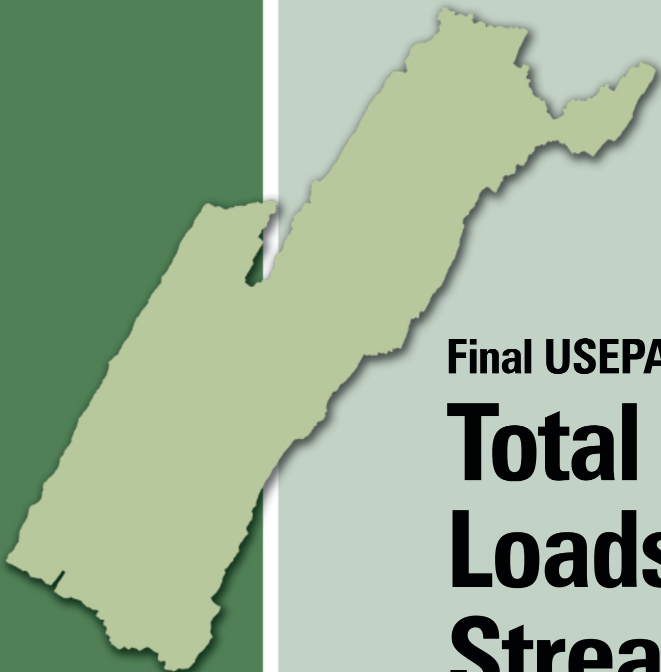

September 2011

Final USEPA Approved Report

Total Maximum Daily Loads for Selected Streams in the North Branch Potomac River Watershed, West Virginia

Prepared for
West Virginia Department of Environmental Protection
Division of Water and Waste Management
Watershed Protection Branch, TMDL Section

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ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

7Q10	7-day, 10-year low flow
BOD	biochemical oxygen demand
CFR	Code of Federal Regulations
CSO	combined sewer overflow
CSR	Code of State Rules
DEM	Digital Elevation Model
DNR	West Virginia Division of Natural Resources
DO	dissolved oxygen
DWWM	[WVDEP] Division of Water and Waste Management
GIS	geographic information system
gpd	gallons per day
HAU	home aeration unit
LA	load allocation
MDAS	Mining Data Analysis System
mL	milliliter
MF	membrane filter counts per test
MPN	most probable number
MOS	margin of safety
MRLC	Multi-Resolution Land Characteristics Consortium
NED	National Elevation Dataset
NLCD	National Land Cover Dataset
NOAA-NCDC	National Oceanic and Atmospheric Administration, National Climatic Data Center
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
POTW	publicly owned treatment works
SI	stressor identification
SRF	State Revolving Fund
STATSGO	State Soil Geographic database
TMDL	Total Maximum Daily Load
TSS	total suspended solids
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UNT	unnamed tributary
WLA	wasteload allocation
WVDEP	West Virginia Department of Environmental Protection
WVSCI	West Virginia Stream Condition Index
WVU	West Virginia University

Watershed

A general term used to describe a drainage area within the boundary of a United States Geologic Survey's 8-digit hydrologic unit code. In this report, the North Branch Potomac River and its West Virginia drainage area from its headwaters to its confluence with the South Branch of the Potomac at Green Spring, WV is referred to as the North Branch Potomac watershed. Throughout this report, the North Branch Potomac watershed refers to the tributary streams that eventually drain to the North Branch Potomac River (Figure I-1). The term "watershed" is also used more generally to refer to the land area that contributes precipitation runoff that eventually drains to the North Branch Potomac River.

TMDL Watershed

This term is used to describe the total land area draining to an impaired stream for which a TMDL is being developed. This term also takes into account the land area drained by un-impaired tributaries of the impaired stream, and may include impaired tributaries for which additional TMDLs are presented. This report addresses 22 impaired streams contained within 3 TMDL watersheds in the North Branch Potomac watershed.

Subwatershed

The subwatershed delineation is the most detailed scale of the delineation that breaks each TMDL watershed into numerous catchments for modeling purposes. The 3 TMDL watersheds have been subdivided into 197 modeled subwatersheds. Pollutant sources, allocations and reductions are presented at the subwatershed scale to facilitate future permitting actions and TMDL implementation.

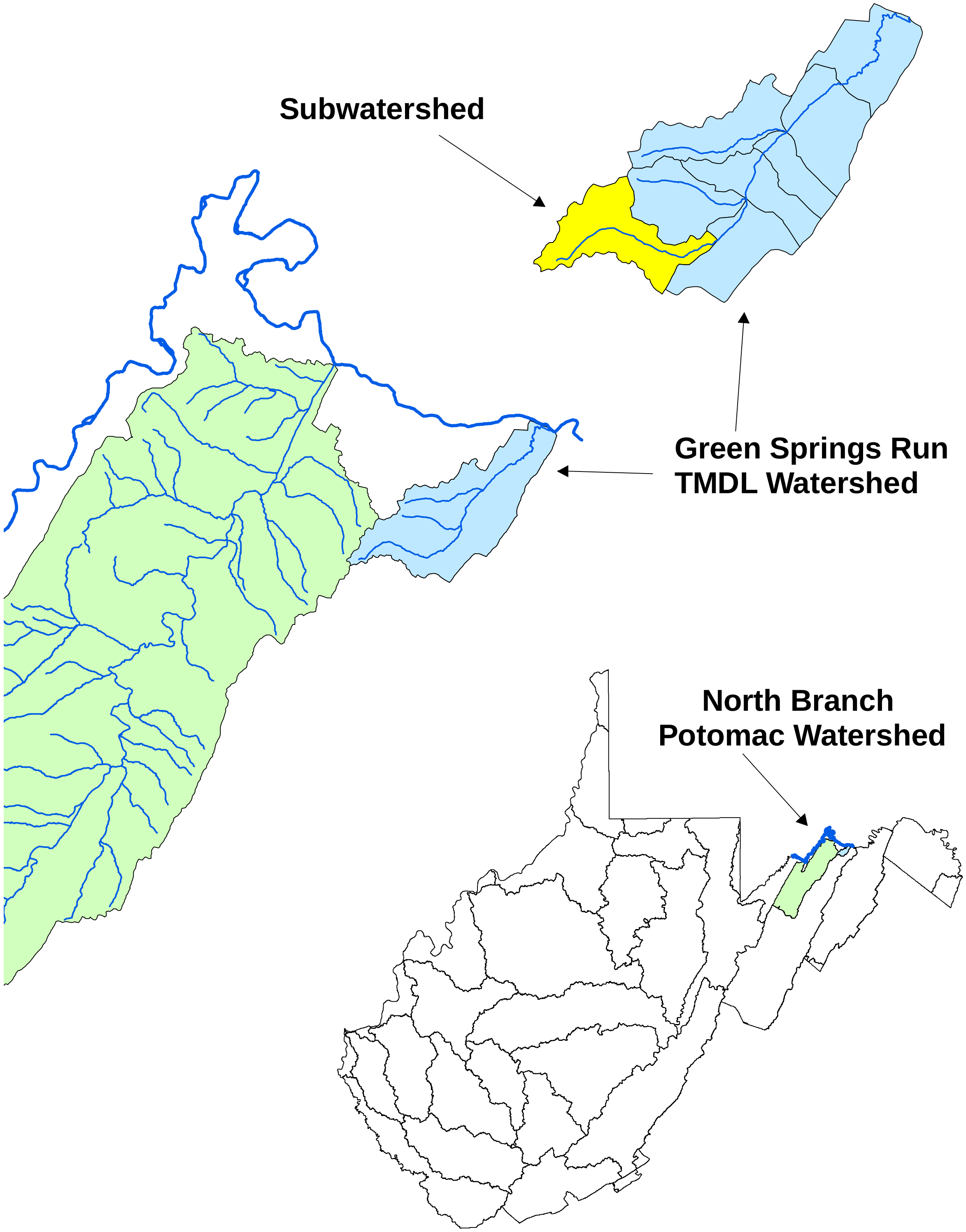


Figure I-1. Examples of a watershed, TMDL watershed, and subwatersheds

EXECUTIVE SUMMARY

This report includes Total Maximum Daily Loads (TMDLs) for 22 impaired streams in the North Branch Potomac River watershed.

