FY 14-15

TENNESSEE

DIVISION OF WATER RESOURCES

SURFACE WATER

MONITORING AND ASSESSMENT PROGRAM PLAN

FINAL
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Tennessee Department of Environment and Conservation
Division of Water Resources
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EXECUTIVE SUMMARY

The purpose of this document is to establish overall goals and objectives for key elements of the Tennessee Department of Environment and Conservation (TDEC), Division of Water Resources Watershed Stewardship and Support Unit, surface water quality monitoring program. Information concerning ground water monitoring will be provided in a separate document by the Water Supply Unit.

The United States Environmental Protection Agency (EPA) is requiring states to implement or commit to developing a monitoring program strategy. The details of this initiative can be found in the document, *Elements of a State Monitoring and Assessment Program,* published in March 2003. This initiative is intended to serve as a tool to assist EPA and the states in determining whether a monitoring program meets the requirements of Clean Water Act Section 106 (e)(1). EPA recommended the following ten elements be included in a state's monitoring program strategy:

1. A long-term state monitoring strategy
2. Identification of monitoring objectives
3. Selection of a monitoring design
4. Identification of core and non-critical water quality indicators
5. Development of quality management and quality assurance plans
6. Use of accessible electronic data systems
7. Methodology for assessing attainment of water quality standards
8. Production of water quality reports
9. Periodic review of monitoring program
10. Identification of current and future resource needs

Tennessee spent considerable time prior to the publication of EPA's recommendations developing an effective monitoring and assessment strategy, which has been used for many years. Publication of EPA's guidance resulted in the review and refinement of the existing plan to make certain all elements were included.

Tennessee already incorporates all 10 elements in its existing monitoring strategy. Those 10 elements have been outlined in this document. The division agrees that improvements can be made on some aspects of its program; particularly when addressing large rivers, lakes, reservoirs and wetlands.

Tennessee has developed a nutrient criteria development plan. The division has published Quality System Standard Operating Procedures (QSSOP's) for conducting bacteriological, biological, periphyton and chemical stream surveys as well as a Quality Assurance Project Plan for 106 Monitoring.

The purpose of the division's water quality monitoring program is to provide an accurate and defensible accounting of Tennessee's progress towards meeting the goals established in the federal Clean Water Act and the Tennessee Water Quality Control Act. To accomplish this task, data are collected and interpreted in order to:

1. Assess the condition of the state's waters.
2. Identify problem areas with parameter values that violate Tennessee numerical or narrative water quality standards.
3. Identify causes and sources of water quality problems.
4. Document areas with potential human health threats from fish tissue contamination or elevated bacteria levels.
5. Establish trends in water quality.
6. Gauge compliance with NPDES permit limits.
7. Document baseline conditions prior to a potential impact or as a reference stream for downstream uses or other sites within the same
8. ecoregion and/or watershed.
9. Assess water quality improvements based on site remediation, implementation of Best Management Practices, and other restoration strategies.
10. Identify proper stream-use classification, including antidegradation policy implementation.
11. Identify natural reference conditions on an ecoregion basis for refinement of water quality standards.

Since 1996 Tennessee's monitoring program has been based on a five-year watershed cycle. The first cycle was completed in 2001. A third cycle was completed in 2011. Tennessee relies heavily on ecoregion reference data to assess impairment and has spent much effort in developing regional reference guidelines for wadeable streams. In 2008, the division initiated monitoring to establish reference guidelines for headwater streams. A future challenge is to develop similar guidelines for rivers, lakes and reservoirs. A major limiting factor to this goal is funding and staff availability.

I. ELEMENTS OF TENNESSEE'S SURFACE WATER MONITORING AND ASSESSMENT PROGRAM

A. Monitoring Program Strategy

The Division of Water Resources (DWR) has a comprehensive monitoring program that serves its water quality management needs and addresses all the state's surface waters including streams, rivers, lakes, reservoirs and wetlands.

In 1996, the Division of Water Pollution Control, currently DWR, adopted a watershed approach that reorganized existing programs and focused on place-based water quality management. The primary goals of the watershed approach are:

Provide for more focused and comprehensive water quality monitoring and assessment
Assure equitable distribution of pollutant limits for permitted dischargers
Develop watershed water quality management strategies that integrate controls for point and non-point sources of pollution
Increase public awareness of water quality issues and provide opportunities for public involvement

There are 55 USGS eight-digit hydrologic units (HUC) in the state that have been divided into five monitoring groups for assessment purposes. One group, consisting of between 9 and 16 watersheds, is monitored and assessed each year**.** This allows intense monitoring of a limited number of watersheds each year with all watersheds monitored every five years.
The watershed cycle provides for a logical progression from data collection and assessments through TMDL development and permit issuance. The watershed cycle coincides with the development of permits that are issued to industries, municipalities, mining and commercial entities. The key activities involved in each five-year cycle are:

1. **Planning and Data Collection** – Existing data and reports from appropriate federal and state agencies as well as private organizations are compiled.

2. **Monitoring** – Field data are collected for targeted waterbodies in the watershed. These data supplement existing data and are used for water quality assessment.

3. **Assessment** – Monitoring data are compared to existing water quality criteria to determine if the waterbodies support their designated uses.

4. **Wasteload Allocation/Total Maximum Daily Load (TMDL)** –TMDL studies identify and quantify sources of pollutants causing loss of use support and then identifies how to correct the problem. The Total Maximum Daily Load is a sum of all the pollution sources plus a margin of safety.

5. **Permits** – Issuance and expiration of all discharge permits are synchronized based on the watershed cycle. Approximately 1700 permits have been issued in Tennessee under the federally-delegated National Pollutant Discharge Elimination System (NPDES) program.

6. **Watershed Management Plans** – Watershed management plans are developed for each watershed. These plans include a general watershed description, water quality goals, major quality concerns and issues as well as pollutant management strategies.

One of the advantages of this approach is that it considers all sources of pollution including discharges from industries and municipalities as well as runoff from agriculture and urban areas. Another advantage is the coordination of local, state and federal agencies and the encouragement of public participation.

B. Monitoring Objectives

The purpose of the division's water quality monitoring program is to provide a measure of Tennessee's progress towards meeting the goals established in the federal Clean Water Act and the Tennessee Water Quality Control Act. To accomplish this task, data are collected and interpreted in order to:

1. Assess the condition of the state's waters.
2. Identify problem areas with parameter values that violate Tennessee numerical or narrative water quality standards.
3. Identify causes and sources of water quality problems.
4. Document areas with potential human health threats from fish tissue contamination or elevated bacteria levels.
5. Establish trends in water quality.
6. Gauge compliance with NPDES permit limits.
7. Document baseline conditions prior to a potential impact or as a reference stream for downstream or other sites within the same ecoregion and/or watershed.
8. Assess water quality improvements based on site remediation, Best Management Practices, and other restoration strategies.
9. Identify proper stream-use classification, including Antidegradation Statement implementation.
10. Identify natural reference conditions on an ecoregion basis for refinement of water quality standards.
11. Identify and protect wetlands.

C. Monitoring Design

The state of Tennessee incorporates several approaches in its monitoring design. The primary monitoring design is a five-year rotational cycle based on USGS eight-digit HUC units.

Watersheds

The watershed approach serves as an organizational framework for systematic assessment of the state's water quality. By viewing the entire drainage area as a whole, the division is better able to address water quality problems through an organized schedule. This unified approach affords a more in-depth study of each watershed and encourages coordination of public and governmental organizations.

The watershed approach is a five-year cycle that has the following features:

1. Commits to a monitoring strategy that results in an accurate assessment of water quality
2. Synchronizes discharge permit issuance to coincide with the development of TMDLs
3. Establishes TMDLs by integrating point and non-point source pollution
4. Partners with other agencies to obtain the most current water quality and quantity data

In attaining the watershed goals mentioned above, four major objectives are to be met:

Monitor water quality intensively within each watershed at the appropriate time in the five-year watershed cycle

1. Establish TMDLs based on best available monitoring data and sound science
2. Develop a watershed water quality management plan
3. Attain good representation of all local interests at public meetings and continue a dialogue with local interest throughout the five-year cycle

Watersheds are organized by the 55 USGS eight digit HUC codes found in Tennessee. The watersheds are addressed by groups on a five-year cycle that coincides with permit issuance. Each watershed group contains between 9 and 16 watersheds. (Table 1). Six watershed groups in middle Tennessee were revised in 2012 to better distribute monitoring load between field offices:

- Stones from Group 1 to Group 2
- Wheeler and Pickwick from Group 2 to Group 1
- Collins from Group 2 to Group 3
- Upper Duck from Group 3 to Group 4
- Cordell Hull from Group 4 to Group 5

Figure 1: Graphic Representation of the Watershed Approach.

More details may be found on the DWR home page
http://www.tn.gov/environment/water/watersheds/

The watershed management groups and timeline are shown in Figure 2 and Table 1

Monitoring activities are coordinated with Tennessee Valley Authority (TVA), Department of Energy (DOE), Tennessee Department of Agriculture (TDA), Tennessee Wildlife Resources Agency (TWRA), United States Geological Survey (USGS), and United States Army Corps of Engineers (USACE) to avoid duplication of effort and increase watershed coverage.

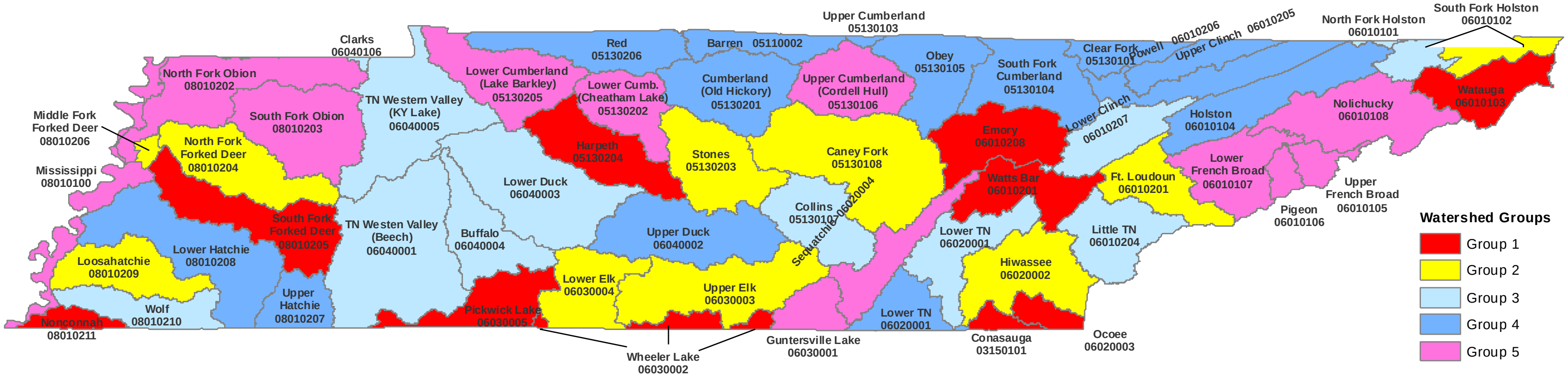


Figure 2: Tennessee Watershed Management Groups

Table 1. Watershed Timeline Groups

Group /Year	Watershed	HUC	EFO	Watershed	HUC	EFO
1	Conasauga	03150101	CH	Ocoee	06020003	CH
	Harpeth	05130204	N	Pickwick Lake	06030005	CL, J
1996	Watauga	06010103	JC	Wheeler Lake	06030002	CL
2001 2006	Upper TN (Watts Bar)	06010201	K, CH, CK	South Fork of the Forked Deer	08010205	J
2011 2016	Emory	06010208	K, CK	Nonconnah	08010211	M
2	Caney Fork	05130108	CK, CH, N	Upper Elk	06030003	CL
	Stones	05130203	N	Lower Elk	06030004	CL
1997 2002 2007	S. Fork Holston (u/s Boone Dam)	06010102	JC	North Fork Forked Deer	08010204	J
2012 2017	Upper TN (Fort Loudoun)	06010201	K	Forked Deer	08010206	J
	Hiwassee	06020002	CH	Loosahatchie	08010209	M
	Collins	05130107	CK, CH, CL	TN Western Valley (Beech)	06040001	J
3	N. Fork Holston	06010101	JC	Lower Duck	06040003	CL
1998 2003	S. Fork Holston (d/s Boone Dam)	06010102	JC	Buffalo	06040004	CL, N
2008 2013 2018	Little Tennessee (Tellico)	06010204	K	TN Western Valley (KY Lake)	06040005	N, J
	Lower Clinch	06010207	K	Wolf	08010210	M
	Tennessee (Chickamauga)	06020001	CH	Clarks	06040006	J
	Barren	05110002	N	Holston	06010104	JC, K
4	Clear Fork of the Cumberland	05130101	K, MS	Upper Clinch	06010205	JC, K
1999	Upper Cumberland	05130103	CK	Powell	06010206	JC, K
2004 2009 2014	South Fork Cumberland	05130104	K	Tennessee (Nickajack)	06020001	CH
2019	Obey	05130105	CK	Upper Duck	06040002	CL
	Cumberland (Old Hickory Lake)	05130201	N	Upper Hatchie	08010207	J
	Red	05130206	N	Lower Hatchie	08010208	J,M

Group /Year	Watershed	HUC	EFO	Watershed	HUC	EFO
5 2000 2005 2010 2015 2020	Lower Cumberland (Cheatham)	05130202	N	Nolichucky	06010108	JC, K
	Lower Cumberland (Lake Barkley)	05130205	N	Sequatchie	06020004	CH
	Upper Cumberland (Cordell Hull)	05130106	CK, N	Guntersville	06030001	CH, CL
	Upper French Broad	06010105	K	Mississippi	08010100	M, J
	Pigeon	06010106	K	Obion	08010202	J
	Lower French Broad	06010107	K	Obion South Fork	08010203	J

Key to EFOs

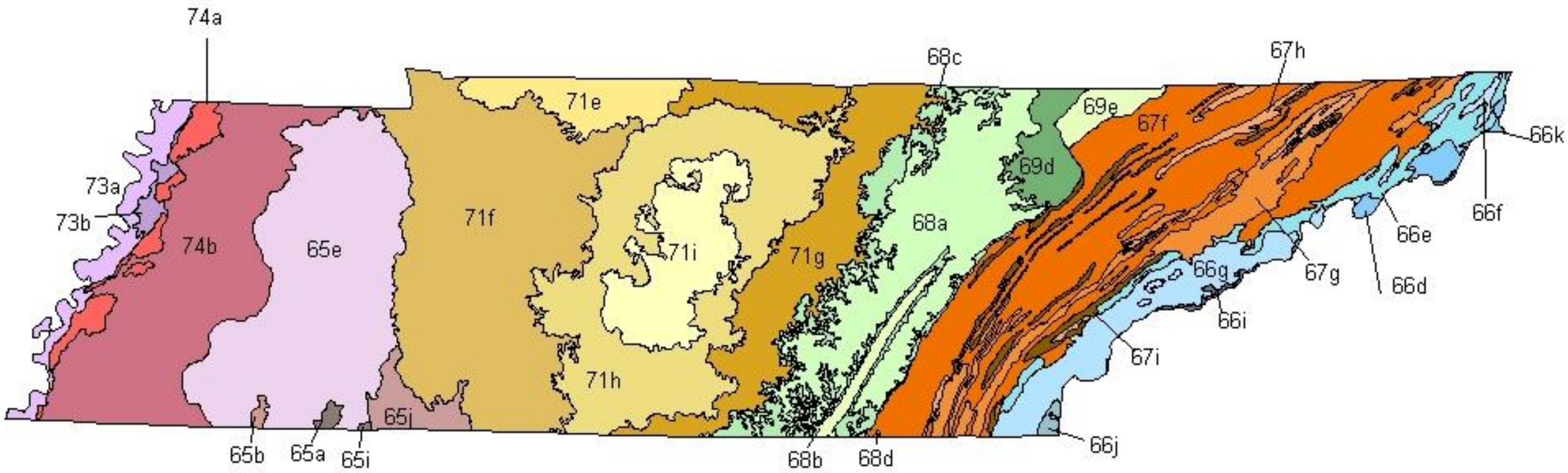
CH	Chattanooga	K	Knoxville
CK	Cookeville	M	Memphis
CL	Columbia	N	Nashville
J	Jackson	JC	Johnson City

Ecoregions

Tennessee relies heavily on ecoregions to serve as a geographical framework for establishing regional water quality expectations (Arnwine et al, 2000). Tennessee has 31 level IV ecoregions (Figure 3).

Since 1999, sites have been monitored as part of the five-year watershed cycle. New reference sites are added, as they are located during watershed monitoring, while some of those originally selected sites have been dropped due to increased disturbances or unsuitability. Periphyton has been added as a second biological indicator. In 2009, headwater streams were added to the reference monitoring program. There are currently approximately 190 active and candidate reference sites being monitored. This reference database has been used to establish regional guidelines for wadeable streams.

Six additional subregions have been added in ecoregions 66, 68, 69 and 73 resulting in 31 Level IV ecoregions in Tennessee. In addition, the names of four subregions have been revised (65e, 66d, 69d and 73a). With the exception of 69e, the majority of new subregions are very small or the streams originate in a different subregion. Therefore, it may not be necessary or even possible to find reference streams. Until such time as reference sites can be established these subregions will be treated as part of their original subregion and/or bioregion for assessment purposes.



65a Blackland Prairie	66k Amphibolite Mountains	69e Cumberland Mountain Thrust Block
65b Flatwoods/Alluvial Prairie Margins	67f Southern Limestone/Dolomite Valleys and Low Rolling Hills	71e Western Pennyroyal Karst
65e Northern Hilly Gulf Coastal Plain	67g Southern Shale Valleys	71f Western Highland Rim
65i Fall Line Hills	67h Southern Sandstone Ridges	71g Eastern Highland Rim
65j Transition Hills	67i Southern Dissected Ridges & Knobs	71h Outer Nashville Basin
66d Southern Crystaline Ridges and Mountains	68a Cumberland Plateau	71i Inner Nashville Basin
66e Southern Sedimentary Ridges	68b Sequatchie Valley	73a Northern Holocene Meander Belts
66f Limestone Valleys and Coves	68c Plateau Escarpment	73b Northern Pleistocene Valley Trains
66g Southern Metasedimentary Mountains	68d Southern Table Plateaus	74a Bluff Hills
66i High Mountains	69d Dissected Appalachian Plateau	74b Loess Plains
66j Broad Basins		

Figure 3: Level IV Ecoregions in Tennessee

Monitoring Priorities

The division maintains a statewide monitoring system consisting of approximately 7000 stations (Figure 4). In addition, new stations are created every year to increase the number of assessed streams. Approximately 600 stations will be monitored in FY 14-15 (Figure 5 and Table 9, in Section II). Stations are sampled monthly, quarterly, bimonthly, semi-annually, or annually depending on the objectives of the project. Within each watershed cycle, monitoring stations are coordinated between the central office and staff in the eight Environmental Field Offices (EFOs) and the Mining Section (MS) located across the state, based on the following priorities.

Antidegradation monitoring: Streams are evaluated as needed generally in response to requests for new or expanded NPDES and ARAP permits. Streams are evaluated for antidegradation status based on a standardized evaluation process, which includes information on specialized recreation uses, scenic values, ecological consideration, biological integrity and water quality. Since permit requests generally cannot be anticipated, these evaluations are generally not included in the workplan. The number of antidegradation evaluations conducted by the state is steadily increasing as the process becomes more refined and standardized.

Ecoregion Reference: Established reference stations are monitored in conjunction with the watershed cycle. Ecoregion reference sites located in the fiscal year watershed group are monitored. Each station is sampled quarterly for chemical quality and pathogens as well as in spring and fall for macroinvertebrates and habitat. Periphyton sampling was added in FY –07. Headwater streams were added in 2009. Both semi-quantitative and biorecon benthic samples are collected to provide data for both biocriteria and biorecon guidelines. If watershed screening efforts indicate a potential new reference site, more intensive reference stream monitoring protocols are used to determine potential inclusion in the reference database.

303(d) Listed segments: The 303(d) List is a compilation of the streams and lakes in Tennessee that are "water quality limited" or are expected to exceed water quality standards in the next two years and need additional pollution controls. Water quality limited streams are those that have one or more properties that violate water quality standards. They are considered impaired by pollution and not fully meeting designated uses.

Imparied waters are monitored, at a minium, every five years coinciding with the watershed cycle. Waters that do not support fish and aquatic life are sampled once for macroinvertebrates (semi-quantitative sample preferred) and monthly for the listed pollutant(s). Streams with impacted recreational uses, such as those impaired due to pathogens are sampled monthly for *E. coli*. (Other acceptable sampling strategies for *E. coli* might be to sample 5 times within a 30-day period, or bimonthly during the prime water contact season).

However, resource limitations or data results may sometimes necessitate fewer sample collections. For example, there are cases where pollutants are at high enough levels that sampling frequency may be reduced while still providing a statistically sound basis for assessments. In other cases, monitoring may be appropriately bypassed during a monitoring cycle. (Chapter II, Section C). Streams posted with pathogen contact advisories are monitored during each cycle.

TMDL: Waterbody monitoring is required to develop TMDLs. Monitoring for scheduled TMDLs in the watershed group is coordinated between the Watershed Management Section (WMS) manager and the EFOS to meet objectives for each TMDL. The frequency and parameters monitored for TMDL monitoring depends on the specific TMDL. Detailed information about TMDLs can be found in the department's 106 Monitoring QAPP, (TDEC 2011), and in the document *Monitoring to Support TMDL Development* (2001).

Long-term Trend Station Monitoring (Ambient): For water quality trend analyses established sites are monitored. These sites include some of the original 23 ambient stations along with about 70 additional ambient sites. Chemical samples are collected and field parameters are measured at least quarterly at each of these stations every year.

Probabilistic Monitoring: In FY-08, 90 probabilistic monitoring stations were established on wadeable streams across the state. These stations will be monitored every 5 years for trend analysis.

Watershed Monitoring: Once the previous priorities are met, each EFO monitors as many additional stations to confirm continued support of designated uses and to increase the number of assessed waterbodies. Macroinvertebrate biorecons, habitat assessments, and field measurements of DO, specific conductance, pH and temperature are conducted at the majority of these sites. Sites are selected in the following priority:

Previously assessed segments. (Note that a single site per assessed segment is adequate if assessment was supporting and no changes are evident).
Sites below point source discharges in wadeable streams where in-stream biological surveys are not required in discharge or stormwater permits.
Sites below ARAP activities in wadeable streams where biological impairment is suspectred. Emphasis is placed on unpermitted activities, violations and those that are large scale or where there are a dense consentration of smaller alterations.
Stream reaches suspected of non-point source pollution for example large scale development, clusters of stormwaer permits or an increase of more than 10% impervious surfaces.
Unassessed reaches especially in third order or larger streams or in disturbed headwaters.

In addition to monitoring conducted by EFO staff in conjunction with the watershed cycle, other types of monitoring include:

a. Fish Consumption Advisory: Fish tissue monitoring for fishing advisories is planned by a workgroup consisting of staff from DWR-TDEC, TVA, ORNL and TWRA. The workgroup proposes to meets annually to coordinate a monitoring strategy.

b. NPDES Monitoring: Tennessee is requiring permitted dischargers to conduct upstream and downstream biological and habitat monitoring consistent with the division's macroinvertebrate QSSOP (TDEC, 2011). These data are submitted to the state for evaluation.

In this way, Tennessee can supplement its monitoring program and permitted dischargers can take the lead in providing information about their receiving stream.

c. Special Studies: When grants become available, Tennessee is proactive in conducting special studies to enhance the water quality monitoring program. In the past, these studies have included ecoregion delineation and reference stream selection, nutrient criteria development, impounded stream monitoring, probabilistic monitoring, and diurnal dissolved oxygen studies, mercury deposition and coalfields drainage. Current studies include headwater reference delineation and Southeast Monitoring Network site change monitoring.

d. Reservoir Monitoring: Tennessee is dependent on TVA and USACE for these data. Timeline for monitoring is dependent on availability of these agencies or federal funding if they are not available.

<u>Large Reservoirs (> 1000 acres)</u>

Tennessee has 29 large reservoirs ranging from the 1,749 acre Chilhowee Reservoir on the Little Tennessee River to the 99,500 acre Kentucky Lake on the Tennessee River. Twenty-seven of these reservoirs are managed by the Tennessee Valley Authority (TVA) or the U.S. Army Corps of Engineers (USACE). All but four are routinely monitored. Six are shared with other states. These shared lakes include Kentucky Lake, Lake Barkley and Dale Hollow (Kentucky); South Holston Lake (Virginia); Guntersville Lake (Alabama); Pickwick Lake (Alabama and Mississippi) and Calderwood Lake (North Carolina). Expertise and data are available from TVA, USACE and Alcoa Power Generating Incorporated (APGI).

TVA samples reservoirs in three areas: the inflow area, which is generally riverine in nature, the transition zone or mid-reservoir, and the forebay. Due to meteorological conditions and year-to-year variation, TVA samples the reservoirs for five consecutive years. Following that, sampling occurs on an every other year basis.

Ecological indicators	**Sampling Frequency**
benthic macroinvertebrates	Late autumn/early winter
chlorophyll	Monthly
dissolved oxygen	Monthly
fish assemblage	In autumn
sediment	Once in mid-summer

Reservoirs sampled by TVA

Beech	Melton Hill
Blue Ridge	Nickajack
Boone	Normandy
Cherokee	Norris
Chickamauga	Parksville

Douglas	Pickwick
Ft. Loudoun	South Holston
Ft. Patrick Henry	Tellico
Great Falls	Tims Ford
Guntersville	Watauga
Hiwassee	Watts Bar
Kentucky	Wheeler

Reservoirs sampled by USACE

Dale Hollow	Old Hickory
Center Hill	Cheatham
J. Percy Priest	Barkley
Cordell Hull	

Medium Reservoirs (251- 1000 acres)

Tennessee has 16 reservoirs falling in this category. Six are fishing or recreational lakes managed by the TWRA. Eight reservoirs are managed by TVA, with 3 of these routinely monitored by TVA's Vital Signs Monitoring Program. One reservoir is monitored by Alcoa Aluminum for power production and one is municipal water supply reservoir.

Small Reservoirs (< 250 acres)

Tennessee has 1,302 documented reservoirs smaller than 250 acres. This only includes reservoirs that are permitted under the Safe Dams or ARAP programs. There are probably many more. These include one TVA managed reservoir (Wilbur Lake), municipal lakes, state parks, city parks, resorts, community developments, agricultural ponds and private lakes. There is little historic data on many of these impoundments. Although they are small, they are often in headwater areas and have the potential to affect downstream reaches. In 2006, downstream reaches of 75 of these small impoundments were monitored as part of a probabilistic study funded by 104(b)3.

