In April 2011 a TMDL for mercury in the North Fork Holston River was approved by EPA. This is an all-inclusive TMDL for 80 miles of the river, and includes seven prior segment listings from the North Fork. Three additional toxics-related TMDLs are being phased for completion in 2013; (1) Levisa Fork and Garden Creek of the Big Sandy basin – PCBs, bacteria, sediment, (2) Smith River watershed – potential PAHs (phased benthic), and (3) Powell River of the Tennessee basin (TDS, TSS, potential PAHs - phased benthic).

PCB TMDL development initiated for the upper tidal James River and the Elizabeth River in 2009 has continued with periodic water column sampling for PCB model calibration. Public meetings were held in December (2010) and January (2011). Completion of this extensive TMDL is scheduled for 2014. The agency's TMDL history, current status and development plans are available at http://www.deq.virginia.gov/tmdl/.

As these TMDLs are completed and scheduled for implementation, and others are added, follow-up monitoring will be initiated to evaluate their effectiveness in reducing toxics contamination. The effective implementation of these TMDLs should result in measurable reductions of contaminants in a number of the state's watersheds within a few years.

A number of water bodies and/or segments previously listed for toxics have recently been removed from the 303(d) list: several segments in the Shenandoah for nitrates (public water supply), several segments in the Elizabeth River system for tributyltin (aquatic life), two segments in the Dan River for DDT (fish consumption), two segments in the Holston River basin for lead (aquatic life), one segment in the Clinch and one in the Russell Fork for PCBs (fish consumption), and two segments of Lake Anna and an adjacent tributary for lead (aquatic life, wildlife). Additional segments with toxics-related impairments are included in the delist package for 2012; once EPA has approved these requests they will be itemized in the next TRISW Report.

Continued Commitment

DEQ continues its commitment to toxics reduction by the prevention of contamination, continued water quality monitoring, and the implementation of remedial measures. The Virginia Pollutant Discharge Elimination System, the Pollution Prevention Program, and the Environmental Education Program join with other agencies, programs and stakeholders to promote public awareness, as well as to control and reduce toxics releases. The Toxics Release Inventory and various water programs constantly monitor and document the release to, and the presence and movement of toxics within aquatic environments. Close coordination between monitoring and assessment activities will identify new sources of contamination as they occur and document the effectiveness of load allocations and other remedial measures developed and implemented by the TMDL Program. The agency anticipates significant reductions of toxics in the state's waters as a result of continued TMDL implementation.

Foreword

State Fiscal Year 2011 Toxics Reduction in State Waters Report (January 2012)

The Virginia Department of Environmental Quality (DEQ) plans and executes its Ambient Water Quality Monitoring Program on an annual basis. Guidelines for the program include:

- A long-term Water Quality Monitoring and Assessment (WQMA) Strategy, revised and accepted by EPA Region 3 in April of 2007 (another revision will be prepared and submitted in 2012),
- Formal Quality Assurance Program and Project Plan (QAPP),
- Established Standard Operating Procedures (SOPs), and
- Standardized Sampling Protocols.

The agency's annual monitoring program plan (MonPlan) corresponds with the calendar year. This helps synchronize various monitoring activities and assessment periods with the 'ecological' or 'water year'. Monitoring activities summarized in this report, however, still refer to the State Fiscal Year (SFY - July 1 of each year through June 30 of the following year) in order to provide complete analytical results by January 1.

The SFY11 Toxics Reduction in State Waters Report (TRISW- Jan 12 - fourteenth in the series) summarizes all toxics monitoring and reduction activities carried out between July 1, 2010 and June 30, 2011. The historical summaries of toxics monitoring results in Folders 3 through 6 are cumulative, with the addition of the corresponding year's results in each new report.

To minimize the size of the report, reduce production time and costs, and facilitate its distribution to interested parties, the data tables, figures and appendices of this report are presented in their complete form on, and may be downloaded from the DEQ WebPages at http://www.deq.virginia.gov/watermonitoring/tox.html. Electronic copies of the complete report, including tables, figures and appendices, are available on CD upon request from Don Smith at (804) 698-4429 or Donald.Smith@deq.virginia.gov.

In the Water Quality Monitoring section, data summaries of yearly sets of monitoring results are available in both tabular and graphical forms. Graphical summaries of historical toxics monitoring results (which use statistical interval-estimates for median parameter values) will continue to appear with each annual report to assist in the visual evaluation of:

- Two- to five-year (short-term) changes in water and sediment quality,
- Differences among drainage basins (contemporary, geographic trends) year by year, and
- Differences among years within individual basins (basin-specific, short-term temporal variations).

Eventually, as each year's results are added to the report, historical results in the form of graphed statistical interval-estimates will facilitate the visual evaluation of longer-term trends. Graphed historical summaries (SFY97 – SFY11) for each major drainage basin appear in this year's report, but the relatively short period of record and changes in methodologies and detection limits make the interpretation of trends difficult.

1.0 Introduction

The Virginia Department of Environmental Quality (DEQ) is submitting this annual Toxics Reduction in State Waters (TRISW) Report to the Governor and the Chairs of the House Agriculture, Chesapeake and Natural Resources Committee and the Senate Agriculture, Conservation and Natural Resources Committee pursuant to Virginia Code § 62.1-44.17:3.

1.1 The Report: Toxics Reduction in State Waters

The primary objective of the TRISW Report is to document the state's commitment to improving water quality; more specifically, in relation to chemical contamination which may induce toxic effects on aquatic life, other wildlife or on human health. This commitment includes:

1. The prevention of contamination of the Commonwealth's waters by toxics,
2. The continued monitoring of the those waters for the presence of toxics, and
3. The implementation of remedial measures to reduce and/or eliminate toxics found in the state's waters.

Each report provides a summary of the toxics-related prevention, monitoring and remediation activities of the previous State Fiscal Year (SFY = July 1 - June 30).

Although the reduction of toxics in the state's waters is primarily the responsibility of the DEQ, various agencies and organizations participate in the process, including the Virginia Department of Conservation and Recreation (DCR), the Virginia Department of Health (VDH), the U.S. EPA's Interstate Chesapeake Bay Program (CBP), and the U.S. Geological Survey (USGS). This report summarizes the results of current activities directed toward toxics reduction and provides guidance on how to access further resources and information on specific subjects.

DEQ submitted the first TRISW Report in January 1998. The January 1999 report provided basic background information related to the report's objectives and a basic model for its continued evolution. The current, fourteenth TRISW Report (January 2012) contains tables of both raw data and statistical summaries of SFY11 monitoring results, as well as cumulative graphical summaries of results from 1997 through the present.

1.2 Functional Definitions: Toxicity, Water Quality Criteria, and Water Quality Standards

1.2.1 Defining "Toxicity":

The Virginia Code (Chapter 3.1, Title 62.1, § 62.1-44.17:2) defines "toxicity" as "the inherent potential or capacity of a material to cause adverse effects on a living organism, including acute or chronic effects on aquatic life, detrimental effects on human health, or other adverse environmental effects." This definition is rather broad, since an excess or even a deficit of many non-toxic substances can also cause adverse effects, both acute and chronic, on living organisms. This report consequently restricts the definition of "toxicity" to include only those substances that are directly and "chemically" detrimental to living organisms when they are "in excess." Direct chemical effects would exclude the physical effects of excess sedimentation or the indirect effects of nutrient enrichment, for example, both of which would also be detrimental to aquatic life. Furthermore, the concept of "other adverse environmental effects" must be defined in biological terms, since toxicity can only be observed, described, and quantified in relation to living organisms. The

classification of chemical substances ("a material") within the category of "toxics" (those that cause toxicity) is always based on the observed effects of their presence on specific living organisms. In fact, the concept of "excess" itself is defined in terms of the concentrations at or above which living organisms experience detrimental effects.

Toxicity varies enormously among chemical substances. The amount and concentration of a substance necessary to demonstrate "deleterious effects" also varies. The Federal Clean Water Act (CWA – 1983) defined the responsibility of the Environmental Protection Agency in identifying the critical concentrations at which distinct chemical substances begin to elicit a specified degree of deleterious effect, and establishing the associated "Water Quality Criteria" to identify impaired waters.

1.2.2 Federal Water Quality Criteria:

The CWA (33 U.S.C. §1251 et seq. - 1972) first described the scope and purpose of water quality standards and defined the authority and responsibility of the United States Environmental Protection Agency (EPA) and the various states in relation to the requirements for, submission of, and approval of such standards. Since then, EPA has published various lists of toxic materials for which the movement, use, and/or release into the environment must be documented or for which concentrations in the environment must be monitored and their effects assessed and subsequently controlled. EPA carefully reviews the results of published studies (both academic and commercial) and conducts its own research to determine what concentrations of chemical substances are detrimental to aquatic life, other wildlife and human health, and to what degree. Based on the results of this evaluation, "Water Quality Criteria" may be established for freshwater, saltwater or drinking water, identifying the concentrations that induce direct chronic or acute toxic effects on aquatic life, subsequent poisonous effects on wildlife or humans, or long term carcinogenic (cancer producing) effects on human health.

- On December 22, 1992, the EPA published in the *Federal Register* a comprehensive list of 126 chemical substances (EPA's "Priority Pollutants") for which it had established water quality criteria related to aquatic life in freshwater and saltwater and/or to human health risks.
- Subsequent studies often (1) identified additional toxics for which criteria were established, or (2) resulted in the establishment of new criteria for previously defined toxics. The list was modified during the ensuing years. For example, the EPA's publication of conversion factors in May 1995 lowered the acute and chronic freshwater criteria and the acute saltwater criteria for the dissolved metals arsenic, cadmium, chromium III and VI, copper, lead, mercury, nickel, silver, zinc, and selenium.
- The EPA provides its most recent complete list of nationally recommended water quality criteria for both priority (120) and non-priority (47) toxic pollutants in electronic format on the EPA WebPages at: http://www.epa.gov/waterscience/criteria/wqcriteria.html.
- EPA continues to update its list with additional modifications of existing criteria, as well as the establishment of criteria for new substances. Detailed information regarding recent updates may be found at:
    - Aquatic Life: http://www.epa.gov/waterscience/criteria/aqlife.html#final
    - Human Health: http://www.epa.gov/waterscience/criteria/humanhealth/15table-fs.htm

1.2.3 State Water Quality Standards - WQS:

Once federal "Water Quality Criteria" have been established for a chemical substance, it is the responsibility of the individual states to establish "Water Quality Standards" that are protective of the

"designated uses" assigned to each body of water. The most commonly designated uses include the support of aquatic life, other wildlife, fish consumption, shellfish consumption, human primary contact (swimming) or secondary contact (fishing, boating) recreation, and public water supplies (where applicable).