A TMDL establishes the maximum allowable pollutant loading for a waterbody to comply with water quality standards, distributes the load among pollutant sources, and provides a basis for actions needed to restore water quality. West Virginia's water quality standards are codified at Title 47 of the *Code of State Rules* (CSR), Series 2, and titled *Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards*. The standards include designated uses of West Virginia waters and numeric and narrative criteria to protect those uses. The West Virginia Department of Environmental Protection routinely assesses use support by comparing observed water quality data with criteria and reports impaired waters every two years as required by Section 303(d) of the Clean Water Act ("303(d) list"). The Act requires that TMDLs be developed for listed impaired waters.

The majority of the subject impaired streams are included on West Virginia's 2010 Section 303(d) List. Documented impairments are related to numeric water quality criteria for fecal coliform bacteria. Certain waters are also biologically impaired based on the narrative water quality criterion of 47 CSR 2–3.2.i, which prohibits the presence of wastes in state waters that cause or contribute to significant adverse impacts on the chemical, physical, hydrologic, and biological components of aquatic ecosystems.

Impaired waters were organized into three TMDL watersheds. For hydrologic modeling purposes, impaired and unimpaired streams in these three TMDL watersheds were further divided into 197 smaller subwatershed units for modeling. The subwatershed delineation provided a basis for georeferencing pertinent source information, monitoring data, and presentation of the TMDLs.

The Mining Data Analysis System (MDAS) was used to represent linkage between pollutant sources and instream responses for fecal coliform bacteria. The MDAS is a comprehensive data management and modeling system that is capable of representing loads from nonpoint and point sources in the watershed and simulating instream processes.

Point and nonpoint sources contribute to the fecal coliform bacteria impairments in the watershed. Failing on-site systems, direct discharges of untreated sewage, and precipitation runoff from agricultural and residential areas are significant nonpoint sources of fecal coliform bacteria. Point sources of fecal coliform bacteria include the effluents of sewage treatment facilities.

Biological integrity/impairment is based on a rating of the stream's benthic macroinvertebrate community using the multimetric West Virginia Stream Condition Index (WVSCI). The first step in TMDL development for biologically impaired waters is stressor identification (SI). Section 4 discusses the SI process. SI was followed by stream-specific determinations of the pollutants for which TMDLs must be developed. Organic enrichment was identified as the causative stressor for the biologically impaired streams addressed in this effort.

The biologically impaired waters also demonstrated violations of the numeric criteria for fecal coliform bacteria. It was determined that implementation of fecal coliform TMDLs would remove untreated sewage and significantly reduce animal wastes, thereby reducing the organic and nutrient loading causing the biological impairment.

This report describes the TMDL development and modeling processes, identifies impaired streams and existing pollutant sources, discusses future growth and TMDL achievability, and documents the public participation associated with the process. It also contains a detailed discussion of the applied allocation methodology. Various provisions attempt to ensure the attainment of criteria throughout the watershed, achieve equity among categories of sources, and target pollutant reductions from the most problematic sources. Nonpoint source reductions were not specified beyond natural (background) levels. Similarly, point source wasteload allocations (WLAs) were no more stringent than numeric water quality criteria.

Applicable TMDLs are displayed in Section 7 of this report. Accompanying spreadsheets provide TMDLs and allocations of loads to categories of point and nonpoint sources that achieve the total TMDL. Also provided is an interactive ArcView geographic information system (GIS) project that allows for the exploration of spatial relationships among the source assessment data. A Technical Report is also available that describes the detailed technical approaches used in the process and displays the data upon which the TMDLs are based.

1.0 REPORT FORMAT

This report describes the overall total maximum daily load (TMDL) development process, identifies impaired streams, and outlines the source assessment for all pollutants for which TMDLs are presented. It also describes the modeling and allocation processes and lists measures that will be taken to ensure that the TMDLs are met. The applicable TMDLs are displayed in Section 7 of this report. The report is supported by a compact disc containing a spreadsheet (in Microsoft Excel format) that provides detailed source allocations associated with successful TMDL scenarios. A Technical Report is also included that describes the detailed technical approaches used in the process and displays the data upon which the TMDLs are based. The CD also contains an ArcView GIS project (and shapefiles) that allows the user to explore spatial relationships among pollutant sources.

2.0 INTRODUCTION

The West Virginia Department of Environmental Protection (WVDEP), Division of Water and Waste Management (DWWM), is responsible for the protection, restoration, and enhancement of the state’s waters. Along with this duty comes the responsibility for TMDL development in West Virginia.

2.1 Total Maximum Daily Loads

Section 303(d) of the federal Clean Water Act and the U.S. Environmental Protection Agency’s (USEPA) Water Quality Planning and Management Regulations (at Title 40 of the *Code of Federal Regulations* [CFR] Part 130) require states to identify waterbodies that do not meet water quality standards and to develop appropriate TMDLs. A TMDL establishes the maximum allowable pollutant loading for a waterbody to achieve compliance with applicable standards. It also distributes the load among pollutant sources and provides a basis for the actions needed to restore water quality.

A TMDL is composed of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. TMDLs can be expressed in terms of mass per time or other appropriate units. Conceptually, this definition is denoted by the following equation:

$$\text{TMDL} = \text{sum of WLAs} + \text{sum of LAs} + \text{MOS}$$

WVDEP is developing TMDLs in concert with a geographically-based approach to water resource management in West Virginia—the Watershed Management Framework. Adherence to the Framework ensures efficient and systematic TMDL development. Each year, TMDLs are developed in specific geographic areas. The Framework dictates that in 2010 TMDLs should be pursued in Hydrologic Group B, which includes the North Branch Potomac River watershed. Figure 2-1 depicts the hydrologic groupings of West Virginia's watersheds; the legend includes the target year for finalization of each TMDL.

WVDEP is committed to implementing a TMDL process that reflects the requirements of the 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. A 48-month development process enables the agency to carry out an extensive data generating and gathering effort to produce scientifically defensible TMDLs. It also allows ample time for modeling, report finalization, and frequent public participation opportunities.

The TMDL development process begins with pre-TMDL water quality monitoring and source identification and characterization. Informational public meetings are held in the affected watersheds. Data obtained from pre-TMDL efforts are compiled, and the impaired waters are modeled to determine baseline conditions and the gross pollutant reductions needed to achieve water quality standards. WVDEP then presents a status update meeting in which allocation strategies and the progress of TMDL development is presented. After the second public meeting, draft TMDL reports are developed. The draft TMDL is advertised for public review and comment, and a third informational meeting is held during the public comment period. Public comments are addressed, and the draft TMDL is submitted to USEPA for approval.

