2016 West Virginia Integrated Water Quality Monitoring and Assessment Report

Prepared to fulfill the requirements of Section 303(d) and 305(b) of the federal Clean Water Act and Chapter 22, Article 11, Section 28 of the West Virginia Water Pollution Control Act for the period of July 2014 through June 2016.

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1.0 INTRODUCTION

The federal Clean Water Act contains requirements to report on the quality of a state's waters. Section 305(b) requires a comprehensive biennial report and Section 303(d) requires, from time to time, a list of waters for which effluent limitations or other controls are not sufficient to meet water quality standards (impaired waters). West Virginia code Chapter 22, Article 11, Section 28 also requires a biennial report of the quality of the state's waters.

This document is intended to fulfill West Virginia's requirements for listing impaired waters under Section 303(d) of the Clean Water Act and the Water Quality Planning and Management Regulations, 40CFR130.7. In addition to the list of impaired waters, it explains the data evaluated in the preparation of the list and methodology used to identify impaired waterbodies. Information is provided that allows the tracking of previously listed waters that are not contained on the 2016 list. The United States Environmental Protection Agency (EPA) has recommended these requirements be accomplished in a single report that combines the comprehensive Section 305(b) report on water quality and the Section 303(d) list of waters that are not meeting water quality standards. The format suggested by EPA for this "Integrated Report" includes provisions for states to place their waters in one of the five categories described in Table 1. Waters that are placed in Category 5 are included on the 2016 Section 303(d) List, located in the back of this report (West Virginia 2016 Section 303(d) List).

Table 1: Integrated Report Categories for West Virginia Waters

Category		Description
Category 1		Waters fully supporting all designated uses
Category 2		Waters fully supporting some designated uses, but no or insufficient information exists to assess the other designated uses
Category 3		Waters where insufficient or no information exists to determine if any of the uses are being met
Category 4		Waters that are impaired or threatened but do not need a total maximum daily load (TMDL)
	4a	Waters that already have an approved TMDL but are still are not meeting standards
	4b	Waters that have other control mechanisms in place which are reasonably expected to return the water to meeting designated uses
	4c	Waters that have been determined to be impaired, but not by a pollutant (ex. low flow alteration)
Category 5		Waters that have been assessed as impaired and are expected to need a TMDL

This Integrated Report is a combination of the 2016 Section 303(d) List and the 2016 Section 305(b) report. In general, this report includes data collected and analyzed between July 1, 2010 and June 30, 2015, from the state's 32 major watersheds (Figure 1) by the West Virginia Department of Environmental Protection's (DEP's) Watershed Assessment Branch and other federal, state, private and nonprofit organizations.

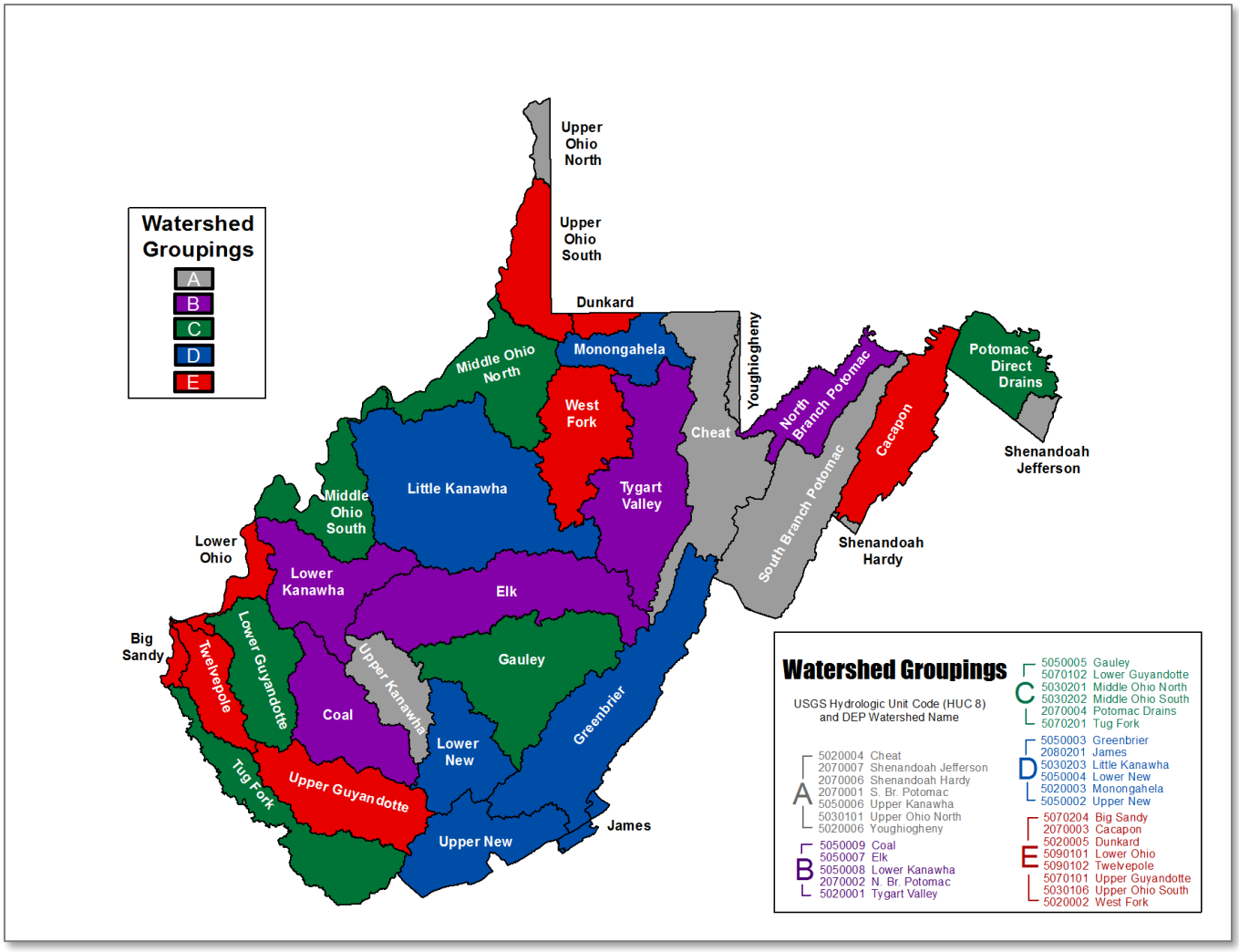

Figure 1: West Virginia Watershed Framework Groupings

2.0 WATER QUALITY STANDARDS

Water quality standards are the backbone of the 303(d) and 305(b) processes of the federal Clean Water Act. In West Virginia, the water quality standards are codified as 47CSR2 – Legislative Rules of the Department of Environmental Protection – Requirements Governing Water Quality Standards. Impairment assessments conducted for the 2016 cycle are based upon water quality standards that have received the EPA's approval and are currently considered effective for Clean Water Act purposes. Information regarding the Water Quality Standards can be found on the DEP's Web page at:

http://www.dep.wv.gov/WWE/Programs/wqs/Pages/default.aspx.

A waterbody is considered impaired if it violates water quality standards and does not meet its designated uses. Some examples of designated uses are water contact recreation, propagation and maintenance of fish

and other aquatic life, and public water supply. Designated uses are described in detail beginning in Section 6.2 of 47CSR2 and are summarized in Table 2. Each of the designated uses has associated criteria that describe specific conditions that must be met to ensure that the water can support that use. For example, the "propagation and maintenance of fish and other aquatic life" use requires the pH to remain within the range of 6.0 to 9.0 standard units, which an example of a numeric criterion. Numeric criteria are provided in Appendix E of the water quality standards.

Designated use attainment is determined by the comparison of available instream values of various water quality parameters to the appropriate numeric or narrative criteria specified for the designated use (see the Assessment Methodology section for more information on use attainment determination). Waterbodies that are impaired by a pollutant are placed on the 303(d) List and scheduled for TMDL development.

Table 2: West Virginia Water Use Designations

Category	Use Subcategory	Use Category	Description
A	Public Water	Human Health	Waters, which after conventional treatment, are used for human consumption
B1	Warm Water Fishery	Aquatic Life	Propagation and maintenance of fish and other aquatic life in streams or stream segments that contain populations composed of all warm water aquatic life
B2	Trout Waters	Aquatic Life	Propagation and maintenance of fish and other aquatic life in streams or stream segments that sustain year-round trout populations. Excluded are those streams or stream segments which receive annual stocking of trout but which do not support year-round trout populations
B4	Wetlands	Aquatic Life	Propagation and maintenance of fish and other aquatic life in wetlands. Wetlands generally include swamps, marshes, bogs, and similar areas.
C	Water Contact Recreation	Human Health	Swimming, fishing, water skiing, and certain types of pleasure boating such as sailing in very small craft and outboard motor boats
D1	Irrigation	All Other	All stream segments used for irrigation
D2	Livestock Watering	All Other	All stream segments used for livestock watering
D3	Wildlife	All Other	All stream segments and wetlands used by wildlife
E1	Water Transport	All Other	All stream segments modified for water transport and having permanently maintained navigation aides
E2	Cooling Water	All Other	All stream segments having one or more users for industrial cooling
E3	Power Production	All Other	All stream segments extending from a point 500 feet upstream from the intake to a point one-half mile below the wastewater discharge point.
E4	Industrial	All Other	All stream segments with one or more industrial users. It does not include water for cooling

Numeric criteria consist of a concentration value, exposure duration and an allowable exceedance frequency. The water quality standards prescribe numeric criteria for all designated uses. For the "propagation and maintenance of fish and other aquatic life" (Aquatic Life) use, there are two forms: acute criteria that are designed to prevent lethality, and chronic criteria that prevent retardation of growth and reproduction. The numeric criteria for acute aquatic life protection are specified as one-hour average concentrations that are not to be exceeded more than once in a three-year period. The criteria for chronic aquatic life protection are specified as four-day average concentrations that are not to be exceeded more than once in a three-year period. The exposure time criterion for human health protection is unspecified, but there are no allowable exceedances.

Water quality criteria also can be written in a narrative form. For example, the water quality standards contain a provision stating that wastes, present in any waters of the state, shall not adversely alter the integrity of the waters or cause significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems. Narrative criteria are contained in Section 3 of 47CSR2. More information regarding the use of narrative criteria is contained in the Use Assessment Procedures section.

Ohio River Criteria

For the Ohio River, both the Ohio River Valley Water Sanitation Commission (ORSANCO) and West Virginia water quality criteria were considered, as agreed upon in the ORSANCO compact. Where both ORSANCO and West Virginia standards contain a criterion for a particular parameter, instream values were compared against the more stringent criterion. The DEP supports ORSANCO's efforts to promote consistent decisions by the various jurisdictions with authority to develop 305(b) reports and 303(d) lists for the Ohio River. In support of those efforts, West Virginia has and will continue to work with ORSANCO and the other member states through a workgroup charged with improving consistency of 305(b) reporting among compact states. ORSANCO standards may be reviewed at: http://www.orsanco.org/programs/pollution-control-standards/

3.0 SURFACE WATER MONITORING AND ASSESSMENT

This section describes West Virginia's strategy to monitor and assess the surface waters of the state. The DEP's Division of Water and Waste Management (DWWM) collects most of the state's water quality data. The Watershed Assessment Branch (WAB) of DWWM is responsible for general water quality monitoring and watershed assessment. The remainder of this section describes the monitoring and assessment activities conducted by the WAB. Table 3 provides a summary of monitoring activities. In addition, WAB water quality data and biological data is currently available at:

https://apps.dep.wv.gov/dwwm/wqdata/

The data at this site is continually updated as the site is live-linked to the database.

3.1 Streams and Rivers

West Virginia has a comprehensive strategy for monitoring flowing waters, by far the most prevalent surface waterbody type in the state. The Watershed Assessment Branch utilizes a tiered approach, collecting data from long-term monitoring stations, targeted sites within watersheds on a rotating basin schedule, randomly selected sites, and sites chosen to further define impaired stream segments in support of TMDL development. The following paragraphs present these approaches in further detail.

3.2 Probabilistic (Random) Sampling

In 1997, the DEP's Watershed Assessment Branch began sampling sites selected through the Environmental Protection Agency's random stratified procedure to better assess the ecological health of watersheds and ecoregions within the state. The data generated from this random stratified (also known as probabilistic) sampling effort allows the DEP and the EPA to make statistically valid comparisons of aquatic integrity between watersheds and ecoregions. The data also assists in monitoring long-term trends in watershed and ecoregion health. Further details are provided in the section titled Probabilistic Data Summary.

3.3 Ambient Water Quality Monitoring Network

The ambient water quality monitoring network concept was established in the mid-1940s. The network currently consists of 26 fixed stations that are sampled bi-monthly. Sampling stations are generally located near the mouths of the state's larger rivers and are co-located with USGS stream gages. The data provides information for trend analyses, general water quality assessments and pollutant loading calculations, and allows water resources managers to quickly gauge the health of the state's major waterways. The stations are displayed on Figure 2 and listed below.

1. Shenandoah River at Harpers Ferry
2. Opequon Creek east of Bedington
3. Cacapon River near Great Cacapon
4. South Branch of the Potomac River
5. Cheat River at Albright
6. Cheat River below Cheat Lake
7. Monongahela River in Star City
8. Dunkard Creek east of Pentress
9. Tygart Valley River at Colfax
10. West Fork River at Enterprise
11. Middle Island Creek at Arvilla
12. Hughes River west of Freeport
13. Little Kanawha River at Elizabeth
14. Kanawha River at Winfield
15. Guyandotte River at Huntington
16. Twelvepole Creek south of Ceredo
17. Tug Fork at Fort Gay
18. Guyandotte River at Pecks Mill
19. Coal River at Tornado
20. Elk River at Coonskin Park
21. Kanawha River at Cheylan
22. Gauley River at Beech Glen
23. New River above Gauley Bridge
24. Greenbrier River at Hinton
25. New River at Hinton
26. New River at Virginia State line

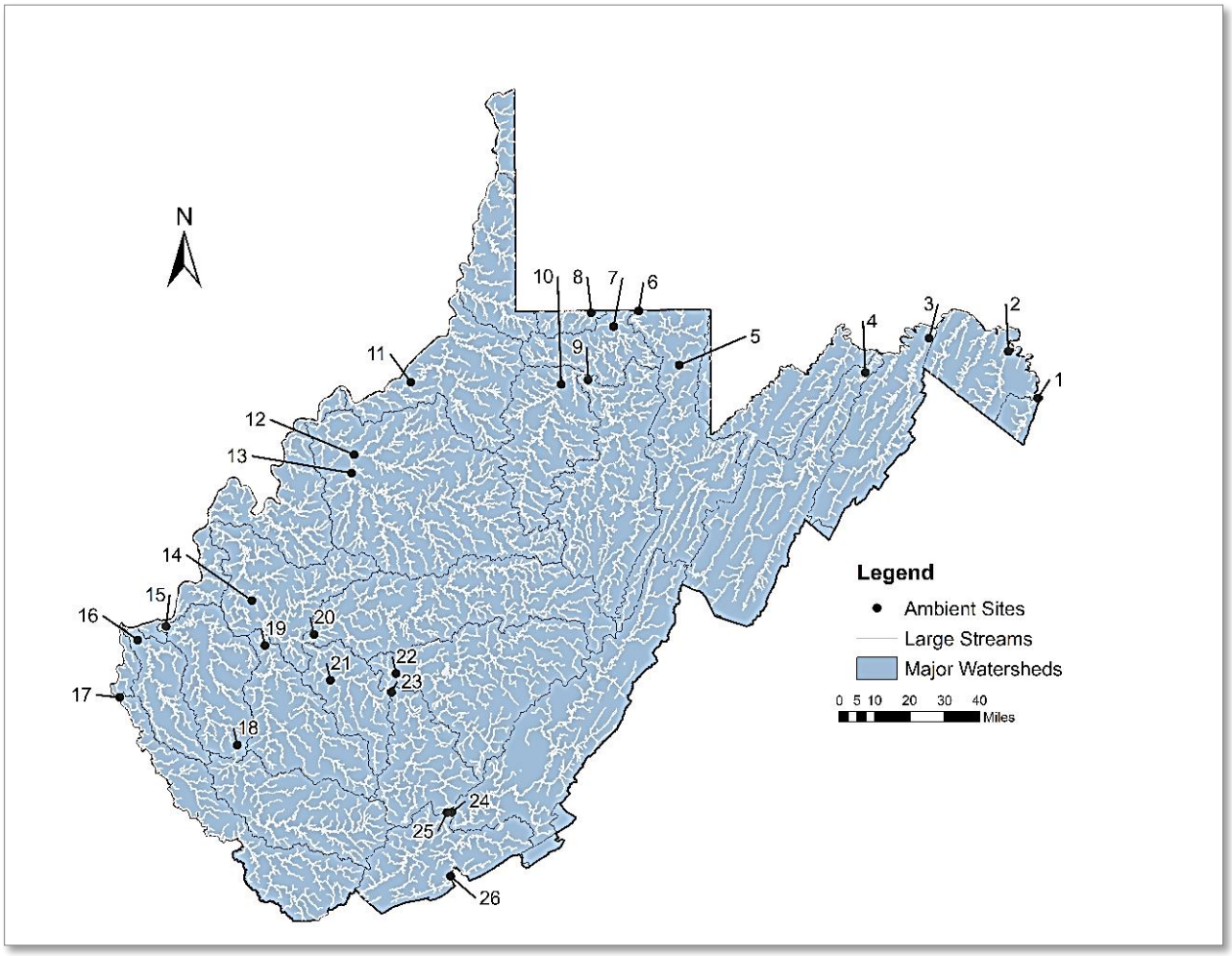

Figure 2: West Virginia Ambient Monitoring Sites

3.4 Targeted Monitoring

Targeted monitoring has been a component of West Virginia's assessment strategy since the Watershed Assessment Program's inception in late 1995. Streams are sampled on a five-year rotating basin approach. Sites are selected from the watersheds targeted for sampling each year. Each site is subjected to a one-time evaluation of riparian and instream habitat, basic water quality parameters, and benthic macroinvertebrate communities.

Sites are selected to meet a variety of informational needs in the following areas:

- Impaired streams
- Reference (minimally impacted) streams
- Spatial trends (multiple sites on streams exceeding 15 miles in length)
- Areas of concern as identified by the public and stakeholders
- Previously unassessed streams

3.5 Pre-Total Maximum Daily Load (TMDL) Development Monitoring

The major objective of this effort is to collect sufficient data for Total Maximum Daily Load (TMDL) modelers to develop stream restoration plans. Pre-TMDL monitoring has traditionally followed the framework cycle, i.e., impaired streams from watersheds in hydrologic group A were sampled in the same year as sampling by other stakeholder agencies participating in the watershed management framework. The 303(d) List is the basis for initial site selection and additional sites are added to comprehensively assess tributary waters and to allow identification of the suspected sources of impairment. More recently, to address impairments that have been listed for several years, watersheds are being selected for TMDL development outside of the schedule established by the framework cycle. Pre-TMDL monitoring is intensive, consisting of monthly sampling for parameters of concern, which captures data under a variety of weather conditions and flow regimes. Pre-TMDL monitoring also includes an effort to locate the specific sources of impairment, with particular attention paid to identifying non-point source land use stressors as well as any permitted facilities that may not be meeting their permit requirements. For more information, see the TMDL Development Process section.

3.6 Lakes and Reservoirs

The DEP resumed a lake monitoring component in 2006 that focuses on water quality, collecting field parameters (dissolved oxygen, pH, temperature, and conductivity), nutrient data, clarity, and chlorophyll a. Multiple sites are sampled in larger lakes and profile data for temperature and dissolved oxygen are obtained.

The DEP added the collection of benthic macroinvertebrates to the lake monitoring program in 2011. Collections are made from near shoreline habitat using jabs and sweeps with a d-net. Plans are to eventually develop an IBI for use in lakes.

Many of West Virginia's largest reservoirs are controlled by the U.S. Army Corps of Engineers. Although the Corps' primary mission is to manage structures to provide navigation and flood control, the agency also is committed to water quality management. Data generated by the Corps has been used for assessment purposes.

Additional lake information is available from the West Virginia Division of Natural Resources (DNR). The DNR, one of the signatory agencies in the Partnership for Statewide Watershed Management, conducts fish community surveys on many of the state's reservoirs.