The Commonwealth of Virginia has established and periodically revised its water quality standards, which EPA must review and approve prior to implementation. Virginia's Water Quality Standards are set forth at 9 VAC 25-260. These state standards undergo a formal "Triennial Review" for periodic updating. The most recently adopted WQS are presented in their entirety in Appendix A and are also available on the DEQ-WQS WebPages at http://www.deq.virginia.gov/wqs. No toxics-related Triennial Review activities took place during SFY2011. The current Virginia Water Quality Standards, with the most recent amendments, became effective upon EPA approval on January 6, 2011.

1.3 Federal Reporting Requirements

In addition to the biennial 305(b)/303(d) Water Quality Integrated Assessment Report, federal law requires reporting procedures for the production, movement, storage, use, and release of many priority toxic substances. These procedures, as well as Virginia's annual Toxics Release Inventory (TRI) Report, are discussed more fully below.

2.0 Toxics Reduction Activities

As indicated above, DEQ's toxics reduction activities fall into three general categories: the prevention of contamination of the Commonwealth's waters by toxics, the monitoring of state waters for the presence of toxics, and the implementation of remediation to reduce and/or eliminate toxics found in the state's waters. All three classes of activity are geared toward maintaining the concentrations of potentially toxic substances in the state's waters below those concentrations that result in toxic effects, *i.e.*, within the bounds defined by water quality standards, with the understanding that many such substances can never be completely eliminated from the environment.

Many potentially toxic substances may be produced or released from the environment by natural processes. The leaching of elemental metals (e.g., arsenic, lead, copper) from natural geologic formations would be one example, or the release of toxic gases by geothermal activity. The weathering or release of naturally occurring organic contaminants from fossil fuels deposits, without human intervention, would be another. It is inevitable, with our current rate of economic and industrial development and our increasing dependence upon manufactured products, that some toxic materials will find their way into the environment during the production, use, and/or disposal of modern products.

2.1 Prevention

The primary prevention activities carried out by DEQ may be characterized as regulatory, non-regulatory, and educational.

The regulatory Virginia Pollutant Discharge Elimination System (VPDES) program requires that concentration limits be established for all potentially toxic substances in permitted discharges from industrial, institutional, and/or municipal wastewater treatment facilities to ensure that Virginia's water quality standards are not violated in the water bodies receiving such discharges.

The non-regulatory programs of the Office of Pollution Prevention (OPP) encourage industries, commercial enterprises, governmental and private facilities throughout the Commonwealth to establish Environmental Management Plans (EMPs) to minimize the use of hazardous materials, and to maximize the use of "green products and services" and the recycling of wastes.

The Office of Environmental Education provides environmental orientation and educational programs for teachers and students through electronic newsletters and other outreach activities (workshops and other training events, meaningful watershed experiences, etc.) to foster environmental stewardship, including non-competitive litter prevention and recycling grants.

2.2 Monitoring and Assessment

The VPDES Program performs end of pipe compliance monitoring in the form of announced and unannounced facility inspections, as well as requiring permitted facilities (industrial and municipal) to monitor their discharges and to file periodic electronic Discharge Monitoring Reports (DMRs) to document their compliance with permit limit requirements.

DEQ's integrated ambient Water Quality Monitoring (WQM) Program collects water, sediment, benthic organisms, and fish tissue samples from the Commonwealth's streams, rivers, lakes and reservoirs, estuaries, and near shore oceanic waters to document compliance with water quality standards and sediment and fish tissue screening values. The structure and integration of the various components of the ambient WQM Program are described in detail in DEQ's Water Quality Monitoring Strategy, available on the DEQ Water Quality Monitoring WebPages (http://www.deq.virginia.gov/watermonitoring/monstrat.html). The major components relating to toxics monitoring include the watershed station network, the freshwater and estuarine probabilistic monitoring networks, the trend monitoring network and special studies, including the TMDL Program. Some program-specific monitoring also contributes to the toxics efforts: the Chesapeake Bay Program, the Lakes Monitoring Program, the Biological Monitoring Program, and the Targeted Fish Tissue and Sediment Monitoring Program.

DEQ's Superfund Amendments and Reauthorization Act (SARA) Title III Program receives annual electronic TRI summaries from reporting facilities statewide, and produces an annual TRI Report, as prescribed by federal regulations, that documents the movement, release, on site disposal, and off site transfer of toxic materials to the air, water and land.

2.3 Remediation

Although there are several DEQ programs that deal with the remediation of toxic contamination (e.g., Brownfields Program, Federal Facilities Program, Superfund Program, etc.), the primary agency-driven program involved in remediation of toxics-related impairments in aquatic environments is the Total Maximum Daily Load (TMDL) Program. Once impaired waters have been identified, it is the responsibility of the TMDL Program to confirm the cause of the impairment, identify its source(s), and develop plans to restore and maintain the water quality. TMDL is a term that represents the total amount of a pollutant (toxicant) a waterbody can assimilate and still meet water quality standards. Once a TMDL has been reviewed and approved by EPA, an implementation plan (based on the TMDL) is developed for reducing the input of the associated toxics into the system. Depending on the type of toxicant, its source(s), and the historical background of the contamination, implementation may include reducing permit limits for a toxicant in the discharge from a permitted facility or, in the specific case of PCBs, establishing programmed Pollutant Minimalization Plans (PMPs) with permitted point sources, executing Best

Management Plans (BMPs) for non-point sources or, on occasion, the physical removal of contaminated substrate from legacy point sources.

2.4 Analysis of Toxics from Ambient Waters

The majority of toxics-related samples collected by the ambient WQM Program are analyzed by the Division of Consolidated Laboratory Services (DCLS) of the Virginia Department of General Services, although academic or commercial laboratories may be contracted for some specialized analyses. Toxic elements and chemical compounds are generally categorized into several primary groups, each of which has specific chemical analysis codes to identify the procedures necessary for its complete analysis by DCLS. The primary groups normally considered include:

- Clean dissolved and total trace metals in the water column,
- Toxic metals in the sediment,
- Dissolved organic contaminants,
- Organic contaminants in the sediment, and
- Toxic metals and organics in fish tissues.

The data summaries provided in the following sections of this report are organized to correspond with these categories. Various groups of toxic organic compounds (*e.g.*, PAHs, other semi-volatiles, and PCBs) are generally evaluated together with pesticides.

Table 1 of this report summarizes the currently active toxics-related Parameter Group Codes and the specifically associated analytes in the current DCLS laboratory catalogue within the DEQ Comprehensive Environmental Data System (CEDS) database, including their associated reportable limits, costs, and turnaround times. The exact reportable limits may vary from day to day, depending on the stability of the analytical apparatus, the purity of reference materials and blanks, and possible interference from other substances present in the samples collected in the field. Various Parameter Group Codes included in this list are seldom utilized within the Ambient WQM Program. Some are specific to other matrices, such as fish tissues, soil, etc., or are utilized specifically for industrial facilities. Other group codes have been updated and replaced with new codes because of concern with new chemical products or the availability of newer analytical methods with lower detection limits for the analytes of interest. Those parameter group codes actually employed by the AWQM Program during SFY11 are enumerated in Table 2.

Table 2.A summarizes the number of samples, the analytical expenses, and the parameter group codes included in toxics-related analyses performed and billed by the state laboratory (DCLS) during SFY 2011. Toxics samples, analytical costs, etc., that are associated with the fish tissue and sediment monitoring program, collected during various toxics-related special studies, or collected during Estuarine and Near-Shore Oceanic Probabilistic Monitoring are generally analyzed elsewhere via contracted services. The costs of contracted analytical services for the major toxics-related programs and special studies are summarized in Table 2.B.

3.0 Toxics-Related Results – SFY2011

3.1 Prevention

3.1.1 Reduction of Toxics by Pollution Prevention

DEQ's Office of Pollution Prevention (OPP) contributes to the reduction of toxics in the state's waters through its multimedia (i.e., air, water, and waste) non-regulatory Pollution Prevention (P2) Program. The P2 Program focuses primarily on the reduction of solid wastes and resource consumption. The reduction of waste and resource consumption, however, also reduces the movement, use, and release of toxic materials. Such reductions occur not only within the consumer population but also among retail outlets and, perhaps most important of all, among industries using and/or producing toxic materials.

The annual P2 Report describes OPP's activities for the year and is available at: http://www.deq.virginia.gov/export/sites/default/p2/pdf/2011_annual_report.pdf. The 2011 report summarizes the pollution prevention strategies developed and implemented by the Virginia P2 Program, which is coordinated with other DEQ activities as well as with those of the Department of Conservation and Recreation. The current annual report characterizes activities carried out by the major components of the P2 Program during the calendar year 2011, several of which are briefly summarized below.

- **Virginia Green Tourism** - Virginia Green, the Commonwealth's initiative to promote voluntary pollution prevention within the tourism industry, began its pilot phase in 2006. In June of 2011, the program achieved its initial goal of 1000 participants, and at the end of September membership was reaching 1,100. Among the participants included are permanent tourist attractions, conference and convention centers, programmed tourist events, lodging facilities, restaurants, travel organizations, visitor centers and numerous other partners, all dedicated to minimizing their impact on the environment by maximizing the use of recyclable materials, reducing water and energy use, and purchasing and using eco-friendly services and products. In honor of the 75th anniversary of Virginia's State Parks, the program launched an effort to register all 35 state parks as Virginia Green attractions. The Virginia Green Suppliers Network was established in September 2010 to provide sources for participants interested in green products and services. A five-minute recruitment video was launched in October 2010, and the program's new marketing website was established at the end of the year:

  http://www.deq.state.va.us/p2/virginiagreen/.