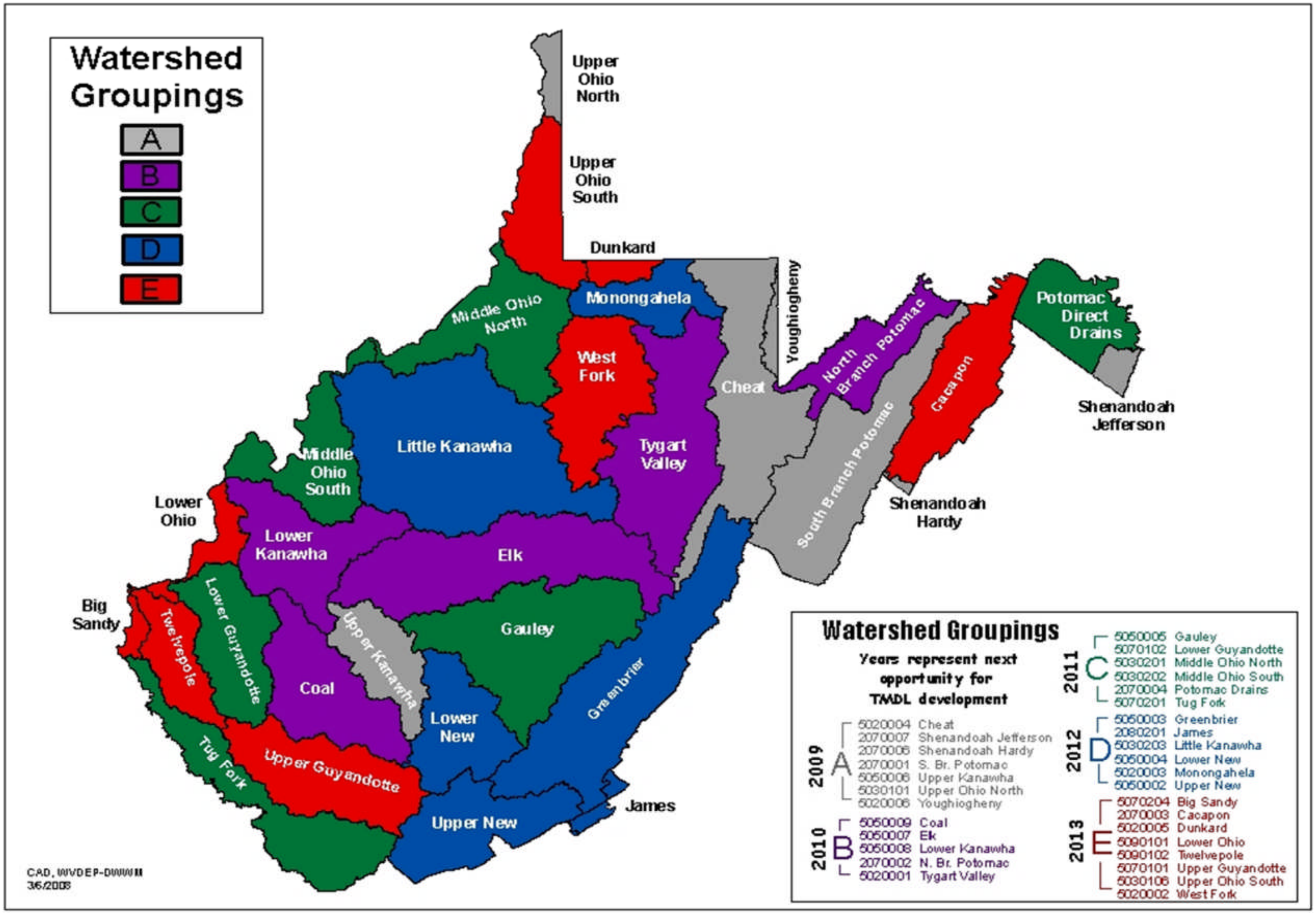


Figure 2-1. Hydrologic groupings of West Virginia's watersheds

2.2 Water Quality Standards

The determination of impaired waters involves comparing instream conditions to applicable water quality standards. West Virginia's water quality standards are codified at Title 47 of the *Code of State Rules* (CSR), Series 2, titled *Legislative Rules*, *Department of Environmental Protection: Requirements Governing Water Quality Standards*. These standards can be obtained online from the West Virginia Secretary of State Internet site (http://www.wvsos.com/csr/verify.asp?TitleSeries=47-02).

Water quality standards consist of three components: designated uses; narrative and/or numeric water quality criteria necessary to support those uses; and an antidegradation policy. Appendix E of the Standards contains the numeric water quality criteria for a wide range of parameters, while Section 3 of the Standards contains the narrative water quality criteria.

Designated uses include: propagation and maintenance of aquatic life in warmwater fisheries and troutwaters, water contact recreation, and public water supply. Water contact recreation and public water supply use impairments have been determined in various waters pursuant to exceedances of numeric water quality criteria for fecal coliform bacteria.

All West Virginia waters are subject to the narrative criteria in Section 3 of the Standards. That section, titled "Conditions Not Allowable in State Waters," contains various general provisions related to water quality. The narrative water quality criterion at Title 47 *CSR* Series 2 – 3.2.i prohibits the presence of wastes in state waters that cause or contribute to significant adverse impacts to the chemical, physical, hydrologic, and biological components of aquatic ecosystems. This provision is the basis for "biological impairment" determinations. Biological impairment signifies a stressed aquatic community, and is discussed in detail in Section 4.

The numeric water quality criteria applicable to the impaired streams addressed by this report are summarized in Table 2-1. The stream-specific impairments related to both numeric and narrative water quality criteria are displayed in Table 3-3.

TMDLs presented herein are based upon the water quality criteria that are currently effective. If the West Virginia Legislature adopts Water Quality Standard revisions that alter the basis upon which the TMDLs are developed, then the TMDLs and allocations may be modified as warranted. Any future Water Quality Standard revision and/or TMDL modification must receive EPA approval prior to implementation.

Table 2-1. Applicable West Virginia water quality criteria

Pollutant	Use designation	
	Water Contact	Public Water Supply
Fecal Coliform	Maximum allowable level of fecal coliform content for Primary Contact Recreation (either MPN [most probable number] or MF [membrane filter counts/test]) shall not exceed 200/100 mL as a monthly geometric mean based on not less than 5 samples per month; nor to exceed 400/100 mL in more than 10 percent of all samples taken during the month.	

Source: 47 CSR, Series 2, Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards.

3.0 WATERSHED DESCRIPTION AND DATA INVENTORY

3.1 Watershed Description

The three modeled TMDL watersheds in the North Branch Potomac River watershed (U.S. Geological Survey [USGS] 8-digit hydrologic unit code 02070002) encompass approximately 348 square miles in the eastern panhandle of West Virginia (Figure 3-1). The three modeled TMDL mainstem drainages, (New Creek, Patterson Creek, and Green Spring Run) flow southwest to northeast to their confluences with the North Branch Potomac main stem. Modeled watersheds fall within portions of Mineral, Grant, and Hampshire Counties. Cities and towns in the vicinity of the area of study are Keyser, Fort Ashby, and Green Spring.

The highest point in the modeled watersheds is 3,525 feet on the Allegheny Front near Bismark, WV. The lowest point is 544 feet at the confluence of Green Spring Run and the North Branch Potomac River at Green Spring, WV. The average elevation is 1,125 feet.