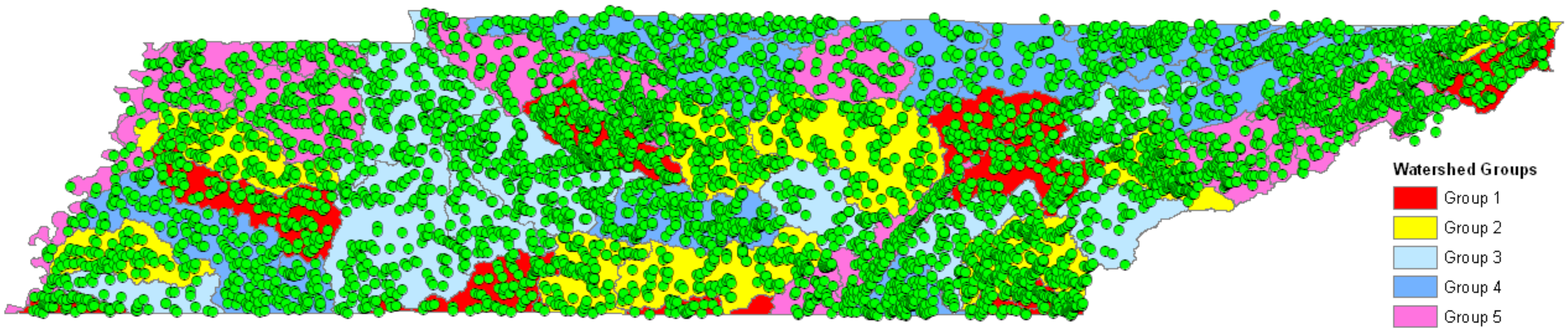


Figure 4: Water Quality Monitoring Stations in Tennessee. Includes biological, chemical and bacteriological stations.

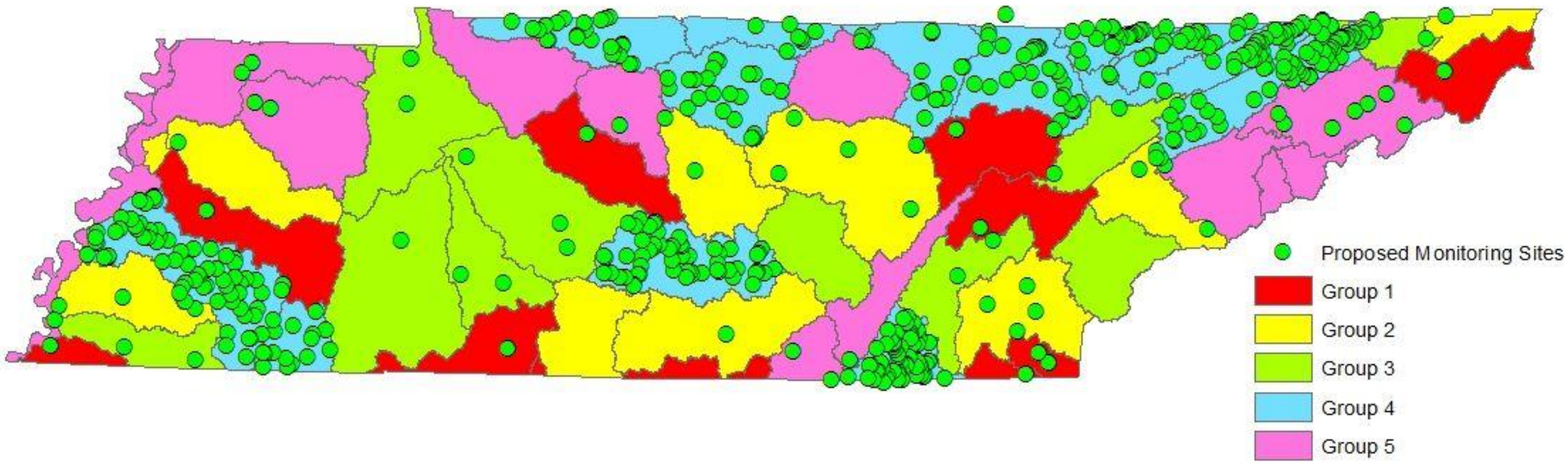


Figure 5: Monitoring stations scheduled to be collected between July 2014 and June 2015. Includes biological, chemical and bacteriological stations.

D. Critical and Non-Critical Water Quality Indicators

1. Biological Water Quality Indicators

Critical Biological

Two types of biological monitoring represent the critical biological indicators in Tennessee. The state relies heavily on macroinvertebrate monitoring for assessing fish and aquatic life use support.

Semi-quantitative Single Habitat macroinvertebrate samples (SQSH) are used for stream tier evaluations (Antidegradation policy), TMDLs, permit compliance and enforcement, as well as reference stream monitoring to refine biocriteria guidelines. Additionally, ambiguous biorecon results can be resolved by use of semi-quantitative results. Biocriteria based on a multi-metric index composed of seven biometrics have been calculated and provide guidelines for each bioregion (TDEC, 2011). The seven indices are:

Taxa Richness
EPT Richness
EPT Density – *Cheumatopsyche* spp.
North Carolina Biotic Index
Density of Oligochaetes and Chironomids
Density of Clingers
Density of Tennessee nutrient tolerant organisms

Macroinvertebrate biorecons are a screening tool used for routine watershed assessments. Biorecons have been performed at reference streams to refine biorecon guidelines. At test streams, a multi-metric index comprised of three descriptive biometrics is calculated and compared to reference guidelines for the bioregion. The three biometrics are:

Taxa Richness
EPT Richness
Intolerant Taxa Richness

Non-Critical Biological

Fish IBI
Periphyton (has been added to reference monitoring and may become critical at nutrient impaired streams once guidelines are developed).
Chlorophyll *a*

2. **Critical Habitat/Physical**

Habitat assessments adapted from protocols by Barbour et al. (1999) are conducted in conjunction with all biological monitoring and some chemical monitoring. The division has found these especially useful in assessing impairment due to riparian loss, erosion and sedimentation. The division's macroinvertebrate QSSOP (TDEC, 2011) defines regional expectations based on reference streams for each of the parameters addressed in the assessment.

- Epifaunal Substrate/Available Cover
- Embeddedness of Riffles
- ChannelSubstrate Characterization
- Velocity Depth Regimes
- Pool Variability
- Sediment Deposition
- Channel Flow Status
- Channel Alteration
- Frequency Re-oxygenation Zones
- Channel Sinuosity
- Bank Stability
- Bank Vegetative Protection
- Riparian Vegetative Zone Width

Non-Critical Physical/Habitat

- Canopy Cover
- Stream Profile
- Particle Count
- Flow

3. **Critical and Non-Critical Chemical/Toxicological**

The type of chemical sampling depends on the monitoring needs. Minimally, the following are collected:

- Routine Watershed Screenings: Critical: dissolved oxygen, pH, temperature, specific conductance. Parameters are found in Table 10.
- 303(d) list: Including, but not limited to the parameters the segment is listed for.
- Fish Consumption: Metals and/or priority organics. Metals may be limited to mercury only.
- Contact Advisory: Critical: *E. coli*, Non-critical: fecal coliform.
- Permit Compliance/Enforcement: Parameters limited in permit.
- Reference Streams: Ecoregion and FECO sites. Parameters are found in Table 10.

- TMDL: Monitoring to support the TMDL program depends on the type of TMDL needed.

E. Quality Assurance

TDEC DWR has developed four Quality System Standard Operating Procedures (QSSOP) for use as guidance for collecting water pollution control data and appropriate quality control in the state. The *QSSOP for Macroinvertebrate Stream Survey* (TDEC, 2011) was first published in March of 2002 and was revised in October 2006 and June 2011. The *QSSOP for Chemical and Bacteriological Sampling of Surface Waters* was first published in March of 2004 and revised in 2009 and June 2011 (TDEC, 2011). The *QSSOP for Periphyton Stream Surveys* was completed in 2010 (TDEC, 2010). *QSSOP's* for habitat stream surveys and naming stations are currently being developed. Each year, the division submits a *Quality Assurance Project Plan* to EPA (TDEC 2014). This document describes monitoring, analyses, quality control, and assessment procedures used by the division to develop TMDLs, 305(b) and 303(d) assessments.

All documents are reviewed annually and revised as needed. A copy of any document revisions made during the year is sent to all appropriate stakeholders and posted on the website. A report is made to the Deputy Commissioner and Quality Assurance Manager of any changes that occur.

Division staff are trained on field techniques outlined in the documents during the division's annual meeting. Biological and chemical samples are analyzed by the TDH Environmental Laboratories. The biological laboratory follows the QSSOP for macroinvertebrate (TDEC, 2011) and for periphyton (TDEC, 2010) sample analysis.   The chemistry laboratory has standard operating procedures which follow approved EPA methodologies. EPA audits both laboratories on a regular schedule.

Quality Assurance Guidelines for Macroinvertebrate Surveys as specified in the 2011 QSSOP:

1. 10% of habitat assessments and biological samples are repeated by a second investigator.
2. Chain of custody is maintained on all biological samples.
3. A digital sample log with backup is maintained for biological samples.
4. 10% of all biological samples are re-sorted and re-identified by a second taxonomist.
5. Reference collections are maintained at the central laboratory for each taxon found in Tennessee. New specimens are verified by outside experts.
6. A minimum of 10% of all data entry and statistical calculations are verified.
7. Staff are trained and updated on new techniques as a group during the division's annual meeting.

Quality Assurance Guidelines for Periphyton Stream Surveys as specified in the 2010 QSSOP:

1. 10% of habitat assessments and biological samples are repeated by a second investigator.
2. Chain of custody is maintained on all biological samples.
3. A digital sample log with backup is maintained for biological samples.
4. 10% of all periphyton samples are re-identified by a second taxonomist.

5. A master collection of images of all taxa identified in the state is maintained at the central Laboratory. New specimens are verified by outside experts.
6. A minimum of 10% of all data entry and statistical calculations are verified.
7. Staff are trained and updated on new techniques as a group during the division's annual meeting.

Quality Assurance for Chemical Field Collections as specified in the 2011 QSSOP:

1. Duplicates, field blanks, equipment blanks, and trip blanks are collected at 10% of sites.
2. Temperature blanks are included in each sample cooler.
3. Water quality probes are calibrated daily and include daily post-calibrations (at the beginning and end of the trip for overnight sampling). Duplicate measurements are recorded at each station.
4. Flow measurements are duplicated at 10% of sites.
5. Chain of custody is maintained on all samples.
6. Staff are trained and updated on new techniques as a group during the division's annual meeting.

F. Data Management

Chemical, bacteriological, flow, macroinvertebrate, periphyton, fish tissue and habitat data collected from stations specified in the workplan are stored in the division's water quality database. There are approximately 62,000 records in this database, which includes data collected from 1996 to the present. The database also includes detailed station information for approximately 7000 monitoring stations. The database is updated and maintained by the Planning and Standards Section. In September 2009 EPA ceased support of the current format data was uploaded to STORET, as such the last historic upload of TDEC WPC data was sent to EPA the end of September 2009. The data can be located at STORET at http://www.epa.gov/storet/dw_home.html.

TDEC DWR staff are working with the state lab to receive data electronically. This data will be uploaded to EPA's Water Quality Exchange (WQX). The Water Quality Exchange (WQX) is a new framework that makes it easier for States, Tribes, and others to submit and share water quality monitoring data over the Internet. TDEC DWR has successfully uploaded close to 100,000 records of water quality monitoring data to EPA WQX WEB, another avenue created by EPA to receive states water quality data for WQX.

The division uses EPA's Assessment Database (ADB) to store assessment information. The ADB currently holds information on approxiamately 5400 waterbody segments, which represent all the state's streams, rivers, lakes and reservoirs.

The division provides public access to assessment information through an online assessment database. The website links information in the assessment database to an interactive map using the Geographic Information System (GIS). The department also partners with EME Environmental Solutions to power a Stream and Watershed Information Management GIS mapping tool to reflect previous, current and potential stream mitigation projects across the state. The Information is updated regularly.

G. Data Analysis/Assessment

The water quality assessment process in Tennessee consists of four parts:

Development of clean water goals (water quality standards) either by promulgating national numeric criteria, statewide narrative criteria, or regional goals based on reference conditions.

Implementation of a statewide water quality monitoring program, based on a watershed cycle.

Comparison of data to water quality standards for each waterbody in order to assess water quality and to categorize use support.

Geographic referencing of all water resources with the National Hydrography Dataset (NHD).

Water Quality Standards

The *Tennessee Water Quality Control Act* requires the protection of water quality in Tennessee. Tennessee first adopted water quality standards in 1967 and has amended them several times thereafter. Water quality standards consist of two principle regulations:

1. "General Water Quality Criteria", Chapter 0400-40-03
2. "Use Classifications for Surface Waters", Chapter 0400-40-04

The three essential elements comprising water quality standards as defined by Section 303 of the Federal Clean Water Act, PL 95-217, are stream use classifications, water quality criteria and the antidegradation statement.

In September 2009 the Water Quality Control Board (WQCB) voted to initiate the rulemaking process for the triennial review of water quality standards. This process was initiated when the division filed a notice for the Tennessee Administrative Register with the Secretary of State's Office in November 2009. At the same time, a set of proposed revisions to the regulations were posted on the department's webpage.

Following public hearings in December 2009 -January 2010 and a public comment period, a proposed final set of revisions were presented to the WQCB. After the WQCB approves the water quality standards the Attorney Generals Office certifies the rules. The rules will then be filed with the Secretary of State for the required 75-day waiting period and were submitted to EPA for formal review. In November, 2011, at the request of the Water Quality Control Board, the previously revised water quality standards were again put on public notice and an additional review period was undertaken in the winter of 2011 and early spring of 2012. The standards became effective in July 2013.

Classification + Criteria + Antidegradation = Standards

Stream-use Classification

Tennessee's criteria specify baseline values for particular parameters of water quality necessary for the protection and maintenance of a prescribed use classification. The State has established seven principal uses of the waters for which criteria of quality are defined.

a. **Fish and Aquatic Life (FAL)** - Criteria protect fish and other aquatic life such as macroinvertebrates. These criteria are based on two types of toxicity. The first is acute toxicity, which refers to the level of a contaminant that causes death in organisms in a relatively short time. The other type is chronic toxicity. Chronic criteria are based on a lower level of a contaminant that causes death over a longer period of time or has other effects such as reproductive failure or the inhibition of growth. Fish and aquatic life criteria are generally the most stringent criteria for toxic substances.

b. **Recreation** - This classification protects the use of streams for swimming, wading, and fishing. Threats to the public's recreational uses of waters include loss of aesthetic values, elevated pathogen levels, and the accumulation of dangerous levels of metals or organic compounds in fish tissue. Tennessee coordinates with TVA, ORNL and TWRA to monitor levels of contaminants in fish. Waterbodies that pose an unacceptable risk to human health are posted for bacteriological or fish consumption advisories.

c. **Irrigation** - Irrigation criteria protect the quality of water so it may be used for agricultural needs.

d. **Livestock Watering and Wildlife** - These criteria protect farm animals and wildlife.

e. **Drinking Water Supply** - Drinking water criteria insure that water supplies contain no substances that might cause a public health threat, following conventional water treatment. Since many contaminants are difficult and expensive to remove, it is more cost-effective to keep pollutants from entering the water supply in the first place.

f. **Navigation** - This use is designed to protect navigational rivers and reservoirs from any alterations that would adversely affect commercial uses.

g. **Industrial Water Supply** - These criteria protect the quality of water used for industrial purposes.

Tennessee has approximately 60,000 stream miles and over 570,000 publicly owned lake and reservoir acres. Most are classified for at least four public uses: protection of fish and aquatic life, recreation, irrigation, and livestock watering and wildlife. These minimum use classifications comply with the Federal Water Pollution Control Act, which requires that all waters provide for the "protection and propagation of a balanced population of fish and wildlife, and allow recreational activities in and on the water" (U.S. Congress, 2000).

Specific designated Use Classifications for Surface Waters in Tennessee are listed in the Rules of TDEC, Chapter 0400-40-04 (TDEC-WQOGB, 2013). All surface waters that are not specifically listed in the regulations are classified for fish and aquatic life, recreation, irrigation, livestock watering and wildlife.

Water Quality Criteria and Assessment Methodologies

The Water Quality Oil and Gas Board (WQOGB) has assigned specific water quality criteria to each of the designated uses. These criteria establish the level of water quality needed to support each of the designated uses. There are two types of criteria:

Numeric criteria - Establish measurable thresholds for physical parameters and chemical concentrations to support classified uses.

Narrative criteria - Are written descriptions of water quality. These descriptions generally state that the waters should be "free from" particular types or effects of pollution. To help provide regional interpretations of narrative criteria, guidance documents have been developed by the division for biological integrity, habitat and nutrient narrative criteria.

Most waterbodies are classified for at least four uses. The regulations require that the most stringent criteria be applied to the waterbody. Typically, the most stringent criteria are for the protection of fish and aquatic life or recreational uses. General Water Quality Criteria for surface waters in Tennessee are listed in the Rules of TDEC, Chapter 0400-40-03 (TDEC-WQOGB, 2013).

Water quality assessments are the application of water quality criteria to ambient monitoring results to determine if waters are supportive of all designated uses. To facilitate this process, several provisions have been made:

1. To help the division interpret water quality expectations for biological integrity, nutrients and habitat, guidance documents for wadeable streams have been developed. These documents are referred to in the General Water Quality Criteria (TDEC-WPCB, 2013). The division has developed a draft 10-year plan to develop nutrient guidelines for large rivers, lakes and reservoirs.

2. Numeric criteria define physical and chemical conditions that are required to maintain designated uses.

3. In order to make defensible assessments, data quality objectives must be met. For some parameters, a minimum number of observations are required in order to have increased confidence in the accuracy of the assessment.

4. Provisions in the water quality criteria instruct staff to determine whether violations are caused by man-induced or natural conditions. Natural conditions are not considered pollution.

5. The magnitude, frequency and duration of violations are considered in the assessment process.

6. Streams in some ecoregions naturally go dry or subterranean during prolonged periods of low flow. Evaluations of biological integrity differentiate whether streams have been recently dry or have been affected by man-induced conditions.

7. Waterbodies on the 303(d) list remain on the list until sufficient recent data provide a rationale for removing the waterbody from the list.

The following guidelines are used for determining specific causes of pollution.

a. Metals and Organics Criteria

One or two chemical samples are not considered an accurate representation of stream conditions. Therefore, more than two observations are used in assessments. Acute fish and aquatic life protection criteria are used, unless a site has 12 or more chemical collections. If a site has 12 or more chemical collections, chronic criteria are applied.

Metals data are appropriately "translated" according to the water quality standards before being compared to criteria. For example, toxicity of metals is altered by stream hardness and the amount of total suspended solids in the stream. Widely-accepted methodologies are used to make these and other translations of the data. The division consults with EPA concerning the latest revisions to the national criteria and updates the state criteria as appropriate.

b. Pathogens

Waterbodies are not assessed as impaired due to high bacteria levels with less than three water samples. The only waters assessed with one or two observations are those previously listed due to elevated bacteria levels or streams with obviously gross conditions, such as failing animal waste lagoons.

E. coli data are generally considered more reflective of true pathogen risk than are fecal coliform data. During the 1997 triennial review process, Tennessee added *E. coli* criteria to its existing fecal coliform criteria. This gave the regulated community time to become accustomed to the new criteria before fecal coliform were removed during the 2003 review.

If flow data are available, low flow, dry season data are considered more meaningful than high flow, wet season data. In the absence of flow data, samples collected in late summer and fall are considered low flow or dry season samples. Wet season pathogen samples are not disregarded. They are simply given less weight than dry season pathogen samples.

c. Dissolved Oxygen

For streams identified as trout streams, including tailwaters, the minimum DO standard is 6.0 mg/L. Streams designated as supporting a naturally reproducing population of trout have a DO standard of not less than 8.0 mg/L. This also includes tributaries to naturally reproducing trout streams as well as all streams in the Great Smoky Mountains National Park.

If the source of the low DO is a natural condition, such as ground water, spring, or wetland, then the low DO is considered a natural condition and not pollution.

d. Nutrients

Regional nutrient goals were developed based on reference condition and are used for guidance when assessing wadeable streams (Denton et al., 2001). Streams are not generally assessed as impaired by nutrients unless biological or aesthetic impacts are also documented. The division has developed a 10-year plan for developing nutrient guidelines in large rivers, lakes and reservoirs. (TDEC, 2007)

One or two chemical nutrient observations are considered a valid assessment only if they are supported by evidence of biological impairment. For example, if the macroinvertebrate community in a stream is very poor and/or the amount of algae present indicates organic enrichment, then one or two nutrient samples could be used to identify a suspected cause of pollution.

e. Suspended Solids/Siltation

Historically, silt has been one of the primary pollutants in Tennessee waterways. The division has experimented with multiple ways to determine stream impairment due to siltation. These methods include visual observations, chemical analysis (total suspended solids), and macroinvertebrate/habitat surveys. Biological surveys that include a habitat assessment have proven to be the most satisfactory method for identification of impairment.

Through monitoring reference streams, staff found that the appearance of sediment in the water is often, but not always, associated with loss of biological integrity. Additionally, ecoregions vary in the amounts of silt that can be tolerated before aquatic life is impaired. Thus, for water quality assessment purposes, it is important to establish whether or not aquatic life is being impaired. For those streams where loss of biological integrity can be documented, the habitat assessment can determine if the stream has excessive amounts of silt.

The division has developed regional expectations based on reference data for the individual habitat parameters most associated with sedimentation including embeddedness and sediment deposition. These values are published in the macroinvertebrate QSSOP (TDEC, 2011) and reviewed annually.

f. Biological Criteria

Biological surveys using macroinvertebrates as the indicator organisms are the preferred method for assessing support of the fish and aquatic life designated use in wadeable streams. Two standardized biological methods, biorecons and semi-quantitative samples, are used to produce a biological index score. These methods are described in the macroinvertebrate QSSOP (TDEC, 2011). As part of the 10-year nutrient criteria development plan, the division will be addressing biological integrity goals in large rivers, lakes and reservoirs.

The most frequently utilized biological surveys are qualitative biorecons. Biological scores are compared to descriptive metric values obtained in ecoregion reference streams. The principal metrics used are the number of mayfly, stonefly and caddisfly (EPT) families (or genera), the total families (or genera), and the number of pollution intolerant families (or genera) found in a stream. The biorecon index is scored on a scale that goes from 1 - 15. A score less than or equal to 5 is considered impaired. A score equal to or greater than 11 is considered supporting. Scores between 5 and 11 are ambiguous and must be supplemented with other information such as chemical data, habitat data or a more intensive biological survey.

If a more definitive assessment is needed in a wadeable stream, a single habitat, semi-quantitative sample is collected. To be comparable to ecoregions guidance, streams must have the same order as the reference streams in a given ecoregion and must have been sampled similarly and at least 80 percent of the upstream drainage in that ecoregion. If both biorecon and single habitat semi-quantitative data are available, and the assessments do not agree, more weight is given to the single habitat semi-quantitative samples. Streams are considered impaired where biological integrity falls below the expected range of conditions found at reference streams.

g. Habitat

Division staff use a standardized scoring system developed by EPA to rate the habitat in a stream (Barbour, et. al., 1999). The macroinvertebrate QSSOP (TDEC, 2011) provides guidance for completing a habitat assessment and how to evaluate the results.

Habitat scores calculated by division biologists are compared to the guidelines developed from the ecoregion reference stream database. Streams with habitat scores lower than the guidance for the region are considered impaired, unless biological integrity meets expectations. If biological integrity meets ecoregional expectations, then poor habitat is not considered impairment.

h. pH

Reference data collected over the last 14 years has shown that natural pH conditions vary by ecoregion. Some ecoregions support a healthy biological community at a lower pH than others. The pH criterion for wadeable streams is now 6.0 - 9.0. For nonwadeable rivers, streams, reservoirs and wetlands the pH criterion remains 6.5 - 9.0. Waterbodies with pH values outside these ranges are considered impaired.

Antidegradation

As one of the elements comprising Tennessee's water quality standards, the antidegradation statement has been contained in the criteria document since 1967. EPA has required the states, as a part of the standards process, to develop a policy and an implementation procedure for the antidegradation statement. "Additionally, the Tennessee Water Quality Standards shall not be construed as permitting the degradation of high quality surface waters. Where the quality of Tennessee waters is better than the level necessary to support propagation of fish, shellfish, wildlife, and recreation in and on the water, that quality will be maintained and protected unless the state finds, after intergovernmental coordination and public participation, that lowering water quality is necessary to accommodate important economic or social development in the area in which the waters are located" (TDEC-WQOGB, 2013).

A three-tiered antidegradation statement was incorporated into Tennessee's 1994 revisions. In the 1997 triennial review, the three tiers were more fully defined. A procedure for determining the proper tier of a stream was developed in 1998. The evaluation took into account specialized recreation, scenic considerations, ecology, biological integrity and water quality.

Tennessee further refined the antidegradation statement in 2004 specifying that alternatives analyses must take place before new or expanded discharges can be allowed in Tier I waters.

In 2006 the antidegradation statement was revised and the Tier designations were replaced by the following categories. (TDEC-WQCB, 2007). The antidegradation statement has been revised in the 2010 version of the Water Quality Standards. (TDEC-WQOGB, 2013).

1. Unavailable parameters exist where water quality is at, or fails to meet water quality criteria in Rule 0400-40-03 (the criterion for one or more parameters)

2. Available parameters exist where water quality is better than the levels specified in the water quality criteria in Rule 0400-40-03.

3. Expectional Tennessee Waters are waters that are in any one of the following categories:

- Waters within state or national parks, wildlife refuges, wilderness areas or natural areas.
- State Scenic Rivers or Federal Wild and Scenic Rivers.
- Federally-designated critical habitat or other waters with documented non-experimental populations of state or federally-listed threatened or endangered aquatic or semi-aquatic plants or animals.
- Waters within areas designated Lands Unsuitable for Mining.
- Waters with naturally reproducing trout.

- Waters with exceptional biological diversity as evidenced by a score of 40 or 42 on the TMI (or a score of 28 or 30 in subregion 73a), provided that the sample is considered representative of overall stream conditions.
- Other waters with outstanding ecological or recreational value as determined by the Department.