- **Virginia Environmental Excellence Program (VEEP)** - At the end of 2011 there were approximately 450 approved or pending facilities in the Virginia Environmental Excellence Program (VEEP). This Program recognizes three levels of performance for participating facilities: (1) E2 (Environmental Enterprise) for facilities that have made significant progress toward the development of an Environmental Management System (EMS), have made a commitment to pollution prevention, and have a record of sustained compliance with environmental regulations, (2) E3 (Exemplary Environmental Enterprise) for facilities that have exceeded the E2 requirements and have a fully-implemented EMS, and (3) E4 (Extraordinary Environmental Enterprise) for facilities that have exceeded the E3 requirements, have completed at least one full cycle of an EMS as verified by a third-party auditor, and have demonstrated a commitment to continuous and sustainable environmental progress and community involvement. Virginia still provides performance-based permit fee discounts for "going beyond compliance." Potential discounts vary by category: 5-20% for hazardous waste reduction, 10-20% for solid waste reduction, and 2-20% for reduction of water use and release. In 2011,

over $126,000 in fee discounts were distributed among VEEP facilities that implemented and performed their Environmental Management Plans.

- A review of VEEP annual performance reports for 2010-2011 indicated the following changes from baseline reference values. Total water use was reduced by 1.034 billion gallons. The use of hazardous materials decreased by 89 tons, and hazardous waste generation was reduced by almost 101,593 tons. Emissions of volatile organic compounds (VOCs) to the air decreased by 547 tons. Over $43 million in cost savings were realized during this process.

- DEQ's Mercury Reduction Initiatives have also been successful. Members of the "Virginia Switch Out" Project for the recycling of automotive mercury switches have removed nearly 67,000 switches, and recycled more than 150 pounds of mercury since 2006, when the program was initiated. Facilities have pledged to annually recycle over 55,000 energy efficient fluorescent light bulbs, which also contain small quantities of mercury. (Refer to DEQ's Mercury Reduction WebPages - http://www.deq.virginia.gov/p2/mercury/homepage.html.)

- The National Partnership for Environmental Priorities (NPEP) program has encouraged public and private organizations to form voluntary partnerships (with states and the EPA) that reduce the use or release of substances that have been designated "Priority Chemicals" – i.e., substances that are persistent, bioaccumulative and toxic - PBTs. NPEP had received great participation by Virginia facilities, but the national program was discontinued in 2011. The program(s) that will replace NPEP are currently under development. Meanwhile, OPP continues its outreach efforts related to the proper handling and reduction of mercury and other priority chemicals in the environment.

For additional information concerning the Pollution Prevention (P2) Program, visit the DEQ WebPages at http://www.deq.virginia.gov/p2/.

3.1.2 Reduction of Toxics from Permitted Discharges and Compliance Monitoring of Permitted Facilities

Both private and public facilities that discharge effluents into the state's waters are required to obtain permits from the State Water Control Board. The Virginia Pollutant Discharge Elimination System (VPDES) regulations require the establishment of limitations for such permits to ensure that Virginia's water quality standards are not violated in the water bodies receiving such discharges.

"Appendix B - Facilities & Outfalls with Toxics Parameter Limits SFY11" of this report lists facilities that currently have, or have applied for, permits that contain limits on the quantity or concentration of discharged toxics in their effluents. During SFY11, 304 reporting facilities, with 609 outfalls, had one or more toxics limits in their permits. The effective limits (when specified) and reporting frequencies for toxics may vary, depending upon the chemical parameters involved. In some cases, a permit may have been modified, reissued, or adjusted in terms of the current limits within the past year. The current toxics parameters included in each permit, along with their limits and required reporting frequencies, are listed in "Appendix C – Permits, Parameters, Units & Frequencies SFY11." The compliance results of each permitted facility's Discharge Monitoring Reports (DMRs) during SFY11 are reported in "Appendix D – Permitted Toxics Parameters & DMR Results SFY11." Some facilities may hold permits requiring only that they report, without a limit-specified value with which they must comply. Of 7,987 parameter-specific DMRs filed in SFY 2011, 4,244 provided the facility's average concentrations of a toxicant. Of these, 81

(1.91%) reports exceeded their permitted limit for average concentration. Parameter-specific maximum concentrations were reported in 6,345 DMRs. Of these, 93 (1.47%) exceeded the limit specified in their permit. Almost all of these were short term exceedances for total recoverable copper or total recoverable zinc at municipal wastewater treatment plants. Runs of three or more consecutive exceedances of maximum concentration limits were only observed nine times; six times for total recoverable copper and three times for zinc.

3.1.3 Contribution to the Reduction of Toxics by Environmental Education

DEQ's Office of Environmental Education (OEE) contributes to toxics reduction in various ways. The Virginia Naturally Program distributes monthly newsletters to over 2,100 educators and litter and recycling program managers across the state. In 2011, 60 new partners signed up to participate in the statewide network. Training was provided to 630 community educators at 37 professional development workshops, and coordination, public information and educational resources were provided to 16,626 people at five outreach events.

In SFY 2011, 308 local governments were given Non-Competitive Litter Prevention and Recycling Grants. A total of $1,742,782 was awarded and was matched by an additional $14,656,272 in cash and in-kind services, a match of 840%. Sixty additional educators enrolled in the Environmental Educators Leadership Program (EELP), with five receiving recognition of their accomplishments in Water and Forestry education.

The OEE continues to build capacity within ten Regional Environmental Education Teams to provide high quality environmental education and encourage direct citizen involvement in natural resource stewardship projects. In 2011, Virginia Naturally Classroom and Partner Grants provided support for students conducting meaningful environmental watershed investigations at 35 schools and organizations for a total of $32,250 in grant funds.

Through the three-year NOAA Bay-Watershed Education and Training (BWET) grant, DEQ has worked to build capacity for meaningful watershed educational experiences. This is done through the training of non-formal educators; sixty-nine educators were trained at the first Watershed Educators Institute, which consisted of eight workshops on a variety of watershed topics. Twenty-six educators received recognition as watershed education leaders for completing a minimum of 30 hours of training in watershed education.

Ten organizations throughout the state of Virginia have agreed to partner with DEQ/OEE to host Project WET trainings. A map of the organizations can be viewed on the Virginia Naturally website. http://www.deq.virginia.gov/vanaturally/

3.1.4 Virginia Toxics Release Inventory

Under the provisions of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, also known as SARA Title III, Virginia manufacturing and federal government facilities that release certain chemicals to the air, water or land, or that transfer these chemicals for off-site treatment, disposal, recycling, or energy recovery, are required to submit reports to the EPA. This information is reported on Form R - Toxic Chemical Release Inventory Reporting Form and is collectively referred to as the Toxic Release Inventory. Although the Report itself is an *a posteriori* monitoring tool, the intent of the program is to minimize the quantity, movement, and disposal of toxic materials.

The most recent Virginia Toxic Release Inventory Report indicated that 421 Virginia facilities filed 1,556 individual reports on the release, transfer, or management of TRI chemicals or chemical categories. This was a 7.5 percent decrease from the 455 facilities and a 6.9 percent decrease from the 1,672 reports filed for calendar year 2008. These reports included 171 of more than 650 chemicals and chemical categories for which TRI reporting is required.

Statewide, the tallied toxic releases to the water totaled approximately 18.2 million pounds or 38.2% of the total onsite releases to all media during 2009. This quantity represents a 10.3% decrease from the 20.3 million pounds released to the water in 2008. On-site releases to water include discharges to surface waters, such as rivers, lakes, ponds, and streams. On-site releases to the land (~ 3.3 million lbs. or 7.0% of the total releases) refer to discharges to landfills, surface impoundments, land treatment, application farming, or any other release of a TRI chemical to land within the boundaries of a facility. Some of these discharges may eventually find their way into the Commonwealth's surface waters as well. Virginia does not permit under-ground injection as a method of hazardous waste disposal; consequently, no under-ground injection of TRI chemicals was reported in 2009. An additional 26.1 million pounds (54.8%) was released to the air, either from stacks or as fugitive air. A portion of these releases may also return to the Commonwealth's soil and waterways in the form of aerial deposition.

The top ten chemicals and chemical categories accounted for more than 99.9% of the on-site TRI chemical releases to water. The top ten TRI chemicals released to water were:

TRI Chemical	Annual Release to Water
1. Nitrate compounds	98.7% = 17,930,000 pounds
2. Manganese and Manganese compounds	0.55% = 99,000 pounds
3. Zinc and Zinc compounds	0.35% = 64,000 pounds
4. Barium and Barium compounds	0.18% = 33,000 pounds
5. Copper and Copper compounds	0.097% = 18,000 pounds
6. Vanadium and Vanadium compounds	0.039% = 7,000 pounds
7. Arsenic and Arsenic compounds	0.024% = 4,000 pounds
8. Various Glycol Ethers	0.016% = 2,900 pounds
9. Nickel and Nickel compounds	0.011% = 2,000 pounds
10. Chromium and Chromium compounds	0.007% = 1,200 pounds

All other releases totaled 0.009% and approximately 1,700 pounds. Nitrate compounds are a common byproduct of industrial and domestic wastewater treatment processes and have consistently been reported as the major chemical released to surface water. Nitrates often induce nutrient problems in water bodies at lower than toxic concentrations.

A considerable amount of additional information on specific groups of chemicals and the quantities of their chemical releases is available in analyses within the original report (2009 Virginia Toxics Release Inventory Report - March 2011) and is available on the DEQ Website at: http://www.deq.virginia.gov/sara3/3132009.html.