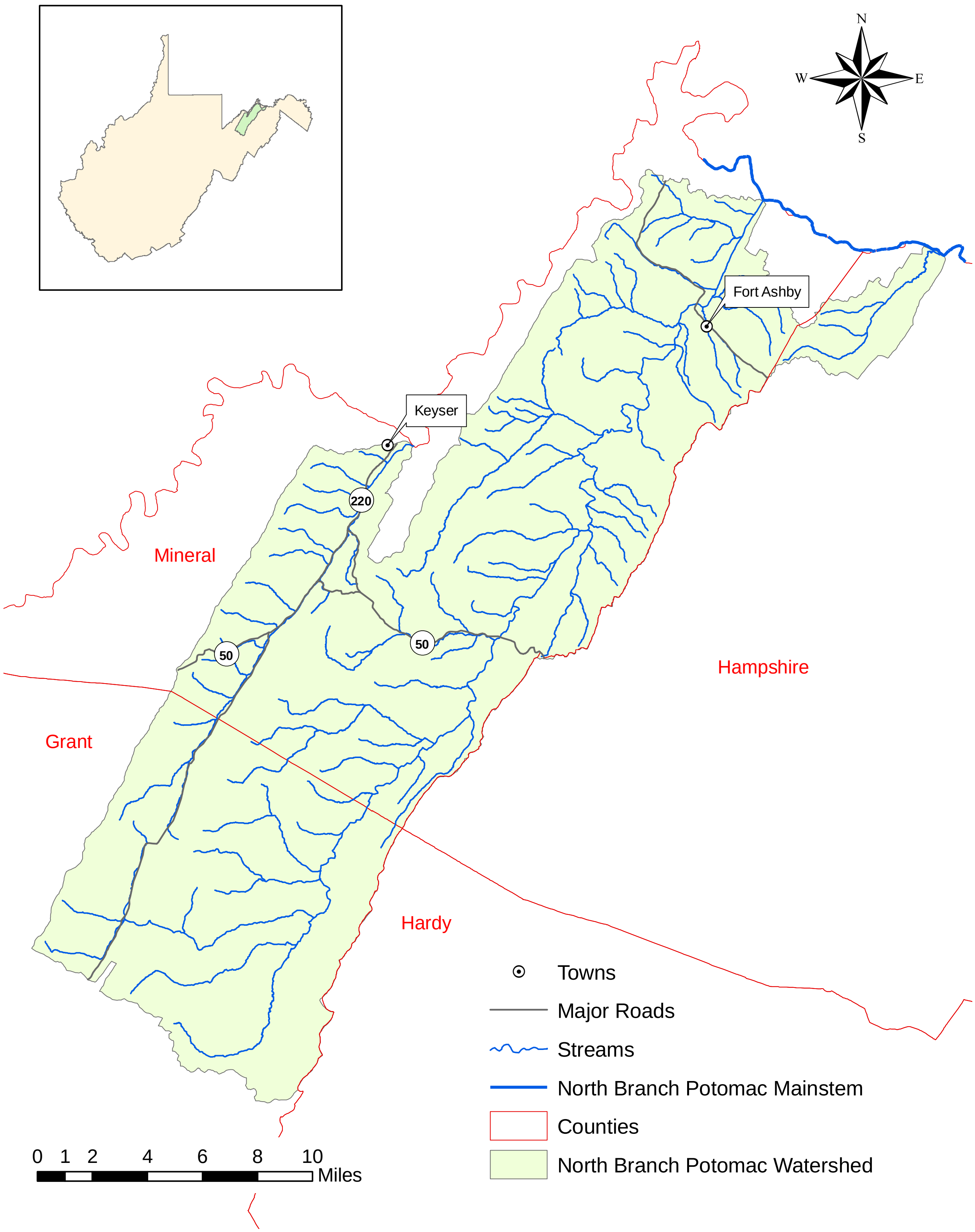


Figure 3-1. Location of the North Branch Potomac watershed in West Virginia

Landuse and land cover estimates were originally obtained from vegetation data gathered from the National Land Cover Dataset (NLCD) 2001. The Multi-Resolution Land Characteristics Consortium (MRLC) produced the NLCD coverage. The NLCD database for West Virginia was derived from satellite imagery taken during the early 2000s, and it includes detailed vegetative spatial data. Enhancements and updates to the NLCD coverage were made to create a modeled landuse by custom edits derived primarily from WVDEP source tracking information and 2003 aerial photography with 1-meter resolution. Additional information regarding the NLCD spatial database is provided in Appendix C of the Technical Report.

Table 3-1 displays the landuse distribution for the 197 modeled subwatersheds in the North Branch Potomac watershed, derived from NLCD as described above. The dominant landuse is forest, which constitutes 77.7 percent of the total landuse area. Other important modeled landuse types are grassland (10.8 percent), urban/residential (5.4 percent), and agriculture (5.6 percent). Individually, all other land cover types compose less than one percent of the total watershed area.

Table 3-1. Modified landuse for the North Branch Potomac TMDL watershed

Landuse Type	Area of Watershed		
	Acres	Square Miles	Percentage
Water	702.3	1.1	0.3
Wetland	6.2	< 0.01	< 0.01
Barren	208.2	0.3	0.1
Forest	173,211.9	270.6	77.7
Grassland	24,051.0	37.6	10.8
Agriculture	12,545.0	19.6	5.6
Urban/Residential	12,092.6	18.9	5.4
Total Area	222,817.3	348.2	100.0

Note: < = less than

3.2 Data Inventory

Various sources of data were used in the TMDL development process. The data were used to identify and characterize sources of pollution and to establish the water quality response to those sources. Review of the data included a preliminary assessment of the watershed’s physical and socioeconomic characteristics and current monitoring data. Table 3-2 identifies the data used to support the TMDL assessment and modeling effort. These data describe the physical conditions of the TMDL watersheds, the potential pollutant sources and their contributions, and the impaired waterbodies for which TMDLs need to be developed. Prior to TMDL development, WVDEP collected comprehensive water quality data throughout the watershed. This pre-TMDL monitoring effort contributed the largest amount of water quality data to the process and is summarized in the Technical Report, Appendix I.

Table 3-2. Datasets used in TMDL development

Type of Information		Data Sources
Watershed physiographic data	Stream network	West Virginia Division of Natural Resources (WVDNR)
	Landuse	National Land Cover Dataset 2001 (NLCD)
	2003 Aerial Photography (1-meter resolution)	WVDEP
	Counties	U.S. Census Bureau
	Cities/populated places	U.S. Census Bureau
	Soils	State Soil Geographic Database (STATSGO) U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) soil surveys
	Hydrologic Unit Code boundaries	U.S. Geological Survey (USGS)
	Topographic and digital elevation models (DEMs)	National Elevation Dataset (NED)
	Dam locations	USGS
	Roads	U.S. Census Bureau TIGER, WVU WV Roads
	Water quality monitoring station locations	WVDEP, USEPA STORET
	Meteorological station locations	National Oceanic and Atmospheric Administration, National Climatic Data Center (NOAA-NCDC)
	Permitted facility information	WVDEP Division of Water and Waste Management (DWWM),)
	Timber harvest data	WV Division of Forestry
	Oil and gas operations coverage	WVDEP Office of Oil and Gas (OOG)
Monitoring data	Historical Flow Record (daily averages)	USGS
	Rainfall	NOAA-NCDC
	Temperature	NOAA-NCDC
	Wind speed	NOAA-NCDC
	Dew point	NOAA-NCDC
	Humidity	NOAA-NCDC
	Cloud cover	NOAA-NCDC
	Water quality monitoring data	USEPA STORET, WVDEP
	National Pollutant Discharge Elimination System (NPDES) data	WVDEP DWWM
Regulatory or policy information	Applicable water quality standards	WVDEP
	Section 303(d) list of impaired waterbodies	WVDEP, USEPA
	Nonpoint Source Management Plans	WVDEP

3.3 Impaired Waterbodies

WVDEP conducted extensive water quality monitoring throughout the North Branch Potomac watershed from July 2007 through June 2008. The results of that effort were used to confirm the impairments of waterbodies identified on previous 303(d) lists and to identify other impaired waterbodies that were not previously listed.