4. Outstanding National Resource Waters (ONRWs) - These Exceptional Tennessee Waters constitute an outstanding national resource due to their exceptional recreational or ecological significance. In 1998, the Water Pollution Control Board voted to accept six of the eight streams proposed for listing as ONRWs. The following streams or portions of the streams are designated as ONRWs are: Little River, Abrams Creek, Little Pigeon River, West Prong Little Pigeon River, Big South Fork Cumberland River and Reelfoot Lake.

In 1999, the Obed River was conditionally added as an ONRW. The condition placed upon the designation was that if the Obed were identified as the only viable drinking water source for Cumberland County, it would revert back to ETW status.

Information on waterbodies that have been evaluated and are identified as Exceptional Tennessee Waters is entered in the Waterlog database and is located on the TDEC website http://www.tn.gov/environment/water.shtml.

Categorization of Use Support and Assessment Process

In order to determine use support, it must be decided if the stream, river or reservoir meets water quality criteria. Monitored waters are compared to the most restrictive water quality standards to determine if they meet their designated uses. Generally, the most stringent criteria are for recreational use and support of fish and aquatic life.

To facilitate these analyses, all major rivers, streams, reservoirs and lakes have been placed into georeferencing sections called waterbody segments. These waterbody segments are given unique identification numbers that reference an eight-digit watershed Hydrologic Unit Code (HUC), plus a reach, and segment number.

All available water quality data are considered, however, not all data comply with state quality control standards and approved collection techniques. Assessments must be founded on scientifically sound monitoring methodologies. After use support is determined, waterbodies are placed in one of the five categories recommended by EPA.

Category 1 waters are those waterbody segments which have been monitored and meet water quality criteria. The biological integrity of Category 1 waters is comparable with reference streams in the same subecoregion and pathogen criteria are met. Previously these waterbodies were reported as fully supporting.

Category 2 waters have only been monitored for some uses and have been assessed as fully supporting of those uses, but have not been assessed for the other designated uses. Often these waterbodies have been assessed and are fully supporting of fish and aquatic life, but have not been assessed for recreational use. In previous assessments, these waters were assessed as fully supporting.

Category 3 waters have insufficient or outdated data and therefore have not been assessed. These waters are targeted for future monitoring. In previous assessments, these waterbodies were identified as not assessed.

Category 4 waters are waters that have been monitored and found to be impaired for one or more uses, but a TMDL is not required. These waters are included in the 303(d) impaired waters list. Category 4 has been subdivided into three subcategories. Previously, these waters were reported as either partially or non-supporting.

Category 4a impaired waters have had all necessary TMDLs approved by EPA.

Category 4b impaired waters do not require TMDL development since "other pollution control requirements required by local, State or Federal authority are expected to address all water-quality pollutants" (EPA, 2003).

Category 4c waters are those in which the impacts are not caused by a pollutant (e.g. certain habitat alterations).

Category 5 waters have been monitored, and found not to meet one or more water quality standards. In previous assessments, these waters have been identified as partially supporting or not supporting designated uses. Category 5 waterbodies are moderately to highly impaired by pollution and need the development of TMDLs for known impairments.

TDEC strongly prefers to base assessments on recently collected data. Judgments based on modeling or land use information are much harder to defend. With given resources, it is not possible to monitor all of Tennessee's waterbodies every two years for 305(b) reporting purposes. Therefore, monitoring and assessments are conducted on the five-year rotating schedule.

The division continues to increase its reliance on rapid biological assessments. These assessments provide a quick and accurate assessment of the general water quality and aquatic life use support in a stream. However, biological assessments do not provide information to pinpoint specific toxic pollutants or bacterial levels in water. The challenge in the next few years will be to combine biological assessments with chemical and bacteriological data so that both use support status and accurate cause and source information can be generated.

Data Sources

The division uses all reliable data gathered in the state for the assessment of Tennessee's waterways. These include data from TDEC, other state and federal agencies, citizens, universities, the regulated community, and the private sector. Every year, the division issues public notices requesting water quality data for use in the statewide water quality assessment. In addition other state and federal agencies known to have data are contacted directly for monitoring information. Tennessee regularly receives data from TVA, USGS, TWRA, and USACE. Biological and habitat data submitted by NPDES dischargers as part of permit requirements are also used.

All submitted data are considered. If data reliability cannot be established, submitted data are used to screen streams for future studies. If the data from the division and another reliable source do not agree, more weight is given to the division's data unless the other data are considerably more recent.

Data Use

The division's goal is to make assessments by quantifiable measures (objective) and therefore, require less professional (subjective) judgment (Table 3). DWR is accomplishing this goal as follows:

Criteria have been further refined to assist in the assessment of water quality data. The ecoregion project has dramatically reduced the uncertainty associated with the application of statewide narrative and numerical criteria.

By use of geographic referencing tools such as the National Hydrography Dataset (NHD), water segments have been further refined to allow more precise water quality assessments. Data from a sampling point are extrapolated over a much shorter distance than in the past. The decision on how far the information is applicable is made on a site-by-site basis using factors such as amount and type of data and the uniformity of the stream.

Minimum data requirements for some of the specific types of data have been set.

Critical periods have been determined for various criteria. Certain collection seasons and types of data have proven more important for the protection of specific water uses. For instance, the critical period for parameters like toxic metals or organics is the low flow season of late summer and early fall. Water contact activities like swimming and wading are most likely to occur in the summer.

Table 2. Types of Data Used in the Water Quality Assessment Process

Chemical Data	**Biological Data**	**Physical Data**	**Sediment And Tissue Data**
Compliance monitoring performed at the nearly 2,000 permitted dischargers in Tennessee. Data collected as a result of complaint investigations, fish kills, spills, and in support of enforcement activities.	Rapid biological surveys completed in association with the watershed project. These are performed primarily in tributary streams as a means of monitoring biological integrity.	Temperature and flow data collected throughout Tennessee.	Sediment and fish tissue data collected at various sites across Tennessee.
Over 7000 stations are established by the division to support the watershed approach.	Ecoregion biological monitoring. Benthic and fish IBI scores calculated at many sites.	Quantitative assessments of habitat made in conjunction with biological surveys.	EPA's report *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States.*
Data collected at the division's 87 ecoregion reference sites. (These stations provide a baseline to which other sites within that ecoregion can be compared.)	Bioassay studies of effluent toxicity at most major NPDES dischargers. Many minor facilities also do this type testing.	Time-of-travel studies of flow, dissolved oxygen sags and BOD decay rates.	Locations of existing fishing advisories in Tennessee.
Chemical data collected by other entities.	Biological data collected by other entities.	Physical data collected by other entities.	Sediment and tissue data collected by other entities.

Future Assessment Goals

The division is committed to the ecoregion approach, particularly for the assessment of wadeable rivers and streams. The use of regional reference streams has proven a valuable tool in establishing guidelines for use indetermining whether waterbodies meet their designated uses. In an effort to continue to improve the assessment process, the division has the following goals (Table 3).

Table 3. Future Assessment Goals

Goal	Milestone	Future Plans
Dissolved oxygen in wadeable streams	Published study of regional dissolved oxygen patterns in 2003 based on diurnal and daylight monitoring. Proposed regional minimum DO criteria based on reference monitoring in 2003.	Continued regional monitoring to enhance existing data. Incorporate criteria base on diurnal patterns (duration and frequency of minimum). Consideration of criteria based on diurnal DO swings in future triennial reviews.
Nutrients in wadeable streams	Published guidance document for regional limits of total phosphorus and nitrate+nitrite in 2001. Incorporated guidance in 2004 WQS.	Continued refinement.
Nutrients in lakes, rivers and non-wadeable streams	Developed criteria development plan in 2004 with revisions in 2007 and 2009. Established biomass criterion in Pickwick Reservoir in 2007.	As resources allow, compose study group of appropriate professionals. Target reservoir for pilot project. Review existing data and look for data gaps. Begin development of criteria guidelines.
Biocriteria	Published macroinvertebrate guidelines for wadeable streams in 2001 which were updated in 2004, 2006 and 2011. Incorporated guidelines in 2004 WQS. Began monitoring of headwater reference streams in 2009. Began monitoring of periphyton at reference streams in 2008.	Continue testing wadeable streams guidelines. Develop guidelines for lakes, reservoirs, rivers and headwater and intermittent streams. Develop periphyton guidelines.

H. Reporting

The division will continue to submit quarterly reports describing monitoring activities to EPA. Waterbodies will continue to be monitored to fulfill data needs for water quality standards, TMDLs, 303(d), 305(b), and special projects.

The Mid-Year Review and End-of-Year Review processes will be utilized by EPA Region 4 as the primary mechanism for evaluating performance and progress in implementing workplan commitments. To comply with EPA Region 4's semi-annual progress reporting requirement, EPA's Mid Year Review Report will serve as the first of the two semi-annual reports required. TDEC will prepare the second report and submit by December 31, 2014.

The 305(b) report details the status of Tennessee waters as well as sources and causes of pollution. The 2012 305(b) Report was finalized in December 2012. The report and assessment database were supplied to EPA Region 4 staff for inclusion in the 305(a) Report to Congress. The report, as well as an interactive database, is provided to the public through the TDEC website http://www.state.tn.us/environment/water/water-quality_publications.shtml

The 303(d) list is a compilation of streams in Tennessee that are not currently meeting water quality standards in spite of the implementation of best available technology (BATs) or best management practices (BMPs). The Final 2010 303(d) list was approved by EPA in October 2011 and is located on the TDEC website http://www.state.tn.us/environment/water/water-quality_publications.shtml. The draft 2012 303(d) list was submitted to EPA in June 2012. The proposed final 2012 303(d) list was submitted to EPA in November 2012. The 303(d) list was approved by EPA in January 2014. Currently the draft 2014 303(d) list is available for public comment.

Tennessee's water quality standards require the incorporation of the antidegradation policy into regulatory decisions (Chapter 0400-40-03-.06). Part of the responsibility the policy places on the division is identification of Exceptional Tennessee Waters. In Exceptional Tennessee Waters, degradation cannot be authorized unless (1) there is no reasonable alternative to the proposed activity that would render it non-degrading and (2) the activity is in the economic or social interest of the public.

The division has compiled a list of streams based on the characteristics of Exceptional Tennessee Waters set forth in the regulation by the Tennessee Board of Water Quality, Oil and Gas. In general, these characteristics are streams with good water quality, important ecological values, valuable recreational uses, and/or outstanding scenery. Wherever possible, the division has utilized objective measures to apply these characteristics and the basis for each listing is provided. The list is on the TDEC website. http://www.state.tn.us/environment/water/water-quality_publications.shtml

Reports routinely produced by the division include technical publications, informational publications, criteria development reports, and standard operating procedures. In addition to reports, the division is committed to communicating information effectively. To reach this goal, the following products, among others, are provided as part of the reporting process:

a. Access to water quality data
b. Water quality assessment reports and on-line assessment database
c. Data and interpretation for NPDES permit support
d. Technical data sets for consultants/researchers
e. Spatial and mapping data using Geographical Information System (GIS) tools
f. Public outreach information, including the Internet
g. Presentations at professional, scientific, citizen and school group meetings

I. Programmatic Evaluation

The division evaluates its monitoring program during each planning and assessment cycle and incorporates changes as needed to provide the most comprehensive and effective plan possible with available resources.

1. Evaluation of Monitoring Program Strategy

During development of the annual monitoring workplan, both central office and EFO staff provide input into monitoring needs:

a. The monitoring plan is reviewed to make sure all sampling and assessment priorities are covered.
b. The ADB is used to look for unassessed segments which are incorporated into the monitoring plan whenever possible.
c. During the monitoring plan development, Central Office and EFO staff coordinates location of monitoring stations and type of samples collected to insure adequate information is provided for TMDLs targeted for completion during that cycle.
d. The location of monitoring stations is coordinated with other state and federal agencies to eliminate duplication of effort.
e. At the end of each monitoring cycle, the plan is reviewed to make sure monitoring needs were covered. Uncompleted sampling or data gaps are incorporated into the next monitoring cycle or might be contracted to the state laboratory for completion.

2. Monitoring Objectives

During evaluation of monitoring objectives, the division strives to:

a. Determine where additional or more current data are needed to enhance the assessment process.
b. Target unassessed segments or those that were originally assessed qualitatively. Incorporate biological monitoring whenever possible to assess fish and aquatic life use support.
c. Develop or refine guidelines for narrative criteria:
d. Nutrients: Refine wadeable streams and develop criteria for rivers, lakes and reservoirs (see nutrient workplan for details).
e. Biological: Refine wadeable streams and develop criteria for rivers, lakes and reservoirs.

f. Habitat: Refine wadeable streams and develop criteria for rivers, lakes and reservoirs.
g. Continue to refine regional numeric criteria whenever possible. Develop diurnal guidelines for dissolved oxygen levels.
h. Revisit monitoring sites every five years to look for changes.
i. Monitor below sites where BMPs or other restoration activities have taken place to assess effectiveness of improvement strategy.
j. Look for opportunities to analyze trends in water quality.

3. Monitoring Design

The division reviews the monitoring program during each cycle to ensure it is efficient and effective in generating data that serve management decision needs and meets the state's water quality management objectives.

a. Probabilistic monitoring results are compared to targeted monitoring results to check for bias in watershed assessment. Results from both types of monitoring are used in an integrated approach.
b. The antidegradation survey process is reviewed and updated based on feedback from field staff.
c. Ecoregion reference sites are re-evaluated annually. New sites are added whenever possible. Existing sites are dropped if data show the water quality has degraded, the site is not typical of the region, or does not reflect the best attainable conditions. Data from other states are used to test suitability of reference sites. Currently the state is reviewing river, lake and reservoir data to target reference conditions in these systems.
d. Watershed groupings are reviewed and revised if needed to ensure staffing is available for adequate coverage.

4. Critical and Non-Critical Water Quality Indicators

The division reviews both critical and non-critical water quality indicators minimally every three years as part of the triennial review process.

a. Biological guidelines for wadeable streams - New biometrics are tested for possible inclusion or replacement of existing index metrics. Additional reference data are incorporated and biometric ranges are adjusted if needed. Bioregions are tested and boundaries are adjusted if appropriate. Guidelines for rivers, lakes and reservoirs are currently in the initial development stage.
b. Nutrient guidelines - Additional reference data are incorporated and regional guidelines are adjusted if appropriate. Nutrient regions are tested and boundaries are adjusted if needed. Regional recommendations are tested against biological community data to test protectiveness. Guidelines for rivers, lakes and reservoirs are currently in the initial development stage.
c. Habitat guidelines - Additional reference data are incorporated and regional guidelines are adjusted if appropriate. Regional recommendations are tested against biological community data to test protectiveness. Guidelines for rivers, lakes and reservoirs are currently in the development stage.

d. Other narrative criteria are reviewed to determine whether guidelines can be developed using regional reference data.
e. Dissolved oxygen criteria - Regionalized dissolved oxygen criteria are being tested and refined as additional data are collected for wadeable streams. Regional recommendations are tested against biological community scores to evaluate effectiveness.
f. Incorporation of national numeric criteria. Changes are incorporated into the state criteria during the triennial review process. Criteria are reviewed to determine effectiveness of statewide approach versus regionalization.

5. Quality Assurance

The division is committed to ensuring the scientific quality of its monitoring and laboratory activities.

a. The division developed and implemented a document entitled *Quality Systems Standard Operating Procedures for Macroinvertebrate Surveys* (including collections, habitat assessments and laboratory analyses) in 2002. This manual will be reviewed annually and updated if needed. The manual was last revised in 2011. Staff are trained on protocols during the annual statewide meeting.
b. The division developed and implemented a document entitled *Quality Systems Standard Operating Procedures for Chemical and Bacteriological Sampling of Surface Waters* in 2011. This manual will be reviewed annually and updated if needed. Staff are trained on protocols during the annual statewide meeting**.**
c. The division has developed a document entitled *Quality Standard Operating Procedures for Periphyton Stream Surveys* in 2010. This manual will be reviewed annually and updated if needed. Staff are trained on protocols during the annual statewide meeting**.**
d. The division is in the process of developing a draft SOP for Habitat Streams Surveys and for antidegradation policy implementation. Additional SOPs for water quality assessments and data management will be developed in the future.
e. The division is in the process of developing standardized templates of quality assurance project plans that can be used by EFOs in developing project plans for various monitoring activities**.**
f. The division uses the state laboratory for chemical, bacteriological and biological analyses. The laboratory has developed standard operating procedures that meet the division’s needs and are in accordance with EPA policy. EPA routinely inspects the laboratory.
g. The division has a policy to maintain chain of custody on all samples.
h. Duplicate collections are completed at 10% of biological and chemical monitoring stations. Trip blanks, field blanks and equipment blanks are collected at 10% of stations.
i. The division developed and implemented a document entitled *Quality Assurance Project Plan* in 2014. This manual will be reviewed annually and updated if needed. Staff are trained on protocols during the annual statewide meeting.

6. Data Management

The division uses electronic formats to store data and assessment information.

a. The state water quality database is reviewed continuously and updated as needed to increase comprehensiveness and ease of use.
b. New updates for STORET/WQX, ADB and GIS are incorporated as they become
c. available and time allows with the states IT divisions assistance.
d. The division is working with the state laboratory to develop the ability to electronically transfer data.
e. The online assessment database is updated regularly to provide current public access to water quality information.

7. Reporting

The division uses feedback from EPA, other state and federal agencies as well as the private and public sectors to improve and enhance the reporting process whenever possible.

J. General Support and Infrastructure Planning

An organizational chart for the Division of Water Resources is illustrated in Figure 6. The division has nine Central Office Sections, eight Environmental Field Offices (EFOs) and the Mining Section (MS) with statewide responsibility.

In 2012 the department created the Division of Water Resources, combining Water Pollution Control, Water Supply and Ground Water Protection.

The division currently has approximately 317 full-time filled staff positions and 14 part time staff which includes members of our Water Quality, Oil and Gas Board. The division staff are divided by activities associated with Clean Water Act, Safe Drinking Water Act and various state program efforts including Safe Dams, Oil and Gas Well Drilling, Abandoned Mine Reclamations, Water Well driller regulation, Operator Certifications and training and the activities associated with the State Revolving Loan Fund. The hope is that the staff activities will be cross-trained on various program areas, but the level of effort for the federal grant for Clean Water Act Section 106 will be at least a level of effort corresponding to at least 39 FTE.

The division's full-time central office staff process permits, develop water quality planning documents and water quality standards, develop standard operating procedures, oversee quality assurance programs, prepare special recovery plans called Total Maximum Daily Loads (TMDLs), track compliance and prepare enforcement documents as needed, manage data, review plans and manage administrative needs of the division.

Water quality monitoring, especially fixed-station and compliance, is generally performed by EFO staff. Data management and review take place both in the central office and in the EFOs. Water quality assessment is also a collaborative effort.

Tennessee has upgrading its accounting and personnel management software to a data system called EDISON. This will improve the state's personnel, fiscal, travel, training, property and inventory into a single integrated system and should allow better tracking of program expenditures.

Program accomplishments are tracked by each field office and most sections in the division with data entry through the Water Pollution Control Information Management System (WaterLog). These data are used by the state's performance based budgeting measurements and for the division's reports to the Water Quality Control Board, Bureau of Environment, and to EPA. Performance-based measures of the department are summarized quarterly for each environmental division and reported to the Department of Finance and Administration. A summary annual report is produced prior to development of the next year's budget by the governor. It is available for review by the state's General Assembly when the budget is acted upon. Additional management use of data is important to the division to support expenditure state appropriation revenue and fee collections.

Current Funding

The cost of a full time technical employee including benefits will be about $78,000 for the year, with indirect costs approximately $14,900.

In 1991, the state legislature passed a law creating the Environmental Protection Fund (EPF) which requires the division to charge fees for certain services such as the annual maintenance of NPDES permits, plans and specs reviews, issuance of aquatic resource alteration permits (ARAP), and gravel dredging permits. Money collected from civil penalties and damage assessments, natural resource damage assessments are added to this fund as well. EPF funds have been used to add staff and upgrade the salaries of existing staff. In the states FY 09-10 year, EPF fees were increased to off-set a $1.4 million reduction of state appropriation to the division's budget. Actual collections in this year appear to be sufficient to off-set the loss of state revenues for the present. The division has seen continued reductions in fees for permit applications and plans reviews but has also seen an increase in civil penalty collections. The depressed economic activity within the state may inhibit the level of funding available to the division until the state's economy is more robust.

604 (b) Planning Funds awarded to Tennessee will be used in accordance with requirements of the Clean Water Act of 1987, and in accordance with recent Environmental Protection Agency guidance (EPA). In FY-15 the 40% pass-through funds were distributed to local and regional planning agencies for watershed management projects. The division intends on working with the development districts in FY-15 to distribute pass-through funds.

Special projects such as probabilistic monitoring, nutrient criteria development and dissolved oxygen criteria refinement are generally funded by 104(b) (3) grants.

Salary Ranges

The division has been historically plagued by two problems generally associated with low salaries: the inability to retain trained staff and the inability to recruit well-qualified replacements. Salary adjustments in the past have come from "across the board" raises as outlined by legislative action on the state budget. Legislatures voted to give employees a 1.5% raise in FY 2014. In addition some employees received a salary adjustment for the position and years of service in that position Table 4 reflects lasts FY salary information from 2013. Current salary information is unavailable

Table 4. Salary Grades for Positions in TDEC DWR

July 1, 2012 to June 30, 2013 (2.5% Increase)				
CLASS CODE	CLASS TITLE	GRADE	SALARY RANGE	
02532	CLERK 2	10	$1,498.00	$2,395.00
02533	CLERK 3	13	$1,716.00	$2,747.00
02942	SECRETARY	14	$1,789.00	$2,862.00
02943	ADMINISTRATIVE SECRETARY	16	$1,939.00	$3,105.00
73121	ADMINISTRATIVE ASSISTANT 1	17	$2,022.00	$3,235.00
73161	ADMINISTRATIVE SERVICE ASST 1	17	$2,022.00	$3,235.00
73162	ADMINISTRATIVE SERVICE ASST 2	19	$2,197.00	$3,215.00
73163	ADMINISTRATIVE SERVICE ASST 3	22	$2,490.00	$3,983.00
73166	ADMINISTRATIVE SERVICE ASST 4	25	$2,819.00	$4,510.00
73164	ADMINISTRATIVE SERVICE ASST 5	27	$3,072.00	$4,918.00
77841	BIOLOGIST 1	21	$2,386.00	$3,819.00
CLASS CODE	CLASS TITLE	GRADE	SALARY RANGE	
77842	BIOLOGIST 2	24	$2,701.00	$4,322.00
77843	BIOLOGIST 3	26	$2,941.00	$4,707.00
77844	BIOLOGIST 4	28	$3,208.00	$5,133.00
77851	CHEMIST 1	23	$2,594.00	$4,152.00
77852	CHEMIST 2	25	$2,819.00	$4,510.00
77853	CHEMIST 3	28	$3,208.00	$5,133.00
77854	CHEMIST 4	30	$3,489.00	$5,583.00
072975	ENV PROGRAM ADMINISTRATOR	118	$5,934.00	$10,692.00
73004	ENV ASST PROGRAM MGR 1	31	$3,630.00	$5,808.00
72974	ENVIRONMENTAL FIELD OFFICE MGR	33	$3,919.00	$6,270.00
72971	ENVIRONMENTAL PROG MGR 1	34	$4,121.00	$6,594.00
72970	ENVIRONMENTAL PROG MGR 2	35	$4,306.00	$6,891.00

72972	ENVIRONMENTAL PROG MGR 3	36	$4,503.00	$7,207.00
72973	ENVIRONMENTAL PROG DIR	116	$5,381.00	$9,698.00
76551	ENVIRONMENTAL PROT SPEC 1	27	$3,072.00	$4,918.00
76553	ENVIRONMENTAL PROT SPEC 3	32	$3,769.00	$6,034.00
76557	ENVIRONMENTAL PROT SPEC 4	33	$3,919.00	$6,270.00
76554	ENVIRONMENTAL PROT SPEC 5	34	$4,121.00	$6,594.00
76555	ENVIRONMENTAL PROT SPEC 6	35	$4,306.00	$6,891.00
76556	ENVIRONMENTAL PROT SPEC 7	36	$4,503.00	$7,207.00
72921	ENVIRONMENTAL SPEC 1	20	$2,289.00	$3,661.00
72922	ENVIRONMENTAL SPEC 3	25	$2,819.00	$4,510.00
72923	ENVIRONMENTAL SPEC 4	28	$3,208.00	$5,133.00
72926	ENVIRONMENTAL SPEC 5	29	$3,354.00	$5,368.00
72924	ENVIRONMENTAL SPEC 6	32	$3,769.00	$6,034.00
76181	OPNS SPECIALIST 1	30	$3,489.00	$5,583.00
76182	OPNS SPECIALIST 2	32	$3,769.00	$6,034.00
77161	SOIL CONSULTANT 2	26	$2,941.00	$4,707.00

Department of Environment and Conservation
Bureau of Environment
Division of Water Resources

Bob Martineau
Commissioner

Shari Meghreblian, Ph.D.
Deputy Commissioner

Chuck Head
Senior Advisor

Tisha Calabrese Benton
Director

Alan Schwendimann
Chief Deputy Director

- Memphis Field Office
- Jackson Field Office
- Nashville Field Office
- Columbia Field Office
- Cookeville Field Office
- Chattanooga Field Office
- Knoxville Field Office
- Johnson City Field Office

Britton Dotson
Deputy Director
Water Quality Branch

- Water-Based Systems
- Land-Based Systems
- Drinking Water
- Natural Resources
- Mining

Jennifer Dodd
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Watershed Stewardship & Support Branch

- Watershed Management
- Planning and Standards
- Compliance and Enforcement
- Information Management & Administrative Support
- State Revolving Loan Fund
- Fleming Training Center

July 18 2014

Future Planning and Needs Assessment for Tennessee's Water Monitoring and Assessment Program

Tennessee has traditionally had a strong water quality monitoring and assessment program. In the last 12 years, water quality monitoring and related activities have increased by more than 400% (Table 5). New procedures such as diurnal dissolved oxygen monitoring, rapid periphyton surveys and probabilistic monitoring have been used to supplement targeted biological and chemical monitoring.

It is evident that Tennessee already spends a great deal of time, effort and money on water quality monitoring. However, a significant funding gap does exist if EPA requirements and guidance are to be met. Without a steady source of federal funding in addition to current funding, it is not likely that program activities will expand or that any significant increase in the percentage of waterbodies monitored and assessed will be feasible. Additional staffing and funding must be permanent and not in the form of competitive or temporary grants to expand programs. Tennessee is not expecting additional funding from other sources for these activities over the next ten years. Therefore, federal funding increases would be vital to implementation of all or part of the following water quality monitoring goals.