Additional sources of information on the TRI: Community Right-to-Know, including the access and use of TRI data and fact sheets for individual states, are available from the EPA's Internet site http://www.epa.gov/tri/. The next Virginia TRI report, summarizing toxic releases for calendar year 2010, should be available in March 2012.

3.2 Monitoring of Toxics in Ambient Waters – SFY2011

3.2.1 Surface Waters and Sediments

During the assessment process, concentrations of toxic contaminants found in the water column are compared with their corresponding Virginia Water Quality Standards ("Appendix A - DEQ Water Quality Standards Jan 2011"), and concentrations of toxic contaminants found in sediment are compared with the screening values found in "Appendix E - Summary of Sediment Screening Values SFY11." "Appendix G – WQM Toxics Monitoring Station Group Code List SFY11" lists all the monitoring stations where water and/or sediment samples were collected for each DCLS toxics parameter group code during SFY11.

Numerous tables and folders containing raw and summarized monitoring results are described in the following sections of this report. The tables contain all the descriptive information (metadata) relative to each monitoring station, the raw data results for each analyte, and descriptive statistical summaries for the results from each major river basin during SFY11. Corresponding Folders contain cumulative historical summaries of the results from each year in which a TRISW Report has been produced, by river basin and analyte. A Microsoft Excel® file titled "Introduction to Tables and Folders" is included in the two directories containing the Tables and Folders. This introductory file lists the specific analytes contained in each table and folder, and explains the meaning of the Program Codes associated with the samples.

At the present time, all existing water quality criteria and standards for toxic substances in water are defined in terms of dissolved concentrations. In many cases, the defined standards are extremely low concentrations, near or below the detection limits of common analytical equipment and methodologies. In the past, it was often necessary to collect and concentrate large volumes of water samples to produce meaningful results. Sampling of waters with such low concentrations of toxics also presents severe problems in terms of sample contamination. Consequently, careful planning and specific Standard Operating Procedures (SOPs) are necessary to ensure the quality control of sample collection, transport of the sample, and subsequent chemical analyses to guarantee the accuracy and defensibility of the results. A number of newly developed sampling and analytic technologies are now in use for improving the representativeness, accuracy, and precision of measuring dissolved toxics in the water column. For more detailed descriptions of these new procedures, refer to the January 2007 TRISW Report.

3.2.1.1 Dissolved Metals in Surface Waters

DEQ's dissolved clean metals SOP (DEQ-WQA, 1998) is currently being applied in the collection and analysis of 19 dissolved trace metals in freshwater and of 16 metals in brackish and saltwater samples. "Table 3 – Clean Dissolved Metals All Basins SFY11" presents the results of clean, dissolved metals monitoring during SFY11. Individual spreadsheets in Table 3 summarize the results from Freshwater and Estuarine Probabilistic Monitoring Programs, the Shenandoah River Basin Mercury Special Study and several TMDL and other Special Studies. Basin-by-basin historical summaries of clean dissolved metals results can be found in the Excel® workbooks "Folder 3 Historic Dissolved Clean Metals - All Basins."

3.2.1.2 Total Metals in Surface Waters

Because there are no Water Quality Standards for total metals in the water column, the sampling of total metals has not normally been included in ambient water quality monitoring. In recent years, however, sampling for benthic TMDL studies has revealed that the health of benthic communities in freshwater streams is often more highly correlated with the concentrations of total metals in the water column than with dissolved metals. Consequently, more recently total clean metals have been sampled along with

dissolved metals at most probabilistic monitoring stations. During SFY11, DEQ researchers also collected clean total mercury samples from the Shenandoah River basin for the purpose of monitoring the transport of mercury (Hg) at many of the same sites where clean dissolved mercury samples were collected. Additional total metals samples were collected for several incident response studies and for industrial compliance monitoring. The resultant data from these samples are included in the spreadsheets of "Table 4 – Total Metals Water All Basins SFY11" and in the workbooks of "Folder 4 – Metals Total Water Historical."

3.2.1.3 Total Metals in Sediments

"Table 5a – Metals Sediment All Basins SFY11" presents tabular results and a statistical data summary of the SFY11 WQM freshwater sediment metals data, primarily from freshwater probabilistic monitoring sites and analyzed by DCLS. "Table 5b – Metals Sediment Estuarine ProbMon SFY11," reports the results of sediment metals analyses from the Estuarine Probabilistic Monitoring Program samples that were collected during the 2011 fiscal year and analyzed by EPA-contracted laboratories. "Table 5c – Metals Sediment Near-Shore Oceanic ProbMon SFY11" provides tabular results and a statistical data summary of the sediment metals that were collected during the 2010 special study to characterize Virginia's eleven near-shore oceanic watersheds.

Screening values for the evaluation of metal and organics concentrations in both freshwater and saltwater sediments can be found in "Appendix E - Summary of Sediment Screening Values SFY11."

The Excel® workbooks of "Folder 5 – Historic Metals Sediment All Basins," present historical summaries of sediment metals in both non-tidal freshwaters and tidal estuarine waters.

3.2.1.4 Dissolved Pesticides and Other Organic Contaminants

The concentrations of dissolved organic compounds in the water column are generally extremely low, often at or below the detection limits of commonly available analytical methods. For this reason, DEQ has suspended most ambient monitoring of dissolved organics using traditional methods. Semi-Permeable Membrane Devices (SPMDs) have been employed in several special studies on the distribution of polychlorinated biphenyls (PCBs) and other organic contaminants in the past.

To assist in the generation of PCB data for use in the development of TMDLs, DEQ now utilizes EPA's low-detect Method 1668. Historically, PCBs were not detected in ambient river water or effluents using traditional compliance methods (EPA Method 608 and 8082). These methods have elevated detection levels and are selective toward PCB Aroclor analysis. Recently, EPA recommended the use of Method 1668 for TMDL development since it is capable of detecting much lower concentrations of PCBs. It uses clean sampling techniques and a congener-specific, high resolution/low detection analytical method to measure concentrations in the pg/L (one picogram or one trillionth of a gram per liter) range. Data have been generated for TMDL development using this method within PCB impaired water bodies in the tidal Potomac River, the Roanoke (Staunton) River, Levisa Fork, New River, the upper tidal James River and the Elizabeth River watershed. Some recent results from the Elizabeth River and the New River studies are presented in Appendices J1 and J2 of this report, respectively.

3.2.1.5 Pesticides and Other Organics in Sediment

3.2.1.5.1 Polycyclic Aromatic Hydrocarbons (PAHs) in Freshwater Sediment

"Table 6d1 PAHs Sediment Grp1 All Basins SFY11" and "Table 6d2 PAHs Sediment Grp2 All Basins SFY11" summarize the results of PAH analyses of freshwater sediment samples collected during SFY2011. The samples were collected from various small streams and the Rivanna River in the City of Charlottesville as part of a continuing benthic TMDL special study.

3.2.1.5.2 Semi-volatile Organics in Freshwater Sediment

"Table 6e Semi-Volatiles Sediment All Basins SFY11" summarized the results of semi-volatile organics analyses performed on sediment samples in SFY2011. These samples were also collected from various small streams and the Rivanna River in the City of Charlottesville as part of the same benthic TMDL special study.

3.2.1.5.3 Organics in Estuarine and Marine Sediments

"Table 6g1 Sediment Organics Estuarine ProbMon SFY11" summarizes the results of sediment organics analyses performed on samples collected from 21 probabilistic estuarine sites during SFY2011. Resources for the analyses of these samples were provided by federal grant funds for the National Coastal Condition Assessment of the National Aquatic Resources Survey (NCCA/NARS). The samples were analyzed by an EPA-contracted commercial laboratory. They include one tidal site from Back Bay, one site from Coastal Delmarva estuaries, one site from the Rappahannock River Basin, eight sites from the James River drainage, and 13 sites from the mainstem and major embayments of Chesapeake Bay. PAH, pesticide, and PCB results are included on separate tabs of the same Excel workbook. "Table 6g2 - Sediment Organics Near-Shore Oceanic ProbMon SFY11" summarized the results from sediment samples collected at 50 near-shore probabilistic sites (five with QA duplicate samples) along Virginia's Atlantic coastline during August of 2010. These results are presented in the same format as those in Table 6g1.

3.2.1.5. 4 Polycyclic Aromatic Hydrocarbons (PAHs) in the Water Column

A single sample for the analysis of PAHs in freshwater was collected during an Incident Response investigation in Walker Creek, northeast of Mechanicsburg, Virginia during SFY2011. The results are presented in "Table 6h PAHs Water All Basins SFY11." No PAHs were detected in the water column.

During the summer of 2010 (July – September, SFY11) water samples for PAH analyses were added to the sample collection at 22 Virginia estuarine sites (Appendix H3b - Estuarine ProbMon Sites - SFY11) within the National Aquatic Resources Survey (NARS), National Coastal Condition Assessment (NCCA), as well as to 50 probabilistic near-shore oceanic sites along the Virginia coast (Appendix H4 Near-Shore Oceanic ProbMon Sites SFY11). This special sampling was carried out because of concern about possible contamination of coastal waters resulting from the Deepwater Horizon Gulf oil spill and to provide baseline data for dissolved PAH levels prior to future offshore oil exploration and extraction along the Middle Atlantic continental shelf. Resources for the analyses of these samples were provided by DEQ's Office of Spill Response and Remediation. The results from this sampling are also included in "Table 6h PAHs Water All Basins SFY11." None of the 19 PAHs analyzed in the petroleum spill study were detectable in estuarine or near-shore oceanic surface waters - all analyte concentrations were below 0.1 µg/L.

3.2.2 Fish Tissue Contamination

DEQ's specialized Fish Tissue and Sediment Monitoring Program was suspended during 2010 and 2011 because of budgetary limitations. No fish or sediment samples were collected by this program during SFY2011. Current planning is tentatively to resume the Fish Tissue and Sediment Monitoring Program on a reduced scale during the summer of 2012, depending upon the availability of funding.