3.7 Wetlands

DEP contributes to the management of the State's wetlands. The current total acreage of wetlands within the state is approximately 89,000 acres and comprises less than one percent of the State's total acreage (National Wetlands Inventory: WV 1980-86) yet are critical to the overall health of our state's aquatic resources by reducing the impacts of floods, removing pollutants, and providing habitat to a wide variety of plants and animals found nowhere else. Management efforts are currently geared toward protection of wetlands by regulatory proceedings or acquisition. Permitting authority for activities impacting wetlands (Section 404) lies with the U. S. Army Corps of Engineers. DEP supports protection through the Section 401 certification program.

Since the submission of the last 305(b) report, DEP's Watershed Assessment Branch has assumed the responsibilities of an EPA Wetlands Development Grant funded project to develop functional assessments for West Virginia's wetlands. The indices developed for the assessment will be used throughout the state to better describe the values that different wetlands can provide in terms of water quality, flood attenuation, wildlife habitat, and recreational, aesthetic, educational functions. The goal of this team is to create a desktop GIS Wetland Assessment Tool (Level I), and to refine the West Virginia Wetland Rapid Assessment Method, WVWRAM (Level II). These two assessments are designed to enable calculation of debits and credits for wetland impacts and mitigation sites. These may be incorporated into the WV Stream and Wetland Valuation Metric (SWVM) which is used by the U.S. Army Corp of Engineers and the WV Integrated Review Team to assess impacts in West Virginia.

As of December 2017, the initial GIS work and related programming for the Level I assessment has been completed, and we now have functional scores for all 43,124 mapped wetlands in the state. Improvements to the field assessment component, the WVWRAM, were made prior to the 2017 field season and were utilized at approximately 25 sites with assistance from several state and federal wetland experts. Based in input received following the 2017 effort, the forms, spreadsheets, and training manuals for the WVWRAM will be further modified and further testing of the protocols will be completed during the summer of 2018.

Table 3: Current and Future Monitoring Activities

Monitoring	Effort
Ambient	26 Ambient Sites are currently and will continue to be monitored monthly (Monongahela River Basin Sites) or bi-monthly
Probabilistic	A fourth round of probabilistic monitoring was completed in 2017. A fifth round will be started in 2018.
Pre-TMDL	Pre-TMDL development monitoring was completed for the Hughes River of the Little Kanawha River watershed, as well as for the mainstem of the Monongahela River by June 2015. Monitoring was completed in the Upper Guyandotte River watershed in 2016 and for select streams in the Lower Ohio, Big Sandy, and Twelvepole Creek watersheds in 2017. Pre-TMDL monitoring for Lower Guyandotte will be completed in 2018.
Targeted	Targeted Sampling was completed at 246 sites on 202 streams in 23 watersheds representing all Five Hydrologic Groups (A-E) from 2014 through 2016.
Lakes	Nine lakes within Group D, 10 lakes in Group E and 11 lakes in group in Group A were sampled a minimum four times during the May – October assessment seasons of 2014 – 2016.
Continuous	Water quality meters were deployed at 133 locations on 97 streams during the 2014 – 2016 term. Parameters measured include pH, temperature, conductivity, and dissolved oxygen.
Long Term	Long Term Monitoring Sites (LTMS or LitMuS) – 195 sites were sampled during the 2014 – 2016 sampling seasons representing all five Hydrologic Groups.

3.8 Citizen Monitoring

West Virginia Save Our Streams is the state's volunteer water quality monitoring program. Initiated in 1989, this program encourages citizens to become involved in the improvement and protection of the state's streams. Save Our Streams has two main objectives. First, it provides the state with enhanced ability to monitor and protect its surface waters through increased water quality and aquatic life monitoring. Second, it improves water quality through educational outreach to the state's citizens. Training workshops are conducted regularly throughout the state to train, certify and provide quality assurance. A major improvement in data accessibility for the program has been the development of an online Volunteer Assessment Database (VAD):

http://www.dep.wv.gov/WWE/getinvolved/sos/Pages/VAD.aspx

Volunteer monitors can register and enter their own data online. The coordinator acts as the database administrator to verify the quality of the information before it is approved and included in the VAD. The database is available for public viewing without registration. In addition, the program periodically prepares the "State of Our Streams" report and coordinates with partners to undertake water quality studies within the state as well as other portions of the Mid-Atlantic region. To learn more visit: http://www.dep.wv.gov/sos.

4.0 ASSESSED DATA

In addition to data collected by the WAB, the agency considered data from external sources for assessment. The agency sought water quality information from various state and federal agencies, including other DEP programs. Specific requests for data were made to state and federal agencies known by the DEP to generate water quality data. Additionally, news releases and public notices requesting data submissions were published in state newspapers and on the DEP Water and Waste Management's website. The DEP has developed guidance for those wishing to submit data to be assessed for 303(d) list development. The guidance includes a list of requirements for data assembly and submission, along with helpful internet links and a checklist for data submitters. The guidance is available at:

http://dep.wv.gov/WWE/watershed/IR/Pages/Third-Party-Data-Guidelines.aspx

Entities that provided information in response to the agency's request for data for the 2016 Section 303(d) list are shown in Table 4. External data received and qualified in the preparation of previous Section 303(d) lists were reconsidered in the 2016 review.

Table 4: Data contributors for the 2016 303(d) List and Integrated Report

Friends of Blackwater	WVDA/Rocky Marsh
Cacapon Institute/Sleepy Creek	US Forest Service
Plateau Action Network	WV Department of Agriculture
US Geological Survey	National Park Service
Friends of Hughes River	Friends of Deckers Creek
Blue Ridge Watershed Coalition	Trout Unlimited
Mammoth Coal, Martin Marietta, NESCO	Fola Coal Company, LLC

All readily available data were considered during the evaluation process. The DEP's staff reviewed data from external sources to ensure that collection methods, analytical methods, detection levels, quality assurance and quality control were consistent with approved procedures. In select instances when contributors reported on malfunctions in their pH probes, pH data were excluded. The DEP generally used water quality data with sample dates between July 2010 and June 2015, intentionally limiting the use of data more than five years old. However, in the absence of newer information, previous assessments are carried forward even if the data becomes older than five years. In specific instances, more recent data were considered. Additionally, if a water quality criteria change is approved which affects an older assessment, the new assessment is based upon the current criteria.

Waters are not deemed impaired based upon water quality data collected when stream flow conditions are less than 7Q10 flow (the seven-consecutive-day average low flow that recurs at a 10-year interval) or within regulatory mixing zones. Further, waters are not deemed impaired based upon "not-detected" analytical results from methodologies that have detection limits that are not sensitive enough to confirm criteria compliance. For example, a dissolved aluminum result of "not detected" using a method with a detection limit of 0.1 mg/l would not prompt a dissolved aluminum listing for trout waters with a criterion of 0.087 mg/l.

5.0 USE ASSESSMENT PROCEDURES

The primary focus of this report is to assess water quality information and determine if the designated uses of state waters are impaired. This section describes the various protocols used to determine use impairment.

5.1 Numeric Water Quality Criteria

The decision methodology for numeric water quality criteria used in preparation of the 2016 Section 303(d) list are consistent with those used in 2014 listing cycle. Table 5 summarizes the rationale used to make 303(d) impairment decisions relative to numeric water quality criteria period for various datasets.

Typically, if an ample data set exists and exceedances of chronic aquatic life protection and/or human health protection criteria occur more than 10 percent of the time, the water is considered to be impaired. If the rate of exceedance demonstrated is less than or equal to 10 percent, then the water is considered to be meeting the designated use under evaluation. Ample data sets are defined as sets with 20 or more distinct observations or samples in the five-year period used for evaluation in this listing cycle (July 2010 to June 2015). If fewer than 20 samples per station (or representative area) exist and three or more values exceed a criterion value, then the water also is considered impaired. For this scenario (three observed violations), if additional non-exceeding monitoring results were available that would increase the data set size up to 29 observations, a greater than 10 percent exceedance frequency would still exist.

Under West Virginia Water Quality Standards, acute aquatic life protection criteria have associated exposure durations of one hour and may be exceeded once every three years. The normal practice of "grab-sampling" ambient waters is generally consistent with the one-hour exposure duration specified in the standards. Therefore, a direct application of the allowable exceedance frequency provided in the standards is made when assessing impairment relative to acute aquatic life protection criteria. If two or more exceedances of acute criteria are observed in any three-year period, the water is considered impaired.

If the data being evaluated is generated as part of a comprehensive network being monitored for a specific purpose, the data may be assigned a higher level of assessment quality, and the "10-percent rule" may be applied with confidence to data sets containing less than 20 observations per station. The primary example of an intensified monitoring program that generates higher assessment quality data is that which is conducted by the DEP to support TMDL development. The pre-TMDL monitoring format includes flow measurement and monthly water quality monitoring for one year at multiple locations throughout a watershed. Information is generated over a range of stream flow conditions and in all seasons. Habitat assessment and biological monitoring are performed in conjunction with water quality monitoring. The information generated under this format is among the most comprehensive available for assessing water quality. Upon conclusion of monitoring, it is then necessary for agency personnel to make a definitive judgment relative to impairment. In most instances, application of the "10-percent rule" to the pre-TMDL monitoring data sets result in the classification of waters as impaired if two or more exceedances of a criterion are demonstrated.

Additionally, the DEP does not interpret the impacts of a single pollution event as representative of current conditions if it is believed that the problem has been addressed. Similarly, the DEP does not intend to interpret the results of clustered monitoring of a single event as being representative of water quality conditions for longer time periods. Datasets are screened for excessive clustering of monitoring, in space or time, to avoid misinterpretation. No data were excluded based on a single pollution event or clustered monitoring of a single event for the 2016 assessment cycle.

The DEP's lake assessment of chlorophyll a and total phosphorus results were based on the average of a minimum of four samples collected within the May 1 through October 31 sampling season.

Table 5: Numeric water quality decision rationale for listing of impaired waters.

Water Quality Criteria	Impairment Thresholds	Additional Considerations
Acute Aquatic Life Protection (Use Category B)	The water is impaired if two exceedances of acute aquatic life protection numeric criteria occur within any three-year period.	If, in the most recent three-year period, no exceedances of criteria are evidenced and at least 12 monitoring results are available, then the water may be considered "not impaired."
Chronic Aquatic Life Protection (Use Category B) Human Health Protection (Use Categories A and C)	The water is impaired if a greater than 10% frequency of exceedance is demonstrated in an ample dataset (20 or more available observations). The water is impaired if three exceedances of criteria occur with less than 20 available monitoring results. The water is impaired if a greater than 10% frequency of exceedance is demonstrated with less than 20 available observations, if the data being evaluated is of high assessment quality (two or more violations)	If, for waters with regularly scheduled monitoring, in the most recent two-year period, no exceedances of criteria are evidenced and at least eight observations are available, then the water may not be considered impaired.

5.2 Segmentation of Streams

The majority of newly listed streams were identified as impaired for their entire length. Segmentation occurred only in limited situations involving streams with impoundments or alternative designated uses, or when knowledge of a specific pollutant source allowed clear distinction of impaired and unimpaired segments or streams with multiple monitoring locations with differing results. Multiple sample site stream segmentation, when done, is accomplished by continuing an assessed condition until samples from additional sites demonstrate a change in water quality. In other words, if water quality results from one site indicate impairment, the stream is considered impaired until downstream or upstream samples indicate compliance with the water quality criterion.

Segmentation based upon the limited amount of water quality monitoring data that is usually available may not accurately portray the extent of impairment and may contradict the ultimate findings of the TMDL

that the listing mandates. The DEP believes the TMDL development process, which links extensive water quality monitoring and source tracking efforts with pollutant sources through computer modeling, provides the best assessment of criterion attainment and the most accurate identification of the watershed sources for which pollutant reductions are necessary. TMDL modeling predicts water quality over a wide range of climatic and stream flow conditions, incorporates the specific exposure duration and exceedance frequency terms of water quality criteria and prescribes pollutant/s allocations that will result in attainment of criteria in all stream segments.

5.3 Evaluation of Continuous Monitoring Data

The DEP uses deployable sondes to collect data on a continuous basis on selected streams. The sampling methodology uses submerged electronic probes that collect data continuously for a period of time ranging from several days to several months. Sondes or continuous monitoring instruments are especially effective for evaluating the specific requirements of water quality criteria for parameters such as pH and dissolved oxygen. For example, the pH criterion states that water quality values should remain between 6.0 and 9.0 standard units at all times (exception for waters with high photosynthetic activity). The use of continuous monitors allows the DEP to better assess if streams are meeting water quality criteria. DEP is currently developing a method to assess the vast amount of data collected by continuous monitoring instruments. The methodology must address both the magnitude and frequency of violation stipulated in current water quality criteria. DEP plans to develop a continuous monitoring assessment methodology for use in the 2018 cycle.

5.4 Evaluation of Fecal Coliform Numeric Criteria

Fecal coliform assessments were based on the previously described decision criteria for numeric water quality criteria (Section 5.1). Given the complexity of fecal coliform criteria, most assessments are performed by comparing observations to the "maximum daily" criterion value of 400 counts/100ml. Evaluation of the monthly geometric mean fecal coliform criterion (200 counts/100ml) occurs only where five or more individual sample results are available within a calendar month.

Numeric fecal coliform water quality criteria are applicable to the Water Contact Recreation and Public Water Supply designated uses. Section 8.13 of Appendix E of the West Virginia Water Quality Standards states:

> *8.13 Maximum allowable level of fecal coliform content for Primary Contact Recreation shall not exceed 200/100ml as a monthly geometric mean based on not less than five samples per month; nor to exceed 400/100ml in more than 10 percent of all samples taken during the month.*
>
> *8.13.1 Ohio River mainstem (zone I) - During the non- recreational season (November through April only) the maximum allowable level of fecal coliform for the Ohio River (either MPN or MF) shall not exceed 2000/100 ml as a monthly geometric mean based on not less than 5 samples per month.*

A practical difficulty exists in accurate assessment of criteria compliance due to the resource commitment that would be necessary to perform monitoring at a sufficient frequency to make determinations using the geometric mean criteria, since the monthly geometric mean criterion is conditioned upon the availability of at least five distinct sample results in a month. The "maximum daily" criterion is not conditioned by a minimum sample set requirement, but practical use of the apparent 10 percent exceedance allowance would involve at least 10 samples per month.

The most frequent and regular fecal coliform water quality monitoring conducted by the Watershed Assessment Section is once per month. That monitoring frequency precludes assessment of the monthly geometric mean criterion and hampers accurate assessment of the maximum daily criterion. Due to limited resources, more frequent fecal coliform monitoring could only be accomplished by significantly reducing the number of West Virginia streams and/or stations where water quality assessments are performed. The DEP does not consider that to be a reasonable alternative.

The DEP uses the following protocols when making assessments relative to fecal coliform numeric criteria:

1. No assessments are based upon the monthly geometric mean criterion (200 counts/100ml) unless an available data set includes monitoring at five per month or greater frequency. When data sets are available, the listing decision criteria for numeric water quality criteria are applied, considering each monthly geometric mean as an available monitoring result.

2. The listing decision criteria are applied to the maximum daily criterion (400 counts/100ml) and available individual monitoring results, but without the monthly prejudice. For example, if twice per month monitoring is conducted for a year and two results in two separate months are greater than 400, the stream would be assessed as fully supporting (2/24 – 8.3 percent rate of exceedance) rather than basing assessments on two months out of 12 in noncompliance (2/12 – 16.7 percent rate of exceedance). If five samples per month monitoring is conducted for one year and four daily results greater than 400 are measured in four different months, the stream would be assessed as fully supporting (4/60 – 6.7 percent rate of exceedance) rather than noncompliance (4/12 – 33.3 percent rate of exceedance), provided that the monthly geometric means were below the 200 counts/100 ml criteria.

The decision criteria do not provide for 303(d) listing of waters with severely limited data sets and exceedance (i.e., one sample in a five-year period > 400 counts/100ml). Such waters would be classified as having insufficient data available for use assessment. The DEP will target these "fecal one-hit" waters for additional monitoring by incorporating them into the pre-TMDL monitoring plans at the next opportunity for TMDL development in their watershed. Where the intensified pre-TMDL monitoring (monthly sampling for one year) indicates impairment, TMDL development will be immediately initiated, even though the water may not be included in Category 5 of the current Integrated Report.

5.5 Evaluation of Ohio River – Total Iron Aquatic Life Standards

Prior to 2012, ORSANCO assessed water quality data along sections of the Ohio River bordering West Virginia based on the state's total iron numeric water quality standard. In 2012, ORSANCO's governing commission began using a weight of evidence approach when assessing all aquatic life standards for its biennial 305(b) report. However, the EPA's Region III office has stated for 303(d) listing purposes, it will only accept assessments based on a philosophy of independent applicability. Therefore, West Virginia's 303(d) assessments for aquatic life will recognize violations based on either water quality or biological survey data. A review of the ORSANCO total iron water quality data revealed violation rates greater than 10 percent for several segments along the state's border and, as such, the segments have been listed as impaired on West Virginia's 2016 303(d) list.

5.6 Narrative Water Quality Criteria – Biological Impairment Data

Passage of Senate Bill 562 in the 2012 regular legislative session required DEP to develop and secure legislative approval of new rules to interpret the narrative criterion for biological impairment found in 47 CSR 2-3.2.i. A copy of the legislation may be viewed at:

http://www.legis.state.wv.us/Bill_Text_HTML/2012_SESSIONS/RS/Bills/SB562%20SUB1%20enr.htm

The narrative water quality criterion of 47CSR2 – 3.2.i. prohibits the presence of wastes in state waters that cause or contribute to significant adverse impact to the chemical, physical, hydrologic and biological components of aquatic ecosystems. Historically, the DEP has interpreted the criterion using the West Virginia Stream Condition Index (WVSCI). The WVSCI is a benthic macroinvertebrate multi-metric index for use in wadeable streams. It is composed of six metrics that were selected to maximize discrimination between streams with known impairments and reference streams. Streams were listed if the data was comparable (e.g., collected utilizing the same methods used to develop the WVSCI, adequate flow in riffle/run habitat, and within the index period). Initially, the WVSCI listing threshold was 60.6, which represented the 5th percentile of reference scores of 68 minus 7.4 points to account for uncertainty. Whereas the WVSCI evaluates biological integrity using only benthic macroinvertebrate data, SB 562 directs the DEP to additionally consider fish in its assessment methodology. The revised assessment methodology called for in SB 562 has not yet been finalized. The development of a multi-assemblage tool has proven to be much more difficult than originally expected.

In its preparation of the Draft West Virginia 2012 Section 303(d) list, the DEP did not add new biological impairments. Previously listed biological impairments were proposed to be retained. In finalizing the

2012 list, the EPA added biological listings to those proposed by the DEP. The EPA considered available benthic macroinvertebrate data and added impairments to the list for biological scores less than 68 under the WVSCI methodology. The EPA determined the uncertainty zone historically used by the DEP was not scientifically supported and therefore used an impairment threshold equal to the 5th percentile of reference scores as originally calculated.

For 2014, the DEP included biological impairment listings based upon the methodology used by the EPA in their 2012 oversight actions. The EPA partially disapproved the DEP's 2014 submission, eventually finalizing the list by adding 28 streams based on a genus level index known as GLIMPSS which has never been used by the DEP for 303(d) listing purposes.

For the 2016 listing cycle, the DEP determined biological impairments based on WVSCI. The DEP maintains that, considering the legislative mandate of SB 562, it would be inappropriate to utilize the GLIMPSS while a new assessment methodology is being developed. That said, the DEP has updated the WVSCI scoring thresholds, based on the current and much larger set of reference site samples available. The WVSCI thresholds were recalculated and are still based on the 5th percentile of reference site index scores. The recalculated impairment threshold used for the 2016 303(d) list is 72.

Each listed stream will be revisited prior to TMDL development. The causative stressor(s) of impairment and the contributing sources of pollution will be identified during the TMDL development process.

Biological impairments identified in the Final West Virginia 2014 Section 303(d) List are proposed to be delisted under the following scenarios:

- Where previous listings were determined to have been made in error.
- Where more recent biological monitoring results demonstrated WVSCI scores greater than 72.
- Where approved TMDLs have been developed pursuant to numeric water quality criteria and the Stressor Identification performed in the TMDL process demonstrated that their implementation would resolve the stress to the benthic macroinvertebrate community that caused the original listing.