Table 5. Water Quality Monitoring From 1998 to 2012

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013*
Chemical Sample Collections	705	1386	2805	2758	2615	2921	3540	3205	3302	3981	3600	4000	3600	3700	4482	>3392
Quality Assurance Sample Collections	76	66	196	159	339	325	628	585	763	941	900	713	776	930	618	>423
Rapid Biological Stations (Biorecon)	86	394	602	672	318	365	183	162	285	248	338	318	223	288	157	>323
Intensive Biological Stations (SQSH)	150	100	222	176	94	330	113	256	226	267	332	353	367	257	247	>190
Habitat Assessments	236	494	824	848	412	695	504	386	462	497	612	597	512	525	361	>446
Periphyton Stations	0	0	94	14	80	154	121	0	2	120	60	72	22	55	10	>27
Antidegrada tion Surveys	2	5	11	5	5	49	33	17	97	81	2	59	51	18	12	>15
Probabilistic Monitoring Stations	0	0	50	50	75	95	313	2	0	90	0	0	90	0	0	0

- All 2013 data have not been entered into the Access Water Quality database so totals are low.

Section 106 grant project activities in TN is funded by state appropriation and EPA grant dollars. Approximately $6.1 million, ($1.1 million federal), was obligated for employee salaries and benefits in support of this program in the state in FY 2012-2013. Another $1.4 million is required for travel, printing, utility, communication, maintenance, professional service, rent, insurance, vehicle and equipment expenses.

The funding necessary to maintain the current program has also risen steadily. This is due to rising lab expenditures from increased sample collections, use of lab personnel for field support and rising analytical costs. The amount spent on laboratory activities more than doubled from $0.6 million in 1998 to $1.5 million in 2005. Laboratory expenses for 2012-2013 were $1.4 million

Table 6. Projected funds necessary to increase wadeable stream assessment by 5% annually

Year	Approximate number of assessed stream miles reassessed annually if plan is funded	Additional stream miles to achieve 5% increase from previous year	Additional stations added (based on average 1 station per 11 stream miles)	Additional staff needed (Personnel Costs)	Indirect Costs (Based on 0.23%)	Additional laboratory analysis including QC	Cumulative federal dollars needed above existing funding
2006	6,059	303	28	2 Field = $154,800	$35,604	$38,000	$223,510
2007	6,362	318	29	2 CO (1 PAS, 1 TMDL) = $154,800	$35,604	$43,000	$430,740
2008	6,680	334	30			$44,000	$475,020
2009	7,014	351	32	2 Field = $154,800	$35,604	$46,000	$684,970
2010	7,365	368	33			$47,000	$731,970
2011	7,733	387	35			$53,000	$784,970
2012	8,120	406	37	2 Field and 2 CO (1 PAS, 1 TMDL) = $309,600	$71,208	$55,000	$1,189,709
2013	8,256	426	39			$57,000	$1,246,709
2014	8,952	448	41			$60,000	$1,306,709
2015	9,400	470	43	2 Field = $154,800	$35,604	$62,000	$1,511,659
2016	9,870	493	45			$68,000	$1,579,659
2017	10,363	518	47			$70,000	$1,649,659

2018	10,881	544	49	2 Field = $154,800	$35,604	$72,000	$1,885,619
2019	11,425	571	52			$75,000	$1,960,619
2020	11,996	600	54			$78,000	$2,038,619

7. Wetlands Monitoring

Tennessee has approximately 787,000 acres of wetlands. The division has identified 54,811 impacted wetland acres. Historically, the largest single cause of impacts to existing wetlands was loss of hydrologic function due to channelization and leveeing. Presently development such as roads, subdivisions and commercial centers are impacting wetlands more than other activities.

Tennessee received a grant from EPA to develop a protocol for wetland assessment and to apply the state's antidegradation rules to wetlands permitting issues. Tennessee has completed its development of a rapid assessment methodology for wetlands. The Tennessee Rapid Assessment Methodology (TRAM) is based on models developed as part of the Hydrogeomorphic (HGM) approach for assessing wetland function in Tennessee. Tennessee has now developed HGM models for depressional, riverine, flat and slope wetlands.

The TRAM will allow for the identification of exceptional wetlands, impaired wetlands, aid in assessing the ecological consequences of §401 and ARAP permitting decisions, and assist in implementation the state's antidegradation rules. The Division of Water Resources Waterlog database will enable the permitting program to track compliance and provide a source of wetland impact and mitigation data for use by agencies involved in wetland's monitoring and research.

In 2010 Tennessee partnered with U.S. Army Corps of Engineers (COE) and The Nature Conservancy to undertake one pilot watershed approach project in Tennessee to fulfill the requirements of the 2008 COE/ EPA Compensatory Mitigation Rule. The pilot Watershed Approach project in Tennessee was targeted for completion by the end of calendar year 2012. The project has not been completed yet. The end product of this project will be 1) a watershed plan that identifies viable/potential wetland and stream restoration and preservation priorities in the selected 8-digit watershed; and 2) a report that summarizes the methodology utilized to apply the Watershed Approach in development of the plan. The report will be designed to serve as a guide for the application of the Watershed Approach in the region.

Tennessee Tech University was awarded an EPA grant to assess wetland mitigation in Tennessee and update their previous study from the late 1990's. The division is assisting in this assessment.

In 2013 Tennessee Department of Environment and Conservation was awarded an EPA Wetland Program Development Grant to build a sustainable and focused wetland program for the state of Tennessee. A key component of the grant is to develop a Wetland Program Plan built on the EPA's Core Elements Framework. This plan will outline the major provisions of the grant and the steps TDEC will take to accomplish them. Some of the primary goals are training personnel on the use of the Tennessee Rapid Assessment Method, the development of a Qualified Wetland Professional (QWP) Program, development of a stream functional assessment to guide compensatory mitigation projects, additional emphasis on enforcement and compliance, and the development of water quality standards for wetlands.

II. RIVER, STREAM, RESERVOIR AND LAKE MONITORING

The division maintains a statewide monitoring system consisting of approximately 7000 stations**.** In addition, new stations are created every year to increase the number of assessed streams. Approximately 600 stations will be monitored in FY 14-15. Stations are sampled monthly, quarterly and semi-annually, depending on the requirements of the project long-term trend monitoring (ambient), 303(d), ecoregion, TMDLs and watershed. Stations are located in Table 9. Additional streams may be added for sampling as the monitoring year progresses. Most large streams have at least one station. A list of parameters to be sampled is provided in Table 10.

After determining the watersheds to be monitored in a given year, monitoring resources are prioritized as follows: Details of the priorities are described in Chapter I, Section C.

Antidegradation Monitoring
Ecoregion Reference Stream Monitoring
303(d) Listed Segments Monitoring
TMDL Development Monitoring
Long-Term Trend Station Monitoring (Ambient)
Watershed Monitoring
- **i. Previously Assessed Streams**
- **ii. Unassessed Stream Reaches with emphasis on third order or larger**

A. Antidegradation Monitoring

Streams are evaluated for antidegradation status based on a standardized evaluation process, which includes information on specialized recreation uses, scenic values, ecological consideration, biological integrity and water quality. Since permit requests generally cannot be anticipated, these evaluations are generally not included in the workplan.

B. Ecoregion Reference Stream Monitoring

Continuing with the division's plan to maintain some level of reference stream monitoring in conjunction with the watershed approach, periphyton (annually), physical, chemical, (quarterly) and macroinvertebrate sampling (semi-annual) will continue at ecoregion reference streams located in the Group 4 Watersheds in FY-15, Table 9. Headwater reference streams will also be sampled.

C. Sampling Frequency for 303(d) Listed Waters

The 303(d) List is a compilation of the streams and lakes in Tennessee that are "water quality limited" or are expected to exceed water quality standards in the next two years and need additional pollution controls. Water quality limited streams are those that have one or more properties that violate water quality standards. They are considered impaired by pollution and not fully meeting designated uses. Impaired waters are monitored, at a minimum, every five years coinciding with the watershed cycle. There are numerous reasons that this is good public policy:

Documentation of current conditions, which may change from year to year. This documentation can provide a rationale for "delisting" a stream from the 303(d) list or may just confirm the water's impairment status.

Sampling can provide data for pre or post TMDL evaluation. Data can be used for model calibration.

Surveys can document the need for enforcement actions.

Data can assist in the evaluation of the effectiveness of BMPs or help target BMP installation for maximum effectiveness.

Results over time can provide insight into historical water quality trends.

Conditions may represent a human health threat.

For these reasons, the monitoring of impaired waters is identified as a high priority for division field staff. The division's intended goal is to always collect new data on these waters, unless there is a compelling reason for not doing so.

Waters that do not support fish and aquatic life are sampled once for macroinvertebrates (semi-quantitative sample preferred) and monthly for the listed pollutant(s). Streams with multiple listed segments should be sampled monthly for the listed pollutant for each segment. Streams with impacted recreational uses, such as those impaired due to pathogens are sampled monthly for *E. coli.* (Other acceptable sampling strategies for *E. coli* might be to sample 5 times within a 30-day period, or bimonthly during the prime water contact season.)

Streams posted for water contact must be monitored at a minimum every five years.. If another responsible party will be monitoring the stream, then the EFO does not need to sample the stream. The failure of another party to sample the stream places the burden back on the EFO to monitor the stream. THERE IS NO ACCEPTABLE REASON FOR FAILURE TO MONITOR A STREAM POSTED FOR WATER CONTACT

Resource limitations or data results may sometimes justify fewer sample collections. For example, there are cases where pollutants are at high enough levels that sampling frequency may be reduced while still providing a statistically sound basis for assessments. In some other cases, monitoring may be appropriately bypassed during a monitoring cycle.

1. 303(d) Listed sites requiring no additional monitoring

All impaired streams in targeted watersheds must be accounted for in the annual monitoring workplan. If a field office is proposing to bypass monitoring of an impaired stream, an appropriate rationale must be provided and included in the workplan (Table 7). It is recommended that the EFO verify the condition of the stream at least every other cycle. Should an impaired stream be dry during two consecutive cycles, consideration should be given to requesting the stream be delisted on the basis of low flow. Streams impacted by poor biology, habitat alterations, or siltation due to habitat alterations must still be monitored at least once (habitat assessment, plus SQSH or biorecon). Streams posted for water contact must be monitored every cycle.

There are individual sites where conditions may justify retaining the impaired status of the stream without additional sampling during an assessment cycle. The reasons may include, but are not limited to, the following:

Data have been collected by the division or another agency within the last five years and water quality is thought to be unchanged. If another division or agency has collected stream samples the EFO should follow up with that division or agency to retrieve the data and forward it to PAS.

Another agency or a discharger has accepted responsibility for monitoring the stream and will provide the data to the division. During the planning process for each watershed cycle, field staff should recommend to the permitting section those streams where it would be appropriate for monitoring to be performed by a discharger. Where permits are up for renewal, such conditions could be added.

The stream is known to be dry or without flow during the majority of the year that sampling is being scheduled.

Impounded streams impacted by flow alteration with no change in management of hydrology.

2. Impaired streams where additional sampling may be limited or discontinued

There are individual sites where initial results may justify a discontinuation of sampling. The reasons are limited to the following:

Where emergency resource constraints may require that sampling be restricted after a monitoring cycle is initiated, but before it is completed. Discontinuation of monitoring on this basis must be approved in advance by the Deputy Director. Before requesting a halting of sampling in impaired streams, assistance from the Department of Health's Aquatic Biology section should be considered. Such requests should be coordinated through the Planning and Standards Section.

Initial stream sampling documents elevated levels of pollutants indicating, with appropriately high statistical confidence, that the applicable water quality criteria are still being violated. (Note – rain event sampling is inappropriate for this purpose.)

The levels of pollutants that indicate continued water quality standards violations with statistical confidence are provided in Table 8. For example, if three samples are collected and all three values exceed the levels in the far right hand column, then sampling for that parameter may be halted, as there is a very high probability that criteria would be exceeded in future sampling. If all three samples do not exceed the level provided in the table, then at least four more samples must be collected. If all seven samples exceed the levels in the middle column of the table, then sampling may cease. If all seven samples do not exceed the value in the table, then all sampling must be completed.

Important notes about this process:

This process only applies to chemical parameters or bacteriological results. Streams impacted by poor biology, habitat alterations, or siltation due to habitat alterations must still be monitored at least once (habitat assessment, plus SQSH or biorecon), flow permitting.

Rain event samples cannot be used to justify a reduction in sampling frequency.

The division is not establishing new criteria with Table 8 and the numbers in the table should not be used independently to assess streams. These numbers, which are based on the actual criteria, simply indicated the statistical probability that the criteria have been exceeded by a dataset when the number of observations are considered.

Where streams are impacted by multiple pollutants, all parameters must exceed the values in Table 8 before sampling can be halted.

Table 7. 303(d) Listed Streams Not Being Sampled

STREAM	WATERBODY ID	JUSTIFICATION	EFO	LAST SAMPLED
Little Trace Creek	TN05110002031-0250	u/s impoundment	CK	
Little Piney Creek	TN05130105019-0710	u/s impoundment	CK	2006
Looper Branch	TN05130105019-0721	u/s impoundment	CK	2004
Charlie Branch	TN05130105019-0800	u/s impoundment	CK	2004
Meadow Creek	TN05130105019-0900	u/s impoundment	CK	2004

STREAM	WATERBODY ID	JUSTIFICATION	EFO	LAST SAMPLED
Cub Creek	TN08010208001-1120	Impoundment not likely to have changed, not sampling for Iron but conducting aerial survery	J	2010
Hudson Branch	TN0801208024-0210	Impoundment not likely to have changed, not sampling for Iron but conducting aerial survery	j	2010
Noah Springs Branch	TN05130206034-0300	Dud bomb field	N	1997

Table 8. Sampling Frequency Guidance for Parameters Associated with Impaired Streams

Nutrient Sampling

Nitrite-Nitrate		**# Samples**	
	10	7	3
73a	< 0.49	0.49 - 0.68	>0.68
74a,65j,68a	< 0.28	0.28 - 0.40	>0.40
74b	< 1.49	1.49 - 2.08	>2.08
65a,65b,65e,65i	< 0.43	0.43 - 0.60	>0.60
71e	< 4.35	4.35 - 6.09	>6.09
71f	< 0.32	0.32 - 0.56	>0.56
71g,71h,71i	< 1.15	1.15 - 1.61	>1.61
68b	< 0.54	0.54 - 0.75	>0.75
69d	< 0.34	0.34 - 0.47	> 0.47
67f,67g,67h,67i	< 1.53	1.53 - 2.14	>2.14
66d	< 0.63	0.63 - 0.88	>0.88
66e,66f,66g,68c	<0.38	0.38 - 0.54	>0.54

Total Phosphate		**# Samples**	
	10	7	3
73a	<0.25	0.25 - 0.44	>0.44
74a	<0.12	0.12 - 0.21	>0.21
74b	<0.10	0.1 - 0.18	>0.18
65a,65b,65e,65i,65j,71e,68b,67f,67h,67i	<0.04	0.04 - 0.07	>0.07
71f,71g	<0.03	0.03 - 0.053	>0.053
71h.71i	<0.18	0.18 - 0.32	>0.32
68a,68c,69d,66f	<0.02	0.02 - 0.035	>0.035

Total Phosphate		# Samples	
67g	<0.09	0.09 - 0.16	>0.16
66d,66e,66g	<0.01	0.01 - 0.018	>0.018

Pathogen Sampling

E Coli		# Samples	
	10	7	3
Statewide	<941	941 - 1647	>1647

Metals Sampling

Metals		# Samples	
	10	7	3
Chromium (hexavalent)	<11	11 - 19.5	>19.5
Mercury	<0.77	0.77 - 1.35	>1.35
Aluminum	<338	338 - 592	>592
Iron	<1218	1218 - 2132	>2132
Manganese	<185	185 - 325	>325
Copper* 65e,65j,66d,66e,66g,68a,74b	<1.25	1.25 - 2.19	>2.19
Copper* 66f,71f	<4.44	4.44 - 7.77	>7.77
Copper* 67f,67h,67i,68b,68c,71g,71h,73a	<11.6	11.6 - 20.3	>20.3
Copper* 67g,71e,74a	<18.0	18.0 - 31.5	>31.5
Lead* 65e,65j,66d,66e,66g,68a,74b	<0.19	0.19 - 0.33	>0.33
Lead* 66f,71f	<1.02	1.02 - 1.79	>1.79
Lead* 67f,67h,67i,68b,68c,71g,71h,73a	<3.51	3.15 - 6.14	>6.14
Lead* 67g,71e,74a	<6.07	6.07 - 10.6	>10.6
Zinc* 65e,65j,66d,66e,66g,68a,74b	<16.8	16.8 - 29.4	>29.4
Zinc* 66f,71f	<58.9	58.9 - 103	>103
Zinc* 67f,67h,67i,68b,68c,71g,71h,73a	<153	153 - 268	>268
Zinc* 67g,71e,74a	<237	237 - 415	>415

*** Dependent on Hardness**

Total Suspended Solids Sampling

TSS		# Samples	
	10	7	3
65a,67i,73a	<64	64 - 112	>112
65e,65i,74b	<29	29 - 51	>51
65b,67g,68c,71e,71g,71i,74a	<13	13 - 23	>23
65j,66d,66e,66f,66g,67f,67h,68a,68b,69d,71f,71h	<10	10 - 18.	>18

D. TMDL Development Monitoring

Waterbody monitoring is required to develop TMDLs. The frequency and parameters monitored for TMDL monitoring depends on the specific TMDL. Stations to be monitored for TMDL development are listed in Table 9.

E. Long-Term Trend Stations (Ambient) Stream Monitoring

Ambient streams will be sampled quarterly and are listed in Table 9.

F . Watershed Stream Monitoring

Watershed streams will be monitored by most EFOs in Group 4 watersheds (Table 9).

Previously assessed segments (Note that a single site per assessed segment is adequate if assessment was supporting and no changes are evident
Unassessed reaches (fish and aquatic life) especially in third order or larger streams or in headwaters that have human disturbance and downstream reaches are not impaired.

SAMPLING FREQUENCY CHEMICAL CODES FOR TABLE 9

Once = Sampling once
B = Bi Monthly (every other month)
SA = Semi- annually (two times a year)
W = Weekly
M = Monthly
Q = Quarterly

5/30 or 7/30 = 5 or 7 samples in 30 day period
5/30W = 5 samples in a 30 day wet period
5/30D = 5 samples in a 30 day dry period
6/12 x2 mo = 6 x in a month, twice a year
#X - # min. # of times a site will be sampled

Table 9. Monitoring Stations to be Sampled

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
NMSTR000.3HM	303(d)	TN06020001001T_0200	CH	M	M	Once	1	1		CH
LOOKO4.3T0.8HM	303(d)	TN06020001003_0300	CH	M	M	Once	1	1		CH
BLACK000.7HM	303(d)	TN06020001003_0400	CH	M	M	Once	1	1		CH
BLACK003.5HM	303(d)	TN06020001003_0400	CH	M	M	Once	1	1		CH
FRIAR000.8HM	303(d)	TN06020001007_0100	CH	M	M	Once	1	1		CH
SCHIC10.4T1.0HM	303(d)	TN06020001007_0200	CH	M	M	Once	1	1		CH
MACKE000.6HM	303(d)	TN06020001007_0300	CH	M	M	Once	1	1		CH
SPRIN000.7HM	303(d)	TN06020001007_0510	CH	M	M	Once	1	1		CH
SCHIC004.9HM	303(d)	TN06020001007_1000	CH	M	M	Once	1	1		CH
SCHIC015.8HM	303(d)	TN06020001007_1000	CH	M	M	Once	1	1		CH
NCHIC7.4T0.7HM	303(d)	TN06020001067_0100	CH	M	M	Once	1	1		CH
NINEM000.6HM	303(d)	TN06020001067_0210	CH	M	M	Once	1	1		CH
BOSTO001.1HM	303(d)	TN06020001067_0500	CH	M	M	Once	1	1		CH
STAND001.3SE	303(d)	TN06020001067_0600	CH	M	M	Once	1	1		CH
HOGSK000.1HM	303(d)	TN06020001067_1100	CH	M	M	Once	1	1		CH
ROGER000.5HM	303(d)	TN06020001067_1400	CH	M	M	Once	1	1		
NCHIC018.7HM	303(d)	TN06020001067_2000	CH	M	M	Once	1	1		CH
SHOAL001.4HM	303(d)	TN06020001087_1000	CH	M	M	Once	1	1		CH
FRUED000.5HM	303(d)	TN06020001109_0200	CH	M	M	Once	1	1		CH
SHORT000.1HM	303(d)	TN06020001109_0300	CH	M	M	Once	1	1		CH
BEE000.8HM	303(d)	TN06020001109_0400	CH	M	M	Once	1	1		CH
CITIC0.7T0.7HM	303(d)	TN060200011240_0100	CH	M	M	Once	1	1		CH
CITIC001.0HM	303(d)	TN060200011240_1000	CH	M	M	Once	1	1		CH

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
DOBBS000.3HM	303(d)	TN060200011244_0100	CH	M	M	Once	1	1		CH
CHATT5.5T0.1HM	303(d)	TN060200011244_0200	CH	M	M		1	1		CH
MCFAR000.2HM	303(d)	TN060200011244_0300	CH	M	M	Once	1	1		
GSPRI000.4HM	303(d)	TN060200011244_0400	CH	M	M	Once	1	1		CH
SSUCK000.1MI	303(d)	TN06020001421_0100	CH	M	M	Once	1	1		CH
STRIN000.6HM	303(d)	TN06020001426_0200	CH	M	M	Once	1	1		CH
MOUNT001.5HM	303(d)	TN06020001426_1000	CH	M	M	Once	1	1		CH
SCHIC000.4HM	303(d)/Ambient	TN06020001007_1000	CH	Q/M	Q/M	Once	1	1		CH
CHATT000.9HM	303(d)/Ambient	TN060200011244_1000	CH	Q/M	Q/M					CH
PINEY005.0RH	Ambient	TN06010201041_1000	CH	Q	Q					
TENNE444.0MI	Ambient	TN06020001	CH	Q	Q					
TENNE477.0HM	Ambient	TN06020001001_1000	CH	Q	Q					
TENNE503.3RH	Ambient	TN06020001020_1000	CH	Q	Q					
TENNE529.5RH	Ambient	TN06020001020_1000	CH	Q	Q					
HIWAS013.4MM	Ambient	TN06020002008_1000	CH	Q	Q					
CANE001.5MM	Ambient	TN06020002081_0100	CH	Q	Q					
OOSTA028.4MM	Ambient	TN06020002083_3000	CH	Q	Q					
OCOEE001.0PO	Ambient	TN06020003001_1000	CH	Q	Q					
OCOEE019.6PO	Ambient	TN06020003013_1000	CH	Q	Q					
SEQUA006.3MI	Ambient	TN06020004001_1000	CH	Q	Q					
TENNE416.5MI	Ambient	TN06030001055_1000	CH	Q	Q					
ECO68A20	Ecoregion	TN06020001397_1000	CH	Q	Q	SA	2	2	CH	CH
FECO68C12	FECO	TN06020001001T_0100	CH	Q	Q	SA	2	2	CH	CH
ECO66G12	SEMN	TN03150101012_0510	CH	Q	Q	SA	2	2	CH	CH
ECO66G20	SEMN	TN06020003013.55_0400	CH	Q	Q	SA	2	2	CH	CH
ECO68C20	SEMN	TN06030001067_1000	CH	Q	Q	SA	2	2	CH	CH
BEE008.0BL	Special Study	TN05130108033_2000	CH							

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
TENNE425.5MI	Watershed Monitoring	TN06020001001_1000	CH				1	1		CH
JMCNA001.2MI	Watershed Monitoring	TN06020001001T_0300	CH			Once	1	1		CH
PGAP000.1HM	Watershed Monitoring	TN06020001001T_0400	CH			Once	1	1		CH
TENNE439.8T0.1HM	Watershed Monitoring	TN06020001001T_0999	CH			Once	1	1		CH
TENNE440.6T0.1HM	Watershed Monitoring	TN06020001001T_0999	CH			Once	1	1		CH
HAYDE000.1HM	Watershed Monitoring	TN06020001001T_0999 N M TRIBS	CH			Once	1	1		CH
HUDGE000.1HM	Watershed Monitoring	TN06020001001T_0999 N M TRIBS	CH			Once	1	1		CH
POPE004.8HM	Watershed Monitoring	TN06020001003_0100	CH	M	Q	Once	1	1		CH
WAUHA000.5_GA	Watershed Monitoring	TN06020001003_0200	CH	M			1	1		CH
LOOKO000.1HM	Watershed Monitoring	TN06020001003_1000	CH	M	Q	Once	1	1		CH
FRIAR000.1HM	Watershed Monitoring	TN06020001007_0100	CH				1	1		CH
FRIAR002.7HM	Watershed Monitoring	TN06020001007_0100	CH				1	1		CH
POE001.3HM	Watershed Monitoring	TN06020001007_0110	CH				1	1		CH
POE001.4HM	Watershed Monitoring	TN06020001007_0110	CH	M	Q	Once	1	1		CH

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
POE001.6HM	Watershed Monitoring	TN06020001007_0110	CH				1	1		CH
RSPRI000.3HM	Watershed Monitoring	TN06020001007_0310	CH	M	Q	Once	1	1		CH
HURRI003.7HM	Watershed Monitoring	TN06020001007_0400	CH	M	Q	Once	1	1		CH
JOHNS000.2HM	Watershed Monitoring	TN06020001007_0410	CH	M	Q	Once	1	1		CH
WCHIC000.1HM	Watershed Monitoring	TN06020001007_0500	CH	M	Q	Once	1	1		CH
SCHIC7.9T0.3HM	Watershed Monitoring	TN06020001007_0999	CH	M	Q	Once	1	1		CH
PITTS000.8HM	Watershed Monitoring	TN06020001067_0200	CH	M	Q	Once	1	1		CH
NINEM002.7HM	Watershed Monitoring	TN06020001067_0215	CH	M	Q	Once	1	1		CH
FWATE001.4HM	Watershed Monitoring	TN06020001067_0300	CH	M	Q	Once	1	1		CH
LFWAT002.7HM	Watershed Monitoring	TN06020001067_0310	CH	M	Q	Once	1	1		CH
CAIN000.3HM	Watershed Monitoring	TN06020001067_0800	CH		Q	Once	1	1		CH
MOSSY000.1SE	Watershed Monitoring	TN06020001067_0810	CH		Q	Once	1	1		CH
COOPE000.3HM	Watershed Monitoring	TN06020001067_0900	CH				1	1		CH
HURRI001.3HM	Watershed Monitoring	TN06020001067_0999	CH				1	1		CH