TMDLs were developed for impaired waters in three TMDL watersheds (Figure 3-2). The impaired waters for which TMDLs have been developed are presented in Table 3-3. The table includes the TMDL watershed, stream code, stream name, and impairments for each stream.

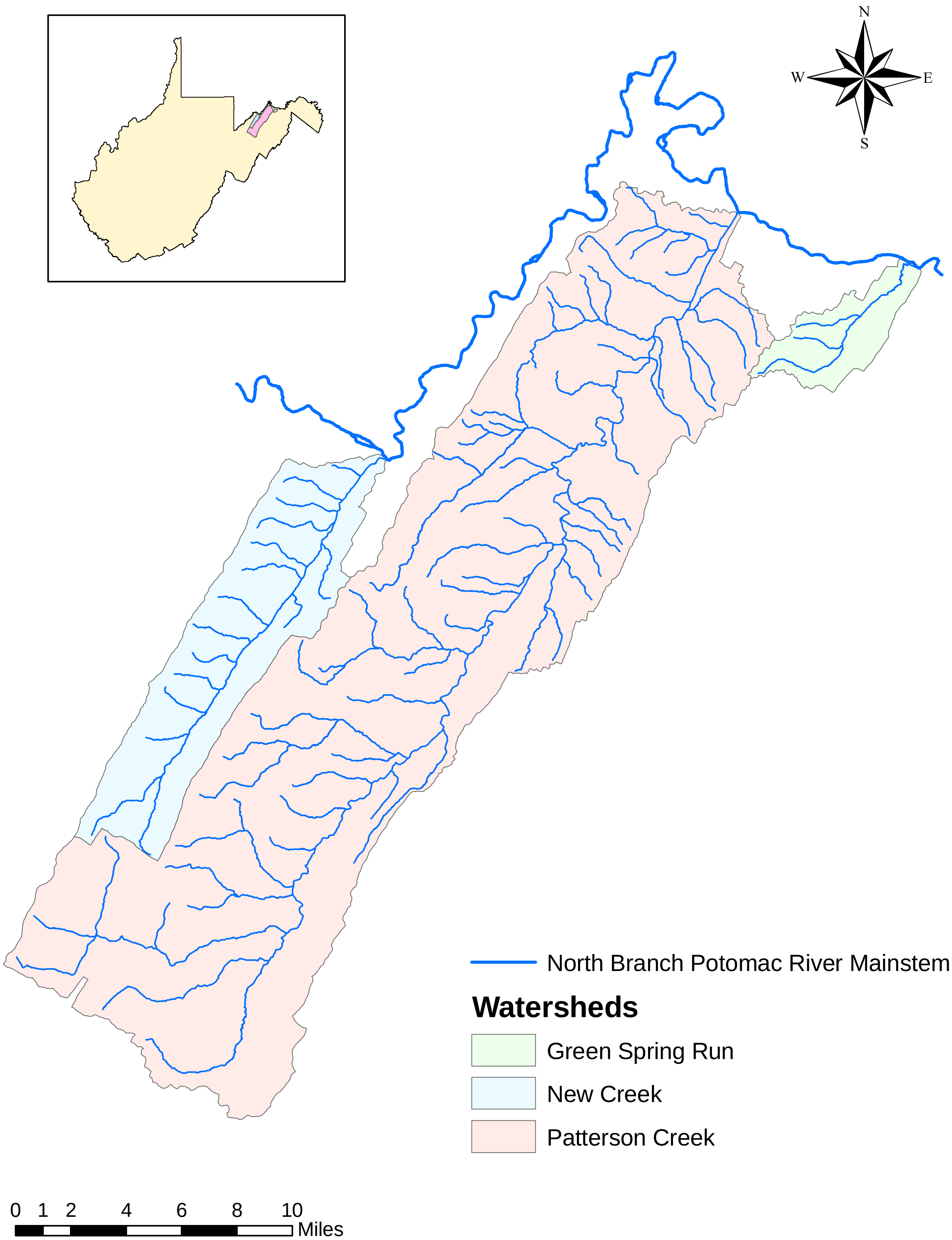


Figure 3-2. North Branch Potomac TMDL watersheds

Table 3-3. Waterbodies and impairments for which TMDLs have been developed

TMDL Watershed	Stream Name	Stream Code	FC	BIO
Green Spring Run	Green Spring Run	WV-PNB-2	x	
Patterson Creek	Patterson Creek	WV-PNB-14	x	
Patterson Creek	Plum Run	WV-PNB-14-B	x	
Patterson Creek	Horseshoe Creek	WV-PNB-14-I	x	x
Patterson Creek	UNT/Painter Run RM 0.9	WV-PNB-14-F-2	x	
Patterson Creek	Cabin Run	WV-PNB-14-AI	x	x
Patterson Creek	Pargut Run	WV-PNB-14-AI-7	x	x
Patterson Creek	UNT/Patterson Creek RM 16.25	WV-PNB-14-AL	x	x
Patterson Creek	Beaver Run	WV-PNB-14-AW	x	
Patterson Creek	Mill Creek	WV-PNB-14-BV	x	x
Patterson Creek	Elliber Run	WV-PNB-14-CH	x	
Patterson Creek	Mikes Run	WV-PNB-14-CK	x	
Patterson Creek	North Fork/Patterson Creek	WV-PNB-14-DM	x	
Patterson Creek	Elklick Run	WV-PNB-14-DM-13	x	
Patterson Creek	UNT/North Fork RM 8.37/ Patterson Creek	WV-PNB-14-DM-14	x	
Patterson Creek	Middle Fork/Patterson Creek	WV-PNB-14-DQ	x	x
New Creek	New Creek	WV-PNB-31	x	x
New Creek	UNT/New Creek RM 1.30	WV-PNB-31-A	x	
New Creek	Stony Run	WV-PNB-31-D	x	
New Creek	Block Run	WV-PNB-31-G	x	
New Creek	UNT/New Creek RM 4.26	WV-PNB-31-H	x	x
New Creek	King Run	WV-PNB-31-K	x	

Note:
RM = River Mile
UNT = unnamed tributary.
FC indicates fecal coliform bacteria impairment
BIO indicates a biological impairment

4.0 BIOLOGICAL IMPAIRMENT AND STRESSOR IDENTIFICATION

Initially, TMDL development in biologically impaired waters requires identification of the pollutants that cause the stress to the biological community. Sources of those pollutants are often analogous to those already described: untreated sewage. Section 2 of the Technical Report discusses biological impairment and the SI process in detail.

4.1 Introduction

Assessment of the biological integrity of a stream is based on a survey of the stream's benthic macroinvertebrate community. Benthic macroinvertebrate communities are rated using a multimetric index developed for use in wadeable streams of West Virginia. The West Virginia Stream Condition Index (WVSCI; Gerritsen et al., 2000) is composed of six metrics that were selected to maximize discrimination between streams with known impairments and reference streams. In general, streams with WVSCI scores of fewer than 60.6 points, on a normalized 0–100 scale, are considered biologically impaired.