Streams that are delisted under the first two scenarios are identified in Supplemental Table A. The prior listings for which surrogate TMDLs address biological impairment are identified in Supplemental Table B

5.7 Narrative Water Quality Criteria - Fish Tissue and Consumption Advisories

The narrative water quality criterion of 47CSR2 – 3.2.e prohibits the presence of materials in concentrations that are harmful, hazardous or toxic to man, animal or aquatic life in state waters. Fish consumption advisories are used to inform the public about potential health risks associated with eating fish from West Virginia's streams. The DEP, the Division of Natural Resources, and the Bureau for Public Health have worked together on fish contamination issues since the 1980s. An executive order from the governor and subsequent Interagency Agreement signed in 2000 formalized the collaborative process for developing and issuing fish consumption advisories.

Risk-based principles are used to determine whether fish consumption advisories are necessary. These advisories are used as a public education tool to help citizens make informed decisions about eating fish caught in state streams. The risk-based approach estimates the probability of adverse health effects and provides a statement on the health risk facing the angler and high-risk groups including women of

childbearing age and children. West Virginia's fish consumption advisories include guidelines on the number of meals to eat and information on proper fish preparation to further minimize risk.

Waterbody-specific fish consumption advisories exist for 12 state streams and five lakes, not including the Ohio River mainstem, for a variety of fish species and contaminants. Additionally, there is a general statewide advisory that recommends limiting the consumption of certain sport-caught fish from all West Virginia waters in relation to low-level mercury and/or polychlorinated biphenyl (PCB) contamination. The statewide advisory provides species-specific recommendations ranging from one meal per week to one meal per month. The following webpage contains the most recently issued West Virginia fish consumption advisories:

http://www.wvdhhr.org/fish/

Generally, the presence of contaminants in fish tissue from commonly consumed species in amounts leading to a two meal per month or more stringent advisory is considered sufficient evidence of impairment, with exception to mercury. Methylmercury, instead of mercury, has a specific body- burden criterion for protection of public water supply and water contact recreation designated uses. The criterion states "The total organism body burden of any aquatic species shall not exceed 0.5 µg/g as methylmercury." Therefore, the DEP must apply the criteria to all aquatic species rather than just the commonly consumed fish species. Fish tissue methylmercury assessment is directly based upon the numeric criterion and not upon fish consumption advisories.

In the 2010 listing cycle, the DEP delisted many previous mercury impairments because they were based upon total mercury rather than methylmercury fish tissue concentrations and upon fillet rather than whole body samples. 2016 mercury listings adhere to the specific conditions of the methylmercury criterion (whole-body, methylmercury, species-specific).

The following methodology was used for assessment of methylmercury in fish tissue. The DEP collected fish from selected streams and lakes in West Virginia based on past listings and waters with suspected contamination. Each fish collected was processed separately and analyzed for whole body methlymercury concentration. For 303(d) purposes, the analytical results were assessed as "pseudo-composites" averaging the individual results within like-sized groups to include only fish with a length equal to or greater than 75% of the longest individual fish in each species at each site. This qualification is based on a general rule for compositing of fish tissue samples. The individual results of all qualified fish within each species were averaged to obtain a value for comparison to the criterion. If the average for any species specific pseudo-composite exceeded the 0.5 µg/g criterion, the waterbody was listed as impaired for methylmercury. The metyhylmercury concentration for a single fish may be used to assess impairment if there are no other like-sized fish to group. The 2016 303(d) list contains six lakes listed as impaired for methylmercury.

For the mainstem Ohio River, the applicable ORSANCO body-burden criterion is 0.3 µg/g. As with previous 303(d) lists, DEP has deferred to ORSANCO's assessment results for mercury listing purposes. ORSANCO's assessment methodology is included in their Biennial Assessment of Ohio River Water Quality Conditions for 2016. ORSANCO's assessment methodology can be found at

http://www.orsanco.org/publications/biennial-assessment-305b-report/

5.8 Narrative Water Quality Criteria - Algal Blooms

The narrative water quality criterion of 47CSR2 – 3.2.g prohibits algae blooms which may impair or interfere with the designated uses of the affected waters. Significant improvements have been made to the assessment methodology used for this criterion in previous cycles. The new methodology (303(d) Listing Methodology for Algae Blooms) was finalized by the DEP in June 2013 and is available at

http://www.dep.wv.gov/WWE/Programs/wqs/Documents/Greenbrier%20Algae/AlgaeListingMethodology2014.pdf

The DEP commissioned research to determine river users' tolerance levels for filamentous algae growth. The report West Virginia Residents' Opinions on And Tolerance Levels of Algae In West Virginia Waters is available at

http://www.dep.wv.gov/WWE/Programs/wqs/Documents/WVAlgaeSurveReport_ResMgmt_WVDEP_2012.pdf .

River users were surveyed to determine how much filamentous algae cover would adversely impact recreational activities. The DEP considered the results of the survey when establishing thresholds for algae blooms that impair the Water Contact Recreation designated use. In general, a stream segment is considered impaired if filamentous algae cover greater than 20% extends for a longitudinal distance greater than three times the average stream width (3xW) OR if filamentous algae cover of greater than 40% is observed, regardless of the longitudinal extent of the bloom.

The DEP also considers streams to be impaired if algae blooms cause taste or odor that interferes with the Public Water Supply designated use. The application of drinking water treatment beyond "conventional treatment" in response to algae blooms is considered direct evidence of use impairment. Additionally, the DEP considers available taste or odor complaints about finished drinking water when assessing the Public Water Supply designated use and may classify the use as impaired even though additional treatment is not implemented.

The application of the assessment methodology to observations from the 2013, 2014, 2015 growing seasons resulted in the following impairments on the 2016 Draft West Virginia 303(d) List:

- Greenbrier River - Stony Creek (MP 12.1) to Howards Creek (MP 50.00)
- Cacapon River – RM 39.0 (North River) to RM 76 (Route 259 Bridge near Wardensville)
- South Branch of Potomac River – RM 23.7 (Johns Run) to RM 58.0 (South Fork)
- Tygart River – RM 73.2 (Grassy Run) to RM 90.1 (Dodson Run) – refinement of 2014 listing

6.0 ASSESSMENT RESULTS

6.1 Streams

This section contains the results from all the data that has been assessed for West Virginia streams. Table 6 shows a summary of the classification of West Virginia waters under the five "Integrated Report" categories (see Table 1). The results reveal that 22% of West Virginia's stream miles are in either Category 1 or 2 (fully supporting all or some assessed uses). Category 3, streams with insufficient data, makes up 34% of stream miles, the largest percentage of the five categories. However, that number is somewhat deceiving. The streams with limited data are typically small unnamed tributaries, which usually contribute to the larger waterbodies which have been assessed. All major rivers in the state have data and have been assessed and placed into one of the other four categories. Approximately 44% of West Virginia's streams are impaired and fall into either Category 4 or 5.

Table 6: 2016 Category Summary for West Virginia Streams

Overall Category	# of Stream Segments	% Stream Segments	Miles	% Miles
1	903	8	3,479	11
2	882	7	2,181	7
3	6,341	53	10,490	34
4a	2,514	21	9,545	31
4b	1	0	2	0
4c	32	0	28	0
5	1,326	11	5,398	17
TOTALS	11,999		31,123	

The lists of Category 1, Category 2, and Category 3 waters are quite large; therefore, they are not published in this document. The waters included in these three categories can be viewed in the *Category Designated Use* spreadsheet at:

http://www.dep.wv.gov/WWE/WATERSHED/IR/Pages/303d_305b.aspx

The guidelines used by the DEP to demonstrate use-support for streams (and subsequent classification into Categories 1, 2 or 3) vary for each of the designated uses. "Supporting" assessments for individual uses are made if certain mandatory(requisite) parameters have been monitored and those results demonstrate compliance with criteria. To demonstrate support, aquatic life uses in wadeable streams require benthic macroinvertebrate monitoring and results showing a WVSCI score greater than or equal to 72. Public Water Supply and Water Contact Recreation uses require compliant fecal coliform monitoring and all other uses require compliant pH and dissolved oxygen monitoring. If monitoring results are available for "non-mandatory" (ancillary) parameters, they also must indicate compliance with any criteria prescribed for the use.

Stream segments where mandatory parameters indicate support of all designated uses are placed in Category 1. Stream segments without sufficient data to determine use support or impairment may be placed in either Category 2 or 3. Category 2 houses waters with some uses determined to be supported, but lacking sufficient information to assess other uses. Waters are placed in Category 3 if insufficient or no information exists to determine if any of the uses are being met. An "insufficient data" designation may result where some water quality data are available, but not enough to conclude that the use is supported or impaired, or where water quality data for mandatory(requisite) parameters is absent.

Impaired waters are placed in Categories 4 or 5. Prior to TMDL development, waters impaired by a pollutant are placed on the Section 303(d) List and in Category 5. After TMDLs are developed and approved, those waters are relocated to Category 4a and are identified in Supplemental Table B of this report. Other impaired streams for which TMDLs need not be developed are placed in Categories 4b or 4c. Category 4b includes waters impaired by a pollutant for which other control mechanisms are in place that will reasonably result in the water meeting designated uses. Waters impaired by something other than a pollutant, for which no TMDL can be developed, are categorized as 4c (ex. low flow alterations). Categories 4b and 4c impaired waters are identified in Supplemental Table D.

Category 5 includes 1,322 impaired stream segments, covering approximately 5,388 stream miles that are impaired and need TMDLs developed. The number and length of impaired streams varies from one list year to the next due, in part, to the TMDL development timeline. TMDLs always are in various stages of development, and with the additional sampling data generated, streams and stream segments may move from Categories 1, 2 or 3 to Category 5. Additionally, TMDLs that have not yet been approved by the EPA remain listed in Category 5. Once these TMDLs are approved, those streams and stream segments will move to Category 4a.

6.2 Lakes

With the exception of listings based on fish tissue methylmercury results, past Integrated Reports have carried forward lake assessments from the previous listing cycles due to a lack of new data or full EPA approval of numeric nutrient criteria. For the 2016 listing cycle, with full EPA approval of the nutrient criteria for lakes and a data set of sufficient size and temporal spacing to meet criteria assessment requirements, the DEP has updated lake assessments. There are currently seven lakes listed for methylymercury or PCBs, seven lakes have been added to 2016 303(d) List for a total of 14 lakes or lake segments now listed for total phosphorus and/or chlorophyll-a criteria violations.

Protocols for IR categorization of lakes into Categories 1, 2 or 3 were revised in the 2014 cycle. In previous cycles, use support for lakes was based upon numeric water quality data, consistent with guidelines previously described for streams. Previous reports generally placed lakes in Category 1 if data indicating attainment was available for mandatory parameters and other parameters. In contrast to stream categorization where aquatic life use support is conditioned upon available biological monitoring that indicates integrity, the DEP lacks an ability to evaluate biological integrity in lakes. With limited tools, the DEP cannot conclude full support of the aquatic life use in lakes. As such, many of the lakes that were previously in Category 1 were reclassified in Category 2 or 3 (Table 7). Such reclassification does not

indicate a lowering of use support, but instead demonstrates the existing inability to effectively assess aquatic life use support in lakes. The summary tables reflect "number of lake segments" rather than number of lakes. In lakes with multiple assessment locations and clear distinction of water quality, the lake is segmented for assessment purposes.

Table 8 and Table 9 contain a breakdown of use support specific to the use categories for the state streams and lakes as set forth in the Water Quality Standards (47CSR2).

Table 7: 2016 Category Summary for West Virginia Lakes

Overall Category	# of Lakes	% Lakes	Acres	% Acres
1	0	0	0	0
2	46	34	6,745	30
3	60	45	3,941	17
4A	6	4	125	1
5	23	17	11,679	52
TOTALS	135		22,490	

Table 8: Designated use support summary for West Virginia streams.

Designated Use	Total Streams		Fully Supporting		Fully Supporting		Insufficient Data		Insufficient Data		Not Supporting		Not Supporting		Unassessed		Unassessed	
	#	Miles	#	%	Miles	%	#	%	Miles	%	#	%	Miles	%	#	%	Miles	%
A - Public Water	11,995	31,119	1,662	14	6,429	21	1,207	10	2,403	8	3,219	27	12,443	40	5,907	49	9,845	31
B1 - Warm Water Fishery	10,864	25,830	1,029	9	3,588	14	1,256	12	2,656	10	3,099	29	10,703	42	5,480	50	8,884	34
B2 - Troutwater	1,135	5,293	307	27	2,009	38	195	17	836	16	318	28	1,757	33	315	28	692	13
C - Contact Recreation	11,999	31,123	1,923	16	7,149	23	1,501	13	3,171	10	2,157	18	9,893	32	6,418	53	10,911	35
D - Agriculture and Wildlife	11,999	31,123	4,093	34	16,773	54	892	7	1,648	5	594	5	1,785	6	6,420	54	10,917	35
E - Industrial	11,999	31,123	4,093	34	16,773	54	892	7	1,648	5	594	5	1,785	6	6,420	54	10,917	35

Table 9: Designated use support summary for West Virginia lakes.

Designated Use	Total Lakes		Fully Supporting		Fully Supporting		Insufficient Data		Insufficient Data		Not Supporting		Not Supporting		Unassessed		Unassessed	
	#	Acres	#	%	Acres	%	#	%	Acres	%	#	%	Acres	%	#	%	Acres	%
A - Public Water	135	22,490	46	34	6,745	30	5	4	3,397	15	16	12	10,015	45	68	50	2,333	10
B1 - Warm Water Fishery	112	17,070		0		0	41	30	9,360	42	20	15	2,142	10	51	38	5,568	25
B2 - Troutwater	23	5420		0		0	10	7	1,030	5	3	2	44	0.2	10	7	4,346	19
C - Contact Recreation	135	22,490	50	37	6,850	30	3	2	2,047	9	24	18	11,683	52	58	43	1,910	8
D - Agriculture and Wildlife	135	22,490	50	37	6,850	30	6	4	4,365	19	1	1	4	0.02	78	58	11,271	50
E - Industrial	135	22,490	50	37	6,850	30	6	4	4,365	19	1	1	4	0.02	78	58	11,271	50

6.3 Causes for Impairment

The list and the summary results of Table 10 and Table 11 provide an overview of the impairment status of West Virginia waters. Some waters are impaired for multiple water quality criteria.

Table 10: Summary of impairment causes for West Virginia streams.

Type	Cause	Miles
Stream	Aluminum	1,318
Stream	Ammonia	6
Stream	Bacteria	243
Stream	Beryllium	17
Stream	Bio	6,837
Stream	Chloride	57
Stream	CNA-Algae	126
Stream	Dioxin	352
Stream	DO	67
Stream	Fecal Coliform	8,259
Stream	Iron	8,782
Stream	Low Flow Alterations	44
Stream	Manganese	116
Stream	PCBs	430
Stream	pH	1,354
Stream	Selenium	666
Stream	Temperature, water	2

Table 11: Summary of impairment causes for West Virginia lakes

Type	Cause	Acres
Lake	Chlorophyll-A	1,148
Lake	DO	4
Lake	Iron	54
Lake	Methylmercury	9,826
Lake	PCBs	630
Lake	Phosphorus	1,217
Lake	Sedimentation/Siltation	189
Lake	Trophic State Index	96

7.0 PROBABILISTIC DATA SUMMARY

The goal of DEP's probabilistic monitoring program is to provide statistically unbiased estimates of stream condition throughout a particular region (i.e., watershed, ecoregion or state) without assessing every stream mile in that region. This approach can be used to describe various aspects of stream condition

including, the proportion of stream miles with biological impairment, the proportion of stream miles with specific water quality criterion violations, and the characterization of the relative importance of stressors such as sedimentation or acid precipitation. The target population for these efforts was small to medium sized (1st - 4th order) wadeable streams. Ninety-eight percent of West Virginia's stream miles are of this size class and approximately 70% of these are wadeable. The probabilistic design used for this summary allows DEP to characterize overall water quality conditions at an ecoregion scale (Figure 3), basin scale (Figure 4), and statewide. The 'basins' are groups of four to six 8-digit HUC watersheds that provide data sufficient to develop estimates of condition with fairly small confidence boundaries. Probabilistic assessment sites were distributed within the three major ecoregions in West Virginia: the Western Allegheny Plateau (70), Central Appalachians (69), and Ridge and Valley (67). Due to its small extent in West Virginia, the Blue Ridge Mountain Ecoregion (66) was combined with Ecoregion 67 for assessments and data analysis. The data used for these analyses are from 313 sites that were sampled at baseflow conditions during the late spring/early summers of 2010 – 2015.

The probabilistically selected sites are assessed using three broad categories of aquatic integrity indicators: biological community quality; water quality; and habitat quality. From these, several individual indicators were chosen to help illustrate the condition of West Virginia's rivers and streams during the period of interest in this report. They are presented for statewide, the three "ecoregions" and six "basins" shown in the figures below.