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
POE000.1HM	Watershed Monitoring	TN06020001067_1200	CH	M	Q	Once	1	1		CH
LICK000.7HM	Watershed Monitoring	TN06020001067_1300	CH	M	Q	Once	1	1		CH
NCHIC21.2HM	Watershed Monitoring	TN06020001067_3000	CH		Q	Once	1	1		CH
NCHIC029.5HM	Watershed Monitoring	TN06020001067_4000	CH		Q	Once	1	1		CH
STANL000.1HM	Watershed Monitoring	TN06020001109_0100	CH	M	M	Once	1	1		CH
MIDDL003.5HM	Watershed Monitoring	TN06020001109_1000	CH	M	M	Once	1	1		CH
CHATT007.9HM	Watershed Monitoring	TN060200011244_2000	CH	M	M	Once	1	1		CH
EGYPT_G0.1MI	Watershed Monitoring	TN060200011441_0100	CH		Q	Once	1	1		CH
RWAT003.7MI	Watershed Monitoring	TN060200011441_1000	CH		Q	Once	1	1		CH
NSUCK000.1HM	Watershed Monitoring	TN06020001421_0200	CH		Q	Once	1	1		CH
CONNE001.6HM	Watershed Monitoring	TN06020001421_0220	CH				1	1		CH
MOUNT4.3T0.1HM	Watershed Monitoring	TN06020001426_0100	CH	M	Q	Once	1	1		CH
MOUNT004.7HM	Watershed Monitoring	TN06020001426_1000	CH	M	M	Once	1	1		CH
ROCK024.8PI	303(d)	TN05130104010_1000	CK	Q	Q	SA	2	2	CK	CK
CUB000.7OV	303(d)	TN05130105015_0300	CK	Q		Once	1			CK

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
ROCKC004.7FE	303(d)	TN05130105019_0300	CK	M	M - (6/30 dry)	Once		1		CK
ROCKC004.9FE	303(d)	TN05130105019_0300	CK	M	M - (6/30 dry)	Once		1		CK
MEADO011.9CU	303(d)	TN05130105019_0950	CK	M		Once	1			CK
BLAUR004.7FE	303(d)	TN05130105019_1300	CK	Q		Once	1			CK
LLAUR000.4FE	303(d)	TN05130105019_1310	CK	Q		Once	1			CK
BPINE000.1FE	303(d)	TN05130105019_1400	CK	Q		Once	1			CK
EFOBE025.8FE	303(d)	TN05130105019_2000	CK	M	M	Once	1			CK
EFOBE039.6OV	303(d)	TN05130105019_3000	CK	M	M	Once		1		CK
TOWN000.1PI	303(d)	TN05130105033_1400	CK	M	M - (6/30 dry)	Once		1		CK
TOWN000.8PI	303(d)	TN05130105033_1400	CK	M	M	Once		1		CK
OBEY002.1CY	303(d)/Ambient	TN05130105001_1000	CK	Q	Q					
CUMBE381.1CY	Ambient	TN05130103001_1000	CK	Q	Q					
CFORK011.2SM	AMBIENT	TN05130108001_1000	CK	Q	Q					
FWATE009.6PU	Ambient	TN05130108045_1000	CK	Q	Q					
ECO71H17	SEMN	TN05130108004_0220	CK	Q		SA	2	2	CK	CK
MYATT005.1CU	SEMN	TN06010208008_0100	CK	Q		SA	2	2	CK	CK
WFLON000.1MA	Watershed Monitoring	TN05110002024_0400	CK			Once		1		CK
LHUNG000.8MA	Watershed Monitoring	TN05110002027_0300	CK			Once		1		CK
LONG003.3MA	Watershed Monitoring	TN05110002027_0400	CK			Once		1		CK
SLICK014.6MA	Watershed	TN05110002027_2000	CK			Once		1		CK

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
	Monitoring									
SLICK016.1MA	Watershed Monitoring	TN05110002027_2000	CK			Once		1		CK
TRACE002.3CY	Watershed Monitoring	TN05110002031_0300	CK			Once	1			CK
PROCT000.1CY	Watershed Monitoring	TN05130103001_0100	CK			Once	1			CK
THOMP004.8PI	Watershed Monitoring	TN05130104010_0100	CK	M		Once	1			CK
CROOK000.1FE	Watershed Monitoring	TN05130104026_0800	CK			Once	1			CK
CROOK010.1FE	Watershed Monitoring	TN05130104026_0800	CK			Once	1			CK
WFOBE008.0OV	Watershed Monitoring	TN05130105015_1000	CK	M	M - (6/30 dry)	Once		1		CK
WFOBE016.5OV	Watershed Monitoring	TN05130105015_2000	CK	M	M - (6/30 dry)	Once		1		CK
WOLF022.2PI	Watershed Monitoring	TN05130105033_1000	CK		M - (6/30 dry)					
GLOBE001.6MY	303(d)	TN06040002002_0300	CL		M	Once	1			CL
EFGLO000.4ML	303(d)	TN06040002002_0310	CL	M	M	Once		1		CL
VICKE000.1ML	303(d)	TN06040002002_0311	CL	M		Once	1			CL
EFGLO002.5ML	303(d)	TN06040002002_0315	CL	M		Once		1		CL
HURRI000.2MY	303(d)	TN06040002002_0700	CL			Once	1			CL
FOUNT014.2MY	303(d)	TN06040002002_3000	CL		M	Once	1			CL
CEDAR002.2MY	303(d)	TN06040002008_1000	CL	M	M	Once	1			CL

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
RICH000.5ML	303(d)	TN06040002010_0100	CL	M	M	Once	1			CL
EROCK001.8ML	303(d)	TN06040002012_0100	CL	M	M	Once	1			CL
SANDE000.2ML	303(d)	TN06040002012_0500	CL			Once		1		CL
SNELL000.3ML	303(d)	TN06040002012_0700	CL			Once	1			CL
BROCK015.8ML	303(d)	TN06040002012_2000	CL	M		Once	1			CL
BROCK020.1ML	303(d)	TN06040002012_3000	CL	M	M	Once	1			CL
DUCK216.2BE	303(d)	TN06040002020_1000	CL		M	Once	1			CL
LSINK001.0BE	303(d)	TN06040002021_0100	CL			Once	1			CL
SINKI001.2BE	303(d)	TN06040002021_1000	CL			Once		1		CL
DAVIS000.2BE	303(d)	TN06040002024_0100	CL			Once	1			CL
SUGAR002.7BE	303(d)	TN06040002024_1000	CL	M	M	Once		1		CL
BOMAR001.0BE	303(d)	TN06040002027_0200	CL	M		Once	1	1		CL
DUCK219.7BE	303(d)	TN06040002027_1000	CL		M	Once	1			CL
DODDY000.7BE	303(d)	TN06040002030_0200	CL			Once	1			CL
DUCK240.0BE	303(d)	TN06040002030_1000	CL		Q	Once	1			CL
CLEAR001.1CE	303(d)	TN06040002032_0300	CL	M	M	Once	1			CL
MUDDY000.1CE	303(d)	TN06040002032_0310	CL	M	M	Once	1			CL
DUCK268.6CE	303(d)	TN06040002032_2000	CL		M	Once	1			CL
BBUCK000.6BE	303(d)	TN06040002033_0300	CL		M	Once	1			CL
MUSE001.1BE	303(d)	TN06040002033_0600	CL			Once	1			CL
WARTR001.2BE	303(d)	TN06040002033_1000	CL		M	Once		1		CL
HURRI001.8BE	303(d)	TN06040002038_0300	CL		M	Once		1		CL
FALL001.2BE	303(d)	TN06040002038_1000	CL		M	Once	1			CL
WEAKL000.2BE	303(d)	TN06040002039_0200	CL		M	Once	1			CL
WEAKL004.8BE	303(d)	TN06040002039_0250	CL	M	M	Once		1		CL
ALEXA000.7BE	303(d)	TN06040002039_0300	CL		M	Once		1		CL
NFORK002.5BE	303(d)	TN06040002039_1000	CL		M	Once	1			CL
NFORK004.7BE	303(d)	TN06040002039_2000	CL	M	M	Once	1			CL

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
NFORK009.4BE	303(d)	TN06040002039_3000	CL	M	M	Once		1		CL
WILSO000.7ML	303(d)	TN06040002046_1000	CL	M	M	Once		1		CL
WFSPR000.4ML	303(d)	TN06040002047_0100	CL			Once	1			CL
EFSPR000.6ML	303(d)	TN06040002047_0200	CL			Once		1		CL
LICK001.8ML	303(d)	TN06040002047_0300	CL		M	Once		1		CL
SPRIN001.3ML	303(d)	TN06040002047_1000	CL		M	Once	1			CL
WALLA000.8WI	303(d)	TN06040002049_0400	CL		M	Once	1			CL
SHANK000.8CE	303(d)	TN06040002502_0220	CL			Once		1		CL
LDUCK000.1CE	303(d)	TN06040002502_1000	CL		M	Once		1		CL
LDUCK004.2CE	303(d)	TN06040002502_2000	CL	M	M	Once		1		CL
ELK133.0FR	AMBIENT	TN06030003015_1000	CL	Q	Q					
SHOAL032.2LW	AMBIENT	TN06030005078_1000	CL	Q	Q					
DUCK248.0BE	AMBIENT	TN06040002030_1000	CL	Q	Q					
BBIGB008.5MY	AMBIENT	TN06040003019_2000	CL	Q	Q					
DUCK113.9MY	AMBIENT	TN06040003024_1000	CL	Q	Q					
BUFFA073.1WE	AMBIENT	TN06040004002_1000	CL	Q	Q					
ECO71I14	Ecoregion	TN06040002049_0200	CL	Q	Q	SA	2	2	CL	CL
ECO71I10	Ecoregion	TN06040002049_2000	CL	Q	Q	SA	2	2	CL	CL
FECO71H01	FECO	not segmented yet	CL	Q	Q	SA	2	2	CL	CL
FECO71I01	FECO	TN06040002048_1000	CL	Q	Q	SA	2	2	CL	CL
ECO71F19	SEMN	TN06040004013_0400	CL	Q	Q	SA	2	2	CL	CL
DUCK141.1ML	Watershed Monitoring	TN06040002001_1000	CL		M	Once	1			CL
FOUNT002.8MY	Watershed Monitoring	TN06040002002_1000	CL			Once	1			CL
DUCK186.9ML	Watershed Monitoring	TN06040002010_1000	CL		M	Once	1			CL
EROCK013.8ML	Watershed	TN06040002012_0150	CL		M	Once	1			CL

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
	Monitoring									
BROCK009.4ML	Watershed Monitoring	TN06040002012_1000	CL			Once	1			CL
LHURR000.9BE	Watershed Monitoring	TN06040002020_0100	CL			Once	1			CL
NHERM000.1BE	Watershed Monitoring	TN06040002026_0300	CL			Once	1			CL
FLAT000.7BE	Watershed Monitoring	TN06040002026_1000	CL			Once	1			CL
DUCK229.2BE	Watershed Monitoring	TN06040002027_2000	CL		M	Once	1			CL
DUCK265.4CE	Watershed Monitoring	TN06040002032_1000	CL			Once	1			CL
DUCK280.1CE	Watershed Monitoring	TN06040002032_3000	CL		M	Once	1			CL
GARRI000.6BE	Watershed Monitoring	TN06040002034_1000	CL			Once	1			CL
NOAH002.1BE	Watershed Monitoring	TN06040002034_1200	CL		M	Once	1			CL
GARRI011.9BE	Watershed Monitoring	TN06040002034_2000	CL			Once	1			CL
CANEY002.6ML	Watershed Monitoring	TN06040002048_1000	CL			Once	1			CL
CRUMP003.0CE	Watershed Monitoring	TN06040002571_1000	CL			Once	1			CL
RANKI001.7SR	303(d)	TN05130201001T_0100	Gallatin MS4	M	M	Once	1			Gallati n MS4
RANKI001.7SR	303(d)	TN05130201001T_0100	Gallatin MS4	M	M	Once	1			Gallati n MS4

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
TOWN000.3SR	303(d)	TN05130201001T_0200	Gallatin MS4			Once	1			Gallatin MS4
TOWN000.3SR	303(d)	TN05130201001T_0200	Gallatin MS4			Once	1			Gallatin MS4
CUMBE246.5T1.5SR	303(d)	TN05130201001T_0400	Gallatin MS4	M	M	Once	1			Gallatin MS4
CUMBE246.5T1.5SR	303(d)	TN05130201001T_0400	Gallatin MS4	M	M	Once	1			Gallatin MS4
COLON001.8HR	303(d)	TN08010207003_0100	J	M						
CYPRE002.6MC	303(d)	TN08010207031_1000	J			Once	1			J
CROOK005.0MC	303(d)	TN08010207031_1300	J			Once	1			J
MUDDY11.5T0.7MC	303(d)	TN08010207031_1640	J							J
CYPRE023.8MC	303(d)	TN08010207031_4000	J							
ROSE001.3MC	303(d)	TN08010207035_0600	J	M	M					
TSPRI001.4HR	303(d)	TN08010207072_0200	J							J
DRY001.0HR	303(d)	TN08010208001_0600	J							J
WADE002.2HR	303(d)	TN08010208001_0800	J			Once	1			J
CUB3.6T1.2HR	303(d)	TN08010208001_1100	J							
CUB005.3HR	303(d)	TN08010208001_1150	J							
SHORT004.7HR	303(d)	TN08010208001_1550	J							J
GAMBL002.1HR	303(d)	TN08010208001_1700	J			Once	1			J
HICKO001.7HR	303(d)	TN08010208001_1800	J			Once	1			J
BMUDD7.2T0.6HY	303(d)	TN08010208007_0400	J			Once	1			J
BMUDD004.3HY	303(d)	TN08010208007_1000	J	M		Once	1			J
LONDO000.7HY	303(d)	TN08010208009_0100	J							J
MORRI000.5HY	303(d)	TN08010208009_0200	J							J
PRAIR001.3HY	303(d)	TN08010208009_0410	J	M		Once	1			J
POPLA014.7HY	303(d)	TN08010208009_1000	J			Once	1			J

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
ODAIN000.3HR	303(d)	TN08010208015_0100	J							
HUDSO000.3HR	303(d)	TN08010208024_0210	J							
PINEY014.6CS	303(d)	TN08010208027_2000	J		Q					
GRAYS7.0T0.9HR	303(d)	TN08010208028_0100	J							
DRY001.2HR	303(d)	TN08010208029_0100	J			Once	1			J
TURKE001.4MN	303(d)	TN08010208030_0100	J			Once	1			J
SUGAR001.5HY	303(d)	TN08010208031_1000	J	M	M	Once	1			J
CYPRE004.3HY	303(d)	TN08010208032_1000	J	M		Once	1			J
LAGOO003.0HY	303(d)	TN08010208033_1000	J	M		Once	1			J
ONELS1.1T0.6LE	303(d)	TN08010208034_0100	J	M	M					
NELSO001.1LE	303(d)	TN08010208034_0200	J							J
HYDE001.0LE	303(d)	TN08010208034_0300	J	M	M	Once	1			J
CANE012.5LE	303(d)	TN08010208034_2000	J	M	M	Once		1		J
CANE017.4LE	303(d)	TN08010208034_3000	J	M	M					J
JEFFE003.4HY	303(d)	TN08010208062_1000	J			Once	1			J
PUGH000.6HR	303(d)	TN08010208066_0100	J							J
RICHL001.7HY	303(d)	TN08010208072_1000	J		M					J
CARTE002.8HY	303(d)	TN080102081866_1000	J	M	M					J
TUSCU008.4MC	303(d)/WS	TN08010207044_1000	J	Q		Once	1			J
BEECH010.0DE	Ambient	TN06040001802_1000	J	Q	Q					
TENNE066.3HN	Ambient	TN06040005020_1000	J	Q	Q					
BSAND015.3BN	Ambient	TN06040005027_1000	J	Q	Q					
NFOBI005.9OB	Ambient	TN08010202009_1000	J	Q	Q					
NFOBI010.7OB	Ambient	TN08010202009_2000	J	Q	Q					
SFOBI005.8OB	Ambient	TN08010203001_1000	J	Q	Q					
MFOBI004.5WY	Ambient	TN08010203015_1000	J	Q	Q					
NFFDE005.3DY	Ambient	TN08010204001_1000	J	Q	Q					
SFFDE027.7HY	Ambient	TN08010205010_1000	J	Q	Q					

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
HATCH126.9HR	Ambient	TN08010208001_3000	J	Q	Q					
ECO65B04	Ecoregion	TN08010207072_1000	J	Q	Q	SA	2	2	J	J
ECO65E11	Ecoregion	TN08010208019_0500	J	Q	Q	SA	2	2	J	J
ECO65E10	Ecoregion	TN08010208019_0610	J	Q	Q	SA	2	2	J	J
FECO65E05	FECO	TN08010207044_0100	J	Q	Q	SA	2	2	J	J
FECO65E07	FECO	TN08010208027_0300	J	Q	Q	SA	2	2	J	J
HATCH174.2HR	Watershed Monitoring	TN08010207001_1000	J	Q	Q					
HATCH186.2MC	Watershed Monitoring	TN08010207001_2000	J	Q	Q					
MUDDY001.1HR	Watershed Monitoring	TN08010207003_1000	J	Q		Once	1			J
MUDDY002.0MC	Watershed Monitoring	TN08010207031_1600	J	Q		Once	1			J
CYPRE014.0MC	Watershed Monitoring	TN08010207031_3000	J	Q		Once	1			J
CYPRE015.8MC	Watershed Monitoring	TN08010207031_3000	J	Q						
LHATC003.1HR	Watershed Monitoring	TN08010207035_1000	J	Q		Once	1			J
HAYES003.3HR	Watershed Monitoring	TN08010208001_0700	J			Once	1			J
HATCH073.7HY	Watershed Monitoring	TN08010208001_3000	J	Q						
HATCH147.9HR	Watershed Monitoring	TN08010208001_3000	J	Q						
JETER000.1HY	Watershed Monitoring	TN08010208009_0400	J			Once		1		J
POTTE000.4HR	Watershed	TN0801020801_0100	J			Once	1			J

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
	Monitoring									
BEAR008.6HY	Watershed Monitoring	TN08010208011_1000	J	Q		Once	1			J
CLEAR003.4HR	Watershed Monitoring	TN08010208015_1000	J	Q		Once	1			J
CLOVE002.1HR	Watershed Monitoring	TN08010208015_1000	J	Q		Once	1			J
PRUN001.0HR	Watershed Monitoring	TN08010208017_1000	J	Q		Once	1			J
SPRIN004.0HR	Watershed Monitoring	TN08010208019_1000	J	Q		Once	1			J
STEWA003.4HR	Watershed Monitoring	TN08010208024_0400	J			Once	1			J
DRY000.3HR	Watershed Monitoring	TN08010208024_0500	J			Once	1			J
PORTE004.4HR	Watershed Monitoring	TN08010208024_1000	J	Q		Once	1			J
PINEY002.0HR	Watershed Monitoring	TN08010208027_1000	J	Q	Q	Once	1			J
BBLAC003.7MN	Watershed Monitoring	TN08010208030_1000	J	Q		Once	1			J
LMUDD006.7HY	Watershed Monitoring	TN08010208946_1000	J	Q		Once	1			J
HOLST089.0HS	303(d)	TN06010104004_1000	JC							
HOLST104.0HS	303(d)	TN06010104004_2000	JC							
SMOUN000.5HS	303(d)	TN06010104004T_0800	JC	6	12	Once	1			
RENFR000.6HS	303(d)	TN06010104004T_0900	JC	6	12	Once	1			
STOCK001.9HS	303(d)	TN06010104004T_1100	JC	6	8	Once	1			
CROCK001.1HS	303(d)	TN06010104004T_1300	JC	6	12	Once		1		

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
TFORK000.1HS	303(d)	TN06010104004T_1510	JC	6	12	Once	1			
WALKE000.2HS	303(d)	TN06010104004T_1610	JC		12	Once	1			
WAR000.9HS	303(d)	TN06010104004T_1700	JC		12	Once	1			
HOLST94.3T0.4HS	303(d)	TN06010104004T_1800	JC	1	12	Once	1			
CANEY008.0HS	303(d)	TN06010104004T_850	JC	6	12	Once		1		
HOLST109.9HS	303(d)	TN06010104009_1000	JC							
SINKI001.1HS	303(d)	TN06010104011_0100	JC	6	12	Once	1			
WASHB000.2HS	303(d)	TN06010104011_0200	JC		12	Once	1			
FORGE000.8HS	303(d)	TN06010104011_0300	JC	6	12	Once		1		
SURGO000.1HS	303(d)	TN06010104011_0400	JC		12	Once	1			
SPOIN001.7HS	303(d)	TN06010104011_0500	JC	6	12	Once	1			
BRADL002.1HS	303(d)	TN06010104011_0600	JC		12	Once	1			
RENFR000.2HS	303(d)	TN06010104011_0610	JC		12	Once	1			
HORD000.4HS	303(d)	TN06010104011_0800	JC		12	Once	1			
ALEXA000.6HS	303(d)	TN06010104011_0900	JC	6	12	Once		1		
ALEXA001.4HS	303(d)	TN06010104011_0950	JC		12	Once	1			
HOLST118.0HS	303(d)	TN06010104011_1000	JC							
SMITH000.9HS	303(d)	TN06010104011_1100	JC		12	Once	1			
ARNOT000.3HS	303(d)	TN06010104011_1300	JC	4	4	Once		1		
SLATE000.2SU	303(d)	TN06010104011_1400	JC	6	12	Once	1			
HUNT001.0HS	303(d)	TN06010104011_1900	JC		12	Once	1			
HOLST135.0HS	303(d)	TN06010104011_2000	JC							
CANEY005.0HS	303(d)	TN06010104015_0500	JC		12	Once	1			
STANL000.1HS	303(d)	TN06010104015_0600	JC		12	Once	1			
BIG7.6T0.1HS	303(d)	TN06010104015_0700	JC	1	12	Once	1			
CLINC166.5T0.2HK	303(d)	TN06010205013_0200	JC	6	8	Once	1			
RHEA000.2HK	303(d)	TN06010205013_0600	JC	4	8	Once	1			
GROCK000.1HK	303(d)	TN06010205013_0800	JC	6	12	Once		1		

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
EFPAN000.1HK	303(d)	TN06010205013_180	JC		12	Once	1			
DAVIS000.2HK	303(d)	TN06010205013_800	JC	4	4	Once	1			
FGAP000.9HK	303(d)	TN06010205014_0500	JC	6	8	Once		1		
CLINC189.7T0.1HK	303(d)	TN06010205016_0100	JC		12	Once	1			
MULBE000.7HK	303(d)	TN06010206007_0800	JC	6	12	Once		1		
LMULB000.3HK	303(d)	TN06010206007_0810	JC		12	Once	1			
NFHOL004.6SU	303(d)/Ambient	TN06010101001_1000	JC	4	4	Once		1		
CLINC189.8HK	303(d)/Ambient	TN06010205016_1000	JC	4	4	Once		1		
ECO67F14 Powell	303(d)/Ecoregion	TN06010206007_2000	JC	4	4	S/A	2	2	JC	JC
SFHOL001.1SU	AMBIENT	TN06010102001_1000	JC	4	4					
BEAVE001.0SU	AMBIENT	TN06010102042_1000	JC	4	4					
BEAVE015.3SU	AMBIENT	TN06010102042_2000	JC	4	4					
DOE001.1CT	AMBIENT	TN06010103013_1000	JC	4	4					
HOLST131.5HS	AMBIENT	TN06010104011_2000	JC	4	4					
NOLIC020.8GE	AMBIENT	TN06010108001_3000	JC	4	4					
NOLIC097.5UC	AMBIENT	TN06010108010_5000	JC	4	4					
BLIME000.5GE	AMBIENT	TN06010108030_1000	JC	4	4					
LICK001.0GE	AMBIENT	TN06010108035_1000	JC	4	4					
SINKI000.5GE	AMBIENT	TN06010108064_1000	JC	4	4					
RICHL001.3GE	AMBIENT	TN06010108102_1000	JC	4	4					
LLIME007.0WN	AMBIENT	TN06010108510_2000	JC	4	4					
ECO67F16 Hardy	Ecoregion	Lee Co VA	JC	4	4	S/A	2	2	JC	JC
FECO67H08	Ecoregion	TN06010104011_1500	JC	4	4	S/A	2	2	JC	JC
ECO6701 Big	Ecoregion	TN06010104015_2000	JC							
ECO67F17 Big War	Ecoregion	TN06010205014_1000	JC							
FECO67F04 Sutt	Ecoregion	TN06010206007_0500	JC	4	4	S/A	2	2	JC	JC
ECO67F23 Martin	Ecoregion	TN06010206007_0700	JC	4	4	S/A	2	2	JC	JC
HOLST097.5HS	RESERVOIR	TN06010104004_2000	JC							

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
ECO6702 Fisher	SEMN	TN06010104015_0100	JC	4		S/A	2	2	1	
ECO66E09 Clark	SEMN	TN06010108010_3200	JC	4		S/A	2	2	1	
DODSO002.6HS	Watershed Monitoring	TN06010104004T_1450	JC	1	8	Once	1			
ROBER000.7HS	Watershed Monitoring	TN06010104004T_1600	JC	1	8	Once	1			
CANEY003.0HS	Watershed Monitoring	TN06010104004T_800	JC	1	8	Once	1			
LAURE000.3HS	Watershed Monitoring	TN06010104011_1600	JC	1	8	Once	1			
MARSH000.2HS	Watershed Monitoring	TN06010104015_0300	JC	1	8	Once	1			
BIG002.0HS	Watershed Monitoring	TN06010104015_1000	JC	1	8	Once	1			
PVALL006.3HS	Watershed Monitoring	TN06010104017_1000	JC	1	8	Once	1			
NORTH000.1HS	Watershed Monitoring	TN0601010408_0100	JC	1	8	Once	1			
BEECH003.8HS	Watershed Monitoring	TN0601010408_1000	JC	1	8	Once	1			
SWAN000.5HK	Watershed Monitoring	TN06010205013_0500	JC	1	8	Once	1			
BRIER000.1HK	Watershed Monitoring	TN06010205013_0700	JC	1	8	Once	1			
PANTH000.1HK	Watershed Monitoring	TN06010205013_1100	JC	1	8	Once	1			
RICHA000.7HK	Watershed Monitoring	TN06010205013_1300	JC	1	8	Once	1			
RICHA000.2HK	Watershed Monitoring	TN06010205014_0300	JC	1	8	Once	1			