Biological assessments are useful in detecting impairment, but they may not clearly identify the causes of impairment, which must be determined before TMDL development can proceed. USEPA developed *Stressor Identification: Technical Guidance Document* (Cormier et al., 2000) to assist water resource managers in identifying stressors and stressor combinations that cause biological impairment. Elements of the SI process were used to evaluate and identify the significant stressors to the impaired benthic communities. In addition, custom analyses of biological data were performed to supplement the framework recommended by the guidance document.

The general SI process entailed reviewing available information, forming and analyzing possible stressor scenarios, and implicating causative stressors. The SI method provides a consistent process for evaluating available information. TMDLs were established for the responsible pollutants at the conclusion of the SI process. As a result, the TMDL process established a link between the impairment and benthic community stressors.

4.2 Data Review

WVDEP generated the primary data used in SI through its pre-TMDL monitoring program. The program included water quality monitoring, benthic sampling, and habitat assessment. In addition, the biologists' comments regarding stream condition and potential stressors and sources were captured and considered. Other data sources were: source tracking data, NLCD 2001 landuse information, Natural Resources Conservation Service (NRCS) State Soil Geographic database (STATSGO) soils data, National Pollutant Discharge Elimination System (NPDES) point source data, and literature sources.

4.3 Candidate Causes/Pathways

The first step in the SI process was to develop a list of candidate causes, or stressors. The candidate causes responsible for biological impairments are listed below:

1. Metals contamination (including metals contributed through soil erosion) causes toxicity
2. Acidity (low pH) causes toxicity
3. Basic (high pH >9) causes toxicity
4. Increased ionic strength causes toxicity
5. Organic enrichment (e.g. sewage discharges and agricultural runoff cause habitat alterations
6. Increased metals flocculation and deposition causes habitat alterations (e.g., embeddedness)
7. Increased total suspended solids (TSS)/erosion and altered hydrology cause sedimentation and other habitat alterations
8. Altered hydrology causes higher water temperature, resulting in direct impacts
9. Altered hydrology, nutrient enrichment, and increased biochemical oxygen demand (BOD) cause reduced dissolved oxygen (DO)
10. Algal growth causes food supply shift
11. High levels of ammonia cause toxicity (including increased toxicity due to algal growth)
12. Chemical spills cause toxicity

A conceptual model was developed to examine the relationship between candidate causes and potential biological effects. The conceptual model (Figure 4-1) depicts the sources, stressors, and pathways that affect the biological community.

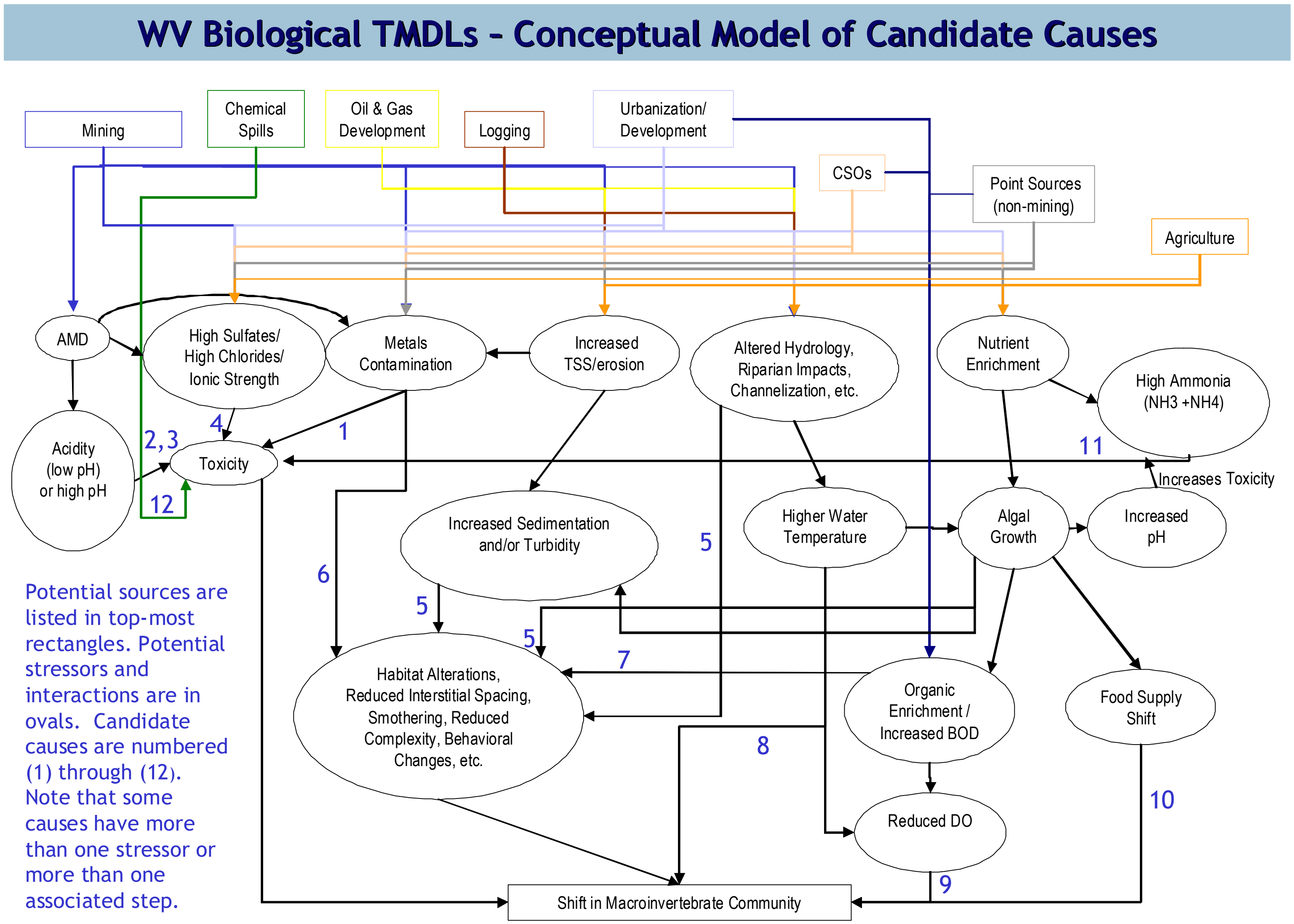


Figure 4-1. Conceptual model of candidate causes and potential biological effects

4.4 Stressor Identification Results

The SI process determined the most significant stressor to all biologically impaired waters as organic enrichment – the combined effects of oxygen demanding pollutants, nutrients, and the resultant algal and habitat alterations.

All biologically impaired waters also demonstrated violations of the fecal coliform water quality criteria. The predominant sources of both organic enrichment and fecal coliform bacteria in the watershed are inadequately treated sewage and runoff from agricultural landuses. WVDEP determined that implementation of fecal coliform TMDLs would remove untreated sewage and significantly reduce loadings in agricultural runoff and resolve the biological impairment in these streams. Therefore, fecal coliform TMDLs will serve as a surrogate for the biological impairments.