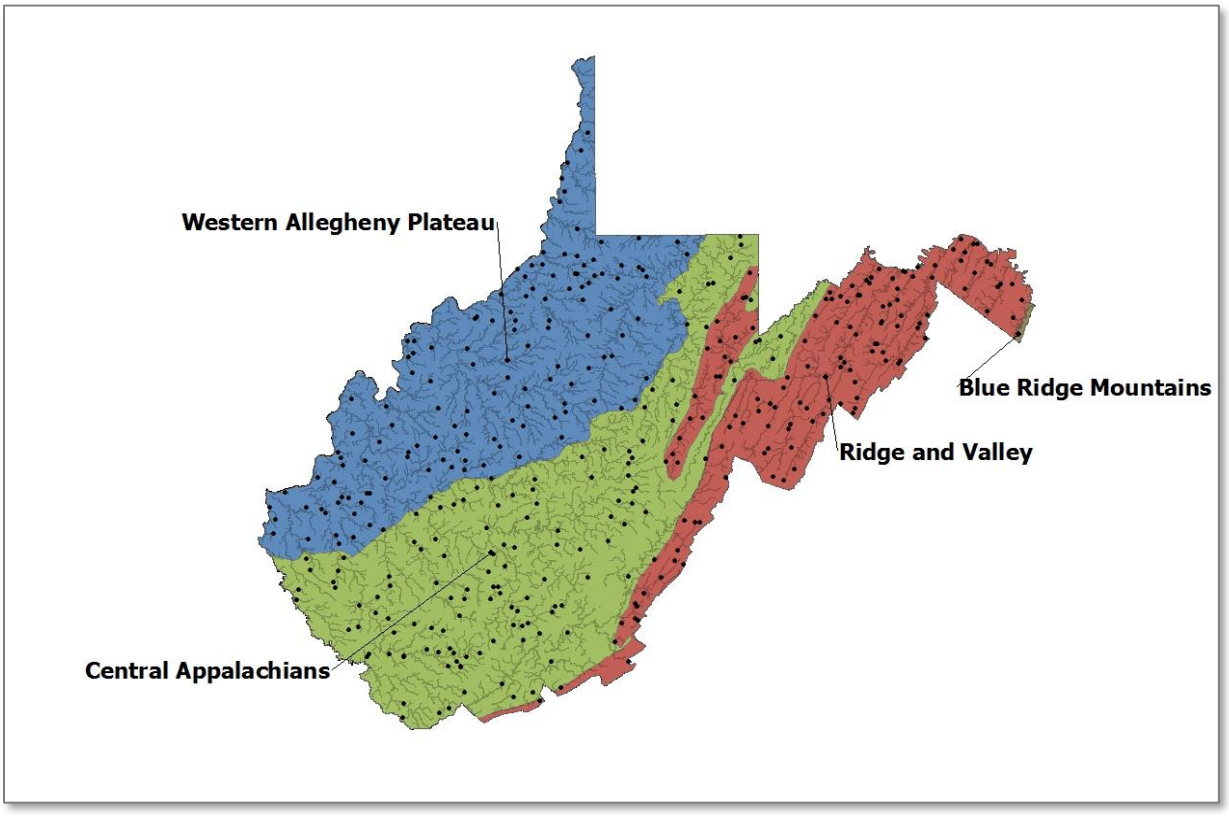

Figure 3: West Virginia Ecoregions

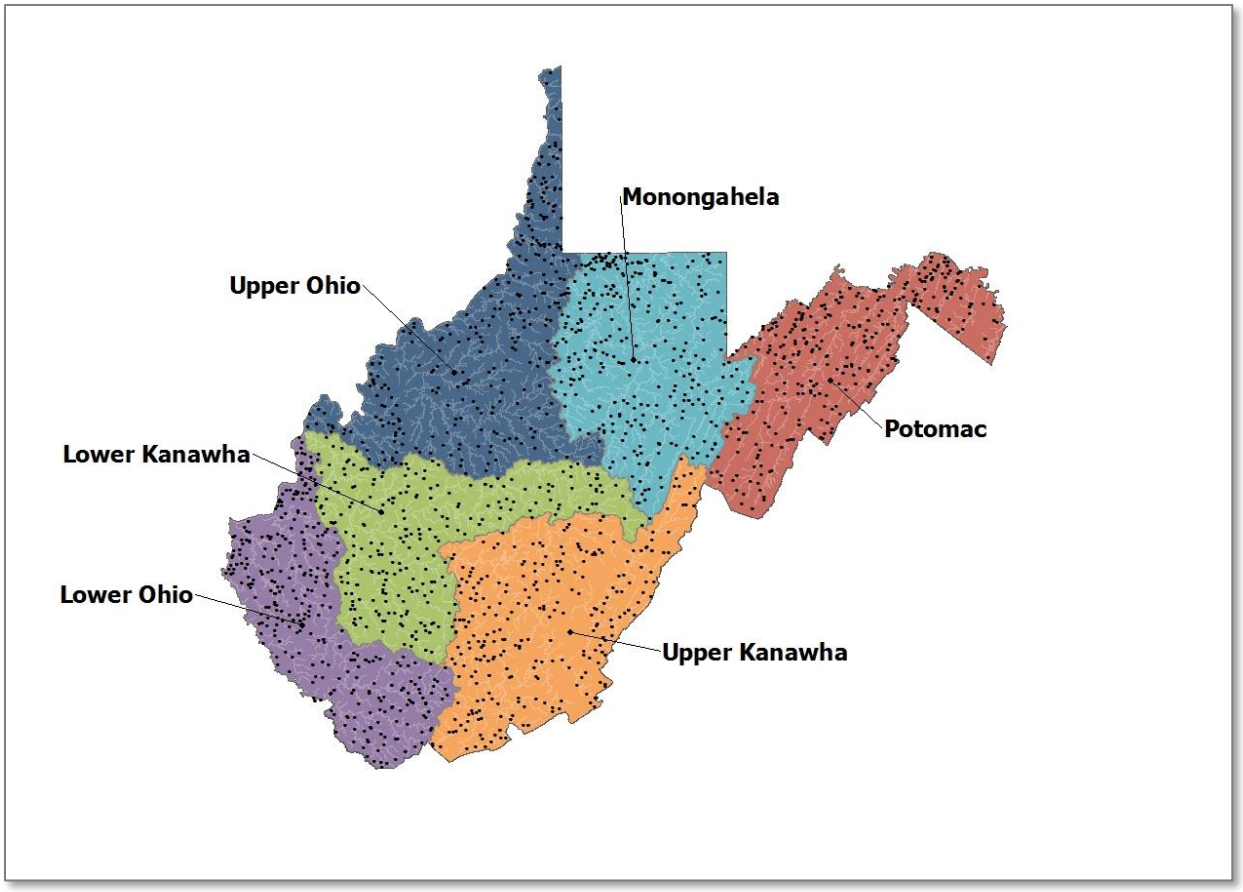

Figure 4: West Virginia Basins

7.1 Indicators of Stream Condition

7.1.1 Biological Community

The biological communities living in West Virginia streams are exposed to many stressors, including toxic contaminants, sedimentation, nutrient enrichment, and acid precipitation. The DEP uses benthic macroinvertebrates to assess the biological condition of streams in the state. These organisms provide reliable information on water and habitat quality in streams and have been used as indicators all over the world for nearly 100 years. They are extremely diverse and exhibit a wide range of tolerances to pollutants. Further, they serve as an excellent tool for measuring overall ecological health, especially when summarized into a single index of biological integrity.

In West Virginia prior to 2012, the health of benthic macroinvertebrate communities had been rated using a statewide family-level multi-metric index developed for use in wadeable riffle/run streams, the West Virginia Stream Condition Index (WVSCI). Beginning in 1998, the DEP started identifying benthic macroinvertebrates to genus level with the intention of eventually developing a new biotic index. Development of a genus level index is now complete. The new tool, known as GLIMPSS (Genus Level Index of Most Probable Stream Status), which is stratified by season and ecoregion, has now been peer

reviewed and published and is ready for use in this summary report. However, the new index is not yet ready for use in determining attainment of a stream's Aquatic Life Use (AQL) for regulatory purposes. During West Virginia's 2012 legislative session, Senate Bill 562 was passed requiring the DEP to develop a new assessment methodology that will be subject to legislative approval. The process to develop and evaluate options for assessing stream health more "holistically" is ongoing, and specifically considers the use of fish community information, along with benthic macroinvertebrate index scores, as part of the assessment methodology. GLIMPSS, similar to WVSCI and other indices of biotic integrity, summarizes scores of various metrics into a single index value. The metrics were selected to maximize discrimination between streams with known stressors and reference streams. Reference streams have little or no human disturbances. All identified reference streams were combined and a subsequent reference condition was established based on their benthic macroinvertebrate communities.

Based on the probabilistic data utilized in this summary and a comparison to low-end reference condition (5th percentile of all appropriate season and ecoregion reference sample GLIMPSS scores), 64.3 percent of wadeable stream miles have scores equal to or above the low-end reference condition threshold (i.e., are generally in good biological condition) statewide with the remaining 35.7 percent scoring less than this threshold (Figure 5). Breaking this down by ecoregion, the Ridge and Valley has the highest percentage of streams with healthy aquatic ecosystems, with 82.4 percent scoring above the 5th percentile threshold. The Western Allegheny Plateau ecoregion scores lowest with an estimated 55.8 percent of stream miles comparable to reference. The percent of stream miles in the Central Appalachians scoring above the GLIMPSS threshold is estimated to be 63.3. Among basins, the Upper Kanawha had the highest percent of streams miles (70.8) above the reference threshold, while the Lower Ohio had the fewest (45.7).

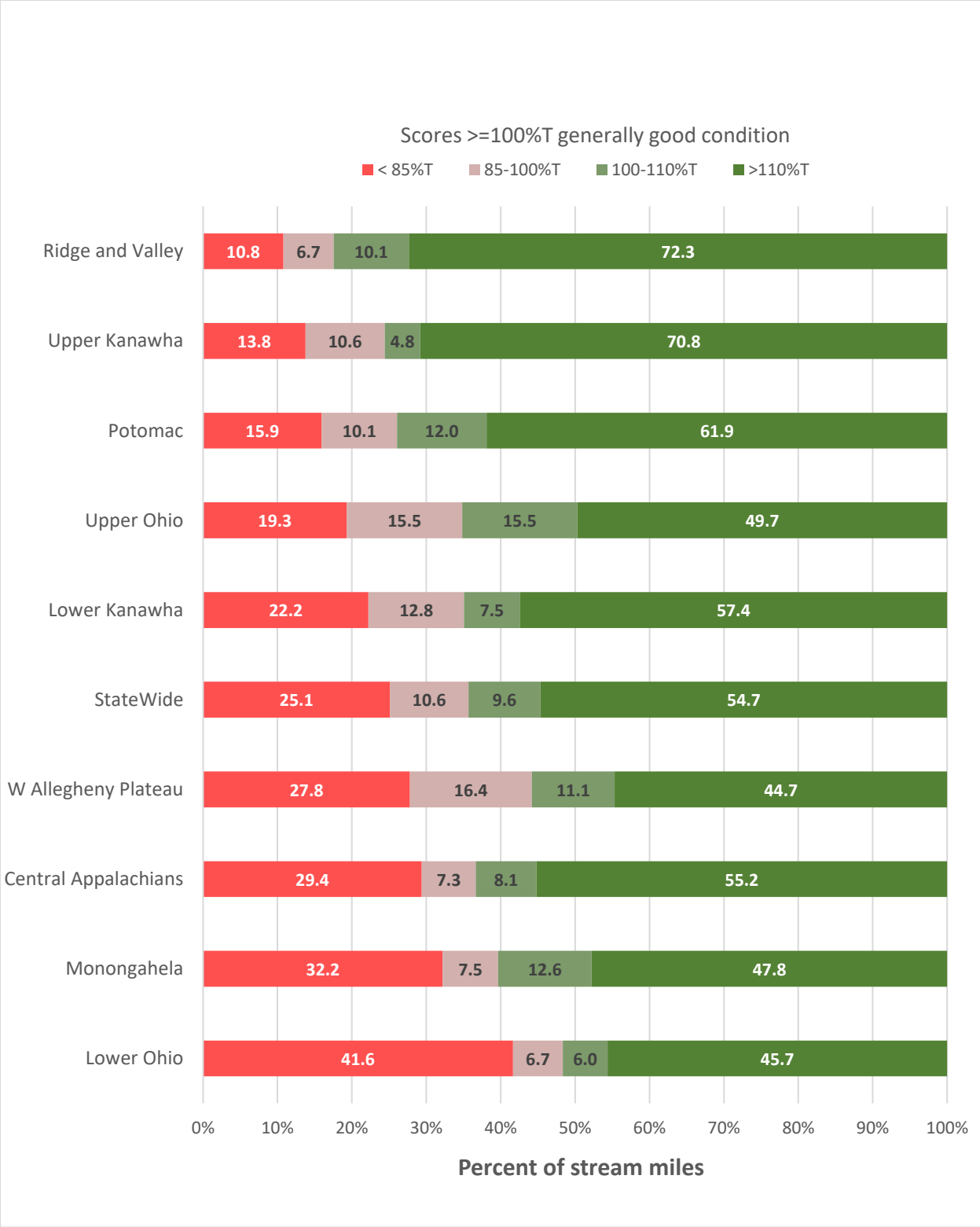

Figure 5: Biological Health – Benthic Macroinvertebrate Community IBI Scores for GLIMPSS at Genus Level (except Chironomidae)

7.1.2 Water Quality Indicators of Aquatic Integrity

The Watershed Assessment Branch analyzes over 20 different water quality parameters at each of the sites sampled as part of the probabilistic monitoring program. Below are the results of five of these parameters, including:

- Conductivity – various levels
- Sulfate > 50mg/L
- Acidity: pH < 5.0 and <6.0
- Bacterial Contamination: fecal coliform bacteria > 400 colonies/100mL
- Total Phosphorus – various concentrations

Conductivity

Conductivity, or specific conductance, is a measure of how well water conducts electricity which is determined by what and how much is dissolved in the water. In certain areas, conductivity is naturally elevated because of calcium and other minerals dissolved from limestone and other soluble rocks. In others, it is high because of added pollution from a variety of sources. Large scale surface mining such as mountain top mining and the use of valleys fills results in high conductivity caused by water percolating through fractured rock that had once been solid. High conductivity waters are often associated with degraded benthic macroinvertebrate communities.

In general, West Virginia streams have relatively low conductivity – with 80% of wadeable stream miles statewide having late spring /early summer levels below 300 µS/cm (levels tend to rise as the streamflow drops during summer and fall) and many regions having the majority of their stream miles less than 100 µS/cm (Figures 6 and 7). The Upper Ohio Basin and the closely aligned Western Allegheny Plateau ecoregion have fewer low conductivity (<100 µS/cm) streams, and also includes some areas (northern panhandle) with the high conductance streams associated with coal mining. The Monongahela Basin includes some of lowest conductivity streams (headwaters of Tygart and Cheat river watersheds) as well as some of the highest conductivity streams that are impacted by mining as well as industrial and residential development. The map at left shows average specific conductivity by 12-digit HUC watersheds using all available data (not limited to probabilistic data). The higher conductivity values in the eastern panhandle is attributable to the limestone geology of the area.

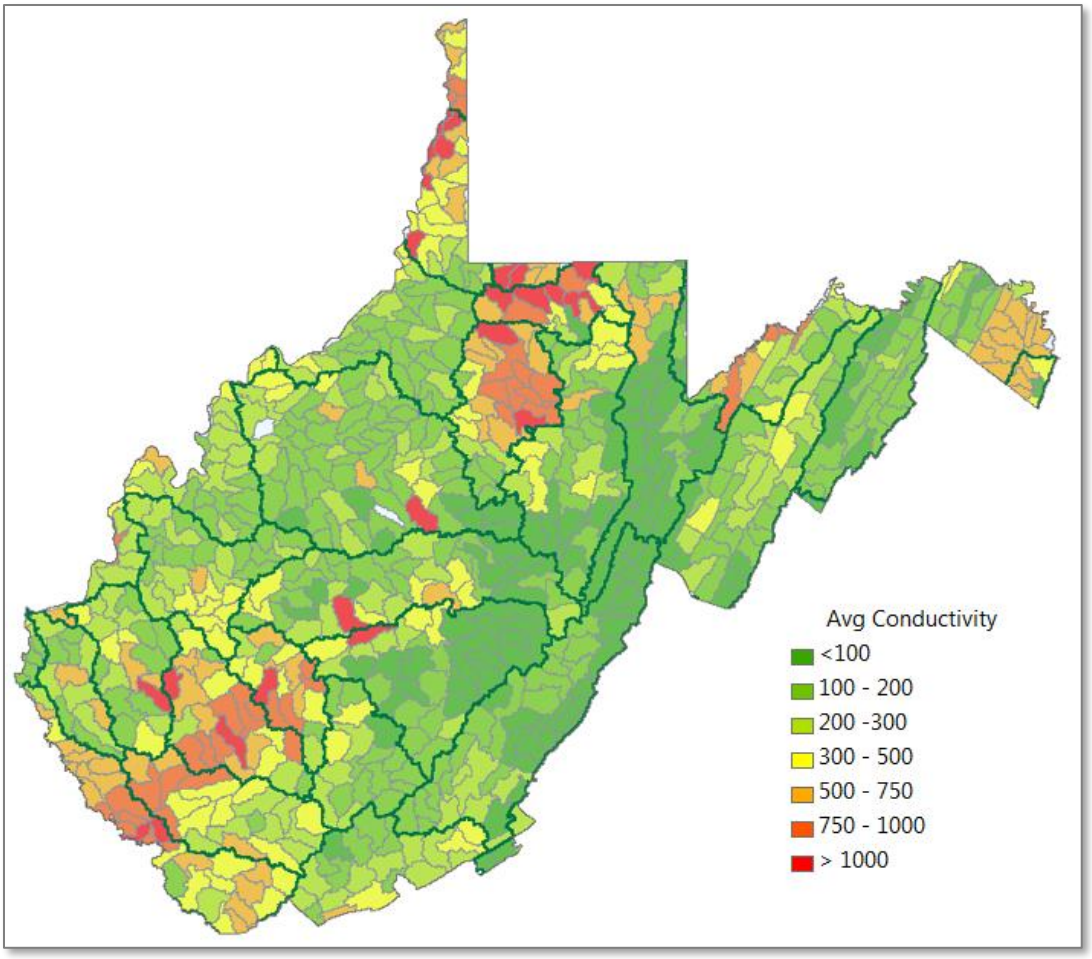

Figure 6: Average Specific Conductance at 12-digit-HUC Scale Watersheds in West Virginia

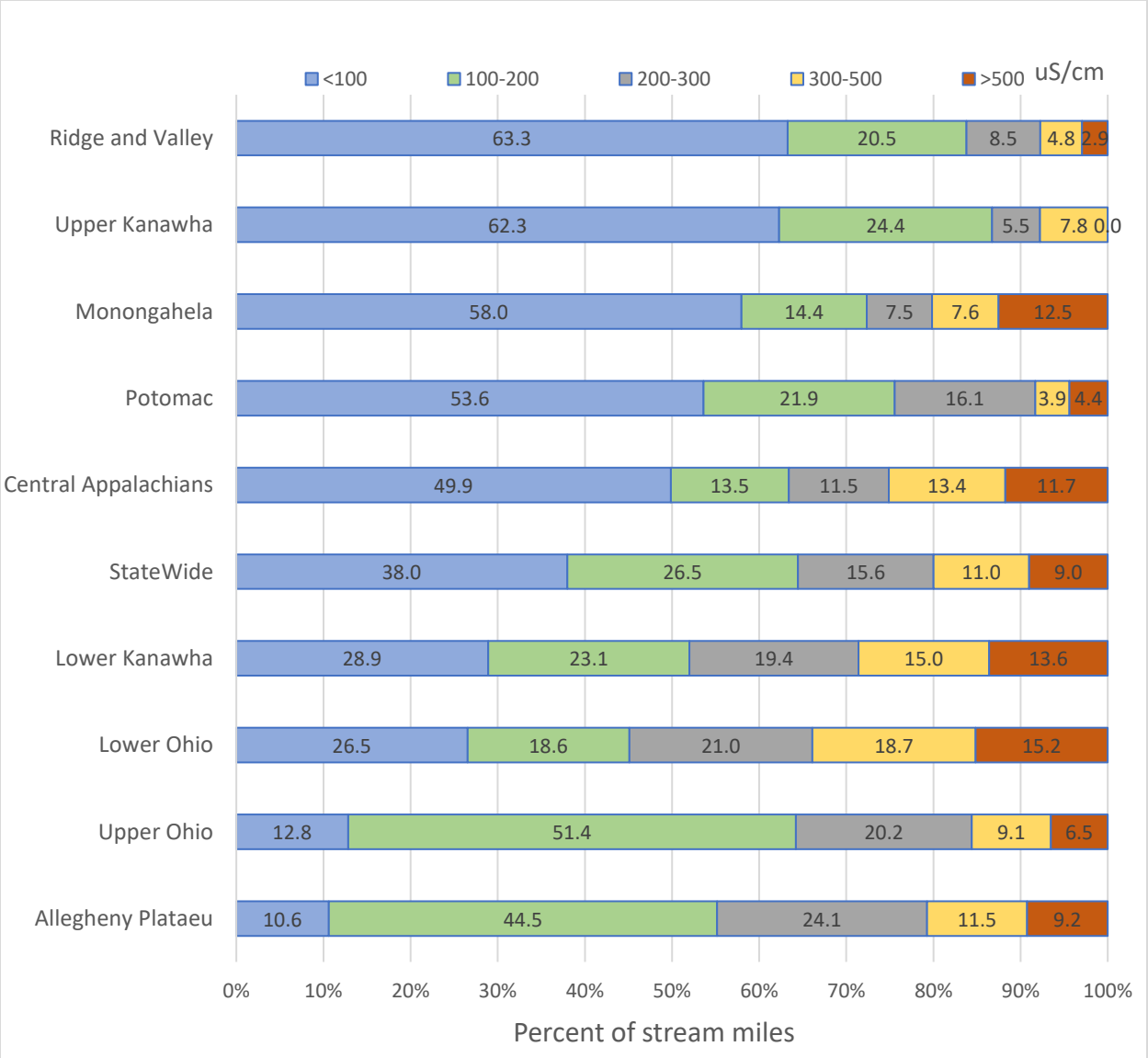

Figure 7: Specific Conductance in West Virginia Streams

Sulfate

Streams receiving mine drainage may be impaired by low pH and/or elevated concentrations of metals, including iron, aluminum, and manganese. Other dissolved ions such as sulfate may also be present in concentrations above background levels. A sulfate concentration greater than 50 mg/L was used to identify probabilistic sites influenced by mine drainage. Following this guideline, approximately 18.5 % of the stream miles statewide are influenced by mine drainage (Figure 8). Observed on an ecoregional basis, mine drainage influences a greater proportion of stream miles in the coal rich Central Appalachians (30.5%) than in the Ridge and Valley (1.6%) or Western Allegheny Plateau (14.0%). Among basins, the Lower Ohio (38.2%) and Lower Kanawha (32.5%) had the highest percent of streams miles exceeding the 50 mg/L threshold of sulfate.