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
LWAR000.1HK	Watershed Monitoring	TN06010205014_0600	JC	1	8	Once	1			
BWAR007.1HK	Watershed Monitoring	TN06010205014_1000	JC	1	8	Once	1			
NFCLI000.1HK	Watershed Monitoring	TN06010205016_0200	JC	1	8	Once	1			
WAR000.6HK	Watershed Monitoring	TN06010205016_0400	JC	1	8	Once	1			
BLACK000.1HK	Watershed Monitoring	TN06010205057_1000	JC	1	8	Once	1			
CLEAR030.5CA	303(d)	TN05130101015_2000	K	5/30	5/30					
WOAK000.7CA	303(d)	TN05130101016_0100	K	5/30	5/30	Once		1		K
DAVIS000.6CA	303(d)	TN05130101016_0200	K	5/30	5/30					
HICKO008.4CA	303(d)	TN05130101016_2000	K	5/30	5/30	Once		1		K
EFORK000.1CA	303(d)	TN05130101091_0100	K	5/30	5/30	Once		1		
LELK000.1CA	303(d)	TN05130101091_0200	K	5/30	5/30					
ELK002.0CA	303(d)	TN05130101091_1000	K	5/30	5/30	Once		1		K
NFPIN000.3SC	303(d)	TN05130104048_0200	K	5/30	5/30					
LITTO000.2SC	303(d)	TN05130104048_0300	K	5/30	5/30					
EFPIN000.1SC	303(d)	TN05130104048_0400	K	5/30	5/30					
PINE10.0T0.4SC	303(d)	TN05130104048_0410	K	5/30	5/30					
SFPIN000.3SC	303(d)	TN05130104048_0500	K	5/30	5/30					
PINE003.6SC	303(d)	TN05130104048_1000	K	5/30	5/30					
PINE006.5SC	303(d)	TN05130104048_2000	K	5/30	5/30	Once		1		K
PINE007.9SC	303(d)	TN05130104048_3000	K	5/30	5/30	Once		1		K
LOVE002.2KN	303(d)	TN06010104001_0100	K	5/30	5/30	Once		1		K
ROSEB000.6KN	303(d)	TN06010104001_0500	K	5/30	5/30	Once		1		K
LOST000.7JE	303(d)	TN06010104001_0800	K	5/30	5/30	Once		1		K
BEAVE000.4JE	303(d)	TN06010104001_0900	K	5/30	5/30	Once		1		K

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
SWANP000.8KN	303(d)	TN06010104001_1400	K	5/30	5/30	Once		1		K
HOLST051.9JE	303(d)	TN06010104001_2000	K	M	M					
FALL003.2HA	303(d)	TN06010104004T_1900	K	5/30	5/30	Once		1		K
TURKE001.7HA	303(d)	TN06010104004T_2300	K	5/30	5/30	Once		1		K
MOSSY001.3JE	303(d)	TN06010104004T_2600	K	5/30	5/30	Once		1		K
MOSSY003.8JE	303(d)	TN06010104004T_2600	K	5/30	5/30					K
RICHL000.8GR	303(d)	TN06010104018_1000	K	5/30	5/30	Once		1		K
RICHL014.4GR	303(d)	TN06010104018_1000	K	5/30	5/30	Once		1		K
LFLAT000.3KN	303(d)	TN06010104019_0100	K	5/30	5/30	Once		1		K
FLAT000.4KN	303(d)	TN06010104019_1000	K	5/30	5/30	Once		1		K
FLAT013.0UN	303(d)	TN06010104019_2000	K	5/30	5/30					
FLAT018.0UN	303(d)	TN06010104019_2000	K	5/30	5/30					
FALL001.5UN	303(d)	TN06010205001T_1400	K			Once		1		K
LSYCA001.6CL	303(d)	TN06010205061_1000	K	5/30	5/30	Once		1		K
BIG017.1CA	303(d)	TN06010205064_1000	K	5/30	5/30	Once		1		K
BIG017.8CA	303(d)	TN06010205064_2000	K	5/30	5/30					K
OTOWN001.5CL	303(d)	TN06010206006_0100	K	5/30	5/30	Once		1		K
GAP004.3CL	303(d)	TN06010206006_0250	K	5/30	5/30	Once		1		K
BLAIR1.2T0.1CL	303(d)	TN06010206006_0310	K			Once		1		K
LITTL000.1CL	303(d)	TN06010206007_0100	K	5/30	5/30					
RUSSE000.5CL	303(d)	TN06010206008_1000	K	5/30	5/30	Once		1		K
RUSSE003.0CL	303(d)	TN06010206008_2000	K	5/30	5/30	Once		1		K
CAWOO000.2CL	303(d)	TN06010206026_0100	K	5/30	5/30	Once		1		K
RUSSE000.3CL	303(d)	TN06010206026_0200	K	5/30	5/30	Once		1		K
DAVIS011.1CL	303(d)	TN06010206026_1000	K	5/30	5/30					K
DAVIS014.6CL	303(d)	TN06010206026_2000	K	5/30	5/30	Once		1		K
DAVIS024.1CL	303(d)	TN06010206026_5000	K	5/30	5/30	Once		1		K
DAVIS020.5CL	303(d)	TN06010206026-3000	K		5/30	Once		1		

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
FBROA003.8KN	AMBIENT	TN06010107001_1000	K	Q	Q					
TENNE643.3KN	AMBIENT	TN06010201020_1000	K	Q	Q					
CLINC010.0RO	AMBIENT	TN06010207001_1000	K	Q	Q					
ECO69E04	Ecoregion	TN05130101016_0500	K	Q	Q	Once	1	1	K	K
ECO69E01	Ecoregion	TN05130101016_0700	K	Q	Q	Once	1	1	K	K
ECO69D06	Ecoregion	TN05130104037_0610	K	Q	Q	SA	2	2	K	K
ECO69D05	Ecoregion	TN05130104037_3000	K	Q	Q	SA	2	2	K	K
ECO67F27	Ecoregion	TN06010205011_1000	K	Q	Q	SA	2	2	K	K
ECO66G05	SEMN	TN06010201032_3000	K	Q	Q	SA	2	2	K	K
ECO67F13	SEMN	TN06010205001T_0300	K	Q	Q	SA	2	2	K	K
ECO67F06	SEMN	TN06010207019_0100	K	Q	Q	SA	2	2	K	K
CAPUC001.9CA	Watershed Monitoring	TN05130101007_0100	K			Once	1			
JELLI026.0SC	Watershed Monitoring	TN05130101007_1000	K			Once	1			
CLEAR020.7CA	Watershed Monitoring	TN05130101015_1000	K	5/30	5/30					
CLEAR021.0CA	Watershed Monitoring	TN05130101015_1000	K			Once		1		K
STINK000.3CA	Watershed Monitoring	TN05130101016_0500	K	5/30	5/30	Once		1		K
HICKO001.4CA	Watershed Monitoring	TN05130101016_1000	K	5/30	5/30	Once		1		K
BSFOR070.SC	Watershed Monitoring	TN05130104013_1000	K	M	M	Once		1		K
CFORK003.8SC	Watershed Monitoring	TN05130104026_1000	K	M	M	Once		1		K
LITTL000.2MG	Watershed Monitoring	TN05130104032_0600	K			Once	1			

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
POLEC000.1MG	Watershed Monitoring	TN05130104032_0600?	K			Once	1			
WOAK005.7MG	Watershed Monitoring	TN05130104032_1000	K			Once	1			
BRIMS009.2SC	Watershed Monitoring	TN05130104038_1000	K			Once	1			
BUFFA000.2GR	Watershed Monitoring	TN06010104001_0600	K	5/30	5/30	Once		1		K
HOLST001.8KN	Watershed Monitoring	TN06010104001_1000	K	M	M					
CLINC159.7CL	Watershed Monitoring	TN06010205013_1000	K	M	M	Once		1		K
BLAIR000.1CL	Watershed Monitoring	TN06010206006_0300	K			Once	1			
BLAIR000.8CL	Watershed Monitoring	TN06010206006_0300	K			Once	1			
POWEL065.5CL	Watershed Monitoring	TN06010206007_1000	K	M	M					
POWEL067.8CL	Watershed Monitoring	TN06010206007_1000	K			Once		1		K
INDIA000.1CL	Watershed Monitoring	TN06010206024_1000	K	5/30	5/30	Once		1		K
CSPRI002.3LE	303(d)	TN08010208001_0200	M	M	M	Once	1			
HATCH40.7T1.6LE	303(d)	TN08010208001_0300	M	M	M	Once	1			
HATCH48.0T1.2LE	303(d)	TN08010208001_0400	M	M	M	Once	1			
MYRON001.8TI	303(d)	TN08010208002_0500	M	M	M					
MYRON1.7T0.6TI	303(d)	TN08010208002_0500	M	M	M					
CANE001.9TI	303(d)	TN08010208002_0600	M	M	M	Once	1			
INDIA005.0TI	303(d)	TN08010208002_1000	M	M	M					

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
INDIA1C6.8TI	303(d)	TN08010208002_1000	M	M	M	Once	1			
CATRO003.1FA	303(d)	TN08010208007_0200	M	M	M	Once		1		
SMART001.0FA	303(d)	TN08010208007_0300	M	M	M	Once		1		
BMUDD014.1FA	303(d)	TN08010208007_2000	M	M	M	Once		1		
LITTL001.3FA	303(d)	TN08010208011_0100	M	M	M	Once	1			
BEAR009.6FA	303(d)	TN08010208011_2000	M	M	M					
CAMP001.9LE	303(d)	TN08010208033_0100	M	M	M					
CANE002.5LE	303(d)	TN08010208034_1000	M	M	M					
FLAT001.8TI	303(d)	TN08010208056_1000	M	M	M	Once	1			
MATHI004.6TI	303(d)	TN08010208065_1000	M	M	M	Once	1			
RICHL001.8TI	303(d)	TN08010208073_1000	M	M	M	Once	1			
TOWN002.3TI	303(d)	TN08010208896_1000	M	M	M					
LOOSA005.0SH	Ambient	TN08010209001_1000	M	Q	Q					
LOOSA1C28.6SH	Ambient	TN08010209004_1000	M	Q	Q					
LOOSA1C53.6FA	Ambient	TN08010209011_2000	M	Q	Q					
WOLF000.7SH	Ambient	TN08010210001_1000	M	Q	Q					
WOLF031.4SH	Ambient	TN08010210003_1000	M	Q	Q					
WOLF072.6FA	Ambient	TN08010210009_2000	M	Q	Q					
NONCO001.8SH	Ambient	TN0801021100711_1000	M	Q	Q					
BMUDD7.2T0.6HY	ANTIDEG	TN08010208007_0400	M	M	M	Once	1			
HATCH009.1TI	Watershed Monitoring	TN08010208001_1000	M	M	M					
HATCH038.6TI	Watershed Monitoring	TN08010208001_2000	M	M	M					
HATCH040.0TI	Watershed Monitoring	TN08010208001_2000	M	M	M					
HATCH055.0TI	Watershed	TN08010208001_3000	M	M	M					

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
	Monitoring									
HURRI000.4TI	Watershed Monitoring	TN08010208002_0900	M	M	M					
EFHUR000.1TI	Watershed Monitoring	TN08010208002_0910	M	M	M	Once	1			
PRICE002.2FA	Watershed Monitoring	TN08010208007_0100	M	M	M					
BENNE004.6CL	303(d)	TN05013101046_0200	MS	Once		Once		1		
BENNE005.2CL	303(d)	TN05013101046_0200	MS	Once		Once		1		
BURRE000.1CL	303(d)	TN05130101046_0200	MS	Once		Once		1		
DAN000.3CA	303(d)	TN05130101091_0123	MS	Once		Once		1		
SMOKY000.8SC	303(d)	TN05130104037_1800	MS	Q						
SMOKY002.5SC	303(d)	TN05130104037_1800	MS	Once		Once		1		
SMOKY006.8SC	303(d)	TN05130104037_1800	MS	Once		Once		1		
RHOUS001.2HS	303(d)	TN06010104004T_0600	MS							
ECO68A03	SEMN	TN05130104016_0100	MS	Q		SA	2	2	MS	MS
ROSE000.1CA	Surface mining	TN05130101015_0300	MS	Q						
TRACY000.2CL	Surface mining	TN05130101015_0500	MS	Q						
VALLE000.1CL	Surface mining	TN05130101015_0600	MS	Q						
STRAI000.1CL	Surface mining	TN05130101015_0700	MS	Q						
TACKE000.5CA	Surface mining	TN05130101015_0800	MS	Q						
CLEAR030.5CA	Surface mining	TN05130101015_2000	MS	Q						
PROCK001.0SC	Surface mining	TN05130104037_0300	MS	Q						
MONTG000.5SC	Surface mining	TN05130104037_0400	MS	Q						
BEECH000.2CA	Surface mining	TN05130104037_0600	MS	Q						
LIGIA000.5AN	Surface mining	TN05130104037_0700	MS	Q						
NEW008.8SC	Surface mining	TN05130104037_1000	MS	Q						
FECO69D01	Surface mining	TN05130104037_1300	MS	Q						

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
INDIA001.0AN	Surface mining	TN05130104037_1600	MS	Q						
NEW045.0AN	Surface mining	TN05130104037_2000	MS	Q						
STRAI001.9SC	Surface mining	TN05130104044_0500	MS	Q						
BUFFA000.1CL	Surface mining	TN05130104044_1000	MS	Q						
BUFFA004.2SC	Surface mining	TN05130104044_1000	MS	Q						
WILBU001.3SR	303(d)	TN05130201001T_0900	N			Once	1			N
BRUNL001.5WS	303(d)	TN05130201001T_1600	N			Once	1			N
DFORK001.2WS	303(d)	TN05130201001T_1700	N			Once	1			N
SSPRI000.1WS	303(d)	TN05130201011_0100	N			Once	1			N
BLACK000.9WS	303(d)	TN05130201013_0300	N	M	M	Once	1			N
NEAL000.1WS	303(d)	TN05130201021_0300	N	M	M	Once	1			N
BLOG000.6WS	303(d)	TN05130201021_0400	N	M	M	Once	1			N
RLICK019.4WS	303(d)	TN05130201021_2000	N	M	M	Once		1		N
RLICK021.0WS	303(d)	TN05130201021_3000	N	M	M	Once		1		N
LGOOS002.0TR	303(d)	TN05130201028_0100	N	M	M	Once	1			N
DRAKE5.3T0.4SR	303(d)	TN05130201047_0100	N			Once	1			N
DRAKE9.8T0.3SR	303(d)	TN05130201047_0200	N			Once	1			N
SINKI000.4WS	303(d)	TN05130201055_0200	N	M	M	Once	1			N
SINKI005.9WS	303(d)	TN05130201055_0250	N	M	M	Once	1			N
DUNBA000.3MT	303(d)	TN05130206002_0100	N			Once	1			N
ELK003.4RN	303(d)	TN05130206002_0200	N	M	M					N DONE
SPRIN001.3RN	303(d)	TN05130206002_0300	N	M	M					
BUZZA001.3RN	303(d)	TN05130206002_0400	N	M	M				N done	N done
SSPRI000.1MT	303(d)	TN05130206002_0700	N	M	M					
RED000.4MT	303(d)	TN05130206002_1000	N	M	M		1			N
RED010.7MT	303(d)	TN05130206002_2000	N	M	M		1			N
RED032.9RN	303(d)	TN05130206002_3000	N	M	M					N done

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
RED044.7RN	303(d)	TN05130206002_4000	N				2			N
RED049.0RN	303(d)	TN05130206002_5000	N	M	M					
CSPRI001.4RN	303(d)	TN05130206003_0100	N			Once	1			N
PEPPE000.4RN	303(d)	TN05130206003_0300	N			Once	1			N
BLACK000.4RN	303(d)	TN05130206003_1200	N			Once	1			N
CARR001.4RN	303(d)	TN05130206003_1300	N	M	M	Once	1			N
CARR10.4T0.3RN	303(d)	TN05130206003_1320	N	M	M					N DONE
CARR005.2RN	303(d)	TN05130206003_1350	N	M	M	Once	1			N
CARR010.0RN	303(d)	TN05130206003_1355	N	M	M					N DONE
BROWN000.4RN	303(d)	TN05130206003_1360	N	M	M	Once	1			N
SULPH023.2RN	303(d)	TN05130206003_3000	N	M	M					
SULPH023.3RN	303(d)	TN05130206003_4000	N	M	M	Once	1			N
SUMM008.6SR	303(d)	TN05130206024_0150	N			Once		1		N
NSPRI000.3MT	303(d)	TN05130206034_0300	N							
LWEST002.8MT	303(d)	TN05130206034_1000	N	M	M					N DONE
SPRIN003.0MT	303(d)	TN05130206039_0100	N	M	M					
SPRIN13.7T0.4MT	303(d)	TN05130206039_0110	N	M	M					
SPRIN009.8MT	303(d)	TN05130206039_0150	N	M	M	Once	1			N
WFRED005.0MT	303(d)	TN05130206039_1000	N	M	M					
ECO71I17	303(d)/Ecoregion	TN05130201013_3000	N	Q	M	SA	2	2	N	N
ECO71I12	303(d)/Ecoregion	TN05130201015_1000	N	Q	M	SA	2	2	N	N
CUMBE262.9WS	Ambient	TN05130201001_1000	N	Q	Q					
CUMBE174.5DA	Ambient	TN05130202001_2000	N	Q	Q					
STONE003.9DA	Ambient	TN05130203001_1000	N	Q	Q					
HARPE040.5CH	Ambient	TN05130204001_1000	N	Q	Q					

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
RED025.5MT	Ambient	TN05130206002_2000	N	Q	Q					
SULPH000.1RN	Ambient	TN05130206003_1000	N	Q	Q					
WFSTO006.2RU	Ambient	TN05130208018_1000	N	Q	Q					
ECO71H?? (new)	Ecoregion	TN05130201001T_0700	N	Q	Q	SA	2	2	N	N
ECO71H?? (new)	Ecoregion	TN05130201047_0500	N	Q	Q	SA	2	2	N	N
BARTO008.9WS	Ecoregion	TN05130201055_1000	N	M	M	Once	1			N
ECO71E14	Ecoregion	TN05130206002_0600	N	Q	Q					
ECO71E18	Ecoregion	TN05130206003_0500	N	Q	Q					
ECO71E19	Ecoregion	TN05130206003_1300	N	Q	Q					
ECO71E17	Ecoregion	TN05130206003_1500	N	Q	Q					
FECO71G02	FECO	TN051100020027_0499	N	Q	Q		2	2	N	N
ECO71F29	SEMN	TN06040003006_1000	N	Q	Q	SA	2	2	N	N
CFORK000.8SR	Watershed Monitoring	TN05110002008_0200	N			Once	1			N
DFORK000.2SR	Watershed Monitoring	TN05110002008_0300	N			Once	1			N
WFDRA042.6SR	Watershed Monitoring	TN05110002008_2000	N			Once	1			N
HOGAN000.1SM	Watershed Monitoring	TN05130201001T_1100	N			Once	1			N
PLUNK000.9SM	Watershed Monitoring	TN05130201001T_1300	N			Once	1			N
BARTO011.5WS	Watershed Monitoring	TN05130201005_2000	N			Once	1			N
SFCED000.1WS	Watershed Monitoring	TN05130201011_0500	N			Once	1			N
WILSO000.2WS	Watershed Monitoring	TN05130201011_0600	N			Once	1			N

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
CEDAR005.2WS	Watershed Monitoring	TN05130201011_1000	N			Once	1			N
SSPRI000.3WS	Watershed Monitoring	TN05130201013_0100	N			Once	1			N
SPRIN004.4WS	Watershed Monitoring	TN05130201013_1000	N			Once	1			N
SANDE000.1SM	Watershed Monitoring	TN05130201026_0500	N			Once	1			N
PEYTO002.7SM	Watershed Monitoring	TN05130201026_1000	N	M	M	Once	1			N
LICK000.5SM	Watershed Monitoring	TN05130201027_0100	N			Once	1			N
DIXON002.8SM	Watershed Monitoring	TN05130201027_1000	N			Once	1			N
LGOOS006.5TR	Watershed Monitoring	TN05130201028_0150	N			Once	1			N
MFGOO000.7TR	Watershed Monitoring	TN05130201028_0300	N			Once	1			N
CARR000.1MA	Watershed Monitoring	TN05130201028_0320	N			Once	1			N
GOOSE004.5TR	Watershed Monitoring	TN05130201028_1000	N	M	M	Once	1			N
DESHE000.4SR	Watershed Monitoring	TN05130201035_0100	N	M	M	Once	1			N
DFBLE001.0SR	Watershed Monitoring	TN05130201035_0200	N	M	M	Once	1			N
BFORK000.2SR	Watershed Monitoring	TN05130201035_0300	N			Once	1			N

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
BLEDS009.9SR	Watershed Monitoring	TN05130201035_1000	N	M	M	Once	1			N
LIBER001.3SR	Watershed Monitoring	TN05130201041_0100	N			Once	1			N
ECAMP005.0SR	Watershed Monitoring	TN05130201041_1000	N			Once	1			N
DRAKE007.4SR	Watershed Monitoring	TN05130201047_1000	N	M	M	Once	1			N
BDAM000.1RN	Watershed Monitoring	TN05130206003_0400	N			Once	1			N
SULPH000.1RN	Watershed Monitoring	TN05130206003_1000	N			Once	1			N
WARTR000.3RN	Watershed Monitoring	TN05130206003_1100	N			Once	1			N
SULPH032.2RN	Watershed Monitoring	TN05130206003_5000	N			Once	1			N
MAXWE000.1SR	Watershed Monitoring	TN05130206019_0100	N			Once	1			N
EMPSO000.2RN	Watershed Monitoring	TN05130206019_0320	N			Once	1			N
HONEY009.5RN	Watershed Monitoring	TN05130206019_0350	N			Once	1			N
SUMM000.8SR	Watershed Monitoring	TN05130206024_0100	N			Once		1		N
BUNTI000.4RN	Watershed Monitoring	TN05130206024_0200	N			Once	1			N
PINEY000.4MT	Watershed Monitoring	TN05130206034_0200	N			Once	1			N

STATION ID	PROJECT NAME	WATERBODY ID	EFO	CHEM FREQ	BACT FREQ	BENTH FREQ	BENTH SAMP METH BR	BENTH SAMP METH SQSH	ALGAE SAMP BY	HAB SAMP BY
PINEY009.6MT	Watershed Monitoring	TN05130206034_0200	N			Once	1			N
JORDA000.7MT	Watershed Monitoring	TN05130206034_0210	N			Once	1			N
JACK000.4HU	Watershed Monitoring	TN060400011000_0100	N			Once	1			N
TUMBL002.0HU	Watershed Monitoring	TN06040003060_1000	N			Once	1			N
PINHO000.4HU	Watershed Monitoring	TN06040005059_0500	N			Once	1			N

Table 10 provides the parameters list for each project for sampling. The *QSSOP for Chemical and Bacteriological Sampling of Surface Water* (TDEC, 2011) describes chemical and bacteriological sampling, field parameter readings, and flow measurement procedures. The *QSSOP for Macroinvertebrate Stream Surveys* (TDEC, 2011) describes protocols for collection of benthic macroinvertebrate samples and habitat assessment. The *QSSOP for Periphyton Stream Surveys* (TDEC, 2010) describes protocols for collection of periphyton sampling.

Table 10. Parameter List for the Water Column

Parameter	TMDLs				Ref. Sites ECO & FECO*	303(d)	Long Term Trend Stations	Watershed Sites
	Metals† /pH	DO	Nutrients	Pathogens				
Acidity, Total	X (pH)							
Alkalinity, Total	X (pH)				X	O	X	O
Aluminum, Al						O	X	O
Ammonia Nitrogen as N		X	X		X	O	X	O
Arsenic, As					X	O	X	O
Cadmium, Cd	X†				X	O	X	O
Chromium, Cr	X†				X	O	X	O
$CBOD_5$		X				O		O
Color, Apparent					X		X	
Color, True					X		X	
Conductivity (field)	X	X	X	X	X	X	X	X
Copper, Cu	X†				X	O	X	O
Cyanide, Cy							O	
Dissolved Oxygen (field)	X	X	X	X	X	X	X	X
Diurnal DO		X	X					
E. Coli				X	X	O	X	O
Flow	X	X	X	R	X	O	X	O
Iron, Fe	X†				X	O	X	O
Lead, Pb	X†				X	O	X	O
Manganese, Mn	X†				X	O	X	O
Mercury, Hg	X†					O	X	O
Nickel, Ni	X†					O	X	O
Nitrate + Nitrite		X	X		X	O	X	O
Orthophosphate			X					
pH (field)	X	X	X	X	X	X	X	X
Residue, Dissolved					X	O	X	O
Residue, Settleable						O	X	O
Residue, Suspended	X		X	X	X	O	X	O
Residue, Total						O	X	O
Selenium, Se	X				X	O	X	O
Sulfates					X (69de & 68a)	O	X	O
Temperature (field)	X	X	X	X	X	X	X	X
Total Hardness	X				X	O	X	O
Total Kjeldahl Nitrogen		X	X		X	O	X	O
Total Organic Carbon	X		X		X	O	X	O
Total Phosphorus (Total Phosphate)		X	X		X	O	X	O
Turbidity			X	X	X	O	X	O
Zinc, Zn	X†				X	O	X	O
Biorecon					X			X (or SQSH)
SQSH			X (or biorecon)		X	X (or biorecon)		
Habitat Assessment					X	X		X

Chlorophyll *a*		R	X (non-wadeable) or periphyton (wadeable)		Periphyton	O (required for nutrient)		

Optional (O) – Not collected unless the waterbody has been previously assessed as impacted by that substance or if there are known or probable sources of the substance. R – Recommended if time allows. † – Sample for pollutant on 303(d) List.

* These analyses are required for Ecosites and established FECO sites, not for candidate FECO sites.

G. Watershed Monitoring Projects [319(h) and 106 Grant Funds]

Selected watershed sites will be monitored as part of a watershed strategy integrating point and non-point sources of pollution. These sites and strategies are described more completely in specific 319(h) and 106 grant applications. TDEC's partnership with the Non-point Source Program at the Tennessee Department of Agriculture has resulted in several contracts being awarded to TDEC involving:

Watershed monitoring
Unified Watershed Assessment (UWA), designated watersheds monitoring
TMDL support

H. Macroinvertebrate Surveys

There are several levels of stream surveys undertaken by the division to fulfill various information needs. These surveys are a very important source of information for the 305(b) report, toxics monitoring, compliance and enforcement activities, and other division information needs.