In the SI process, hydrologic modification and sedimentation could not be completely eliminated as biological stressors. Although potentially present, available information does not suggest that those stressors overshadow the stress from organic enrichment. Flood control ponds are present in the watersheds in some of the biologically impaired streams, but adverse impacts from hydrologic modification is not appropriate for TMDL development because the impairment would not be caused by a pollutant. Also, any secondary sedimentation impacts would be mitigated by the management practices necessary to implement the fecal coliform TMDLs.

Table 4-1. Significant stressors of biologically impaired streams in the North Branch Potomac watershed

Stream Name	Stream Code	Biological Stressors	TMDLs Developed
Horseshoe Creek	WV-PNB-14-I	Organic Enrichment	Fecal Coliform
Cabin Run	WV-PNB-14-AI	Organic Enrichment	Fecal Coliform
Pargut Run	WV-PNB-14-AI-7	Organic Enrichment	Fecal Coliform
UNT/Patterson Creek RM 16.25	WV-PNB-14-AL	Organic Enrichment	Fecal Coliform
Mill Creek	WV-PNB-14-BV	Organic Enrichment	Fecal Coliform
Middle Fork/Patterson Creek	WV-PNB-14-DQ	Organic Enrichment	Fecal Coliform
New Creek	WV-PNB-31	Organic Enrichment	Fecal Coliform
UNT/New Creek RM 4.26	WV-PNB-31-H	Organic Enrichment	Fecal Coliform

5.0 FECAL COLIFORM SOURCE ASSESSMENT

5.1 Fecal Coliform Point Sources

Publicly and privately owned sewage treatment facilities and home aeration units are point sources of fecal coliform bacteria. Combined sewer overflows (CSOs) are additional point sources that may contribute loadings of fecal coliform bacteria to receiving streams. The following sections discuss the specific types of fecal coliform point sources that were identified in the North Branch Potomac watershed.

5.1.1 Individual NPDES Permits

WVDEP issues individual NPDES permits to both publicly owned and privately owned wastewater treatment facilities. Publicly owned treatment works (POTWs) are relatively large facilities with extensive wastewater collection systems, whereas private facilities are usually used in smaller applications such as subdivisions and shopping centers.

In the subject watersheds of this report, one individually permitted POTW, the Frankfort PSD Fort Ashby Wastewater Treatment Plant, discharges treated effluent at one outlet. One additional privately owned sewage treatment plant operated by the Knobley Estates Sanitation Corporation, operating under an individual NPDES permit, discharges treated effluent at one outlet. There are no CSOs present in subject watersheds of this report.

These sources are regulated by NPDES permits that require effluent disinfection and compliance with strict fecal coliform effluent limitations (200 counts/100 mL [geometric mean monthly] and 400 counts/100 mL [maximum daily]). Compliant facilities do not cause fecal coliform bacteria impairments because effluent limitations are more stringent than water quality criteria.

5.1.2 General Sewage Permits

General sewage permits are designed to cover like discharges from numerous individual owners and facilities throughout the state. General Permit WV0103110 regulates small, privately owned sewage treatment plants (“package plants”) that have a design flow of 50,000 gallons per day (gpd) or less. General Permit WV0107000 regulates home aeration units (HAUs). HAUs are small sewage treatment plants primarily used by individual residences where site considerations preclude typical septic tank and leach field installation. Both general permits contain fecal coliform effluent limitations identical to those in individual NPDES permits for sewage treatment facilities. In the areas draining to streams for which fecal coliform TMDLs have been developed, there are no permitted HAUs and 11 facilities are registered under the “package plant” general permit.

5.2 Fecal Coliform Nonpoint Sources

5.2.1 On-site Treatment Systems

Failing septic systems and straight pipes are significant nonpoint sources of fecal coliform bacteria. Information collected during source tracking efforts by WVDEP yielded an estimate of

6,164 homes that are not served by centralized sewage collection and treatment systems. Estimated septic system failure rates across the watershed range from three percent to 28 percent.

Due to a wide range of available literature values relating to the bacteria loading associated with failing septic systems, a customized Microsoft Excel spreadsheet tool was created to represent the fecal coliform bacteria contribution from failing on-site septic systems. WVDEP's pre-TMDL monitoring and source tracking data were used in the calculations. To calculate loads, values for both wastewater flow and fecal coliform concentration are needed.

To calculate failing septic wastewater flows, the TMDL watersheds were divided into four septic failure zones. During the WVDEP source tracking process, septic failure zones were delineated by soil characteristics (soil permeability, depth to bedrock, depth to groundwater and drainage capacity) as shown in United States Department of Agriculture (USDA) county soil survey maps. Two types of failure were considered, complete failure and periodic failure. For the purposes of this analysis, complete failure was defined as 50 gallons per house per day of untreated sewage escaping a septic system as overland flow to receiving waters and periodic failure was defined as 25 gallons per house per day. Figure 5-1 shows the failing septic flows represented in the model by subwatershed.