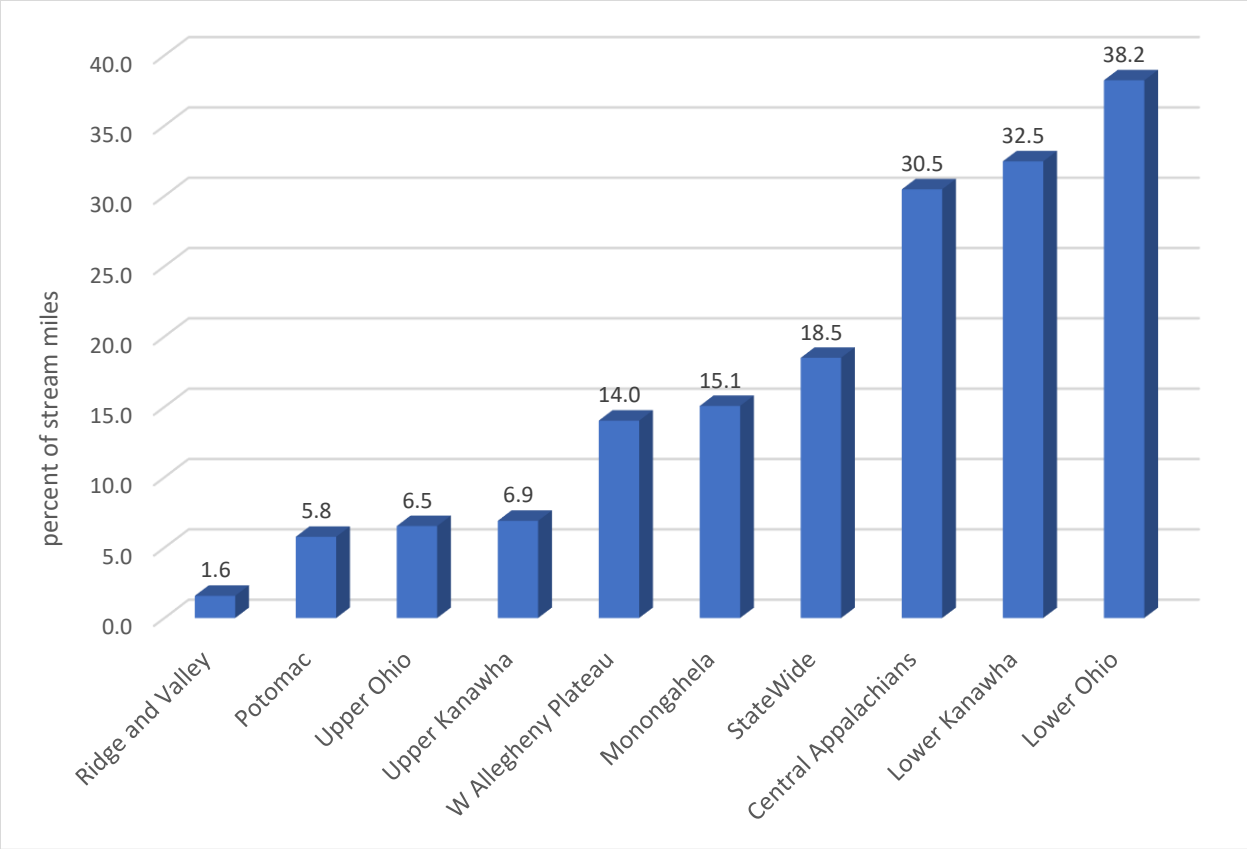

Figure 8: Sulfate in West Virginia Streams

Bacterial contamination

Many West Virginia streams contain elevated levels of fecal coliform bacteria. Contributors to the problem include leaking or overflowing sewage collection systems, illegal homeowner sewage discharges by straight pipes or failing septic systems, and runoff from urban or residential areas and agricultural lands. Based on probabilistic data, 14.0% of stream miles in the state have fecal coliform bacteria levels that exceed the criterion of 400 colonies/100mL (Figure 9). In general, watersheds in the more developed regions of the state had a greater proportion of stream miles exceeding the criterion. Among ecoregions, the proportion of stream miles violating the criterion was highest in the Western Allegheny Plateau with 25.3 % of stream miles exceeding the criterion. The proportions of stream miles exceeding the criterion were considerably lower in the Central Appalachians at 7.7% and Ridge and Valley Ecoregions at 5.7%. It should be noted that DEP's probabilistic monitoring is performed at baseflow conditions. Because samples are not collected during storm runoff events, bacteria levels that may increase under these higher flow conditions are not represented in the results. The Upper Ohio and Lower Ohio basins had the highest percent of stream miles exceeding the bacteria criterion with 22.9% and 20.3%, respectively.

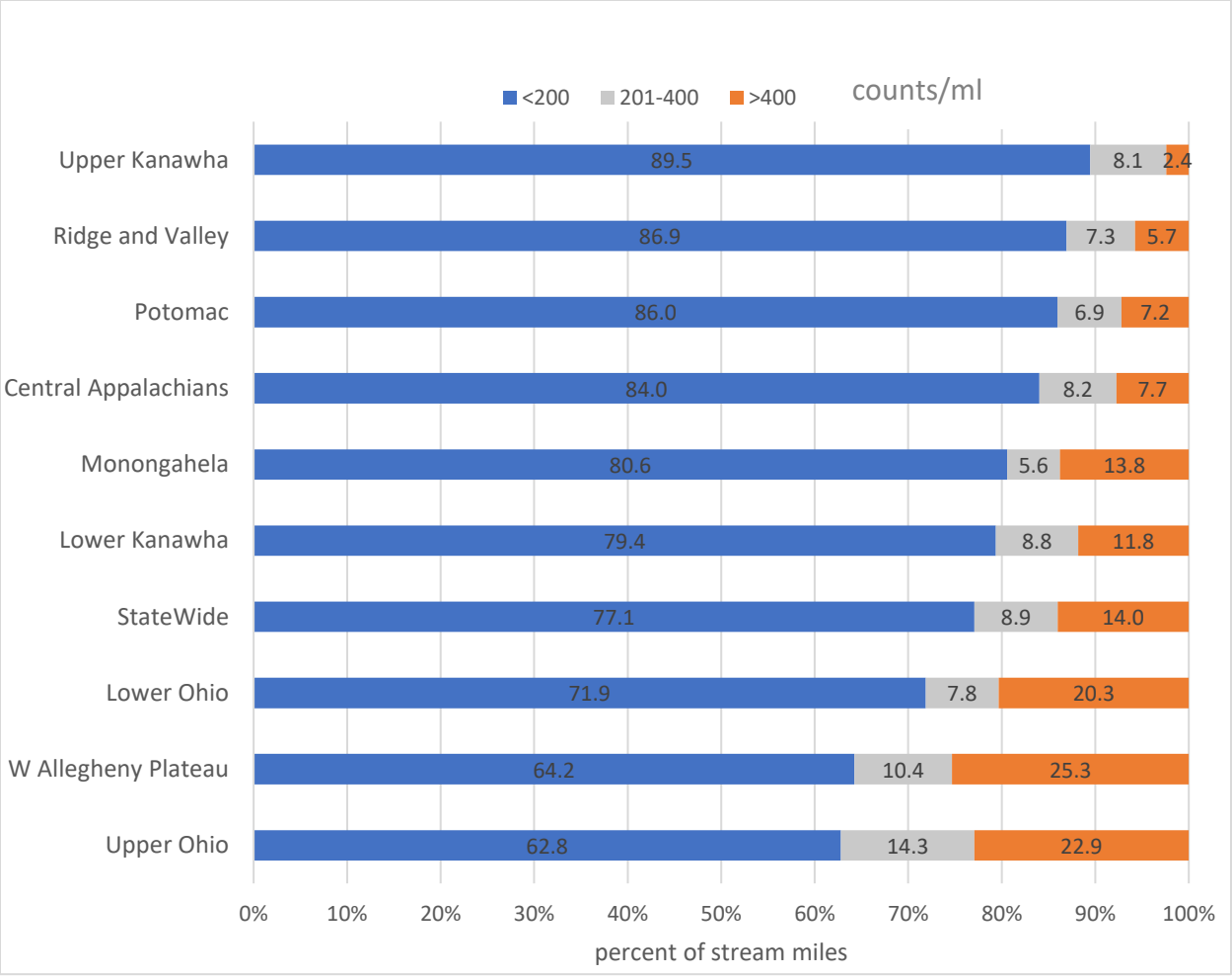

Figure 9: Fecal Coliform Bacteria in West Virginia Streams

Acidity

Aquatic life communities in the headwater sections of many West Virginia streams continue to be impacted by low pH, and thus, acidic water quality. The impairment is most prevalent in watersheds with soils of low buffering capacity and most often caused by acid precipitation and less often (but potentially more severely) by acid mine drainage. An evaluation of probabilistic data indicates that approximately 7.9% of the stream miles in the state have pH values below 6.0 (Figure 10). Most of the stream miles identified as impacted by acidic waters are in the Central Appalachians Ecoregion, representing 14.8% of the stream miles within this area. Specifically, the Forested Hills and Mountains section of this ecoregion are largely susceptible to acid precipitation impacts due to infertile soils and resistant sandstones of the Pottsville group. The Ridge and Valley Ecoregion is less susceptible to the impacts of acid deposition with geologic materials such as limestone and shale providing more buffering capacity to neutralize acid precipitation. Nonetheless, probabilistic data indicates that approximately 7.9% of the stream miles in the Ridge and Valley Ecoregion are impacted by acidic conditions. Although present, the extent of stream miles impacted by acidic waters within the Western Allegheny Plateau Ecoregion is near 0.0%. In fact,

their proportion to the overall size of the total population of stream miles is insignificant enough to result in no acidic stream miles based on this cycle's probabilistic analysis. Again, this ecoregion has well buffered soils that limit the impacts of acid precipitation. Furthermore, where they do exist in the western Allegheny Plateau ecoregion, acidic waters are more likely the result of acid mine drainage than acid precipitation. The Monongahela had the highest level of low pH waters among basins with nearly 19% of stream miles estimated to be acidic. The Monogahela basin likely has significant contributions from both acid deposition and acid mine drainage.

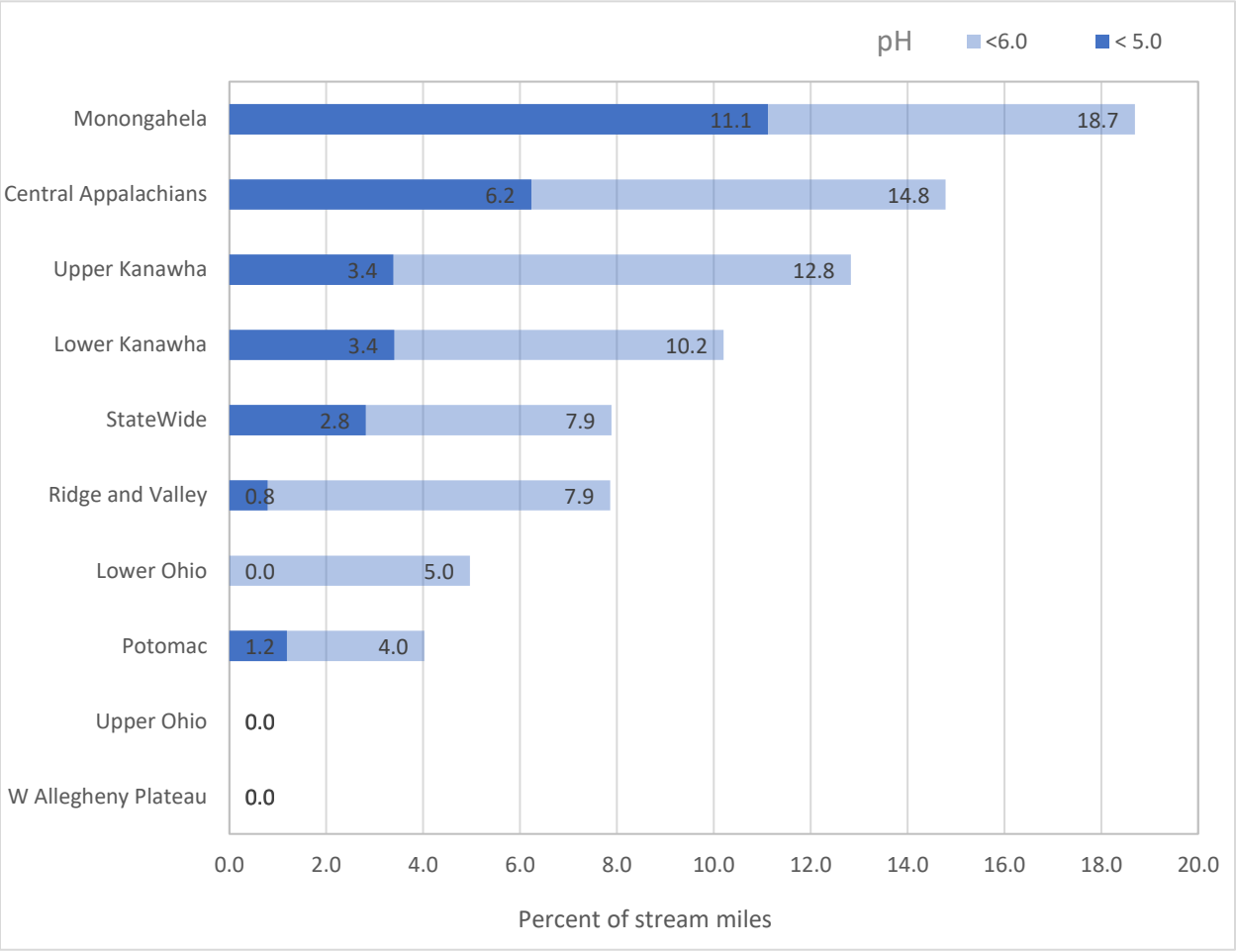

Figure 10: Acidic Streams in West Virginia as Indicated by pH

Phosphorus

A large proportion of total phosphorus (TP) from our probabilistic efforts have results that are below quantifiable reporting limits of the analytical labs. With nutrients considered one of the country's most widespread pollutants, having so many results below detectable levels is overall a good thing. Unfortunately, there are several different detection limits used for this sample period preventing the ability to provide a clear comparison of TP levels across regions of the state. However, the results do allow for a comparison of percentage of stream miles with TP that are below those detection limits. From the graph

below (Figure 11), we know that the Western Allegheny Plateau has the highest percentage of stream miles with TP greater than 50 µg/L (7.3%) as well as the lowest percentage of stream miles with TP below the lowest detection level (33.1%) and that approximately two thirds of stream miles in the Upper Kanawha basin have TP below the lowest detection limit of 10 µg /L.

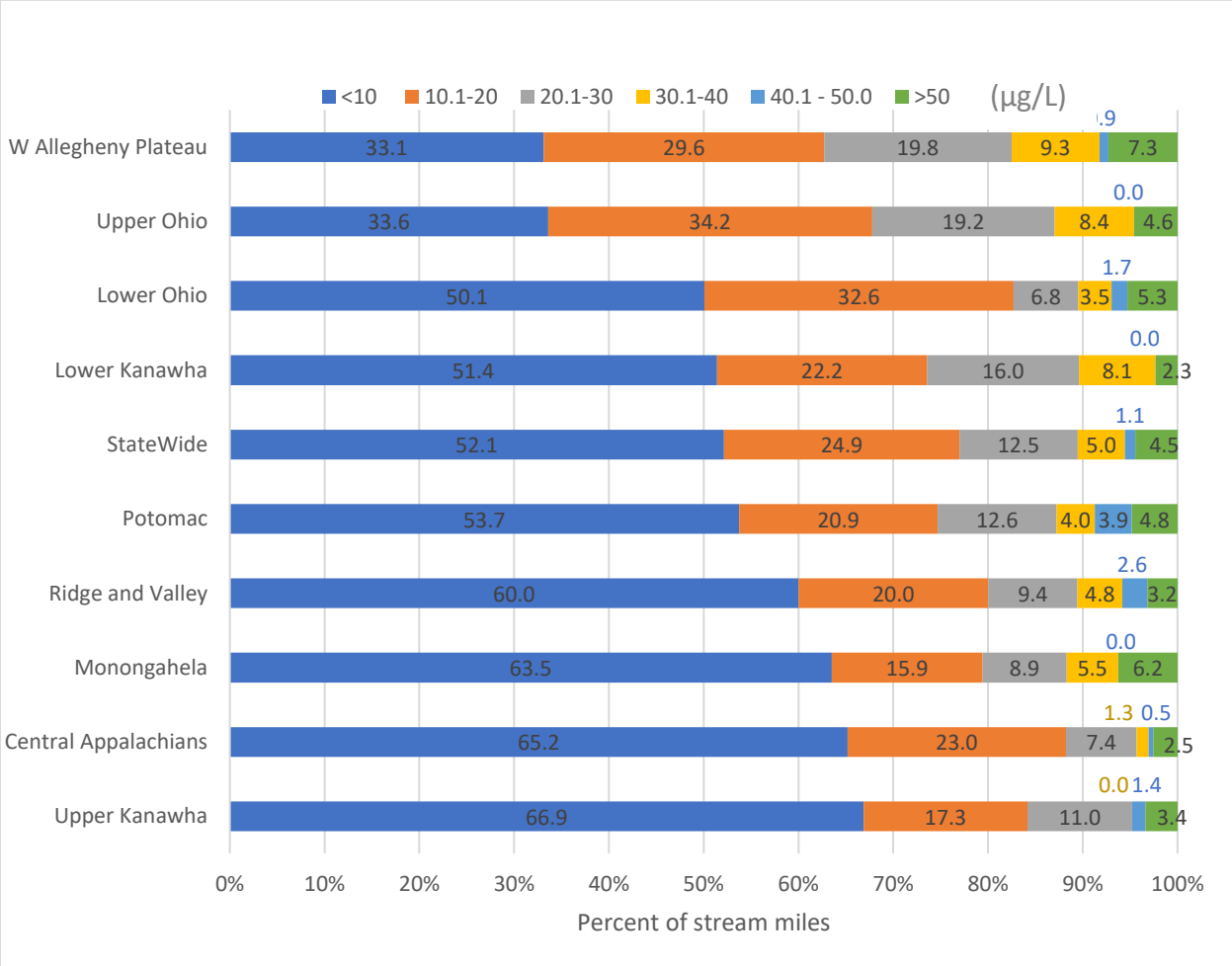

Figure 11: Total Phosphorus (µg/L) in West Virginia Streams

7.1.3 Habitat Indicators of Aquatic Integrity

Overall Stream Habitat Condition

During the course of probabilistic sampling, DEP personnel collect data on many features of both riparian and instream habitat known to be important to the biological communities of streams. Habitat parameters from EPA's Rapid Bioassessment Protocol (RBP) were measured. These include measures of the amount of sediment and embeddedness in the stream channel as well as measures of the vegetation along the bank and riparian zone in the stream corridor. Specifically, ten parameters are scored (0-20) based on their quality and then combined to assess the overall physical habitat condition of the site. The overall scores (Total RBP Habitat – max score 200 pts.) were categorized as good, moderate, or poor (Figure 12). Based

on probabilistic data, just 9.9% of stream miles statewide have good habitat quality (total RBP score of 160 or greater), 73.5% of stream miles have moderate habitat quality (110–159), and 16.6% of stream miles have poor habitat quality (< 110). While these categorical thresholds are somewhat arbitrary, they do provide a good comparison of habitat conditions between geographic areas.

On an ecoregional basis, the Ridge and Valley had the highest proportion of stream miles rated in the good category for overall habitat quality at 19.9%. Additionally, this ecoregion had the least number of stream miles rated as poor for overall habitat quality at only 4.4%.

Total habitat quality scores are lower in the Western Allegheny Plateau. The presence of more widespread development and factors such as higher rates of soil erosion in this ecoregion are potential causes for only 0.5% of its stream miles being rated as good in overall habitat quality. Additionally, the percentage of stream miles with poor habitat quality (28.4%) is substantially higher in this ecoregion.

The Upper Kanawha basin stands out as having the highest percentage of stream miles (35.1%) with good overall habitat. This basin includes large portions of the Monongahela National Forest and several undisturbed wilderness areas. The Upper and Lower Ohio basins have almost no miles in good condition and over a quarter of their stream miles in poor condition.

It is important to consider that approximately 90% of stream miles in the state are in the moderate or poor habitat categories. This indicates that most of the state's stream miles have at least some degree of habitat degradation. Although the DEP may gain insight into overall habitat conditions by combining the individual measures, it is useful to examine specific habitat characteristics.