DEQ and VIMS, as a DEQ-contracted service, collected estuarine fish samples from 21 estuarine probabilistic sites during July through September 2010 as part of the National Aquatic Resources Survey, National Coastal Condition Assessment (NARS/NCCA) Program. Those samples are being analyzed by EPA-contracted commercial laboratories and the results from fish samples are not yet available. Tissue analyses within this program, however, will be of whole fish samples to be evaluated for "ecological risk" rather than fish fillet samples that are normally used for "human health risk" evaluations (See "Appendix F-Risk Based Screening Values - Fish Tissues SFY11.")

Several recent reports on agency fish tissue and sediment monitoring can be found on the DEQ WebPages at http://www.deq.virginia.gov/fishtissue.

3.2.3 Biological Monitoring

Benthic Community Evaluation: Field sampling and evaluation of both freshwater and estuarine benthic communities has proven to be an invaluable tool in the assessment of water and sediment quality. Significantly stressed benthic communities may indicate the impact of toxics in the environment, but follow-up evaluation is required to confirm the cause of the observed benthic impairment.

3.2.3.1 Freshwater Benthic Monitoring

"Appendix H1 – Freshwater Biological Stations SFY11" of this report lists the freshwater biological monitoring stations visited during the fall of 2010. Site visits during the spring of 2011 have not yet been recorded in the Ecological Data Application System (EDAS) database. Regional biologists carried out a total of 282 site visits at 255 sites; 219 sites in the Piedmont and Appalachian Zones were subsequently evaluated using the Virginia Stream Condition Index (VSCI). Of those visits, approximately 14.5% resulted in evaluations of severe stress, possibly related to toxics. An additional 42 visits were made to 36 sites for evaluation using the Coastal Plain Macroinvertebrate Index (CPMI). Approximately 14.3% of those scores also indicated severe stress. The list in Appendix H1 includes a number of the 98 freshwater probabilistic sites that are also described in Appendix H2.

"Appendix H2 - Freshwater Probabilistic Monitoring Sites SFY11" provides a comprehensive list of the freshwater probabilistic monitoring stations that were included in the ambient program during fiscal year 2011. Many of these (the wadeable sites) were also sampled for benthic invertebrate populations and are also included in Appendix H1. This list summarizes 104 site visits to 98 freshwater probabilistic stations, including autumn visits to calendar year 2010 sites, as well as a number of follow-up visits for other purposes (e.g., TMDL or other special study projects). Most spring visits in calendar year 2011 have not yet been entered into the EDAS database.

Severe stress may result from toxics in the water column or in the sediment, but most benthic impairments result from sedimentation or habitat alteration.

3.2.3.2 Estuarine Benthic Monitoring

Chesapeake Bay and other tidal waters: The Chesapeake Bay Program conducts probabilistic monitoring of benthic communities. As a second phase of assessment based on the CBP Benthic Index of Biotic Integrity (B-IBI), a stressor Diagnostic Tool calculates the probability of contamination as a cause for each impaired benthic sample. Appendix H3a – CBP ProbMon Benthics SFY11 lists 100 CBP benthic sites that were sampled during the summer (Jul – Sep) of 2010, along with their B-IBI scores and Diagnostic Tool classifications. Of 100 probabilistic sites sampled, the benthic communities of 51 scored "Meets Goals" (B-IBI = 3.00). Of the 49 sites classified as "Degraded" or "Severely Degraded" 34 had a higher probability of being so as a result of contamination than from other causes. Twenty-three sites (23% of the total) had probabilities = 0.75 of being degraded because of contamination.

Another benthic assessment methodology is used for estuarine probabilistic monitoring following NCCA protocols in the Bay and other tidal estuarine waters. It consists of a weight-of-evidence evaluation based on the Sediment Quality Triad (SQT). Estuarine probabilistic monitoring following the NCCA protocols provides data on the chemical contamination of sediment, the toxicity of sediment, and an evaluation of benthic community wellbeing using three indices of stress, the Chesapeake Bay Program's B-IBI plus Diagnostic Tool in tidal Chesapeake Bay waters, the Mid-Atlantic Region B-IBI for other tidal coastal waters, and the EMAP (MAIA) discriminant function "Index of Estuarine Condition for the Virginia Biogeographic Province" (VA-IEC) as a secondary index in all tidal waters. This methodology is described in detail in the current Final 2012 Water Quality Assessment Guidance Manual (http://www.deq.virginia.gov/wqa/) for the biennial 305(b)/303(d) Water Quality Integrated Assessment Reports.

"Appendix H3b - Estuarine ProbMon Sites Summer SFY11" provides a complete list of the DEQ estuarine probabilistic stations sampled during July - September 2010. Weight-of-evidence assessments for Aquatic Life Use at Estuarine ProbMon stations sampled during the six-year 2003 – 2008 period were included in the 2010 305(b)/303(d) Water Quality Integrated Report. The 2012 305(b)/303(d) Water Quality Integrated Report covers the calendar years 2005 - 2010 and will include additional weight-of-evidence assessments of the Estuarine ProbMon sites sampled during the summers of 2009 and 2010.

"Appendix H4 - Near-Shore Oceanic ProbMon Sites SFY11" provides the complete list of near-shore oceanic sites sampled for benthos during August 2010. An integrated over-all Weight-of-Evidence characterization of near-shore oceanic waters is being performed with the data from these sites. Although screening values are available for chemical contamination of marine sediments, and acute toxicity tests were performed on the sediment samples, there is no established, verified B-IBI available for the evaluation of impact on the benthos in Mid-Atlantic oceanic waters.

3.2.4 Special Studies Related to Toxics

3.2.4.1 Regional Special Studies Involving Toxics

Special studies are often initiated independently at the Regional Office level in response to locally recognized problems. Often, these regional special studies are related to TMDL development for impaired waters, but they may also be initiated to evaluate new monitoring or analytical methods, or to investigate potential problems with new local issues, etc.. Regional special studies that dealt specifically with toxics during SFY11 are summarized in detailed descriptions within "Appendix I – Special Studies Related to Toxics SFY11." Briefly, they consist of:

Central Office	Artificial Hardness special study (with participation by NRO, PRO, and BRRO-Lynchburg)
Northern RO	Tripps Run/Holmes Run Benthic Study (metals)
Piedmont RO	James River PCB Study
Blue Ridge RO	
- Lynchburg	None other than hardness study above during SFY 2011
- Roanoke	Smith River Benthic Study (possible PAHs) Roanoke River PCB Study New River PCB Study
Southwest RO	Bluestone River PCB Study Levisa Fork PCB Study Clinch River Low Level Mercury Sampling Study Straight-pipe Sewage Benthic Study (complicated by coal mine drainage)
Tidewater RO	Low Level PCB Study in Elizabeth and Lower James Rivers
Valley RO	Continuing South River Mercury Studies Meadow Creek/Schenks Branch/Moores Creek Benthic Study (PAHs) (Charlottesville – Albemarle County) Shenandoah River PCB Study

The names and contact information for the responsible individuals at the Regional and/or Central Offices are provided in Appendix I. Interim or final reports from various toxics-related studies are also available on the DEQ Website - "Water Reports" page (http://www.deq.virginia.gov/water/reports.html) and "TMDLs in Virginia" page (http://www.deq.virginia.gov/tmdl/).

3.2.4.2 Probabilistic Near-Shore Oceanic Survey

During August of 2010, DEQ carried out a first ever probabilistic survey of near-shore oceanic waters between Virginia's continental barrier beaches and the three-nautical-mile state territorial limit. During this survey, dissolved metals, total metals, and selected PAHs were sampled, as well as conventional parameters such as chlorophyll, nutrients and bacteria, from the water column at 50 random sites. Additional samples were collected for the evaluation of the sediment quality triad (sediment chemistry, sediment toxicity, and benthic community health) at the same 50 sites ("Appendix H4 – Near-Shore Oceanic Probabilistic Monitoring Sites – Summer SFY11"). The analytical chemical results of these analyses are presented in Table 3 (clean dissolved metals), Table 4 (clean total metals), Table 5c (sediment metals), and Table 6g2 (sediment organics).

3.2.5 Other Program-Specific Studies

3.2.5.1 The Chesapeake Bay Program

3.2.5.1.1 Toxics Reduction and Prevention Strategy

The 1987 Chesapeake Bay Agreement committed the signatories to develop, adopt and begin implementation of a basin wide toxics strategy to achieve a reduction of toxics, consistent with the federal

Water Quality Act of 1987, which would ensure protection of human health and living resources. Following the implementation of a multi-jurisdictional effort to define the nature, extent, and magnitude of toxics problems, the initial strategy was further strengthened with the adoption of the 1994 Basin Wide Toxics Reduction and Prevention Strategy. The primary goal of the 1994 strategy was to have a:

> *"Bay free of toxics by reducing and eliminating the input of chemical contaminants from all controllable sources to levels that result in no toxic or bioaccumulative impact on living resources that inhabit the Bay or on human health."*

3.2.5.1.2 Toxics 2000 Strategy

Building upon progress achieved through the implementation of the 1994 Strategy, the Chesapeake Bay Program Executive Council adopted a revised strategy in December 2000 known as the "Toxics 2000 Strategy". With the retention of the 1994 goal, new objectives and commitments were developed and incorporated into the document. An important strategy objective was to strive for zero release of chemical contaminants from point and non-point sources through pollution prevention and other voluntary means. For those areas with known chemical contaminant problems and referenced as "Regions of Concern", such as the Elizabeth River in Southeastern Virginia, the strategy included commitments leading to their restoration. Finally, the strategy included commitments that would provide the means to measure progress toward meeting the overall strategy goal. One approach consisted of periodic toxics characterizations, accomplished in 1999 and again in 2008, in which information derived from biological and chemical monitoring were synthesized within the context of toxicological impacts. An additional characterization, extending to non-tidal portions of the Bay watershed, has now been scheduled for November of 2012.