In recent years, the division's general trend has been to standardize stream survey methodologies. The surveys performed recently have relied heavily on biological data instead of chemical data. The *QSSOP for Macroinvertebrate Stream Surveys* (TDEC, 2011) describes protocols for collection of benthic macroinvertebrate samples and habitat assessment. The Planning and Standards Section is responsible for the coordination of survey activities. Macroinvertebrate sampling is listed in Table 9.

A biological reconnaissance (Biorecon) is often performed when a brief visit to a stream is appropriate. The biorecon is a field based assessment that yields relatively small amounts of data in a short amount of time, These surveys can be used for a water quality assessment in which the presence or absence of clean water indicator organisms reflects the degree of support of designated uses.

An intensive survey, using a Single Habitat Semi-Quantitative Bank (SQBANK) or Single Habitat Semi-Quantitative Kick (SQKICK), is used wthen a quantifiable assessment of the benthic community is needed, Biometrics using relative abundance can be calculated. This method can be compared to the division's numeric translators for biocriteria. Both biorecon and intensive surveys are valuable when information beyond long-term trend monitoring is needed concerning a specific location.

I. Fish Tissue Monitoring

Fish tissue samples are often the best way to document chronic low levels of persistent contaminants. In the mid-1980's, sites were selected that had shown significant problems in the past and would benefit from regularly scheduled monitoring, one to five year cycle. A list of established fish tissue stations appears in Table 11. Parameters to be sampled are listed in Table 12. TDEC WPC, TVA, TWRA and DOE regularly meet to discuss fish monitoring for FY-15. Data from these surveys help the division assess water quality and determine the issuance of fishing advisories.

J. Stream and Reservoir Posting

The TDEC Commissioner is identified in the Tennessee Water Quality Control Act as having the authority to post bodies of water based on public health concerns. The Commissioner has delegated authority to the Director of the Division of Water Resources. This authority is carried out with assistance from TWRA and TVA. Bacteriological contamination is the major reason for posting a stream against water contact recreation. The major reason for posting a stream against the consumption of fish is bioaccumulation of carcinogens. The most current list of posted streams can be found in on http://tn.gov/environment/water/water-quality_publications.shtml
The list is also published in the 305(b) Report which is published every two years.

Table 11. Locations Of Fish Tissue Sampling Sites

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
BEECH000.5WE	Beech Ck	Beech Creek embayment	Metals, Organics, Dioxin, PCBS	2008	LAB
BEECH002.0WE	Beech Ck	U/S Morrison Creek	Organics, PCBS	1994	TDEC
BEECH036.0HE	Beech Res	Near Lexington	Metals	2013	TVA
BFORK002.5WA	Barren Fork Rv	Near Spring Cave McMinnville	Metals, Organics, PCBS	1995	TDEC
BFORK005.0FR	Tims Ford Res/Boiling Fork	Hwy 41 at Manchester	Metals, Organics, Dioxin, PCBS	1993	TDEC
BRADL000.0CE	Woods Res/Bradley Ck	Bradley Creek Embayment	PCBS	1989	TDEC
BRUMA000.0FR	Woods Res/Brumalow Ck	200' U/S old Brick Church Rd	Metals, Organics, PCBS	1999	TDEC
BSAND007.4HN	Kentucky Res/Big Sandy Rv	D/S Poplar Creek	Metals, Organics, PCBS	2014	LAB

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
BSAND015.1BN	Kentucky Res/ Big Sandy Rv	D/S of levee at dewatering area	Metals	2014	LAB
BSAND021.1BN	Kentucky Res/ Big Sandy Rv	U/S Hwy 641/70	Metals	2014	LAB
BSAND038.4BN	Kentucky Res/ Big Sandy Rv	Hwy 114	Metals	2014	LAB
BUFFA017.7PE	Buffalo Rv	Old Hwy 14 D/s Lobelville	Metals, Organics, PCBS	2011	TVA
BUFFA026.0PE	Buffalo Rv	U/S Lobelville STP	Metals	2008	TWRA
BUFFA041.0PE	Buffalo Rv	Hwy 412 Linden	Metals	2008	TWRA
BUFFA073.1WE	Buffalo Rv	Hwy 13 near Flatwoods	Metals	2008	TWRA
BUFFA098.1LS	Buffalo Rv	Hwy 99 near Oak Grove	Metals	2008	TWRA
CFORK028.0DB	Center Hill Res	near Center Hill Dam	Metals, Organics, PCBS	1993	TDEC
CFORK058.9DB	Center Hill Res	Hwy 70/ Sligo Bridge	Metals, Organics, Dioxin, PCBS	1994	TDEC
CHATT000.9HM	Chattanooga Ck	Rendering Plant	Metals, Organics, Dioxin, PCBS	1999	TDEC
CLINC001.2RO	Watts Bar Res/Clinch River	Near Kingston	Metals	2009	TWRA
CLINC002.3RO	Watts Bar Res/Clinch Rv	Brashear Island	Metals, Organics	2004	DOE
CLINC006.8RO	Watts Bar Res/Clinch Rv	U/S Young Creek	Metals	2003	TVA
CLINC008.0RO	Clinch Rv	2 mi d/s of Brashear Island	Metals	2009	TWRA
CLINC010.0RO	Watts Bar Res/Clinch Rv	D/S Gallaher Bridge	Metals	2009	TWRA
CLINC014.5RO	Watts Bar Res/Clinch Rv	U/S East Fork Poplar Creek	Metals	2003	DOE
CLINC017.9RO	Watts Bar Res/Clinch Rv	Grubbs Island	Metals	2003	DOE
CLINC019.0RO	Watts Bar Res/Clinch Rv	Jones Island	Metals, PCBs	2013	TVA
CLINC022.0RO	Watts Bar Res/Clinch Rv	U/S Hwy 321	Metals	2004	TVA
CLINC024.0RO	Melton Hill Res/Clinch Rv	1 mi U/S Melton Hill Dam	PCBS	2013	TVA

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
CLINC043.5AN	Watts Bar Res/Clinch Rv	Solway Bridge	Metals	2007	DOE
CLINC045.0AN	Melton Hill Res/Clinch Rv	Near Hwy 62	PCBS	2013	TVA
CLINC048.0AN	Melton Hill Res/Clinch Rv	Bull Run Steam Plant	Metals,	2004	DOE
CLINC080.0CA	Norris Res/Clinch Rv	Near Dam	Metals, Organics, Dioxin, PCBS	2015	TVA
CLINC120.5UN	Norris Res/Clinch Rv	Hwy 33	Metals	2008	TWRA
CLINC125.0CL	Norris Res/Clinch Rv	D/S Straight Creek	Metals	2015	TVA
CLINC128.0CL	Clinch Rv	Black Fox Area	Organics, PCBS	2009	TWRA
CLINC172.4HK	Clinch Rv	D/S Swan Island	Metals, Organics, PCBS	2015	TVA
CUMBE185.7DA	Cheatham Res/Cumberland Rv	Bordeaux Bridge	Metals, Organics, Dioxin, PCBS	2007	TDEC
CUMBE191.1.DA	Cheatham Res/Cumberland Rv	Shelby Street Bridge	Metals, Organics, PCBS, Dioxin	2007	TDEC
CUMBE216.2DA	Old Hickory Res/Cumberland Rv	Near dam	Metals, Organics, Dioxin, PCBS	1993	TDEC
DUCK002.0HU	Kentucky/Duck Rv	Embayment	Metal, Organics, PCBS	2008	TWRA
DUCK026.0HU	Duck Rv	D/S Tumbling Creek	Metal, Organics, PCBS	2011	TVA
DUCK032.2HI	Duck Rv	Hwy 22 near Only	Metal, Organics, PCBS	2008	TWRA
DUCK064.0HI	Duck Rv	Hwy 50, D/S Centerille	Metal, Organics, PCBS	2008	TWRA
DUCK113.9MY	Duck Rv	Hwy 50 @ Williamsport	Metal, Organics, PCBS	2008	TWRA
DUCK249.5CE	Normandy Res/Duck RV	Near dam		2014	LAB
DUCK255.1CE	Normandy Reservoir	Near pumping station	Hg,Se	2014	LAB
EFPOP007.0RO	East Fork Poplar Ck	U/S Gum Hollow Road	Metals, Organics, Dioxin, PCBS	1998	TDEC

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
ELK036.5GS	Elk Rv	Prospect	Metals, Organics, PCBS	2008	TDEC
ELK041.5GS	Elk Rv	d/s Richland Creek at Hanna Ward Bridge		2014	LAB
ELK077.1LI	Elk Rv	Off Hwy 273 D/S Fayettville	Metals, Organics, PCBS	2008	TDEC
ELK135.0FR	Tims Ford Res/Elk Rv	Near Marble Plains	Hg, Se	2014	LAB
ELK150.0FR	Tims Ford Res/Elk Rv	Hwy 41, Maple Bend	Hg, Se	2014	LAB
ELK176.0FR	Woods Res/Elk Rv	Near Hwy 127 causeway	Metals, Organics, PCBS	1999	TDEC
EMORY021.4MG	Emory Rv	Camp Austin Bridge Deermont Rd	Mercury, PCBs	2013	TVA
EMORY027.7MG	Emory Rv	Nemo Br	Mercury	2008	TWRA
FBROA051.0JE	Douglas Res/French Broad Rv	Near Indian Creek and Douglas Estates	Metals, Organics, PCBS	2008	TVA
FBROA061.0CO	Douglas Res/French Broad Rv	Taylor Bend D/S Allen Ck	Dioxin	1993	TDEC
FBROA071.4CO	Douglas Res/French Broad Rv	Rankin Bridge	Metals, Organics, Dioxin, PCBS	2007	TDEC
FBROA077.5CO	French Broad Rv	Hwy 321 bridge at junction with Hwy 160 NE of Newport	Metals	2008	TVA
FBROA083.5CO	French Broad Rv	Hwy 70 east of Newport	Metals, Organics, Dioxin, PCBS	2008	TDEC
FBROAD033.0SV	Douglas Res/French Broad Rv	Near dam	Metals, Organics, Dioxin, PCBS	2008	TWRA
FWATE005.2PU	Center Hill Res/Falling Water Rv	U/S Cookeville Boatdock	Metals, Organics, PCBS	1993	TDEC
GREEN011.0WE	Green Rv			2008	TWRA
HARPE110.7WI	Harpeth Rv	D/S General Smelting	Metals	1999	TDEC
HATCH001.2TI	Hatchie Rv		Metals, Organics, PCBS	2007	TWRA

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
HIWAS007.4ME	Chickamauga Res/Hiwassee Rv	Bridge on TN Hwy 58	Metals, Organics, PCBS	2012	TVA
HIWAS012.0BR	Chickamauga Res/Hiwassee Rv	Near Rogers Ck	Metals	1990	TVA
HIWAS015.4MM	Chickamauga Res/Hiwassee Rv	I-75, D/S/ Bowaters	Metals, Organics, Dioxin, PCBS	2007	TDEC
HIWAS018.6MM	Chickamauga Res/Hiwassee Rv	U/S Hwy 11 Bridge	Metals, Organics, Dioxin, PCBS	2008	OCEAN
HIWAS037.0PO	Hiwassee Rv	Patty Station Rd	Metals	2012	TVA
HIWASS057.5PO	Hiwassee Rv	Mouth of Coker Creek	Metals	2013	LAB
HOLST055.0GR	Holston Rv	forebay	Metals	2013	TVA
HOLST076.0HA	Holston Rv	Mid-reservoir	Metals	2013	TVA
HOLST097.5HS	Holston Rv	Cherokee Lake at Malinda Br		2009	TWRA
HOLST118.7HS	Holston Rv	U/S Cox Island Near Surgoinsville	Metals	2013	TVA
HOLST121.0HS	Holston Rv	Phipps Bend	Metals	2007	TWRA
HOLST131.5HS	Holston Rv	Near Goshen Valley bridge	Metals	2007	TWRA
HOLST135.0HS	Holston Rv	D/S Holston Army Ordinance near Goshen Valley	Metals, Organics, Dioxin, PCBS	2007	TDEC
LITTL001.0BT	Fort Loudon/Little River	Near East Topside Road	Metals, Organics, Dioxin, PCBS	1993	TDEC
LOOSA001.5SH	Loosahatchie Rv	Benjestown Road	Metals, Organics, Dioxin, PCBS	1997	TDEC
LOOSA005.0SH	Loosahatchie Rv	Watkins Rd	Metals, Organics, Dioxin, PCBS	1998	TDEC
LOOSA017.0SH	Loosahatchie Rv	Hwy 14	Metals, Organics, Dioxin, PCBS	1998	TDEC
LSEQU001.3MI	Little Sequatchie Rv	Hwy 28 Bridge	Hg, Se	2014	LAB
LSEQU009.0MI	Little Sequatchie Rv	Off Coppinger Cove Rd at RM 9.0	Hg, Se	2014	LAB
LTENN001.0LO	Tellico Res/Little Tennessee River	At dam	Metals, Organics, PCBS	2009	TVA

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
LTENN015.0LO	Tellico Res/Little Tennessee River	U/S Baker Creek	Metals, Organics, PCBS	2009	TVA
MCKEL001.8SH	McKellar Lake	McKellar Lake	Metals, Organics, Dioxin, PCBS	2006	TWRA
MISSI724.6SH	Mississippi Rv	Memphis South Plant	Metals, Organics, Dioxin, PCBS	2007	TWRA
MISSI735.0SH	Mississippi Rv	I-40	Metals, Organics, Dioxin, PCBS	2006	TWRA
MISSI754.0TI	Mississippi Rv	Meeman-Shelby S.P.	Metals, Organics, Dioxin, PCBS	1998	TWRA
MISSI786.0LE	Mississippi Rv	Osceola	Metals, Organics, Dioxin, PCBS	2008	TWRA
MISSI817.8LE	Mississippi Rv	Blytheville	Metals, Organics, Dioxin, PCBS	2008	TWRA
MISSI838.5LA	Mississippi Rv	I-55 near Caruthersville	Metals, Organics, Dioxin, PCBS	2008	TWRA
MISSI873.0LA	Mississippi Rv	Tiptonville	Metals, Organics, Dioxin, PCBS	2006	TWRA
NFFDE009.8DY	North Fork Forked Deer Rv	Hwy 412 Linden	Metals	2008	TDEC
NFFDE020.5DY	North Fork Forked Deer Rv	Hwy 104	Metals, Organics, PCBS	2008	TDEC
NFHOL004.6SU	North Fork. Holston Rv	Brat Cloud Ford	Metals	2013	TVA
NOLIC008.5HA	Nolichucky Rv	Hurley Island	Hg, Se	2014	LAB
NOLIC072.5WN	Nolichucky Rv	Jonesboro Water Plant Intake	Metals, Organics, PCBS	1992	TDEC
NOLIC097.5UC	Nolichucky Rv	Chestoa Bridge	Hg, Se	2014	LAB
OBED021.1CU	Obed River	Potters Bridge		2010	TWRA
OBEY008.0CY	Dale Hollow Res/Obey Rv	Near dam	Organics, Dioxin, PCBS	1993	TDEC
OBION002.0DY	Obion River	Near Hwy 181	Metals, Organics, Dioxin	2007	TWRA
OCOEE012.5PO	Parksville Res/Ocoee Rv	Near dam (Ocoee # 1)	Metals, Organics	2015	TVA
OCOEE014.0PO	Parksville Res/Ocoee Rv	Near FR 17 (Ocoee #1)	Metals, Organics	1992	TDEC

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
OCOEE031.0PO	Parksville Res/Ocoee Rv	Near Tumbling Creek Ocoee #3	Metals, Organics, Dioxin, PCBS	1994	TDEC
PIGEO007.6CO	Pigeon Rv	Tannery Island u/s of Newport	Hg, Se 106 organics, dioxin	2014	LAB
PIGEO008.2CO	Pigeon Rv	Tannery Island	Metals, Organics, Dioxin, PCBS	2008	TWRA
PIGEO016.5CO	Pigeon Rv	Denton Greasy Cove Road	Hg, Se 106 organics, dioxin	2014	LAB
PIGEO024.7CO	Pigeon Rv	Waterville Powerhouse	Hg, Se 106 organics, dioxin	2014	LAB
POPLA000.1RO	Watts Bar Res/Poplar Ck	Watts Bar Embayment D/S DOE-25 plant	Metals, Organics, PCBS	1998	TDEC
POWEL030.0UN	Norris Reservoir/Powell Rv	Stiners Woods	Metals	2015	TVA
POWEL065.5CL	Norris Reservoir/Powell Rv	Gaging station off river rd u/s Hwy 25 bridge		2015	TVA
REELF00002LA	Reelfoot Lake	Rays Camp	Metals, Organics, Dioxin	1993	TDEC
REELF000030B	Reelfoot Lake	Indian Creek Embayment	Metals, Organics, Dioxin	1993	TDEC
REELF000050B	Reelfoot Lake	Walnut Log Ditch	Metals, Organics, Dioxin	1993	TDEC
RICHL024.3GS	Richland Creek	Pulaski, U/S Lowhead dam and STP	Metals	2008	TDEC
ROLLI000.0FR	Woods Res/Rollins Ck	Embayment	Metals, Organics, Dioxin, PCBS	2008	TDEC
SEQUA006.3MI	Sequatchie River	Valley Ebenezer Road		2011	TVA
SEQUA023.0MI	Sequatchie River	Near Whitwell	Metals	2008	TDEC
SEQUA048.8SE	Sequatchie River	Hwy 111 near Dunlap	Metals	2008	TDEC
SFHOL001.1SU	South Fork Holston River	Ridgefields Bridge in Kingsport	Metals, Organics, Dioxin, PCBS	2008	TDEC
SFHOL002.9SU	South Fork Holston River	Hwy 126 bridge near Kingsport	Metals, Organics, Dioxin, PCBS	2008	TDEC
SFHOL007.7SU	South Fork Holston River	D/S Ft. Patrick Henry Dam	Metals, Organics, Dioxin, PCBS	1998	TDEC

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
SFHOL008.5SU	Ft. Patrick Henry Res/South Fork Holston Rv	Ft. Patrick Lake at Dam	Metals, Organics, PCBS	2009	TVA
SFHOL018.8SUB	Boone Res/South Fork Holston Rv	Dam	Metals, Organics, Dioxin PCBS	2009	TVA
SFHOL022.5SU	Boone Res/South Fork Holston Rv	Mouth of Wagner Creek	Metals, Organics, Dioxin, PCBS	2007	TDEC
SFHOL027.0SU	Boone Res/South Fork Holston Rv	South Holston Arm/ U/S Devault Road Bridge	Metals, Organics, Dioxin, PCBS	2009	TVA
SFHOL050.0SU (51.)	South Fork Holston	South Holston Lake Dam	Metals	2013	TVA
SFHOL062.7SU (62.5)	South Fork Holston	TN/VA line over South Holston Lake	Metals,	2013	TVA
TENNE085.0HU	Kentucky/Tennessee Rv	D/S Turkey Creek (and transition QA)	Metals, Organics, PCBS	2008	TVA
TENNE097.0HU	Kentucky/Tennessee Rv	D/S Dupont-Johnsonville Plant	Metals, Organics, Dioxin, PCBS	2008	TDEC
TENNE200.0HD	Kentucky/Tennessee Rv	Near Hamburg and Inflow QA	Metals, Organics, PCBS	2008	TVA
TENNE206.7HD	Tennessee River	Pickwick Forebay		2015	TVA
TENNE230.0_AL	Tennessee River			2011	TVA
TENNE417.1MI	Guntersville/Tennessee Rv	South Pittsburg Waterworks Intake	Metal, Organics, PCBS	1992	TDEC
TENNE425.5MI	Nickajack Res/Tennessee Rv	Near dam	Metals, Organics, PCBS	2015	TVA
TENNE457.2HM	Nickajack Res/Tennessee Rv	D/S Moccasin Bend WWTP	Metals, Organics, Dioxin, PCBS	2004	TVA
TENNE469.0HM	Nickajack Res/Tennessee Rv	Tailwater	Metals, Organics, PCBS	2015	TVA
TENNE472.3HM	Chickamauga Res/Tennessee Rv	Chickamauga Forebay near lighted buoy	Metals, Organics, Dioxin, PCBS	2009	TVA
TENNE489.8HM	Chickamauga Res/Tennessee Rv	Opossum Ck Light	Metals, Organics, PCBS	2009	TVA

STATION ID	RESERVOIR NAME/STREAM NAME	LOCATION	PARAMETER	LAST FY SAMPLED	SAMPLING AGENCY
TENNE518.0ME	Chickamauga Res/Tennessee Rv	Hwy 30	Metals, Organics, PCBS	2009	TVA
TENNE529.5HM	Chickamauga Res/Tennessee Rv	Below Watts Bar Dam	Metals, Organics, PCBS	2003	TVA
TENNE531.0RH	Watts Bar Res/Tennessee Rv	Near dam	Metals, PCBS	2013	TVA
TENNE560.8RO	Watts Bar Res/Tennessee Rv	Near Bullet Branch	Metals, PCBS	2012	TVA
TENNE600.0LO	Watts Bar Res/Tennessee Rv	D/S/ Ft. Loudon/Tellico Reservoirs near Lenoir City	Metals, PCBS	2013	TVA
TENNE602.0LO	Watts Bar Res/Tennessee Rv	Ft. Loudon dam tailrace	Metals, Organics, PCBS	2007	TWRA
TENNE604.0LO	Ft. Loudoun Res/Tennessee Rv	Forebay	Metals, Organics	2011	TVA
TENNE624.6KN	Ft. Loudoun Res/Tennessee Rv	D/S Lackey Creek near Lakeview	Metals, Organics, PCBS	2011	TVA
TENNE643.3KN	Ft. Loudoun Res/Tennessee Rv	Marine Base	Metals, Organics, Dioxin, PCBS	1999	TDEC
TENNE652.0KN	Ft. Loudoun Res/Tennessee Rv	D/s Confluence French Broad River	Metals, Organics, PCBS	2011	TVA
WATAU003.0SU	Boone Res/Watauga Rv	Watuaga arm near Deerlick Bend	Metals, Organics, Dioxin, PCBS	2007	TDEC
WATAU006.0SUB	Boone Res/Watauga Rv	Watauga Rv Arm At Pickens Bridge	Metals, Organics, PCBs	2009	TVA
WATAU036.6CT (37.4)	Watauga Rv	Watauga Lake at dam (forebay)	Metals	2013	TVA
WATAU045.6JO (45.5)	Watauga Rv	Near Elk River Embayment (mid reservoir)	Metals,	2013	TVA
WOLF000.5SH	Wolf Rv	North Plant Pipe crossing	Organics, PCBS	1992	TDEC
WOLF001.5SH	Wolf Rv	Hwy 51	Metals, Organics, Dioxin, PCBS	2007	TWRA
WOLF009.3SH	Wolf Rv	Hwy 14	Metals, Organics, Dioxin, PCBS	1998	TWRA
WOLF015.3SH	Wolf Rv	Walnut Grove Road	Organics	1992	TDEC

Table 12. Analyses For Fish Tissue

Parameter		Parameter		Parameter
Weight (Pounds)		Chlordane, total		Methoxychlor
Length (Inches)		CIS Chlordane		Dioxins
Lipid Content (Percent)		Trans Chlordane		Selenium
PCBs		CIS Nonachlor		Zinc
Aldrin		Trans Nonachlor		Furans
Dieldrin		Alpha BHC		
DDT, total		Gamma BHC		
O, P - DDE		Hexachlorobenzene		
P, P - DDE		Arsenic		
O, P - DDD		Cadmium		
P, P - DDD		Chromium		
O, P - DDT		Copper		
P, P - DDT		Mercury		
Endrin		Lead		

* Fish Tissue results reported in mg/kg (ppm), wet weight. Analyzed by Tennessee Department of Health (TDH), Laboratory Services or a contract laboratory.

K. Sediment Sampling

The division collected a considerable number of sediment samples from 1984 - 1994. However, analysis of the data has been handicapped by a lack of sediment criteria. When criteria become more available, analysis of sediment samples will be a more widely used component of long-term trend monitoring. During FY-15, sediment samples will be collected on an as-needed basis.

L. Tennessee Headwater Reference Stream Project (106 Supplemental Grant)

Project Description

Tennessee has established macroinvertebrate and nutrient guidelines for narrative criteria for assessing wadeable streams throughout the state based on reference stream monitoring in each of 25 ecoregions. The reference streams were generally 3rd order or larger and are not appropriate for comparison to headwater streams. This study proposes to identify and monitor first and second order reference streams in 13 Tennessee bioregions to aid in development of biological and nutrient criteria guidelines in headwater streams.

These guidelines will be used to assess headwater streams for the 305(b) report and 303(d) list, locate exceptional headwater streams through the anti-degradation process, provide information for point-source discharge and aquatic resource alteration permits as well as provide information for TMDL studies. The study will also help Tennessee achieve three of its nutrient criteria workplan goals (develop nutrient criteria guidelines for headwater streams, develop associated biological criteria for headwater streams, add a second biological indicator group (periphyton) to nutrient and biological criteria.

Project Goals

Establish a minimum of 77 headwater reference streams in 13 Tennessee bioregions over a five-year period.

Collect and analyze nutrient, habitat, dissolved oxygen, pH, temperature, specific conductance, flow, macroinvertebrate during two seasons at each station in accordance with the five year watershed cycle. Collect and analyze periphyton data once during the growing season.

Determine appropriate sampling seasons for headwater streams in various bioregions.

Determine appropriate biological metrics for assessment of headwater streams.

Develop macroinvertebrate and periphyton indices appropriate for assessment of headwater streams, thereby achieving two of the state's nutrient criteria development workplan goals.

Calculate background nutrient levels typical for headwater streams in various Tennessee ecoregions, thereby achieving one of the state's nutrient criteria development workplan goals.

Utilize the project to help meet departmental public outreach goals.

Specific Objectives for the Project Goals

Establish a minimum of 77 headwater reference stations in 13 bioregions. The following criteria will be used for site selection. Table 13 lists the possible station ids and huc codes.

Streams are first or second order and less than 2 square mile drainage.

Stream type, flow regime and substrate are typical of the bioregion. Perennial streams will be targeted except in those ecoregions where the majority of headwater streams are intermittent.

Streams are in a protected watershed or upstream land-use is primarily forested.   In heavily urban or agricultural bioregions, stations will be selected where upstream watershed is least disturbed and is comparable to percent forested of larger established reference streams.

The upstream watershed does not contain a municipality, mining area, permitted discharger and is not heavily impacted by nonpoint source or other non-regulated source of pollution.

Upstream drainage is at least 80% within a single ecoregion.

The stream flows in its natural channel. There are no flow or water level modification structures such as dams, irrigation canals or field drains.