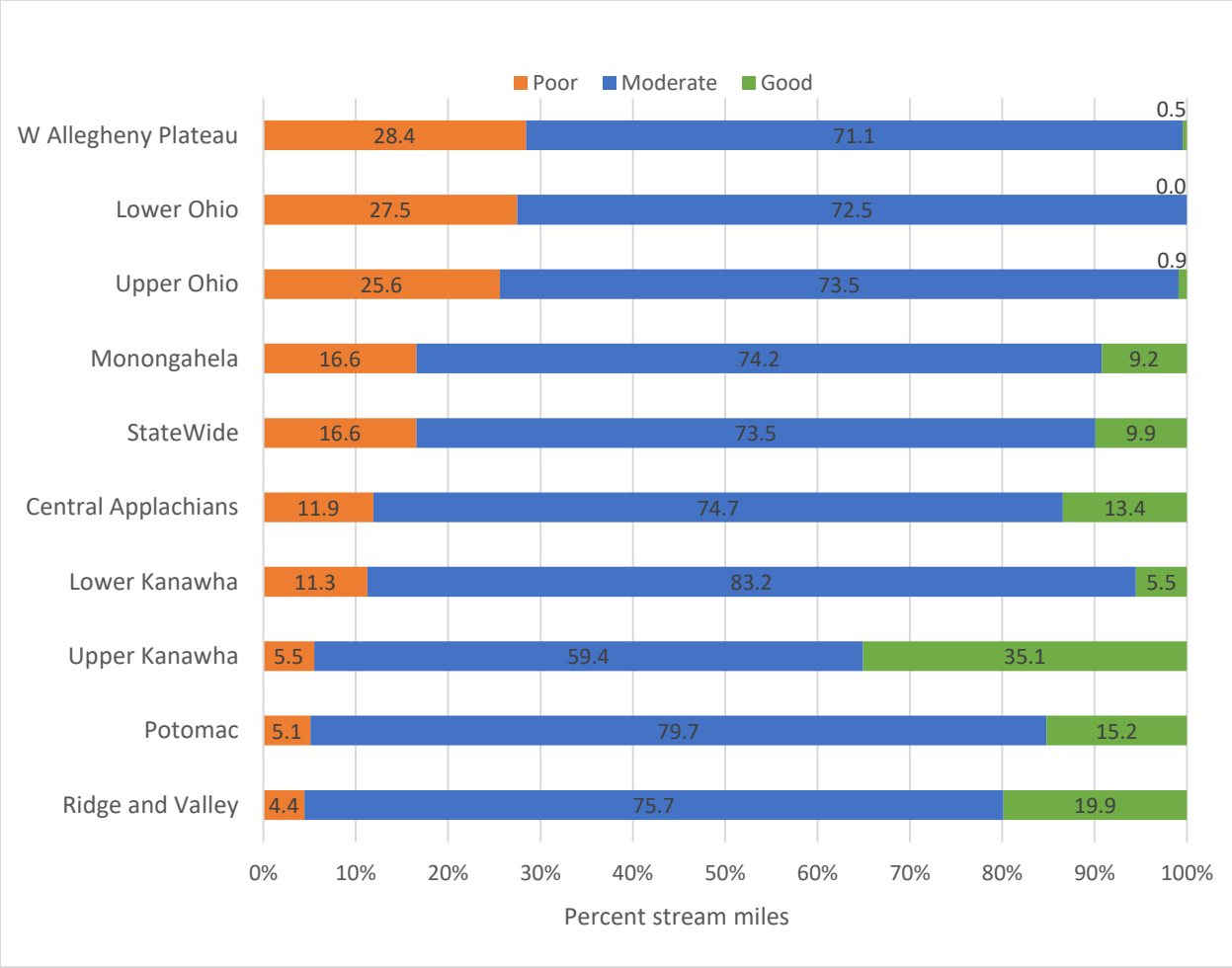

Figure 12: Overall Stream Habitat (RBP Total Score) in West Virginia Streams

Relative Presence of Embeddedness

Sedimentation and the resulting embeddedness is one of the most important problems facing West Virginia streams. Figure 13 shows the extent to which rocks (gravel, cobble, and boulders) are covered or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish for shelter, spawning, and egg incubation is decreased. The Western Allegheny Plateau had the highest percentage of streams with poor or very poor ratings (39.5%) for embeddedness. This is likely because this region has slower, low-gradient streams, has more erodible soils, and more land-disturbing activities than in other areas. The Central Appalachians and Ridge and Valley streams fared better with 22.8% and 9.6% combined poor and very poor ratings, respectively. The Lower Ohio and Upper Ohio basins had the highest percent of stream miles in the poor or very poor category with 47.7% and 33.9%, respectively.

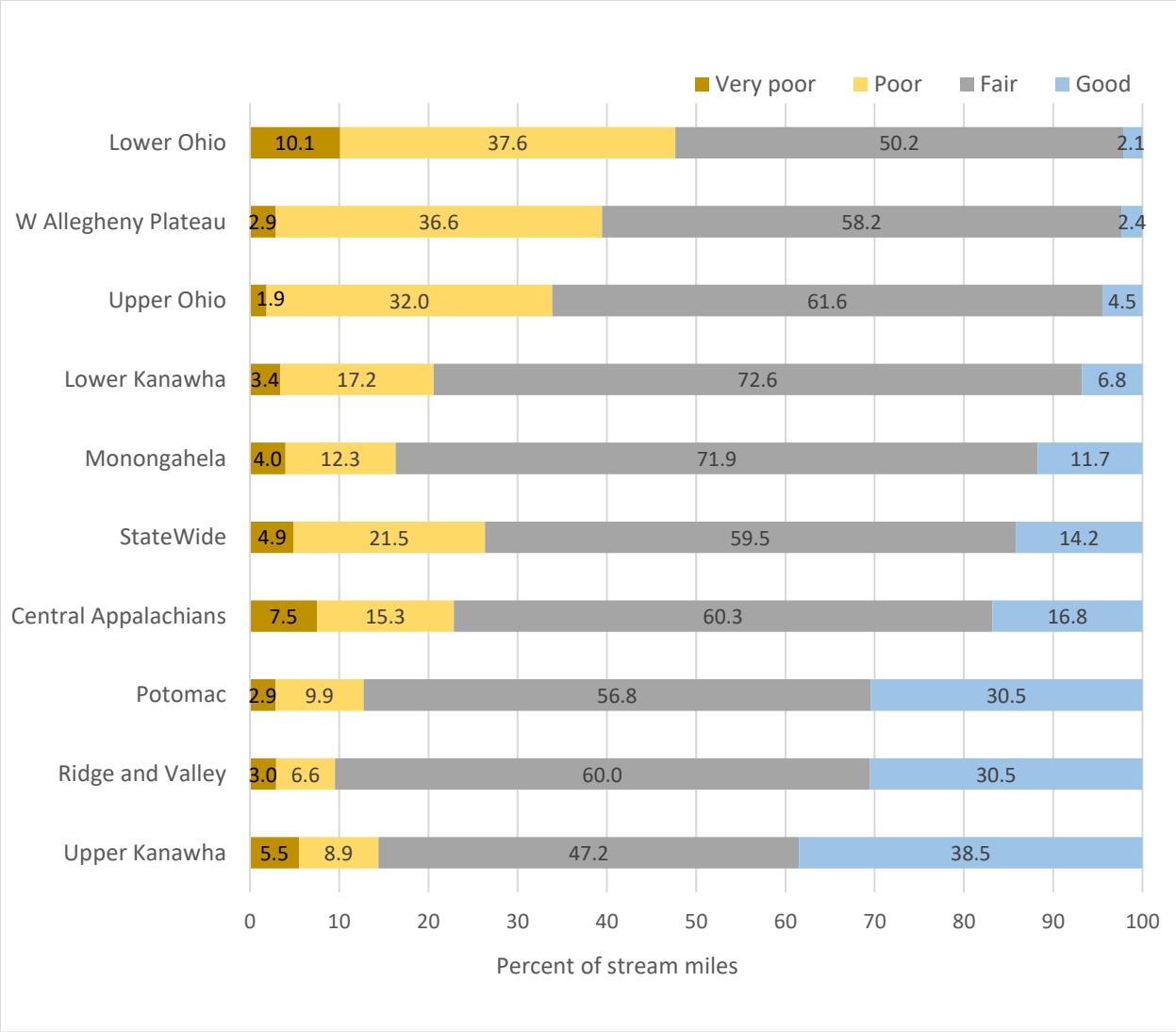

Figure 13: Embeddedness Scores in West Virginia Streams

Condition of Riparian Vegetation Zones

The Ridge and Valley ecoregion had the highest percentage of wide, undisturbed riparian zones at 46.7% (Figure 14). This indicator rates streamside zones on the amount of undisturbed vegetation present, which is desirable for providing shade, creating a more stable stream bank and minimizing the amount of sediment, excess nutrients and other pollutants entering the stream. In contrast, the Central Appalachians and Western Allegheny Plateau, have a much smaller percentage of riparian zone vegetation rated as excellent with 30.8% and 13.2%, respectively. Among basins, the Upper Kanawha was far better than the others for riparian zone intactness with an estimate of 61% of its stream miles in the good category.

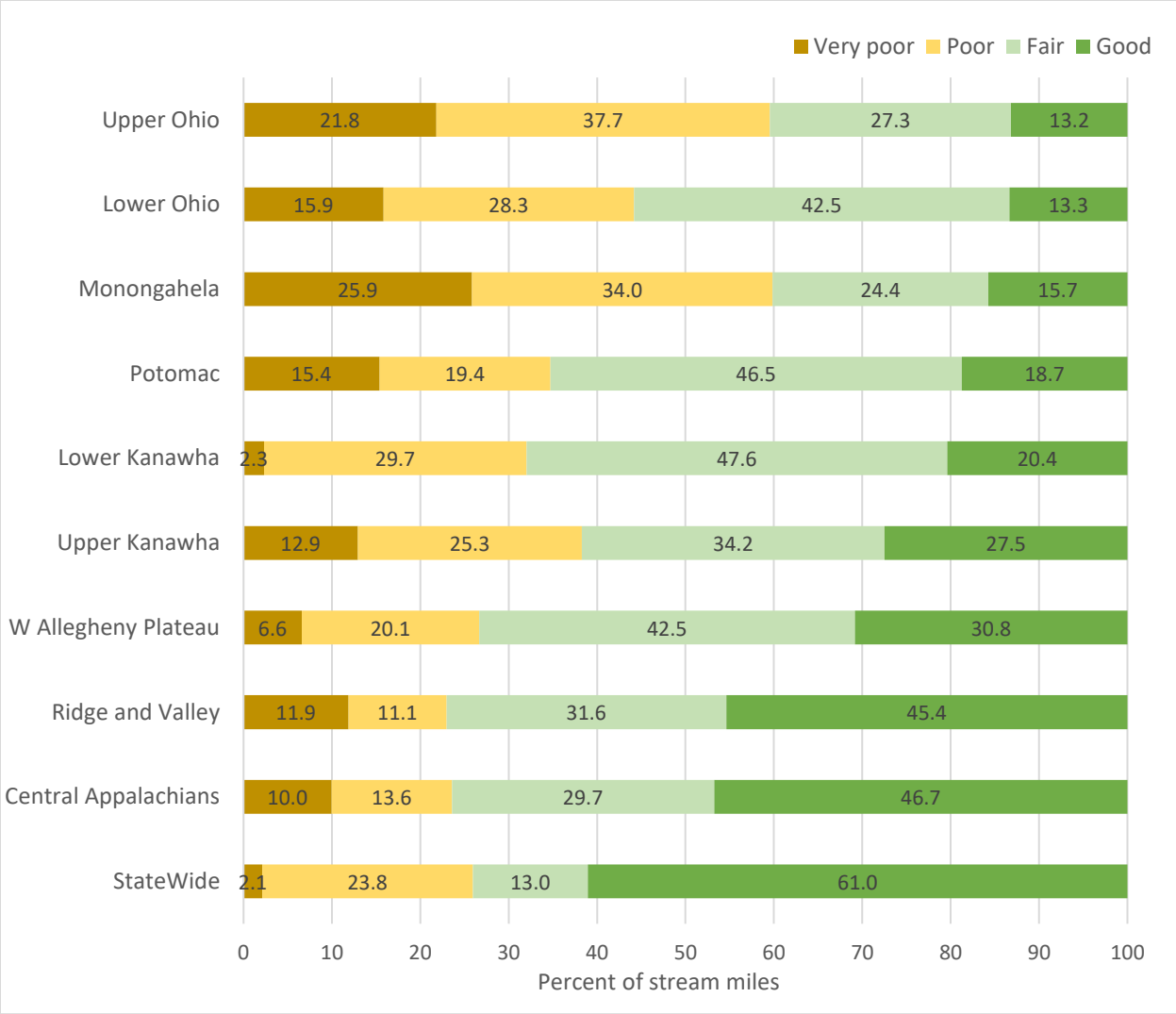

Figure 14: Riparian Zone Vegetation Scores in West Virginia Streams

Range of Human-Refuse Intensity Values - Trash/Aesthetic Index

The "Trash/Aesthetic Index" is a measure of the amount of human refuse that is in and around the stream (including that which could be washed into the stream at high flows) (Figure 15). Of the three ecoregions, the Ridge and Valley has the highest percentage of "clean" streams, with almost 53.3 percent of stream miles in that category. The Central Appalachians had a slightly lower percentage of clean streams (43.8%) but had the highest percentage of trashy streams, with more than a fourth of its stream miles moderately trashy or worse. The Upper Kanawha and Potomac were the "cleanest" basins with 68.3% and 55.4% of their stream miles rated as clean, respectively.

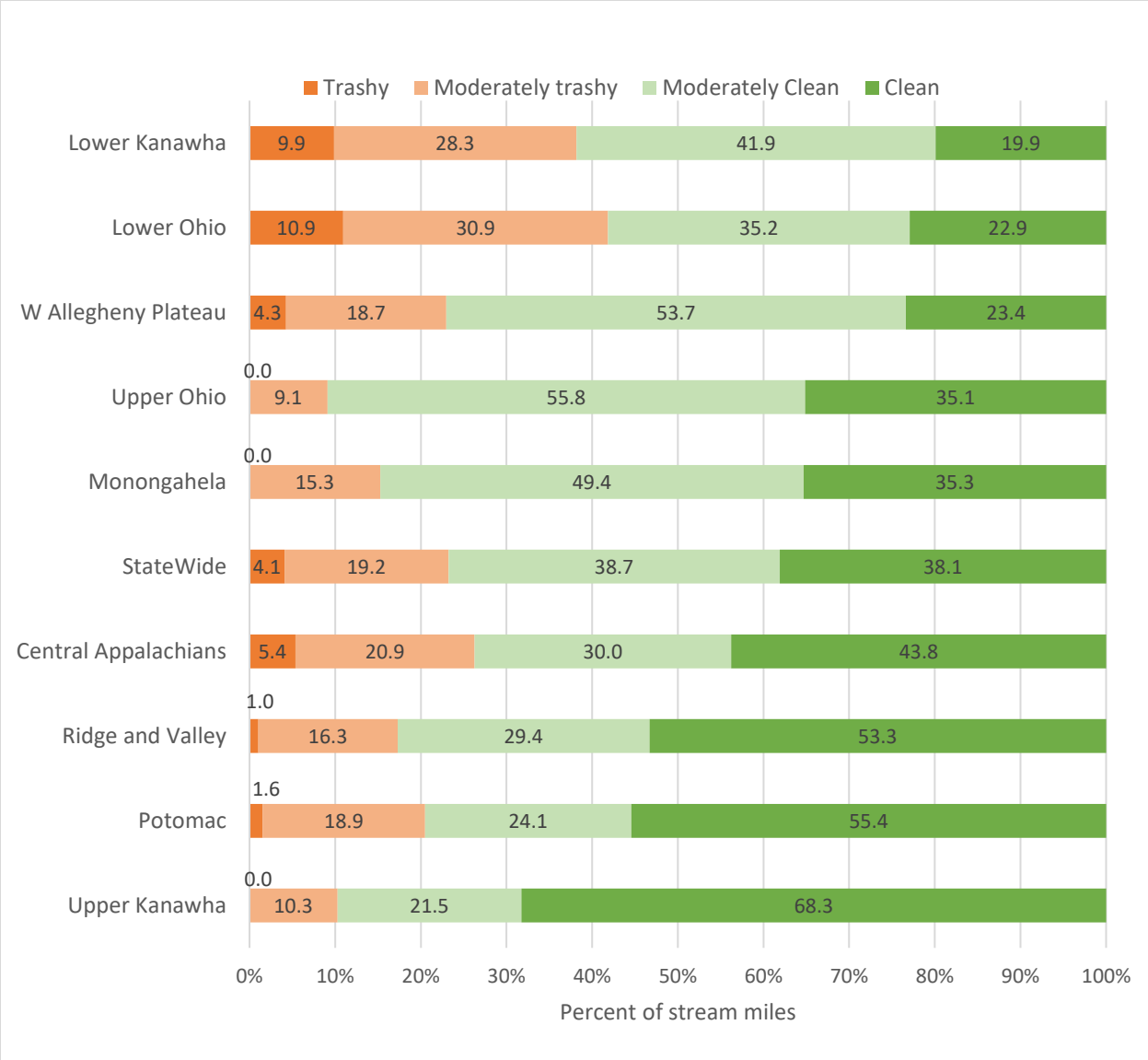

Figure 12: Trash/Aesthetic Scores in West Virginia Streams

8.0 INTERSTATE WATER COORDINATION

8.1 Virginia DEQ on Bluestone River PCB monitoring and TMDL development

DEP has been working with the Virginia Department of Environmental Quality (VADEQ) to assess Polychlorinated Biphenyls (PCBs) impairment along the Virginia section of the Bluestone River. The product of this cooperative effort will be a TMDL for the Bluestone River and tributaries with loadings and allocated reductions for sources in both Virginia and West Virginia. The West Virginia DEP, Virginia DEQ and EPA Region III have been cooperating in an effort to locate and reduce sources of PCBs to the Bluestone River. As part of this effort, remediation of the now defunct Lyn Electric Site in Bluefield,

W.Va. has been completed. Efforts included leveling and removal of the electric motor remanufacturing buildings on the site. Also, contaminated water and debris were removed from the site and clean material used to backfill the open basement areas of the property. Within the watershed additional monitoring and source evaluation is on-going to determine what steps, if any, need to be taken in the future.

8.2 Virginia DEQ on New River PCB TMDL development

Virginia DEQ has been developing a PCB TMDL for the mainstem New River and selected tributaries and impoundments. DEP's review of the initial draft TMDL documents revealed a concern with target instream PCB values at the VA/WV border. Currently, VADEQ is addressing DEP concerns by ensuring instream attainment of WV water quality standards at the border. DEP remains committed to working with VADEQ via its Technical Advisory Committee to ensure the final TMDL meets both state's water quality standards.

8.3 Ohio River Valley Water Sanitation Commission – ORSANCO

As with previous reports, the DEP's 2016 Integrated Report includes assessments based on data provided by ORSANCO. Throughout the development of ORSANCO's 2016 Biennial Assessment, the DEP has been involved with ORSANCO's efforts to standardize assessments among the compact states. The DEP's personnel continue to participate in several standing committees, along with representatives from other compact states, charged with helping direct ORSANCO's water quality and biological monitoring efforts.

8.4 Chesapeake Bay

The Chesapeake Bay is impaired by nutrients and sediment from multiple sources originating locally and in upstream states. This biologically diverse waterbody is an important economic and recreational resource.

The need to restore this waterbody is a high priority for many agencies, organizations and the public in general. Approximately ten percent of West Virginia's stream miles drain into the Potomac River and on into the Bay. In addition, portions of the James River Watershed in West Virginia contribute flow to the Bay.

In June 2002, Governor Bob Wise signed the Chesapeake Bay Program Water Quality Initiative Memorandum of Understanding, committing West Virginia to nutrient and sediment load reductions. In November 2005, West Virginia proposed pollutant reduction plans in the West Virginia Potomac Tributary Strategy. In December 2010, EPA finalized TMDLs for the Chesapeake Bay and other impaired tidal waters in Virginia and Maryland. In response to the TMDLs, West Virginia and the other Bay jurisdictions developed Watershed Implementation Plans (WIPs). The West Virginia WIP identifies actions and controls that the State will pursue to implement the TMDLs, and West Virginia will accomplish its TMDL responsibilities if the WIP is successfully executed. Many DEP programs are actively participating in this effort. The West Virginia WIP and supporting documents may be viewed at: http://www.wvchesapeakebay.us/docs.cfm

8.5 Interstate Commission on Potomac River Basin

The Commission is a non-regulatory agency of basin states (Maryland, Pennsylvania, Virginia and West Virginia), Washington, D.C. and the federal government. The Commission promotes watershed-wide solutions to the pollution and water resources challenges facing the basin and its more than 6.11 million residents. Examples of current commission efforts include the Chesapeake Bay Program involvement, stream biological assessments, support of selected stream gages, the Potomac Groundwater Assessment, Potomac Basin Drinking Water Source Protection Partnership coordination and Potomac Watershed Toxic Spill Model support. In addition, the Commission's public outreach program supports and helps coordinate an annual watershed-wide clean-up effort and produces and distributes the newsletter Potomac Basin Reporter to 20,000 subscribers. The commissioners are appointed by their respective jurisdictions and provide policy guidance and oversight for a skilled staff of scientists and educators.