3.2.5.1.3 Current Toxics-Related Activities

A general organizational restructuring of the Chesapeake Bay Program was carried out in 2008 and activities of the former Toxics Subcommittee were temporarily suspended. The new structure does not expressly include a Toxics Subcommittee, but it does include a "team" with the objectives to "Protect and Restore Water Quality." The current shift in realignment of CBP monitoring efforts from tidal to non-tidal watershed sources of nutrient and sediment input (both point and non-point) and emphasis on the Bay-wide TMDL development for these stressors temporarily resulted in less emphasis on toxics in tidal waters.

In October 2011 the EPA Interstate Chesapeake Bay Program, Department of the Interior (USGS, FWS), National Oceanic and Atmospheric Administration, and the US Department of Agriculture, along with various other state and academic stakeholders, held a workshop to initiate compliance with Executive Order 13508 – Chesapeake Bay Protection and Restoration (May 2009). The Chesapeake Bay Workgroup for Toxic Contaminants will issue a report by November of 2012 summarizing the extent and seriousness of toxic contaminants in the Bay and its watershed (both estuarine and non-tidal waters).

During the summer (June-September) of 2010, because of the concern about potential petroleum pollution from the Deepwater Horizon Gulf oil spill and from future petroleum exploration off the coast of Virginia, DEQ added water column PAH sampling and analyses to its Estuarine Probabilistic Monitoring Program. This effort, in conjunction with the NARS/NCCA, will help establish baseline reference values for petroleum-related hydrocarbons in the water column. Twenty-one of 23 NCCA probabilistic sites fell within the Chesapeake Bay watershed, and the CBP provided resources for the purchase of sample containers and PAH analyses of samples from those sites. The results of PAH analyses from the Chesapeake Bay tidal water are presented in the Estuarine ProbMon worksheet of Table 6h. No detectable PAHs were found among the 19 compounds for which analyses were conducted. In addition, the CBP

provided resources for fish tissue analyses of PAHs at five of the NCCA probabilistic sites. The results from the fish tissue analyses are not yet available.

Additional information on the concentrations and trends of toxic substances and other water quality parameters in the Chesapeake Bay and its tributaries is currently available on the Chesapeake Bay Website at http://www.chesapeakebay.net/toxics1.htm, or by using the search engine available at http://www.chesapeakebay.net/pubsearch.aspx?menuitem=14874

3.2.5.2 The Elizabeth River Program

In 1997, in response to indications of water quality impairment by toxics in the Elizabeth River and its tributaries, DEQ and a group of Elizabeth River Project stakeholders collaborated to produce a comprehensive Water Quality Monitoring plan for the water bodies of concern. Under guidelines included in that plan, a baseline environmental study began in January 1998 with the goal of allowing the future assessment of trends in contaminant concentrations and their effects. Scientists from the Virginia Institute of Marine Science, Old Dominion University, and the Department of Environmental Quality worked with representatives from state, federal, and local authorities and other stakeholders to design and conduct the monitoring effort.

While DEQ and ODU continue to monitor for conventional pollutants and nutrients, most studies specifically involving toxics and their effects in the Elizabeth River system have been concluded. Because of reduced regional office staff and lack of Elizabeth River funding, toxics-related activities during 2011 were restricted to continued sampling and public meetings related to PCB studies and TMDL model development.

The Elizabeth River and its tributaries have VDH fish consumption advisories for PCBs. Ambient water samples for PCB analyses were collected under both "dry" and "wet" weather conditions from locations throughout the watershed during 2010-2011. Some of these results are now available (Appendix J.1) and will be used to support model calibration for a TMDL for PCBs within the watershed. Completion of this TMDL is now scheduled for 2014.

3.3 The Calendar Year 2012 Water Quality Monitoring Plan

The Annual Monitoring Plan (MonPlan) provides a complete list of the ambient WQM stations that will be actively sampled during the corresponding calendar year. The DEQ Monitoring Year now corresponds to the calendar year in order to synchronize various ambient monitoring program schedules with one another, with the ecological and water year cycles, and with the "assessment window" or monitoring period considered for each 305(b)/303(d) Water Quality Integrated Report assessment and listing cycle. The synchronization scheme is described in detail in the 2007 revision of DEQ's Water Quality Monitoring and Assessment Strategy (http://www.deq.virginia.gov/watermonitoring/monstrat.html).

The MonPlan for calendar year 2012 will be completed in December 2011 and will be implemented on January 1, 2012. It will complete the third two-year rotation in the second six-year cycle of DEQ's statewide Watershed Monitoring Network. Once finalized, each annual MonPlan is summarized and posted on the DEQ Website at http://www.deq.virginia.gov/watermonitoring/. That portion of the new plan that deals with long-term trend stations will continue with minimum modification. Because 2012 constitutes the second year of a two-year rotation (January 1, 2011 through December 31, 2012) of the watershed monitoring network, it will not require the relocation/rotation of watershed monitoring sites. Other aspects

of the Plan, which deal with TMDLs and other special studies or with shorter term rotations such as lake monitoring or citizen requests, require significant updating for inclusion in each new MonPlan.

4.0 Assessment of Toxics in Ambient Waters:

4.1 The 305(b)/303(d) Water Quality Integrated Assessment Report

A new Water Quality Integrated Assessment Report (IR) is in preparation for 2012. The six-year assessment window for this IR extends from January 1, 2005 – December 31, 2010. The list of impaired segments being submitted to EPA for delisting includes several segments that have previously been 303-listed for toxics-related impairments. The complete list of approved toxic-related delistings should be available for inclusion in next year's Toxic Reduction Report.

The previous (2010) 305(b)/303(d) Water Quality Integrated Assessment Report, the associated 2010 Assessment Guidance Manual, and interactive maps are still available via the DEQ Water Quality Assessment WebPages at: http://www.deq.virginia.gov/wqa/homepage.html . Any recent changes in assessment methodologies for toxics, such as revised or new water quality standards, are described in the Final 2012 Assessment Guidance Manual which is available from the same WebPages.

4.1.1 The 305(b) Water Quality Assessment

The 2010 Assessment identified a total of 12,101 miles of impaired rivers, 96,651 acres of lakes, and 2,157 square miles of impaired estuaries. The extents of impairments caused by specifically identified toxics are summarized in the table below. The total river miles, lake acres and estuarine square miles of toxics impairments summed at the foot of the table are not comparable to the totals cited above, because many of the impaired reaches summarized in the table may be included under two or more causes (e.g., the same river mile may be listed under PCBs in fish tissue and mercury in fish tissue). Of the listings in the table, the vast majority were the result of fish tissue consumption advisories: 92.7% of impaired river miles, 98.5% of impaired lake acres, and 99.5% of impaired estuarine square miles. Fish consumption advisories were primarily for PCBs (31.0% of the toxics-related river impairments, 56.1% of the lakes, and 98.4% of the estuaries), or mercury (61.5% of the river impairments, 42.3% of the lakes, and 1.0% of estuaries). Both of these contaminants are persistent and bioaccumulative, being found in much higher concentrations in fish tissues than in the surrounding environment.

These figures and the following text will be updated in the 2012 Toxics Reduction in State Waters Report (to be submitted January 2013), once the 2012 305(b) / 303(d) Integrated Report has been finalized and approved by EPA.

4.1.2 The 303(d) Impaired Waters List

The impaired waters list from the 2010 305(b)/303(d) Water Quality Integrated Assessment Report included a total of 6,769 impaired waterbody segments. Of these, 2,146 (31.7%) are potentially related to contamination by toxic substances ("Appendix K1 – Segments Potentially Impaired by Toxics - 2010 303d List"). Of the 2,146 impaired segments that are potentially toxics related, however, only 1,482 (21.9% of the total segments) could be attributed to specifically identified contaminants. Bioassessment of benthic communities accounted for the other 664 impaired segments, and impaired benthic communities are more often the result of excessive sedimentation, eutrophication, hydrological modification, or other forms of habitat disturbance than a result of contamination.

Of the 1,482 impairments associated with specifically identified contaminants, the vast majority (1,418 segments or 95.7%) were for fish consumption. Fish consumption advisories were posted based on fish tissue screening values being exceeded by PCBs (1,031 segments), metals (mercury - 312 segments), pesticides (23 segments), dioxin (20 segments), and PAHs (8 segments).

Because the size and number of segments united into each TMDL vary with the hydrography and the extent of the impairment, the exact number of TMDLs to be developed and implemented, and the schedule for doing so are not yet certain. DEQ's PCB Strategy (2005) establishes priorities for TMDL development and discusses various options for remediation. Any new PCB-impaired segments identified in the 2012 Integrated Report will be integrated into the strategy.

4.1.3 Delisted, previously impaired segments

Several segments with toxics-related impairments are included in the delisting package currently being prepared for submission to EPA in 2012. A list of EPA- approved toxics-related delistings will be provided in the 2012 (January 2013) TRISW Report.

A number of waterbody segments listed as impaired in previous Water Quality Integrated Assessment Reports were partially delisted or removed from the 303(d) list in 2010 ("Appendix K2 – Delisted Formerly Impaired Segments 2010 IR"). Among those associated with identified toxics were Muddy Creek (1 seg - Shenandoah River Basin - Nitrates - Public Water Supply), Elizabeth River mainstem (3 segs), Elizabeth River Eastern Branch (1 seg), Elizabeth River Southern Branch (2 segs), and Lafayette River (1 seg) (James River Basin - Tributyltin - Aquatic Life), Dan River (2 segs - Roanoke River Basin - DDT in fish tissue - Fish Consumption), Beaver Creek (2 segs - Holston River Basin, South Fork - Lead - Aquatic Life), Stock Creek (1 seg - Clinch River Basin) and Russell Fork (1 seg - Big Sandy River Basin - PCB in fish tissue - Fish Consumption), and Contrary Creek and adjacent Lake Anna (2 segs - York River Basin - Lead - Aquatic Life/Wildlife). Nitrate levels in Muddy Creek declined following TMDL implementation. Tributyltin listings in the Elizabeth River system were removed following the EPA approval of a revised DEQ saltwater criterion for tributyltin. Delisting of the Beaver Creek lead impairment was approved by EPA Region 3 in 2005, based on more contemporary results that revealed sediment lead concentrations well below the screening values, plus the presence of several metals-sensitive benthic macroinvertebrate taxa. Unfortunately, the authorization for delisting was overlooked during the preparation of the previous (2008) Integrated Report. Fish consumption advisories for DDT (Dan River) and PCB (Stock Creek, Russell Fork) were removed when results from additional, more recent fish sampling and tissue analyses revealed no exceedances of fish tissue criteria. The Contrary Creek/Lake Anna listing for lead was removed because the original listing had been an error; further review of the data from 2003 through 2008 revealed that no exceedances of the lead criterion had occurred.