No power lines or pipelines or any structure that is routinely cleared crosses upstream of the monitoring station.

The upstream watershed contains few or no roads.

For each station to be included in the study, obtain permission to sample (if on private land) and establish stations.

Determine most appropriate seasons for biological monitoring of headwater streams. Document seasonal variation.

Collect chemical, physical, stream flow and biological data at each station in two seasons over a five-year periods in accordance with watershed cycle. Approximately 16 sites will be sampled each year (2 in each of 8 field offices). All sampling and surveys will be conducted by DWR staff in accordance with the TDEC QSSOPs for macroinvertebrate and chemical monitoring, and the QAPP for 106 monitoring.

Collect a Semi-Quantitative Single Habitat (SQSH) macroinvertebrate sample during two seasons where continuous flow has occurred for at least five weeks and an established macroinvertebrate community is present.

Collect a genus-level biorecon macroinvertebrate sample during two seasons where continuous flow has occurred for at least five weeks and an established macroinvertebrate community is present.

Collect a periphyton sample (soft algae and diatoms) once during the growing season in conjunction with biological and nutrient samples.

Complete a habitat assessment twice in conjunction with macroinvertebrate samples.

Collect biannual chemical samples and measure field parameters and flow twice in conjunction with biological monitoring. Field parameters to include dissolved oxygen, pH, specific conductance, and temperature. Chemical parameters to be analyzed in the lab include total phosphorus, nitrate+nitrite, ammonia, total kjeldahl nitrogen, total organic carbon and suspended solids.

Project data will be placed in the divisions Access Water Quality database and another database being developed.

All sampling, plus QA/QC work, will be completed in a manner consistent with the department's published monitoring QAPP and SOP documents. Sampling at 10% of the sites will be duplicated. Field blanks and trip blanks will be collected at 10% of the sites.

5. Analyze chemical and biological data.

Chemical sample analyses will be completed by the state environmental laboratory following approved TDH SOP and will include required quality assurance protocols.

Macroinvertebrate sample analyses will be completed by the state environmental laboratory following the approved TDEC QSSOP and QAPP and will include required quality assurance protocols.

Periphyton samples will be sub-contracted to an outside expert through the state laboratory. If, during the five-year period, the state laboratory gains expertise in periphyton analyses, samples will be analyzed at the state laboratory.

Develop biological and nutrient criteria translators for narrative criteria associated with headwater streams in each of the state's bioregions (thirteen).

Develop family and genus level biorecon guidelines based on a minimum of three qualitative metrics for each bioregion.

Determine the most sensitive biometrics to various pollution types and develop a multi-metric index specific to headwater streams based on a minimum of seven metrics for semi-quantitative macroinvertebrate samples in each bioregion.

Develop a periphyton index for headwater streams in each bioregion (will be dependent on assistance from outside experts that is not included in this grant request). At a minimum, reference taxonomic lists and biometric scores for each bioregion will be developed.

Nutrient guidelines based on reference total phosphorus and nitrate+nitrite levels will be determined for headwater streams in each bioregion and/or nutrient region.

Develop habitat assessment guidelines (total score and parameter specific) in each bioregion in headwater streams.

Utilize the project to help meet departmental public outreach goals.

Provide public information concerning project results. Progress reports and a final project report will be published. Additionally, project findings will be incorporated into other division publications such as the 303(d) list and 305(b) report.

Published results will be available in hard copy and on the department's website.

Results will be presented at professional meetings including the Tennessee Water Resources Symposium and the Southeastern Water Pollution Biologists Association.

Timeline:

July 2008 – June 2009	Locate and monitor headwater reference streams in Group 3 watersheds.
December 2009	Complete analyses of all Group 3 biological and chemical samples.
July 2009 – June 2010	Locate and monitor headwater reference streams in Group 4 watersheds.
December 2010	Complete analyses of all Group 4 biological and chemical samples.
July 2010 – June 2011	Locate and monitor headwater reference streams in Group 5 watersheds.
December 2011	Complete analyses of all Group 5 biological and chemical samples.
July 2011 – June 2012	Locate and monitor headwater reference streams in Group 1 watersheds.
December 2012	Complete analyses of all Group 1 biological and chemical samples.
July 2012 – June 2013	Locate and monitor headwater reference streams in Group 2 watersheds.
December 2013	Complete analyses of all Group 2 biological and chemical samples.
January 2014 – April 2014	Complete selection of biometrics and analysis of seasonal variations. Develop guidelines for biorecons, SQSH, habitat and nutrients for each bioregion. Compile regional species lists and biometrics for periphyton samples.
June 2014	Submit draft report for peer review.
September 2014	Complete final report.

Table 13. Candidate first order ecoregion reference sites updated 9-5-13 (7-3-14)

Station Id	Watershed	Group	EFO	Stream	Monitoring Status
FECO65E01				Dropped	Dropped
FECO65E02				Dropped	Dropped 6-16-09
FECO65E03	06040001	3	J	Dabbs Creek UT to UT.	Monitored FY09
FECO65E04	06040001	3	J	Cub Creek UT	Monitored FY09
FECO65E05	08010207	4	J	Tuscumbia River UT	Monitoring FY15
FECO65E06	08010205	1	J	Little Sugar Creek	Monitored FY12
FECO65E07	08010204	2	J	Little Piney Creek	**Monitoring FY-15**
FECO65J01	06030005	2	J	Haw Branch	**Monitored FY-13**
FECO65J02	06040001	3	J	Horse Creek UT	Monitored FY09
FECO65J03	06040001	3	J	English Creek	Monitored FY09.
FECO66D01	06010103	1	JC	Black Branch	Monitored FY12.
FECO66D06	06010108	5	JC	Tumbling Creek	Monitored FY10-11
FECO66D07	06010103	1	JC	Little Stony Creek	Monitored FY12.
FECO66E01	06010108	5	JC	UT to Clarks Creek in Hell Hollow.	Monitored FY11
FECO66E02	06010103	1	JC	Dye Leaf Branch	Monitored FY12.
FECO66E03	06010102	2	JC	Birch Branch	Spring Completed?
FECO66F01	06010103	1	JC	Laurel Creek UT in Negro Grave Hollow	Monitored FY13
FECO66F02	Any	Any	JC	To be named	FY13 change to FY14 any watershed
FECO66F03	06010201	2	K	Wolf Creek	Monitored FY-13
FECO66G01	06010204	3	K	Indian Branch	Monitored FY09, 2014
FECO66G02	06010107	5	K	Texas Branch	Monitored FY11.
FECO66G03	06010201	2	K	Laurel Cove Creek	Monitored FY 13
FECO66G04	06020003	1	CH	Tumbling Creek UT	Monitored FY12
FECO66G05	06020003	1	CH	Rock Creek	Monitored FY-13
FECO66J01	06020002	2	CH	Negro Creek UT at Hwy 68 and New Stansbury Rd	Monitored FY12
FECO66J02	06020002	2	CH	Negro Creek UT at Hwy 68 and Cedar Spring Rd	Monitored FY12.
FECO66J03	06020002	2	CH	Turtletown Creek UT	Monitored FY -13

FECO67F01	06010205	4	JC	Clinch River Unnamed Trib – dropped 6-30-11	Monitoring FY 11-12. May be atypical.
FECO67F02	06010207	3	K	Mill Creek	Monitored FY09, 2014
FECO67F03	03150101	1	CH	Council Spring	Monitored FY11
FECO67F04	06010206	4	JC	Sutton Branch	Monitoring FY12
FECO67F05	06010201	1	K	Cave Spring Branch	Monitored FY12
FECO67F06	Any		JC	To be named	Replacement for FECO67F01 FY14
FECO67G01	Any		JC	To be named	FY14 any watershed
FECO67G02	06010105	5	K	French Broad River Unnamed Trib in Reed Hollow	Dropped
FECO67G03	Any		JC	To be named	FY14 any watershed
FECO67G04	06020002	1	CH	Taylor Branch	Monitored FY12
FECO67G05			K	TBD	FY-14
FECO67G11	06010102	2	JC	North Prong Fishdam Creek	FY13 Status?
FECO67H01	06020001	3	CH	Taliaferro Branch	Monitored FY11
FECO67H04	06020002	2	CH	Blackburn Creek	Monitored FY-13
FECO67H08	06010104	4	JC	Parker Creek	Monitored FY10.
FECO67I01	06020002	3	CH	Acre springs Branch	Monitored FY11.
FECO67I02	06020002	3	CH	Oostanaula UT.	Monitored FY11.
FECO67I12	06010207	3	K	Mill Branch	Monitored FY09, 2014
FECO68A01	06010208	1	K	Douglas Branch	Monitored FY12
FECO68A02	05130107	4	CK	Armstrong Creek	Monitored FY-13
FECO68A03	06010208	1	CK	South Fork Elmore Creek	Monitored FY-13, not benthics stream dry
FECO68A04	06010208	1	CK	Crabapple Creek	Monitored FY-13
FECO68A05	05130107	3	CK	Lick Creek	Monitored FY-13
FECO68B01	06020004	5	CH	Blue Spring	Monitored FY11.
FECO68B02	06020004	5	CH	Clear Spring Branch	Monitored FY11.

FECO68B03	06020004	5	CH	Little Creek UT	Too shallow to sample Fall 10; sampling to begin 2011. Upstream drainage not in 68b. Dropped 5-16-11 Replace if possible.
FECO68B04	06020004	5	CH	Daniel Creek	Monitored FY12
FECO68C01	06030001	5	CL	Crow Creek UT	Monitored FY12
FECO68C02	06020004	2	CH	Coops Creek	Monitored FY-13
FECO68C12	06020001	4	CH	Ellis Gap Branch	Monitoring in FY15.
FECO69D01	05130104	4	SM	New River UT	Monitored FY10. No BR due to small stream size FY -13
FECO69D02	05130104	4	SM	Dropped	Existing station created by SM for antideg. Dropped due to dangerous access.
FECO69D03	06010205	4	SM	Bear Branch	Monitored FY10
FECO69D04	05130104	4	SM	Wheeler Creek UT	Monitored FY10
FECO69E01	06010205	4	SM	Titus Creek Unnamed Tributary	Monitored FY 11-12.
FECO69E02	05130105	4	SM	Davis Creek U T	Monitored FY11-12.
FECO69E03	05130105	4	SM	Tackett Creek UT	Monitored FY11-12
FECO71E01	05130206	4	N	Sulphur Fork UT	Monitored FY10. Dropped as candidate. Need replacement.
FECO71E02	05130206	4	N	Savage Branch	Monitored FY-10.
FECO71E03	05130206	4	N	Brush Creek	Monitored FY-10.
FECO71F01	06040003	3	CL	Little Swan Creek UT	Monitored FY-10.
FECO71F02	06040004	3	CL	Wolfpen Branch	Monitored FY-12,FY-14
FECO71F03	06040003	3	N	Ethridge Hollow	Monitored FY-09, FY-14
FECO71F04	05130202	5	N	Little Marrowbone Creek UT	Monitored FY-11. Scoured by major flooding. Put on inactive status till recovery.
FECO71F05	05130204	1	N	Kelly Creek	Monitored FY12.
FECO71F06	05130202	5	N	Marks Creek	Monitored FY11-12
FECO71G01	05130106	4	CK	Flat Creek	Monitored FY11.
FECO71G02	05110002	4	N	Long Fork UT	Monitoring FY-15
FECO71G03	05130108	2	CK	Town Creek UT	Monitored FY-13
FECO71G04	06030003	2	CL	Neal Creek	Monitored FY-13
FECO71G05	06030002	2	CL	Mason Branch	Monitored FY-13.

FECO71H01	06030002	3	CL	Riley Creek UT	Monitorin FY-15
FECO71H02	05130203	1	CK	UT East Fork Stones River	Monitored FY-12
FECO71H03	05130203	1	N	Haws Spring Fork	Monitored FY12-13.
FECO71H04	05130108	2	CK	Wilmouth Creek UT	Monitored FY-13
FECO71H05	06030003	2	CL	Hurricane Creek	Monitored FY-13
FECO71I01	06040002	3	CL	Caney Creek	Monitoring FY-15
FECO71I02	05130201	4	N	Young Branch	Monitored FY10, FY-14
FECO71I03	05130203	1	N	McKnight Branch UT	Monitored FY12
FECO71I04	05130203	1	N	East Fork Hurricane Creek	Monitored FY-13.
FECO71I05	05130203	1	N	West Fork Stones River	Dropped
FECO71I06	05130201	4	N	Cedar Creek UT	Monitored FY13
FECO73A01	08010202	5	J	Bayou Duchien UT	Monitored FY13
FECO73A02	08010100	5	J	To be named	Nothing identified. Headwater streams < 2 sq appear to be highly intermittent in this ecoregion.
FECO73A03	08010100	5	M	Grassy Lake UT	Monitored FY11.
FECO73B01	08010202	5	J	Candidate site selected.	Nothing identified. Headwater streams < 2 sq appear to be highly intermittent in this ecoregion.
FECO73B02	08010206	2	J	To be named	Nothing identified. Headwater streams < 2 sq appear to be highly intermittent in this ecoregion.
FECO73B03	08010206	2	J	To be named	Nothing identified. Headwater streams < 2 sq appear to be highly intermittent in this ecoregion.
FECO74A01	08010202	5	J	Reelfoot Creek UT at Spout Springs WMA. Poor biological diversity dropped for consideration.	Dropped

FECO74A02	08010202	5	J	UT Running Reelfoot Bayou Ck east of Lake Ison and just south of Pawpaw Ck	Monitored FY11
FECO74A03	08010202	5	J	Rock Branch	Monitored FY-11.
FECO74A04	08010100	5	M	Barnishee Bayou UT	Monitored FY-13
FECO74B01	08010210	3	M	North Fork Wolf River UT	Monitored FY-09, FY-14
FECO74B02	08010208	4	J	Hatchie River UT	Dropped
FECO74B03	08010202	5	J	North Fork Obion River UT	Monitored FY-11.
FECO74B04	08010205	1	J	To be determined	Nothing Identified. There are very few possibilities in this ecoregion.
FECO74B05	08010204	2	J	To be determined.	Nothing Identified. There are very few possibilities in this ecoregion.

M. Southeast Monitoring Network Sites in Tennessee FY 2012 and 2013 106 Supplemental Monitoring Initiative

During the Southeastern Water Pollution Biologist Association(SWPBA) annual meeting, in November 2011, the potential for stream community changes resulting from variations in hydrology and termperature as a result of changing climate was a focus of the Southeastern Water Pollution Biologist Association (SWPBA). The result was the creation of an interagency workgroup consisting of freshwater biologists from the eight EPA region IV states and the Tennessee Valley Authority (TVA) interested in developing a joint reference stream monitoring network. Staff from EPA, USFS and USGS are also on the committee to provide technical support and advise. Although two main goals of the group are to assess existing responses to climate change and identify climate-sensitive indicators, it was agreed that a reference network with consistent sampling methodology would be useful for establishing regional reference conditions and consistency in assessments of shared watersheds and ecoregions.

Each of the region IV states and TVA agreed to target and monitor reference streams beginning in 2013 and continue annual monitoring indefinitely. Existing monitoring programs will be adjusted at key reference sites to include additional parameters so that monitoring will be consistent for all sites in the network. At a minimum, sampling will include macroinvertebrates, habitat assessments, field parameters, flow and continuous temperature monitoring. Some agencies, including TN intend to add periphyton, water quality, channel profiles and continuous flow. TVA has agreed to sample fish at sites draining into the Tennessee River. Protocols and selection of vulnerable streams were based on studies done by the Northeast Climate Change Monitoring group.

Existing data will be mined where available. The goal is to establish a minimum of 30 reference sites in protected watersheds where land-use is not expected to change significantly for at least 20 years. Tennessee has agreed to monitor 10 sites in ecoregions 66, 67, 68 and 71 (Table 14). Ten sites will enable some statistical determinations using sate data in addition to analysis of grouped data.

<u>Project Objectives</u>

Establish annual monitoring at 10 reference streams consistent with protocols agreed upon by Southeast Monitoring Network.
Develop a formal interagency partnership to develop a monitoring program that is done consistently, long-term and can withstand changes in staff.
Combine data with other SE states for statistical interpretation of current reference condition and changes over time in undisturbed systems.
Determine whether stream communities are being affected by climate associated variables such as changes in hydrology, temperature or riparian vegetation species.
Distinguish potential climate change effects from natural variation and other stressors.
Isolate biometrics/taxa that would be reliable indicators of climate change.

Detect potential climate-related changes early in a way that informs management strategies such as restoration and adaption.

<u>Methodology (Protocols to be finalized by SE monitoring workgroup prior to sampling in Spring 2013).</u>

Develop a joint inter-agency monitoring plan.
Select 10 established reference sites based on agreed upon reference criteria in ecoregions 66, 67, 68 and 71.
Deploy two continuous monitoring temperature and water level (barometric pressure) probes at each site (both water and air).
Monitor each site a minimum of twice annually for macroinvertebrates and periphyton. Conduct habitat assessments concurrent with biological monitoring.
Analyze biological data to species level.
Monitor each site four times annually for standard TN ecoregion reference water quality parameters as well as any additional parameters specified by SE monitoring group.
Measure flow and field parameters quarterly at each site.

Timeline (timing of biological samples subject to change pending SE workgroup workplan)

July 2012 – Feb 2013: Purchase equipment.
March 2013 – April 2013: Collect spring biological and water quality samples.
July 2013 – August 2013: Collect summer water quality samples.
October 2013 – November 2013: Collect fall biological and water quality samples.
December 2013 – January 2014: Collect winter water quality samples.
June 2014 – Complete sample analysis and report data.
March 2014 – April 2014: Collect spring biological and water quality samples.
July 2014 – August 2014: Collect summer water quality samples.
October 2014 – November 2014: Collect fall biological and water quality samples.
December 2014 – January 2015: Collect winter water quality samples.
March 2015 – April 2015: Collect spring biological and water quality samples.
July 2015 – August 2015: Collect summer water quality samples.
October 2015– November 2015: Collect fall biological and water quality samples.
December 2015 – January 2016: Collect winter water quality samples.
Sample analysis and report completed June 2016.

All field sampling and sample collection will be conducted by trained Environmental Specialists and Biologists with Tennessee Department of Environment and Conservation (TDEC), Division of Water Resources. Macroinvertebrate analyses to species level will be contracted to Aquatic Resources Center through the Aquatic Biology Section, Tennessee Department of Health (TDH). Periphyton analysis will be conducted the Aquatic Biology Section. Chemical analysis will be completed by the Inorganic Chemistry Section, TDH. Data will be maintained and publicly available in a joint database with data from other agencies in the monitoring network.

Table 14. Southeast Monitoring Network Sites – Tennessee

Station	Stream	EFO	Lat	Long	HUC	ECOIV	Drainage sq mi.	% Forest	Protected Drainage
ECO66E09	Clark Creek	JC	36.15077	-85.5291	TN06010108	66E	9.2	96	Sampson Mtn Wilderness; Cherokee NF
ECO66G05	Little River	K	35.65333	-83.5773	TN06010201	66G	34.9	100	Great Smoky Mtns NP
ECO66G12	Sheeds Creek	CH	35.00305	-84.6122	TN03150101	66G	5.7	99	Big Frog Wilderness; Cherokee NF
ECO66G20	Rough Creek	CH	35.05386	-84.48031	TN06020003	66G	6.04		
ECO6702	Fisher Creek	JC	36.4900	-82.9403	TN06010104	67F	11.6		
ECO67F06	Clear Creek	K	36.21361	-84.05972	TN06010207	67F	4.59		
ECO67F13	White Creek	K	36.34361	-83.89166	TN06010205	67F	3.1	91	Chuck Swann Wildlife Management Area
ECO68A03	Laurel Fork Station Camp Creek	MS	36.51611	-84.6981	TN05130104	68A	5.9	90	Big South Fork NRRA
ECO68C20	Crow Creek	CH	35.1155	-85.9111	TN06030001	68C	18.4	95	Carter State Natural Area
ECO71F19	Brush Creek	CL	35.4217	-87.5355	TN06040004	71F	13.3		
ECO71F29	Hurricane	N	35.99393	87.7554	TN06040003	71f	21.5		
ECO71H17	Clear Fork Creek	CK	35928651	-85.992117	TN05130108	71H	14.3		
MYATT005.1CU	Myatt Creek	CK	36.1299	-84.98272	TN06010208	68A	5.1		
CITIC011.0MO	Citico Creek	TVA	35.4561	-84.1190	TN06010204	66G	45.6		
WOLF000.4CO	Wolf Creek	TVA	35.9133	-82.9210	TN06010105	66G	11		

III. WATER QUALITY PLANNING AND WASTE LOAD ALLOCATION/TMDL DEVELOPMENT

A. Water Quality Planning and Standards (Section 604(b) Grant Activity)

Consistent with federal requirements, Tennessee maintains a policy to review its water quality standards every three years through the Triennial Review process. After the division plans and proposes a set of revisions, the public is afforded an opportunity to voice concerns with the existing standards and the proposed revisions. These standards can either be approved or revised by the Tennessee Board of Water Quality, Oil and Gas. The Standards are then submitted to the Secretary of State's Office and to the Environmental Protection Agency for final approval.

Funds from the FY-15 Section 604 (b) Grant will be used to fund staff to develop the 305(b) report, develop the 303(d) list, review and analysis of water quality data collected for assessment of conditions and interpretation of information included in EPA's Assessment database, and develop the water quality standards. Additionally, analysis of data collected for special surveys and development of ecoregion standards are also included in their assignments. This grant will cover 40% of the expenses for two staff members; one Environmental Program Manager 1 and one Environmental Specialist 5, from July 2014 – June 2015. Also, the division intends to pass through funds to development districts for the purpose of enhancing water quality management planning. Details on those plans will be submitted in another document.

Tennessee first adopted water quality standards in 1967 and has amended them several times thereafter. The last revisions to standards were finalized in 2012.

Water quality standards consist of two principle regulations:

1) The "General Water Quality Criteria," Rule 0400-40-03

2) The "Use Classifications for Surface Waters", Rule 0400-40-04.

The three essential elements comprising water quality standards as defined by Section 303 of the Federal Clean Water Act, PL 95-217, are water quality criteria, stream use classifications, and the Antidegradation statement.

Tennessee's criteria specify baseline values for particular parameters of water quality necessary for the protection and maintenance of a prescribed use classification. The State has established seven principal uses of the waters for which criteria of quality are defined: 1) domestic water supply, 2) industrial water supply, 3) fish and aquatic life, 4) recreation, 5) irrigation, 6) livestock watering and wildlife, and 7) navigation. Trout streams and streams with naturally reproducing trout have specific criteria, however, these criteria are listed as a subset under the fish and aquatic life protection criteria.

B. Wasteload Allocations/TMDL Development – (state appropriations, 106 funds, and 319(h) funds)

Prior to issuance of NPDES permits, the limits for specific chemical constituents of the effluent must be determined. This process, known as a wasteload allocation, is based on the amounts of pollutants that the receiving waters can assimilate without adversely affecting the uses of the water.

Wasteload allocations are performed using computer models that represent the complicated physical and chemical processes occurring in the receiving waters. Variables in this mathematical model are often assumed, but would ideally be confirmed and verified by performing a field study called an assimilative capacity survey. EPA's consent decree requires that all 792 water quality segments and associated pollutants on the 1998 303(d) list be addressed either by the division developing a TMDL, EPA developing a TMDL, or EPA determining that a TMDL is no longer needed (Table 15). The development of the TMDLs by the division is funded by state appropriations, 106 funds, and 319(h) funds. Streams to be sampled for TMDLs in FY-15 appear in Table 9**.**

Table 15. Cumulative % and Number of TMDLs

Year	Cumulative % of TMDLs to be Submitted that appear on the 1998 303(d) List	Cumulative Number of TMDLs to be Submitted that appear on the 1998 303(d) List
2002	5%	40
2003	10%	80
2004	15%	120
2005	20%	160
2006	25%	200
2007	40%	319
2008	55%	438
2009	70%	557
2010	85%	676
2011	100%	792

*Agreement between TDEC and EPA (May 1998). If unexpected circumstances warrant it, TMDLs may be written regardless of their scheduled development.

IV. COMPLAINTS, FISH KILLS AND WASTE SPILLS

A. Complaints

The division investigates and attempts to resolve over 1900 complaints each year. Most of these are filed by private citizens who wish to convey information concerning suspected pollution events. As such, these complaint investigations are an important source of information. The division places a high priority on the investigation of these reports. Staff are assigned to this activity for the investigation to be accomplished in a timely and efficient manner. Due to its sporadic nature, complaint investigations are difficult to plan and often divert staff from other program needs.

On occasion, a formal 118(a) complaint is filed with the Commissioner's office. When the complaint involves water pollution, a formal process coordinated by the Enforcement and Compliance Section is begun. The division investigates the complaint and develops a formal response, which is then approved by the Commissioner's office.

B. Fish Kills and Waste Spills

The Federal Emergency Management Agency (FEMA) requires that each state have an Emergency Management Plan (EMP). Employees of the State are required to serve under emergency situations. The State has instituted the Tennessee Emergency Management Agency (TEMA) program for coordinating emergency response to spills of materials that may adversely affect Tennessee's waters. The main responsibilities are to respond in all emergency situations including, but not limited to:

1. Disasters, including natural and accidental; for example, truck wrecks or train derailment, structural or mechanical failure, fish kills due to spills or bypassing from wastewater treatment plants, etc.

2. War-related emergency (conventional or nuclear)

3. Resource crises (for example, shortage of water treatment plant chemicals)

When a fish kill is reported to the division, the ensuing investigation is often a joint effort between the division and the Tennessee Wildlife Resources Agency (TWRA). When arriving on-site, a preliminary attempt is made to determine whether the fish kill is due to natural conditions or human causes. If the fish kill appears related to pollution, division staff members collect samples, take photographs, and inspect nearby facilities for potential pollutant sources. The TWRA officer counts and identifies the dead fish, and calculates a monetary value of the damage to the fishery. An enforcement package is prepared and turned over to the Enforcement and Compliance Section of DWR

Organizational changes in TDEC have resulted in the creation within each EFO of an Emergency Response Team (ERT). If a waste spill has occurred, the ERT responds to major emergencies; teams usually have a DWR staff member and staff from other divisions. Moderate emergencies may be handled by DWR or the ERT, depending on the ERT's decision. Minor emergencies are handled by DWR. As soon as the major emergency is over, the ERT turns over the follow-up activities and remediation efforts to WPC or Solid Waste Management (SWM) as appropriate. DWR may recommend containment and mitigation efforts on-site. An enforcement package is often prepared if a source can be identified. A detailed list of waste spills and fish kills will be kept for environmental indicator purposes.

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