9.0 TOTAL MAXIMUM DAILY LOAD (TMDL) DEVELOPMENT PROCESS

From 1997 until 2003, EPA Region III developed West Virginia TMDLs under the settlement of a 1995 lawsuit, Ohio Valley Environmental Coalition, Inc., West Virginia Highlands Conservancy, et. al. v. Browner, et. al. The lawsuit resulted in a consent decree between the plaintiffs and the EPA that specifies TMDL development requirements and compliance dates. While the EPA was working on developing TMDLs, the DEP concentrated on building its own TMDL program. With the help of the TMDL stakeholder committee, the agency secured funding from the state legislature and created the TMDL section within the Division of Water and Waste Management.

The TMDL section is committed to implementing a TMDL process that reflects the requirements of TMDL regulations, provides for the achievement of water quality standards, and ensures that ample stakeholder participation is achieved in the development and implementation of TMDLs. The DWWM's approach to TMDL development allows 48 months to develop a TMDL from start to finish. This approach enables the agency to carry out an extensive data generation and gathering effort to produce scientifically defensible TMDLs, and allows ample time for modeling, report drafting and frequent public participation opportunities.

The DEP's TMDLs are developed according to the Watershed Management Framework cycle. The framework divides the state into 32 major watersheds and operates on a five year, five-step process. The watersheds are divided into five hydrologic groups (A - E). Each group of watersheds is assessed once every five years. A map depicting the 32 watersheds and hydrologic groupings is provided as an attachment to this document before the List Key. The TMDL process begins in the first year of the cycle with pre-TMDL sampling and public meetings in the affected watersheds. The data is compiled and TMDL development begins in year two of the cycle. In the third year, TMDL development continues and the TMDL is drafted. The TMDL is finalized in the fourth year. In the fifth year of the cycle, TMDL implementation is initiated through the NPDES permitting process and efforts toward limiting nonpoint source loading. Throughout the TMDL development process, there are numerous opportunities for public participation and input.

The 303(d) list identifies and prioritizes the waters and impairments for which future TMDLs will be developed by specifying the year in the "Projected TMDL Year" column. The impaired waters intended for TMDL development in 2017, 2018 and 2019 are known and identified[1]. For other waters and impairments, where the timing of TMDL development is less certain, the "Projected TMDL Year" is identified as the latest year where an opportunity exists per the DEP's plans to develop TMDLs in concert with the Watershed Management Framework. Pre-TMDL sampling has traditionally followed the framework cycle, i.e., impaired streams from watersheds in hydrologic group A were sampled in the same year as the targeted sampling. More recently, to address impairments that have been listed for several years, watersheds are being selected for TMDL development outside of the framework cycle schedule.

At any point in time, the DEP personnel are working on TMDLs in each of the five hydrologic groups (A-E). Each set of TMDLs moves through several stages of development prior to finalization and the EPA's approval. Table 12 shows the state's TMDL development progress.

Table 12: DEP TMDL Development

Hydrologic Group	Watersheds	Progress
A3	South Branch of Potomac Upper Kanawha Upper Ohio North	EPA Approved
B3	Tygart Valley	EPA Approved
C3	Gauley (Meadow River) Potomac Direct Drains (Rockymarsh Run and Warm Springs Run)	EPA Approved
D3	Monongahela main-stem Little Kanawha (Hughes River)	Pre-TMDL sampling complete TMDL development ongoing
E3	Upper Guyandotte	Pre-TMDL ongoing until June 2016
E4	Big Sandy Lower Ohio Twelvepole Creek	Public Meetings complete Pre-TMDL sampling to begin July 2016

The DEP's Web site contains all approved TMDL documents and the draft TMDL documents currently out for public comment. These documents can be found at:

1 "On June 13, 2017 the US EPA and WVDEP signed a Memorandum of Agreement that includes a requirement to develop within 30 days an addendum to that agreement that contains a schedule with date-specific deadlines for completing TMDLs addressing all causes of biological impairment, including Ionic toxicity where relevant, for waters identified in the U.S. District Court for the Southern District of West Virginia's February 14, 2017 Memorandum of Opinion and Order in Ohio Valley Environmental Coalition (OVEC) et al. v. Pruitt et al., No. 3:15-0271. The Addendum to the Memorandum of Agreement was signed on July 13, 2017 by WVDEP and EPA. The Addendum provides WVDEP's ionic toxicity TMDL development schedule with date-specific deadlines to be completed by June 30, 2026. The schedule of TMDL development will be included in WV's 2018 Integrated Water Quality Monitoring and Assessment Report and will be posted on WV's TMDL Development website upon completion."

http://www.dep.wv.gov/WWE/watershed/TMDL/Pages/default.aspx

10.0 WATER POLLUTION CONTROL PROGRAMS

10.1 Division of Water and Waste Management

The Division of Water and Waste Management's mission is to preserve, protect, and enhance West Virginia's watersheds for the benefit and safety of all its citizens through implementation of programs controlling hazardous waste, solid waste and surface and groundwater pollution, from any source.

The DWWM strives to meet its mission through implementation of programs controlling surface and groundwater pollution caused by industrial and municipal discharges as well as oversight of construction, operation and closure of hazardous and solid waste and underground storage tank sites. In addition, the division works to protect, restore and enhance the state's watersheds through comprehensive watershed assessments, groundwater monitoring, wetlands preservation, inspection and enforcement of hazardous and solid waste disposal and proper operation of underground storage tanks.

Environmental Enforcement (EE) is a branch of the Division of Water and Waste Management charged with assuring compliance with many of the state pollution control regulations. EE promotes compliance with the Solid Waste Management Act, Water Pollution Control Act, Groundwater Protection Act, Hazardous Waste Management Act, Underground Storage Tank Act, and Dam Safety Act by providing assistance, inspecting regulated sites, and enforcing conditions required by these acts.

10.2 National Pollution Discharge Elimination System (NPDES) Program

The DWWM's primary mechanism for controlling point sources is the West Virginia NPDES permitting program. This program, administered by the Permitting Branch, regulates activities and facilities involved in the installation, construction, modification, and operation and maintenance of wastewater treatment systems as well as their discharges. Individual and general permits are used to implement the program. Most permits include effluent limits and requirements for facility operation and maintenance, discharge monitoring and reporting. Other permits require the installation and implementation of best management practices in lieu of effluent limitations and discharge monitoring requirements. The Permitting Branch also administers a pretreatment program in conjunction with the NPDES program, which outlines procedures for regulating proposed industrial wastewater connections to publicly owned treatment works (POTW). The program imposes discharge limitations for indirect discharges and requires the installation of pretreatment facilities where necessary to prevent interference with POTW operations and sludge disposal practices and to ensure that the pollutants contributed by industrial users do not pass through the POTW and violate water quality standards. The National Combined Sewer Overflow (CSO) Policy is implemented as a component of the NPDES Permits for POTWs with CSOs. The DEP has issued three Concentrated Animal Feeding Operation (CAFO) permits with no further permits currently under consideration. Activities administered by the Permitting Branch include the regulation of industrial solid

waste landfills and the land application of sewage sludge, and developing wasteload allocations for new or expanding sewage treatment facilities. Below is a list of permit actions for the time period beginning in July 2013 and ending in June 2015.

In addition to permitting, compliance assessment and enforcement activities are coordinated between Permitting and Environmental Enforcement. Noncompliance is initially addressed by administrative actions to compel compliance. These may include warning letters, notices to comply, enforcement orders, or referrals for civil action.

NPDES PERMITTING	- PERMIT ACTION REPORT (7/1/2013 - 6/30/2015)											
	Applications Received This Period	Applications Denied this Period	Permits Registrations and Modifications Issued This Period	Permits Registrations and Modifications Issued Year-to-Date for Current Fiscal 2018	Withdrawn and Voided This Period	Applications Pending as of 6/30/2015					Average DEP Time to Issue Permits This Period (In Days)	Average Total Time to Issue Permits This Period (In Days)
						Greater Than 180 dep days	Less Than, 180, > 90 dep days	Less Than, Equal to 90 dep days	Total (dep days)	Greater Than 180 total days		
INDIVIDUAL PERMITS	233	0	167	63	24	65	29	41	135	86	232	254
GENERAL PERMITS												
Home Aeration Units	2570	0	1708	141	25	284	346	343	973	525	99	105
Sewage General	13	0	13	42	6	0	1	9	10	8	510	680
Storm Water Construction	951	1	932	151	71	3	1	72	76	18	46	51
All Others	1799	11	1378	345	141	93	53	158	304	216	96	106
MODIFICATION PERMITS	552	6	452	144	65	48	18	59	125	72	76	88
TRANSFER PERMITS	234	1	229	42	30	15	6	22	43	37	37	60
TOTAL - PERMITS	6352	19	4879	928	362	508	454	704	1666	962		

NOTE: The permits used to calculate for the "Average DEP Time" column are those that were submitted after June 30, 1999, when ERIS was deployed for Division of Water and Waste Management.

10.3 Nonpoint Source Control Program

The Nonpoint Source Control Program focuses on restoration and protection of streams from nonpoint source pollution. The program assesses nonpoint source impacts, then develops and implements watershed based plans and projects designed to reduce pollutant loads from agricultural, silviculture, resource extraction, urban runoff, construction activities, and failing septic systems. Program initiatives are based upon education, technical assistance, financial incentives, demonstration projects, and enforcement, as necessary. The division's Nonpoint Source Program supports overall administration and coordination of the nonpoint source activities through these participating state agencies: the West Virginia Conservation Agency, the Office of Oil and Gas, and the Division of Health and Human Resources. Each year, specific activities are funded under the Nonpoint Source Program.

Many of the streams being listed on the state's list of impaired waters are affected by nonpoint sources. The majority of the Total Maximum Daily Loads being developed involve nonpoint source water quality impacts. To more effectively respond to TMDL implementation needs, the Nonpoint Source Management Plan was updated in 2000 to incorporate watershed management principles, including integration of TMDL and Watershed Management Framework scheduling. In addition to several plans currently under development, the Nonpoint Source Program has 27 watershed-based plans in various stages of implementation that address a variety of nonpoint sources of pollution. These plans are developed in cooperation with the stakeholders, including federal, state and local government agencies, within the watershed. As a result of these plans, numerous nonpoint source remediation projects for acid mine drainage, agriculture, streambank erosion, and dirt roads have been undertaken. The goal of the watershed-based plans is to restore the impaired streams to meet water quality standards. The successes to date emphasize the need to focus more resources on voluntary installation of best management practices in identified priority watersheds where local stakeholders are interested in making a difference.

10.4 Groundwater Program

Under the Groundwater Protection Act, West Virginia Code Chapter 22, Article 12, Section 6.a.3, DEP's Groundwater Program is responsible for compiling and editing information for a biennial report to the Legislature on the status of the state's groundwater and groundwater management program. The DEP, the West Virginia Department of Agriculture and the West Virginia Department of Health and Human Resources all have groundwater regulatory responsibility and contribute to the report. These state boards and six standing committees currently share the responsibility of developing and implementing rules, policies and procedures for the Ground Water Protection Act (1991). The Environmental Quality Board, the Groundwater Coordinating Committee, the Groundwater Protection Act Committee, the Groundwater Monitoring Well Drillers Advisory Board, the Well Head Protection Committee, and the Nonpoint Source Coordinating Committee are the standing committees. The report provides a concise, thorough overview of those programs that are charged with the responsibility of protecting and ensuring the continued viability of groundwater resources in West Virginia. The current biennial report to the Legislature covers the period from July 1, 2011 through June 30, 2013. Copies of the report "Groundwater Programs and Activities: Biennial Report to the West Virginia 2014 Legislature" may be obtained by contacting the Groundwater Program at the Division of Water and Waste Management, 601 57th St., S.E., Charleston, WV 25304 or by calling (304) 926-0495. The report also may be reviewed at:

http://www.dep.wv.gov/WWE/Programs/gw/Documents/2014/FinalReport14.pdf

The Ambient Groundwater Quality Monitoring Network was established by the DWWM in cooperation with the USGS in 1992 and is an ongoing project. The network provides critical data needed for proper management of West Virginia's groundwater resources. The major objective of this USGS study is to assess the ambient groundwater quality of major systems (geologic units) within West Virginia and to characterize the individual systems. Characterization of the quality of water from the major systems helps to:

- Determine which water quality constituents are problems within the state

- Determine which systems have potential water quality problems
- Assess the severity of water quality problems in respective systems
- Prioritize these concerns

Only by documenting present ambient groundwater quality of the state's major systems can regulatory agencies assess whether water quality degradation has occurred in certain areas and whether potential degradation is a result of natural processes or those associated with human activity. The USGS is currently working with the DEP on a 5-year groundwater assessment framework. In year 1, they collect groundwater data from a network of 27 sentinel wells to obtain current status of groundwater quality and track changes over time. In years 2 through 5, the USGS will conduct a variety of topical studies. The most recent topical study provides a baseline of current surface water and groundwater quality in the Monongahela River Basin related to shale gas development. All associated groundwater quality data for each well sampled and summaries of groundwater quality for each respective watershed are published in the USGS Water Resources Data for West Virginia annual report.

10.5 Division of Mining and Reclamation

The mission of the Division of Mining and Reclamation (DMR) is to regulate the mining industry in accordance with federal and state law. Activities include issuing both National Pollutant Discharge Elimination System and Surface Mining Control and Reclamation Act permits for mineral extraction sites and related facilities, inspecting facilities for compliance, monitoring water quality, tracking ownership and control, and issuing and assessing violations. The DMR is responsible for the computer databases that track their regulatory activities - Environmental Resources Information System (ERIS) and Applicant Violator System (AVS, the federal OSM database). The Permitting Unit is responsible for reviewing permit applications for surface and underground coal mines, preparation plants, coal loading facilities, haulage ways, and coal-related dams. This unit also reviews permit applications for non-coal quarry operations (sand, gravel, limestone, etc). Permit review teams staffed with geologists, hydrologists, engineers and others are located in each regional office throughout the state and in the headquarters office.

The DMR's Inspection and Enforcement unit is responsible for inspecting all coal mining and quarry operations in the state. It enforces compliance through regular inspections and Notices of Violation; and ensures site reclamation through final release of the operation. This unit is also responsible for civil penalty assessments, show cause proceedings, bond forfeiture and collection. The DMR's Program Development unit is responsible for implementing a proactive approach to policy issues, legislation and training. This unit is designed to keep the Division staff current with technological advances and to provide clear direction through development of cogent policy and guidance to meet legal and regulatory requirements. This unit provides regulatory interpretation and support to field offices, develops and updates handbooks and forms, drafts legislation and initiates regulation changes. Other responsibilities of this unit include Small Operators Assistance Program, public relations, including responses to Freedom of Information Act requests, special projects, employee training and research of laws, regulations and policy.

11.0 COST BENEFIT ANALYSIS

A true cost/benefit analysis on the economic and social costs and benefits of water pollution control is a difficult and time-consuming task. Particularly, the evaluation of industrial facilities would be a monumental task considering the various types of industry (mining, chemical, power generation, etc), each having a very different process of pollution control. However, the information contained in the following paragraphs provides an idea of the amount of money currently expended to construct and upgrade both the municipal facilities within the state as well as programs available to homeowners wanting to correct failing onsite sewage systems.

11.1 Funding for Water Quality Improvements

The DEP is responsible for administering a combination of state and federal funds expended for projects to improve water quality in state streams. The following narrative provides an overview of the programs within the DEP's Division of Water and Waste Management that provide funding for water quality improvements and a summary of the funds dispersed between July 2013 and June 2015 to improve water quality.

11.2 Clean Water State Revolving Fund Program

The Clean Water State Revolving Fund (CWSRF) program is a funding program administered by the State Revolving Fund Branch to address water quality problems through wastewater facility construction, upgrades, or expansions. The branch is charged with general oversight, fiscal management and technical and administrative compliance review of local governmental entities that receive funds and provides information and guidance on what administrative actions are needed to process a loan through the program. When a community has been recommended by the West Virginia Infrastructure and Jobs Development Council to seek CWSRF program funding for financial assistance, the community is contacted by a financial manager and project engineer. A meeting may be scheduled to advise the community leaders about the overall program requirements and specifically what they should do next to obtain a CWSRF loan. There are federal, state, and program requirements that must be met prior to scheduling a loan closing. The CWSRF currently has three financial assistance programs available. These three programs are described below.

11.3 Low Interest Loan Program

A low interest loan program for construction of municipal wastewater treatment works is available for municipalities and public service districts to build, upgrade, or expand treatment facilities and collection systems. Conventional loans with a repayment period of 20 years are available with an interest rate and annual administrative fee not exceeding 2% for certain communities. Loans with repayment periods from 21 to 40 years are available for disadvantaged communities where financial affordability is an issue. The interest rate and annual administration fee on these loans do not exceed 1/2%. From July 2013 through June 2015, 24 wastewater treatment facility loans totaling $171,020,924 were funded.

11.4 Agriculture Water Quality Loan Program

The Agriculture Water Quality Loan Program is a partnership with the West Virginia Conservation Agency developed to address pollution from nonpoint sources using Best Management Practices approved by the U.S. Environmental Protection Agency. CWSRF money is loaned to participating banks so they can offer below market rate low interest loans to qualifying applicants. For more information, contact your local Conservation District office, http://www.wvca.us/map.cfm. From July 2013 through June 2015, 8 nonpoint source agriculture BMP loans totaling $288,032 were funded.

11.5 Onsite Systems Loan Program

In cooperation with the West Virginia Housing Development Fund and Safe Housing and Economic Development office (Welch, WV) a low interest loan program has been established to address onsite sewage disposal problems. Called the "Onsite Systems Loan Program," loans are available to replace malfunctioning septic systems and to install new onsite sewage systems for homes that have direct sewage discharges to ditches and streams. Centralized treatment for these homes will not be available in the next five years. For the current reporting period of July 2013 through June 2015, a total of $700,000 pass through was provided to the two agencies.

In conclusion, although funding for maintenance and improvement of water quality is often a controversial issue, the DEP recognizes that millions of dollars are expended annually by businesses, municipalities, private and public entities (including state and federal agencies) to improve and maintain water quality in West Virginia. These expenditures address pollutants from various media including solid and hazardous waste, air and water.

12.0 PUBLIC PARTICIPATION AND RESPONSIVENESS SUMMARY

The draft Section 303(d) List was advertised for public comment on July 21, 2017. Legal notices of the availability of the draft document and request for public comments were placed in newspapers statewide. The draft document was also promoted via e-mail and the Internet. The public comment period extended from July 21, 2017 to August 21, 2017. The DEP considered all comments and modified the list as appropriate. Comments have been compiled and responded to in this summary.

Public comments were received from Doug Wood on behalf of the Kanawha Forest Coalition Members, Carolyn Thomas, and Fola Coal Company, LLC. In addition, public comments were received from more than 100 individuals (Table 13) through a WV River Action Network Campaign. The campaign provided commenters with a sample letter summarized below. The contents of the individual letters were reviewed and substantially different comments are addressed, separately. The DEP appreciates the efforts commenters have put forth to improve West Virginia's listing process. Comments and comment summaries are bold and italicized. Agency responses appear in plain text.

Through the WV River Action Network Campaign, over one hundred commenters (Table 13), including the Greenbrier River Watershed Association, requested that DEP revise the methodology used to determine biological impairment and use the genus level Index of Biotic Integrity (IBI) developed for use in West Virginia known as GLIMPSS. The USEPA also submitted comments suggesting the DEP must evaluate existing and readily available data, citing 40 CFR 130.7(b)(5), and that the genus level data accumulated over the last 15 years are existing and readily available. They point out the GLIMPSS is available and utilizes the existing genus-level data.