Numerous segments of transition zone waters in the tidal Potomac (2 segs), James (4 segs), Rappahannock (33 segs), Chowan/Dismal Swamp (10 segs), Severn (1 seg), and York (9 segs) River Basins had previously been listed for Aquatic Life and Wildlife uses because of chloride exceedances. These segments were delisted following EPA approval of the Triennial Review conclusion that the chloride criterion should not be applied to transitional (oligohaline) tidal waters.

Although listings for benthic macroinvertebrate impairments are not necessarily related to toxics, they are used as a warning flag to prompt the search for causative stressors. Seven estuarine segments, associated with five probabilistic monitoring sites, that had previously been listed based on weight-of-evidence aquatic life use assessments, were delisted because sediment chemistry and toxicity analyses did not reveal sufficient toxics-related cause. The segments/sites were reclassified from 5A (impaired - requiring TMDL)

to 3B (observed effects – requiring further study) based exclusively on their benthic index scores. Ten additional segments, associated with six freshwater monitoring sites, were delisted because more recent repetitive evaluations with an improved Stream Condition Index (SCI) scored the benthic communities as non-impaired.

Extent of Impairment by Confirmed Toxics in the 2010 305(b)/303(d) Integrated Report

Pollutant	Water Body Type (units)	Extent Impaired (whole numbers)	Pollutant	Water Body Type (units)	Extent Impaired (whole numbers)
Aldrin (Fish tissue)	Rivers (miles)	6	DDD/DDE	Rivers (miles)	0 / 15
	Lakes (acres)	0		Lakes (acres)	44 / 44
	Estuaries (sq. miles)	0		Estuaries (sq. miles)	0 / 0
Ammonia (un-ionized)	Rivers (miles)	3	Dioxin	Rivers (miles)	0
	Lakes (acres)	0		Lakes (acres)	0
	Estuaries (sq. miles)	0		Estuaries (sq. miles)	3
Benzo(a)pyrene Benzo(b)flouranthene (PAHs)	Rivers (miles)	7	Heptachlor Epoxide	Rivers (miles)	14
	Lakes (acres)	74		Lakes (acres)	0
	Estuaries (sq. miles)	0		Estuaries (sq. miles)	0
Benzo(k)fluoranthene (PAH)	Rivers (miles)	7	Manganese	Rivers (miles)	4
	Lakes (acres)	74		Lakes (acres)	0
	Estuaries (sq. miles)	1		Estuaries (sq. miles)	0
Cadmium	Rivers (miles)	5	Mercury (Fish tissue)	Rivers (miles)	2,059
	Lakes (acres)	26		Lakes (acres)	56,202
	Estuaries (sq. miles)	0		Estuaries (sq. miles)	22
Chlordane	Rivers (miles)	5	Mirex	Rivers (miles)	54
	Lakes (acres)	0		Lakes (acres)	0
	Estuaries (sq. miles)	0		Estuaries (sq. miles)	0
Chloride	Rivers (miles)	11	PCBs (Fish tissue)	Rivers (miles)	1,036
	Lakes (acres)	0		Lakes (acres)	74,496
	Estuaries (sq. miles)	5		Estuaries (sq. miles)	2,087
Copper	Rivers (miles)	10	PCBs (Water column)	Rivers (miles)	102
	Lakes (acres)	574		Lakes (acres)	1,245
	Estuaries (sq. miles)	0		Estuaries (sq. miles)	1
DDT	Rivers (miles)	13	Sediment Bioassays (Estuarine and Marine waters)	Rivers (miles)	N/A
	Lakes (acres)	0		Lakes (acres)	N/A
	Estuaries (sq. miles)	0		Estuaries (sq. miles)	1
DDT (Fish tissue)	Rivers (miles)	2	Zinc	Rivers (miles)	9
	Lakes (acres)	44		Lakes (acres)	26
	Estuaries (sq. miles)	0		Estuaries (sq. miles)	0

Total Toxics Impairments	Rivers (miles)	3,347	Total Fish Consumption Impairments	Rivers (miles)	3,103	92.71%
	Lakes (acres)	132,761		Lakes (acres)	130,742	98.48%
	Estuaries (sq. miles)	2,120		Estuaries (sq. miles)	2,109	99.48%

4.2 Most Recent Virginia Department of Health Fishing Restrictions and Health Advisories

The Virginia Department of Health regularly issues :Fish Consumption Advisories and Restrictions" for Virginia Waterways based upon the results from the DEQ Fish Tissue and Sediment Monitoring Program and other sources. All waters subject to these restrictions and advisories are included in DEQ's biennial 303(d) lists. The VDH Website contains the most recently published updates to fishing restrictions and closures due to concerns related to human health and fish consumption. The complete VDH fishing restrictions and health advisories currently in effect for any waters in the state can be found summarized and mapped by basin at:
http://www.vdh.virginia.gov/epidemiology/DEE/PublicHealthToxicology/Advisories/index.htm.

The DEQ Fish Tissue and Sediment Monitoring Program was suspended in 2010 to address current needs with limited available resources and will tentatively be resumed in the summer of 2012. Fish samples were collected by DEQ and VIMS at 21 probabilistic estuarine sites during the summer (June – September) of 2010, in conjunction with the National Coastal Condition Assessment of the National Aquatic Resources Survey (NCCA/NARS). Nineteen of the sites were within the tidal portions of the Chesapeake Bay watershed, one additional was collected from coastal Delmarva, and another from Back Bay. The whole-fish tissue analyses from those samples are being performed by EPA-contracted laboratories for ecological risk assessment and the results are not yet available.

No new fishing restrictions or health advisories were issued during State Fiscal Year 2011. The most recent new advisories and modifications of previous advisories were issued during SFY 2010. Advisories on PCB contamination in blue crabs, specifically related to consumption of the hepatopancreas or "mustard," were issued in January 2009 for the Southern Branch Elizabeth River and for King Creek, a tributary to the York River. In October 2009, geographic extensions were added to several previous advisories on PCBs in fish tissues, among them tidal embayments and tributaries to the Potomac River, Mill Creek near Fort Monroe (Hampton City), Dan River below Danville, Lovills Creek Lake –Yadkin River, lower Nottoway River, Emporia Reservoir and lower Meherrin River, tidal Poquoson and Piankatank Rivers, Mattaponi and Pamunkey Rivers. An additional fish consumption advisory was announced by the Virginia Department of Health on November 18, 2009. This was in response to a North Carolina Division of Public Health advisory for mercury in walleye collected in the North Carolina portion of Lake Gaston.

Several recent reports as well as analytical results from fish tissue and sediment monitoring by the agency are available on the DEQ WebPages at http://www.deq.virginia.gov/fishtissue.

5.0 Remediation of Toxics in Ambient Waters:

Total Maximum Daily Load (TMDL) Program

The TMDL Program is an important component of DEQ's toxics remediation in aquatic environments. A number of toxics-related TMDLs have been completed and approved in recent years. Completed TMDLs can be identified and viewed by using the search form on the TMDL WebPages at https://www.deq.virginia.gov/TMDLDataSearch/ReportSearch.jspx. Queries can be performed based on pollutant, major river basin, political jurisdiction, and water body name or watershed identification. Various other toxics-related TMDLs have completed the public comment phase and have been submitted to EPA for final approval. They are listed on DEQ's TMDL WebPages at https://www.deq.virginia.gov/TMDLDataSearch/DraftReports.jspx.

Approved Toxics-Related TMDLs – SFY2011

TMDL	Basin	Pollutant(s)	EPA Approval Date
North Fork Holston River (80 miles, including seven segment listings)	Holston River	Mercury	04/26/2011

Phased Toxics-Related TMDLs

TMDL	Basin	Pollutant(s)	Final TMDL Due
Levisa Fork Watershed including Garden Creek	Big Sandy River	PCBs, Bacteria, Sediment	Spring 2013
Smith River Watershed	Smith River	Potential PAHs (phased benthic)	Spring 2013
Powell River PAH	Tennessee River	TDS, TSS, Potential PAHs (phased benthic)	March 2013

Other toxics-related TMDLs have been on-going. TMDL investigations to identify PCB sources began in SFY 2009 and are scheduled to be completed in 2014 for the Tidal James River Basin, including the Elizabeth River. For purposes of calibrating the model, monthly PCB samples have also been collected at two stations in the James and Elizabeth Rivers (see Appendix J1). PCB source investigation work has also been on-going in the New River Basin (data presented in Appendix J2) with TMDL development scheduled to begin in 2013. Several TMDLs have been phased (*i.e.*, developmental period extended), including the Levisa Fork for a PCB impairment, a benthic impairment for eleven segments in the Tennessee/Big Sandy basin (PAHs), and a single benthic impairment (unknown toxicant) in the Roanoke Basin. PAHs have been identified as a possible stressor in the phased benthic Powell River TMDL. The Phased TMDL monitoring plan will include additional benthic sampling to determine if the PAHs are bioavailable. If they are found to be bioavailable the determination will be made as to include PAHs as a probable stressor. TMDLs are phased when there is substantial uncertainty in the TMDL (e.g., stressor has not been confirmed as the cause for the impairment; source(s) of the pollutant causing the impairment have not been identified or confirmed).