DEP acknowledges that EPA has recommended that DEP utilize the genus-level macroinvertebrate data set for 303(d) purposes. DEP also acknowledges that GLIMPSS is available and that it utilizes the existing and available data that has been collected. However, DEP has interpreted SB 562, passed in 2012, as a mandate to secure legislative approval of any new assessment methodology for biological integrity prior to implementation. The DEP regrets the delays that it has experienced but intends to present a methodology to the Legislature that will accurately identify biological integrity impairments.

Table 13. Participants in WV River Action Network Campaign

First Name	Last Name	City	State	Country
Judith	Clark	Dunmore	West Virginia	US
Michael	Whitten	Peytona	West Virginia	US
Autumn	Crowe	Lewisburg	West Virginia	US
Amanda	Pitzer	Kingwood	West Virginia	US
Anne	Chopyak	Buckhannon	West Virginia	US
Ellen	Wine	Sutton	West Virginia	US
Katie	Donnelly	Morgantown	West Virginia	US
Susan	Bouldin	Alderson	West Virginia	US
Bryan	Bailey	Buckhannon	West Virginia	US
Bert	Lustig	Berkeley Springs	West Virginia	US
Cam	Trowbridge	Martinsburg	West Virginia	US
Carl	Bolyard	Elkins	West Virginia	US
Christopher	Craig	Harpers Ferry	West Virginia	US
Cynthia	Ellis	Red House	West Virginia	US
Charlotte	Fremaux	Harpers Ferry	West Virginia	US
David	Billups	Morgantown	West Virginia	US
Debbie	Naeter	Frankford	West Virginia	US
Don	Sauter	Bruceton Mills	West Virginia	US
David	Bott	Westover	West Virginia	US
Francis	Mulkeen	Independence	West Virginia	US
Greenbrier River	Watershed Association	Lewisburg	West Virginia	US
Dave	Harshbarger	Morgantown	West Virginia	US
Lisa	Murphy	Shenandoah Junction	West Virginia	US
Rita	Lewis	Newton	West Virginia	US

First Name	Last Name	City	State	Country
William	Turner	Lewisburg	West Virginia	US
Judith	Peascoe	Vienna	West Virginia	US
Jane	Birdsong	Elkins	West Virginia	US
JB	Witten	Elkins	West Virginia	US
Jerry	Carson	Cross Lanes	West Virginia	US
Jenni	Kovich	Leon	West Virginia	US
John	Pullen	Shepherdstown	West Virginia	US
Julie	Pratt	Charleston	West Virginia	US
Kat	Cooper	Hedgesville	West Virginia	US
Kate	Leary	Davis	West Virginia	US
John	Huerta	Elkins	West Virginia	US
Larry & Evelyn	Dadisman	Charleston	West Virginia	US
Pam	Leonard	Webster Springs	West Virginia	US
L.	Koval	Charleston	West Virginia	US
Alan	Smith	Cairo	West Virginia	US
Mary	L.	Charleston	West Virginia	US
DK	Anestos	Nitro	West Virginia	US
Meredith	Kiger	Morgantown	West Virginia	US
Meryl	Hall	Elkins	West Virginia	US
Duane	Nichols	Morgantown, WV	West Virginia	US
Olga	Gioulis	Sutton	West Virginia	US
Peggy	Burkhardt	Beckley	West Virginia	US
Penny	Manion	Shepherdstown	West Virginia	US
Jeff	Iliff	Berkeley Springs WV	West Virginia	US
Robert	Gall	Wheeling	West Virginia	US
Miriam	Miller	Morgantown	West Virginia	US
Sara	Wilts	Bruceton Mills	West Virginia	US
Angela	Hughes	Charleston	West Virginia	US
Sarah	Chayes	Paw Paw	West Virginia	US
Scott	Gibson	Saint Albans, WV	West Virginia	US
Steve	Malafy	French Creek	West Virginia	US
Stanley	Oaks	Berkeley Springs	West Virginia	US
Steven	Runfola	Morgantown	West Virginia	US
Tom	Hilgartner	Charleston	West Virginia	US
Thomas	Bouldin	Talcott, WV	West Virginia	US
Vivian	Stockman	Spencer	West Virginia	US
Chuck	Wyrostok	Spencer	West Virginia	US
Amy	Miller	Parkersburg	West Virginia	US
John	Estes	Birmingham	Alabama	US
Christine	Stewart	Escondido	California	US

First Name	Last Name	City	State	Country
John	Pasqua	Escondido, San Diego Co.	California	US
Rob	Seltzer	Malibu	California	US
Tia	Triplett	Los Angeles	California	US
Cheryl	Pullen	Shepherdstown	Colorado	US
Larry	Thomas	Circleville	Colorado	US
Brad	Smith	Slatyfork	Florida	US
Ginny	Pendas	P. B. G	Florida	US
Rachael	Pappano	Mattawamkeag	Maine	US
Christopher	Ecker		Maryland	US
Jennifer	Sass	Kensington	Maryland	US
Bob	Bousquet	Bryantville	Massachusetts	US
Joe	Marsala	Knob Noster	Missouri	US
Susan	Kessler	Grantham	New Hampshire	US
Susan	Hamann	Chester	New Jersey	US
Paula	Bushkoff	Princeton	New Jersey	US
Jerry	Rivers	Roosevelt	New York	US
Kimberly	Wiley	Rochester	New York	US
Mary	Hawkins	New York	New York	US
Jorge	Flores	Morgantown	North Carolina	US
Lenore	Madeleine	Candler	North Carolina	US
Martha	Spencer	Brevard	North Carolina	US
Jeriene	Walberg	Bend	Oregon	US
Max	Salt	Coventry	Rhode Island	US
Doug	Krause	Winnipeg	Texas	US
Kevin	Rolfes	Austin	Texas	US
Adam	D'Onofrio	North Dinwiddie	Virginia	US
Eli	Helbert	Broadway	Virginia	US
Joshua	Kucharski	Roanoke	Virginia	US
Jonathan	Rugh	Blacksburg	Virginia	US
Richard	Hieber	Memmingen	Bayern	DE
Lorenz	Steininger		Georgia	DE
Paul	Jenkins	London	England	GB
Virginia	Jarrell	Shrewsbury	Shropshire	GB
Sandra	Arapoudis	Rhodos	Å iauliÅ³ Apskritis	GR
Patricia	Vazquez	Mexico City	Distrito Federal	MX

On September 24, 2018, DEP received a request for additional technical information that explains why WVDEP is not using genus level macroinvertebrate data for 303(d) listing purposes in our final 2016 Integrated Report? We responded to this request in a letter dated October 2, 2018, which included the following:

WVDEP is not using the genus level macroinvertebrate dataset for 303(d) listing purposes currently due to concerns with the robustness of the genus level reference dataset in several season / ecoregion specific IBIs. The Summer Plateau, Summer Mountain > 60 mi^2, and Spring Plateau IBI's currently have less than 10% of the number of reference samples that were used in the recent update of the statewide WVSCI impairment threshold, with the Summer Plateau having just 6.4% of the number of reference samples used for the WVSCI update. WVDEP has determined that these numbers are too low to provide confidence in use of these IBIs.

WVDEP will not be using our genus level macroinvertebrate data or GLIMPSS for 303(d) listing purposes. WVSCI, with an updated impairment threshold of 72, will be used for AQL assessments for the Integrated Reports. WVDEP does utilize genus level macroinvertebrate data for other purposes. WVDEP uses genus level data for statewide probabilistic water quality condition summaries and for TMDL stressor identification purposes.

One commenter offered congratulations and support to the DEP regarding the improvements to the water quality in Three Forks Creek (WVMT-12) in Taylor County, WV, following the installation of water treatment to address acidity and metals in the watershed.

The DEP appreciates the recognition of the water treatment efforts in Three Forks Creek and the support from the commenter.

One commenter expressed concern with changes in legislation believed to plan spills of waste from fracturing activities that would require cleanup activities.

The DEP does not plan nor permit spills of fracturing fluid.

One commenter expressed concern with recent legislation that changed instream flow rates for which contaminant concentration apply.

The commenter is most likely referring to the inclusion of harmonic mean flow, as it applies to human health criteria for carcinogens. Harmonic mean flow is the recommended method for implementing human health criteria (USEPA Water Quality Standards Handbook 2014). As stated in 47 CSR 2 subsection 8.2.a, and as indicated in EPA criteria development procedures, criteria developed for human health, whether for recreation, fish consumption, or public water supply, are based on the risk of one additional cancer case per one million people, over a 70-year lifetime of exposure. Human health criteria are developed to be fully protective of human health, and their protectiveness is not dependent upon the current flow of a waterbody, whether it is at flood stage or during drought. Because of the way these criteria are developed, the long-term average flow, or harmonic mean, is the best fit for designing the critical flow for human health carcinogens.

One commenter asked that the source of pollution in Kanawha Fork (WVK-39-M) and Rush Creek (WVK-51) be noted as coal mining instead of "unknown".

In general, source tracking information to absolutely identify the causative sources of impairment is not available at the time of listing. The DEP maintains that causative sources are best determined after additional monitoring and source tracking performed in the TMDL development process. The use of

"unknown" as the source allows the study of all pollutant sources in a stream's watershed that cause or contribute to the water quality violation. All pollutant sources are represented in development of load and wasteload allocations for the TMDL.

Source identification in the 303(d) list is not a prerequisite for NPDES permit controls that ensure discharges do not cause or contribute to water quality impairments. NPDES permits for discharges into impaired waters must include criterion end-of-pipe limitations if the discharge has reasonable potential to contribute pollution.

One commenter asserted that the health of Rocky Marsh Run (WVP-3), as well as many streams in the eastern panhandle, could be drastically improved by fencing out livestock and asked what the DEP improvement plan is for Rocky Marsh Run.

USEPA approved the Total Maximum Daily Loads (TMDL) for the Rockymarsh Run and Warm Spring Run Watersheds, West Virginia in November 2016. In preparation of the development of the TMDL, the DEP monitored the water quality and studied pollutant sources of the Rockymarsh Run watershed. The TMDL provides wasteload and load allocations for point and non-point sources of fecal coliform, including pastures. Implementation of the TMDL is expected to result in water quality improvements.

One commenter provided additional selenium water quality data for Boardtree Branch (WVKG-5-M) for consideration.

The dataset was evaluated and met the quality assurance requirements for use in assessment decisions. The dataset demonstrated that the water quality criterion for selenium in the water column is being attained in Boardtree Branch. The selenium impairment for Boardtree Branch was removed from the 303(d) list.

13.0 LIST SUPPLEMENTS OVERVIEW

Seven supplements are provided that contain additional information.

Supplemental Table A - Previously Listed Waters – No TMDL Developed

Previously listed waters from the 2014 list that are not on the 2016 list are included in this supplement if a TMDL has not been developed, and these waters have been reevaluated and determined not to be impaired. Causes for revision of the impairment status include recent water quality data demonstrating an improved water quality condition, revision to the water quality criteria associated with the previous listing, documentation that the water was previously listed in error or a modification of the listing methodology.

Supplemental Table B - Previously Listed Waters - TMDL Developed

TMDLs have been developed for many previously listed waters. TMDL development allows the removal of an impaired water from the 303(d) list. In the suggested format of the Integrated Report, such waters are to be classified in Category 4A and clearly distinguished from Category 5 and the 303(d) list. Waters included in Category 4A have TMDLs developed, but water quality improvements are not yet complete

and/or documented. The waters identified in Supplement B will match those of Category 4A of the Integrated Report.

Supplemental Table B1 - Existing TMDL Resolves Newly Identified Impairment

This table lists waters with newly identified impairments that occur in the watersheds of existing TMDLs. While TMDLs are not prescribed for these waters specifically, implementation of load and wasteload allocations for the pollutant of concern in the drainage areas for these waters is expected to resolve impairment.

Supplemental Table C - Water Quality Improvements

The goal of TMDLs and stream restoration projects is to bring the stream back to the point where it meets its designated uses and the associated water quality criteria. Supplement C includes a listing of streams with improved water quality due to TMDL implementation or pre-TMDL stream restoration work resulting in delisting. Delisting occurs when sufficient data provides clear evidence that the criteria for listing are no longer met. In the Integrated Report, the waters in Supplement C can be included in Category 1 if all designated uses are being met provided that impairments for other uses/pollutants are not evidenced.

Supplemental Table D - Impaired Waters - No TMDL Development Needed

This table lists impaired waters for which either other control mechanisms are in place to control pollutants or the water is not impaired by a pollutant (i.e., flow alterations caused by mining). These waters will be contained in Integrated Report Categories 4b and 4c unless TMDLs need to be developed for other pollutant-related impairments (Category 5).

Supplemental Table E - Total Aluminum TMDLs Developed

Supplemental Table E - Total Aluminum TMDLs identify waters for which aluminum TMDLs were developed based upon water quality criteria that are no longer effective. After the subject TMDLs were developed, EPA approved revisions to West Virginia water quality standards that changed the aluminum numeric water quality criteria from total to dissolved form. This table is included to document the development of the obsolete TMDLs and to distinguish them from the effective TMDLs identified in Supplemental Table B. Once these streams are assessed for dissolved aluminum, they will be removed from Table E.

Supplemental Table F - New Listings for 2016

This table is a list of impaired waters that are new on the list for 2016 and were not on the 2014 Section 303(d) list.

WV 2016 SECTION 303(D) LIST KEY

List Format

Impaired waters are first organized by their hydrologic group pursuant to the West Virginia Watershed Management Framework (i.e. Hydrologic Group A waters are shown first, followed by Hydrologic Group B, etc.). Within each hydrologic group, major watersheds are displayed alphabetically (e.g. within Hydrologic Group C, the Gauley Watershed is displayed first, followed by the Lower Guyandotte and so on). Within each major watershed, impaired waters are arranged by their stream code. The following table displays the format of the West Virginia 2014 Section 303(d) List and contains excerpts designed to display various intricacies.

Stream Name	Stream Code	Criteria Affected	Source	Impaired Size (stream-miles) (lake-acres)	Reach Description	Projected TMDL Year (No Later Than)	2014 list?
HYDROLOGIC GROUP A							
CHEAT WATERSHED - HUC# 05020004					*4 Lake 1738 acres*	*31 streams 237 miles*	
Cheat River	WVMC	Fecal Coliform	Unknown	24.7	RM 19.5 to RM 44.2	2024	Yes
Cheat Lake	WVMC-(L1)	Methylmercury	Unknown	1730.0	Entire lake	2024	Yes
Coopers Rock Lake	WVMC-6-(L1)	Chlorophyll-A	Unknown	4.6	Entire Lake	2029	No
Webster Run	WVMC-12-B-0.5	CNA-Biological	Unknown	3.2	Entire length	2024	Yes
UNT/Greens Run RM 6.88	WVMC-16-E	CNA-Biological	Unknown	1.0	Entire length	2024	Yes
Shavers Fork	WVMCS	Aluminum (trout) (d)	Unknown	80.4	RM 16.5 (Little Black Fork) to HW	2029	No
Smoky Hollow	WVMCS-0.5	CNA-Biological	Unknown	0.9	Mouth to RM 0.9	2019	Yes

West Virginia's streams are coded under an alphanumeric system. Major rivers have been assigned an alphabetical code that symbolizes their name. For example, the code "WVPSB" symbolizes West Virginia – Potomac - South Branch. Adding a numerical suffix to the major river code codifies tributaries to the mainstems of the major rivers. Suffixes are applied in ascending order from mouth to headwaters. Tributaries of tributaries are codified by alternately adding numerical and alphabetical suffixes, always in ascending order from mouth to headwaters. In

the example table, Mill Creek (WVPSB-9) is the 9th tributary of the Potomac - South Branch (WVPSB) and Elmlick Run (WVPSB-9-G) is the 7th tributary of Mill Creek.

The "Criteria Affected" column identifies the water quality criterion that is not attained in the impaired water. On the list, a separate line is provided for each affected criterion. The "Source" column identifies the general source(s) of the impairment. In most instances, the actual source of impairment is not known at the time of listing. For all waters and impairments, the impaired length is provided, as well as the impaired reach description, in as much detail as possible. If the exact length of impairment is unknown, the entire length of the stream is indicated by default. Sources of impairment and impaired reach descriptions will be confirmed in the TMDL development process. The "Projected TMDL Year" column indicates the latest year in which the DEP plans to develop a TMDL for the impairment. The last column of the list provides information as to whether or not the stream appeared on the West Virginia 2012 Section 303(d) List or is a new listing.

Designated Uses

The affected designated uses associated with each listing are not displayed in the tabular format. Instead, the following table and discussion provides information regarding the affected designated use(s) for all criteria exceedances that resulted in the listing of impaired waters.

Criterion	Affected Designated Use			
	Aquatic Life	Contact Recreation	Public Water Supply	All Other Uses
Aluminum, dissolved	X			
Beryllium	X		X	
Chloride	X		X	
Chromium, hexavalent	X			
CNA-Algae		X	X	
CNA-Biological	X			
Dioxin (2, 3, 7, 8-TCDD)		X	X	X
Fecal coliform/Bacteria		X	X	
Iron	X		X	
Lead, dissolved	X			
Manganese			X	
Mercury	X	X	X	
Methylmercury	X	X	X	

Criterion	Affected Designated Use			
	Aquatic Life	Contact Recreation	Public Water Supply	All Other Uses
Nitrite	X			
PCBs		X		
pH	X	X	X	X
Selenium	X		X	

Abbreviations and Acronyms

The following table defines abbreviations and acronyms used.

AQ	Aquatic Life	(Trout)	Used to signify trout water criterion
CNA	Conditions Not Allowable	Mp	Mile Point
(dis)	Dissolved	RM	River Mile
HW	Headwaters	TMDL	Total Maximum Daily Load
HUC	Hydrologic Unit Code	UNT	Unnamed Tributary
CNA-Biological (Surrogate)- Used in Supplemental Table B to identify biological impairments resolved by the implementation of an approved pollutant specific TMDL.			

2006 Section 303(d) List

Supplemental Table A: Previously Listed Waters – No TMDL Developed

Previously listed waters from the 2014 list that are not on the 2016 list are included in this supplement if a TMDL has not been developed, and these waters have been reevaluated and determined not to be impaired.

Causes for revision of the impairment status include recent water quality data demonstrating an improved water quality condition, revision to the water quality criteria associated with the previous listing, documentation that the water was previously listed in error or a modification of the listing methodology.

Supplemental Table B - Previously Listed Waters - TMDL Developed

TMDLs have been developed for many previously listed waters. TMDL development allows the removal of an impaired water from the 303(d) list. In the suggested format of the Integrated Report, such waters are to be classified in Category 4A and clearly distinguished from Category 5 and the 303(d) list. Waters included in Category 4A have TMDLs developed, but water quality improvements are not yet complete and/or documented. The waters identified in Supplement B will match those of Category 4A of the Integrated Report.

Supplemental Table B1 - Existing TMDL Resolves Newly Identified Impairment

This table lists waters with newly identified impairments that occur in the watersheds of existing TMDLs. While TMDLs are not prescribed for these waters specifically, implementation of load and wasteload allocations for the pollutant of concern in the drainage areas for these waters is expected to resolve impairment.

Supplemental Table C - Water Quality Improvements

The goal of TMDLs and stream restoration projects is to bring the stream back to the point where it meets its designated uses and the associated water quality criteria.

This table lists streams with improved water quality due to TMDL implementation or pre-TMDL stream restoration work resulting in delisting. Delisting occurs when sufficient data provides clear evidence that the criteria for listing are no longer met. In the Integrated Report, the waters in Supplement C can be included in Category 1 if all designated uses are being met provided that impairments for other uses/pollutants are not evidenced.

Supplemental Table D - Impaired Waters - No TMDL Development Needed

This table lists impaired waters for which either other control mechanisms are in place to control pollutants or the water is not impaired by a pollutant (i.e., flow alterations caused by mining). These waters will be contained in Integrated Report Categories 4b and 4c unless TMDLs need to be developed for other pollutant-related impairments (Category 5).

Supplemental Table E - Total Aluminum TMDLs Developed

This table identifies waters for which aluminum TMDLs were developed based upon water quality criteria that are no longer effective. After the subject TMDLs were developed, EPA approved revisions to West Virginia water quality standards that changed the aluminum numeric water quality criteria from total to dissolved form. This table is included to document the development of the obsolete TMDLs and to distinguish them from the effective TMDLs identified in Supplemental Table B. Once these streams are assessed for dissolved aluminum, they will be removed from Table E.

Supplemental Table F - New Listings For 2016

This table lists impaired waters that are new on the list for 2016 and were not on the 2014 Section 303(d) list.