As additional TMDLs are completed and scheduled for implementation, and others are added, follow-up monitoring will be initiated to evaluate their effectiveness in reducing toxics contamination. The effective implementation of these TMDLs should result in measurable reductions of contaminants in the state's waters over time. The agency's TMDL history, current status, and development plans are available at http://www.deq.virginia.gov/tmdl/.

Close coordination between monitoring and assessment activities identifies new sources of contamination as they occur and document the effectiveness of load allocations and other remedial measures developed and implemented by the TMDL Program. The agency anticipates significant reductions of toxics in the state's waters as a result of continued TMDL implementation.

6.0 Summary and Conclusions

DEQ's commitments to toxics reduction include (1) the prevention of contamination of the state's waters by toxics, (2) the continued monitoring of those waters for the presence of toxics, and (3) the development of TMDLs and the implementation of remedial measures to reduce and/or eliminate toxics found in the state's waters. The following summary is organized in relation to the interacting, cyclic relationship among these three activities.

6.1 Pollution Prevention

6.1.1 Virginia Pollutant Discharge Elimination System (VPDES)

During SFY11, DEQ's Toxics Management Program included 304 reporting facilities with 609 outfalls that had toxics limits in their VPDES permits (Appendix B). Fifty-six of the associated permitted facilities renewed their permits or established new permits during State Fiscal Year 2011. A total of 7,987 parameter-specific Discharge Monitoring Reports (DMRs) were filed during state fiscal year 2011. Of the 6,345 parameter-specific max-concentration DMR results reported, 93 (1.47%) had measured values that exceeded their permitted maximum concentration limits (Appendix D). Among the 4,245 DMRs submitted for average concentration, 81 (1.91%) exceedances were observed. In most cases, they resulted from minor isolated variations that occasionally exceeded the limit - almost always for total metals but occasionally for dissolved metals (copper and zinc were the most common) at municipal wastewater treatment plants. Parameter-specific exceedances persisted during multiple (=3) reporting dates on nine occasions during the period.

6.1.2 Office of Pollution Prevention

The 2011 Pollution Prevention Annual Report is available on the DEQ WebPages at http://www.deq.virginia.gov/p2/homepage.html . Virginia Green, the Commonwealth's initiative to promote pollution prevention within the tourism industry, now includes almost 1,100 members. At the end of 2011, the Virginia Environmental Excellence Program (VEEP) included approximately 450 approved or pending facilities. Twelve of these facilities were among the 30 statewide that received Governor's Environmental Excellence Awards for their performance during 2011. Virginia distributed over $126,000 in fee discounts to VEEP facilities for the implementation and performance of their Environmental Management Plans. VEEP reported an 89 ton reduction in the use of hazardous materials, and hazardous waste generation was reduced by almost 101,593 tons in the past two years. Emissions of volatile organic compounds (VOCs) to the air were reduced by 547 tons. In the past two years total water use was reduced by 1.034 billion gallons. These reductions resulted in cost saving of over $43 million. The reduction of total energy consumption continues to be one of OPP's priorities. Since its inception in 2006, nearly 67,000 mercury switches have been removed from recycled automobiles and more than 150 pounds of mercury have been recycled, and facilities have pledged the annual recycling of over 55,000 mercury containing fluorescent light bulbs. One non-profit VEEP member that manages a shooting range recovered more than 200,000 pounds of lead that could be sold for re-use. Its sale provided more than enough to pay for the recovery operation and will also support additional environmental stewardship activities in the future.

6.1.3 Environmental Education

Across the state, ten regional teams continue to bring together local conservation organizations and education agencies to implement stewardship projects, provide field experiences for students and educate citizens about local issues. Virginia Naturally's monthly electronic newsletter provides over 2,100 educators and litter and recycling program managers across Virginia with information on special features (conferences, etc.), funding and awards deadlines, upcoming events, partner updates, and resources. Non-competitive litter prevention and recycling grants ($1,742,782 in 2010) have been provided to 308 local governments. This was matched by an additional $14,656,272 in cash and in-kind services, a match of

840%. The Environmental Educators Leadership Program and numerous Stewardship Training Workshops have provided training for hundreds of educators statewide.

6.1.4 Toxics Release Inventory (TRI)

The March 2011 TRI Report is available on the DEQ Website at: http://www.deq.virginia.gov/sara3. It summarizes data from calendar year 2009, during which 421 facilities filed 1,556 individual reports. Statewide toxic releases to the water totaled approximately 18.2 million pounds or 38.2% of the total onsite releases to all media during 2009. This quantity represents a 10.3% decrease from the 20.3 million pounds released to the water in 2008. Nitrate compounds (17.9 million pounds) represented 98.7% of the top ten TRI chemicals released to water. Nitrates, however, are of more concern for their effects as nutrients rather than as toxics. Toxics criteria for dissolved nitrates in drinking water were not exceeded during SFY 2011.

6.2 Monitoring - Water Quality Monitoring Programs

Statewide, DEQ's Water Quality Monitoring Programs collected and analyzed 707 toxics-related samples at DCLS during SFY11. Much of the sampling was in association with mercury in the Shenandoah and South Fork Shenandoah special studies (21.9%), and the Freshwater and Estuarine/Near-shore Oceanic Probabilistic Monitoring Programs (27.1% and 25.8%, respectively) represented most of the remaining. TMDL and other toxics-related special studies accounted for another 8.7% and quality assurance samples 11.4% (Appendix G). The Estuarine Probabilistic Monitoring Program also collected 24 sediment samples from an additional 22 sites and the Near-shore Oceanic survey 55 samples from 50 sites; these were analyzed elsewhere for chemical contamination (metals and organics) and toxicity, as well as for benthic community health. Scheduled activities from the current Water Quality Monitoring Plan are available at http://www.deq.virginia.gov/watermonitoring/.

6.3 Assessment, Remediation, and the Continued Reduction of Toxics

6.3.1 Assessed Impairments – The 2010 305(b)/303(d) Water Quality Integrated Assessment Report

The 2010 Integrated Assessment Report identified 12,101 miles of impaired streams and rivers, 96,651 acres of impaired lakes, and 2,157 square miles of impaired estuaries. Of those impaired by specifically identified toxics, 92.7% of the river miles, 98.5% of lake acres, and 99.5% of the estuarine area were listed for fish consumption advisories, primarily for PCBs (31.0% of toxics impaired rivers, 56.1% of lakes, 98.4% of estuaries) or mercury (61.4% of rivers, 42.3% of lakes, 1.0% of estuaries). Because the number of segments united into each TMDL varies with the hydrography and the extent of the impairment, the exact number and schedule of TMDLs to be developed and implemented is not yet certain. DEQ's PCB Strategy (2005) establishes priorities for TMDL development and discusses various options for remediation, and any newly identified PCB-impaired segments will be integrated into the strategy.

All of these figures will be updated as soon as the 2012 Integrated Assessment Report is completed and approved by EPA.

6.3.2 Remediation / Reduction

A number of toxics-related TMDLs have been completed and approved since 2000; two in 2002, three in 2004, and 16 in 2007, all for PCBs in the Shenandoah (5) or in other Virginia tributaries to the Potomac (16). The Potomac tributary PCB TMDLs were incorporated into the interstate Potomac River PCB TMDL

developed under the auspices of the Interstate Commission for the Potomac River Basin. This TMDL was submitted in November 2007and was subsequently approved by EPA. Two benthic TMDLs were completed for toxics parameters in 2006, one (copper and zinc) in the New River basin and one (PAHs and lead) in the Shenandoah. Two toxics-related TMDLs were approved in 2007, one for chlorides in Garden Creek of the Big Sandy Basin, and the other, mentioned above, for PCBs in the Potomac. A TMDL that included ammonia was approved for Strait Creek in the Shenandoah Basin in 2009. A PCB TMDL was approved for the Roanoke (Staunton) River in April of 2010 and a TMDL for mercury in the South River, South Fork Shenandoah River, and Shenandoah River was approved in June of 2010. An additional TMDL for mercury was approved for the North Fork Holston River in April of 2011 (80 miles of river, including seven previously listed segments).

The draft TMDL for PCBs (plus bacteria and sediment) in the Levisa Fork completed public comment in February 2010 and the draft Smith River benthic TMDL, in which PAHs are implicated, underwent public comment in the spring of 2010. Both continue as phased TMDLs until specific causes are identified. A draft TMDL for heptachlor epoxide and sulfates in the North Fork Powell and Powell Rivers completed public comment in March of 2010. Several additional toxics-related TMDLs are in development. The source identification study for PCBs, initiated during 2009 for TMDL development on the upper tidal James River and the Elizabeth River, was continued in 2011 with the collection of additional water column samples for model calibration. The agency's TMDL history, current status and development plans are available at http://www.deq.virginia.gov/tmdl/.

As these TMDLs are completed and scheduled for implementation, and others are added, follow-up monitoring will be initiated to evaluate their effectiveness in reducing toxics contamination. The effective implementation of additional TMDLs should result in similar measurable reductions of contaminants in a number of the state's watersheds within a few years.

6.3.3 Continued Commitment

DEQ continues its commitment to toxics reduction by the prevention of contamination, continued water quality monitoring, and the implementation of remedial measures. The Office of Environmental Education continues to bring together local conservation organizations and education agencies to implement stewardship projects, provide field experiences for students and educate citizens about local pollution issues. The Virginia Pollutant Discharge Elimination System and the Pollution Prevention Program join with other programs and stakeholders to control and reduce toxics releases. The Toxics Release Inventory and various water programs constantly monitor and document the release to, and the presence and movement of toxics within aquatic environments. Close coordination between monitoring and assessment activities will continue to identify new sources of contamination as they occur and document the effectiveness of load allocations and other remedial measures developed and implemented by the TMDL Program. The agency anticipates significant reductions of toxics in the state's waters as a result of continued TMDL implementation.

7.0 References

A cumulative bibliography of general references and publications cited in this and previous TRISW Reports is included in "Appendix L – References."