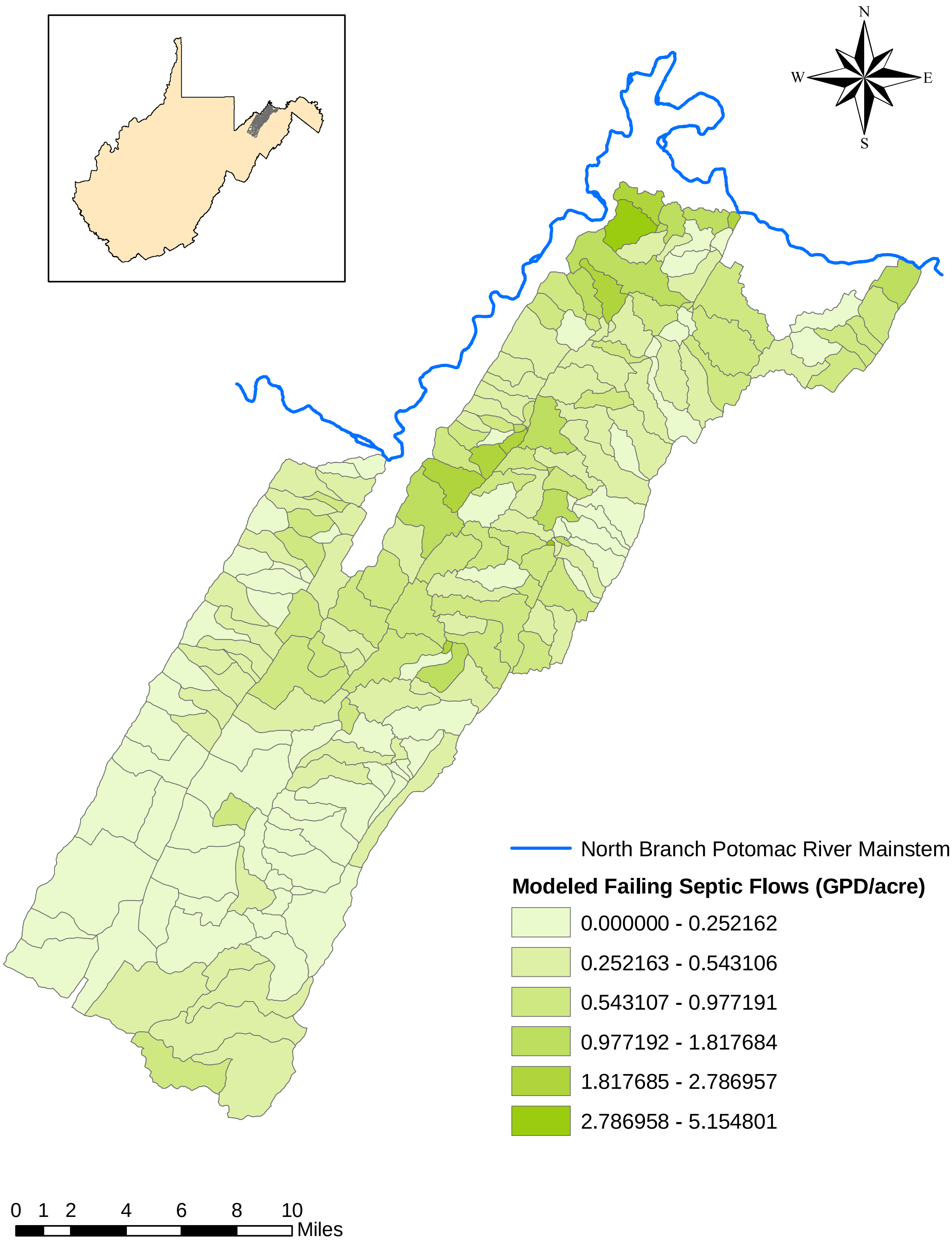


Figure 5-1. Failing septic flows in the North Branch Potomac watershed

Once failing septic flows were modeled, a fecal coliform concentration was determined at the TMDL watershed scale. Based on past experience with other West Virginia TMDLs, a base concentration of 10,000 counts per 100 ml was used as a beginning concentration for failing septic systems. This concentration was further refined during model calibration. A sensitivity analysis was performed by varying the modeled failing septic concentrations in multiple model runs, and then comparing model output to pre-TMDL monitoring data. Additional details of the failing septic analyses are elucidated in the Technical Report.

For the purposes of this TMDL, discharges from activities that do not have an associated NPDES permit, such as failing septic systems and straight pipes, are considered nonpoint sources. The decision to assign LAs to those sources does not reflect a determination by WVDEP or USEPA as to whether they are, in fact, non-permitted point source discharges. Likewise, by establishing these TMDLs with failing septic systems and straight pipes treated as nonpoint sources, WVDEP and USEPA are not determining that such discharges are exempt from NPDES permitting requirements.

5.2.2 Urban/Residential Runoff

Stormwater runoff from residential and urbanized areas can be a significant source of fecal coliform bacteria. These landuses are considered to be nonpoint sources and load allocations are prescribed. The modified NLCD 2001 landuse data were used to determine the extent of residential and urban areas and source representation was based upon precipitation and runoff.

5.2.3 Agriculture

Agricultural activities can contribute fecal coliform bacteria to receiving streams through surface runoff or direct deposition. Grazing livestock and land application of manure result in the deposition and accumulation of bacteria on land surfaces. These bacteria are then available for wash-off and transport during rain events. In addition, livestock with unrestricted access can deposit feces directly into streams.

Agricultural activity is a ubiquitous fecal coliform bacteria nonpoint source in the watershed. Pasture/cropland landuses were determined to be present in approximately 91% of the modeled subwatersheds. Source tracking efforts identified pastures and feedlots near impaired segments that have localized impacts on instream bacteria levels. Source representation was based upon precipitation and runoff, and source tracking information regarding number of livestock, proximity and access to stream, and overall runoff potential were used to develop accumulation rates.

5.2.4 Natural Background (Wildlife)

A certain “natural background” contribution of fecal coliform bacteria can be attributed to deposition by wildlife in forested areas. Accumulation rates for fecal coliform bacteria in forested areas were developed using reference numbers from past TMDLs, incorporating wildlife estimates obtained from West Virginia’s Division of Natural Resources (DNR). In addition, WVDEP conducted storm-sampling on a 100 percent forested subwatershed (Shrewsbury Hollow) within the Kanawha State Forest, Kanawha County, West Virginia to determine wildlife contributions of fecal coliform. These results were used during the model calibration process. On the basis of the low fecal accumulation rates for forested areas, the storm water sampling results, and model simulations, wildlife is not considered to be a significant nonpoint source of fecal coliform bacteria in the watershed.

6.0 MODELING PROCESS

Establishing the relationship between the instream water quality targets and source loadings is a critical component of TMDL development. It allows for the evaluation of management options that will achieve the desired source load reductions. The link can be established through a range of techniques, from qualitative assumptions based on sound scientific principles to sophisticated modeling techniques. Ideally, the linkage will be supported by monitoring data that allow the TMDL developer to associate certain waterbody responses with flow and loading conditions. This section presents the approach taken to develop the linkage between sources and instream response for TMDL development in the North Branch Potomac watershed.

6.1 Model Selection

Selection of the appropriate analytical technique for TMDL development was based on an evaluation of technical and regulatory criteria. The following key technical factors were considered in the selection process:

- Scale of analysis
- Point and nonpoint sources
- Fecal coliform bacteria impairments are temporally variable and occur at low, average, and high flow conditions
- Time-variable aspects of land practices have a large effect on bacteria concentrations
- Bacteria transport mechanisms are highly variable and often weather-dependent

The primary regulatory factor that influenced the selection process was West Virginia’s water quality criteria. According to 40 CFR Part 130, TMDLs must be designed to implement applicable water quality standards. The applicable water quality criterion for fecal coliform bacteria in West Virginia is presented in Section 2, Table 2-1. West Virginia numeric water quality criteria are applicable at all stream flows greater than the 7-day, 10-year low flow (7Q10). The approach or modeling technique must permit representation of instream concentrations under a variety of flow conditions to evaluate critical flow periods for comparison with criteria.

The TMDL development approach must also consider the dominant processes affecting pollutant loadings and instream fate. In the North Branch Potomac watershed, an array of point and nonpoint sources contributes to the impairments. Most nonpoint sources are rainfall-driven with pollutant loadings primarily related to surface runoff, but some, such as inadequate onsite residential sewage treatment systems, function as continuous discharges. Fecal coliform point sources are continuous discharges. While loading function variations must be recognized in the representation of the various sources, the TMDL allocation process must prescribe WLAs for all contributing point sources and LAs for all contributing nonpoint sources.

The Mining Data Analysis System (MDAS) was developed specifically for TMDL application in West Virginia to facilitate large scale, data intensive watershed modeling applications. The MDAS is a system designed to support TMDL development for areas affected by nonpoint and point sources. The MDAS component most critical to TMDL development is the dynamic watershed model because it provides the linkage between source contributions and instream response. The MDAS is used to simulate watershed hydrology and pollutant transport as well as stream hydraulics and instream water quality. It is capable of simulating different flow regimes and pollutant loading variations. A key advantage of the MDAS' development framework is that it has no inherent limitations in terms of modeling size or upper limit of model operations. In addition, the MDAS model allows for seamless integration with modern-day, widely available software such as Microsoft Access and Excel. Fecal coliform bacteria were modeled using the MDAS.

6.2 Model Setup

6.2.1 General MDAS Configuration

Configuration of the MDAS model involved subdividing the TMDL watersheds into subwatershed modeling units connected by stream reaches. Physical characteristics of the subwatersheds, weather data, landuse information, continuous discharges, and stream data were used as input. Flow and water quality were continuously simulated on an hourly time-step.

The 3 TMDL watersheds were broken into 197 separate subwatershed units, based on the groupings of impaired streams shown in Figure 6-1. The TMDL watersheds were divided to allow evaluation of water quality and flow at pre-TMDL monitoring stations. This subdivision process also ensures a proper stream network configuration within the basin.

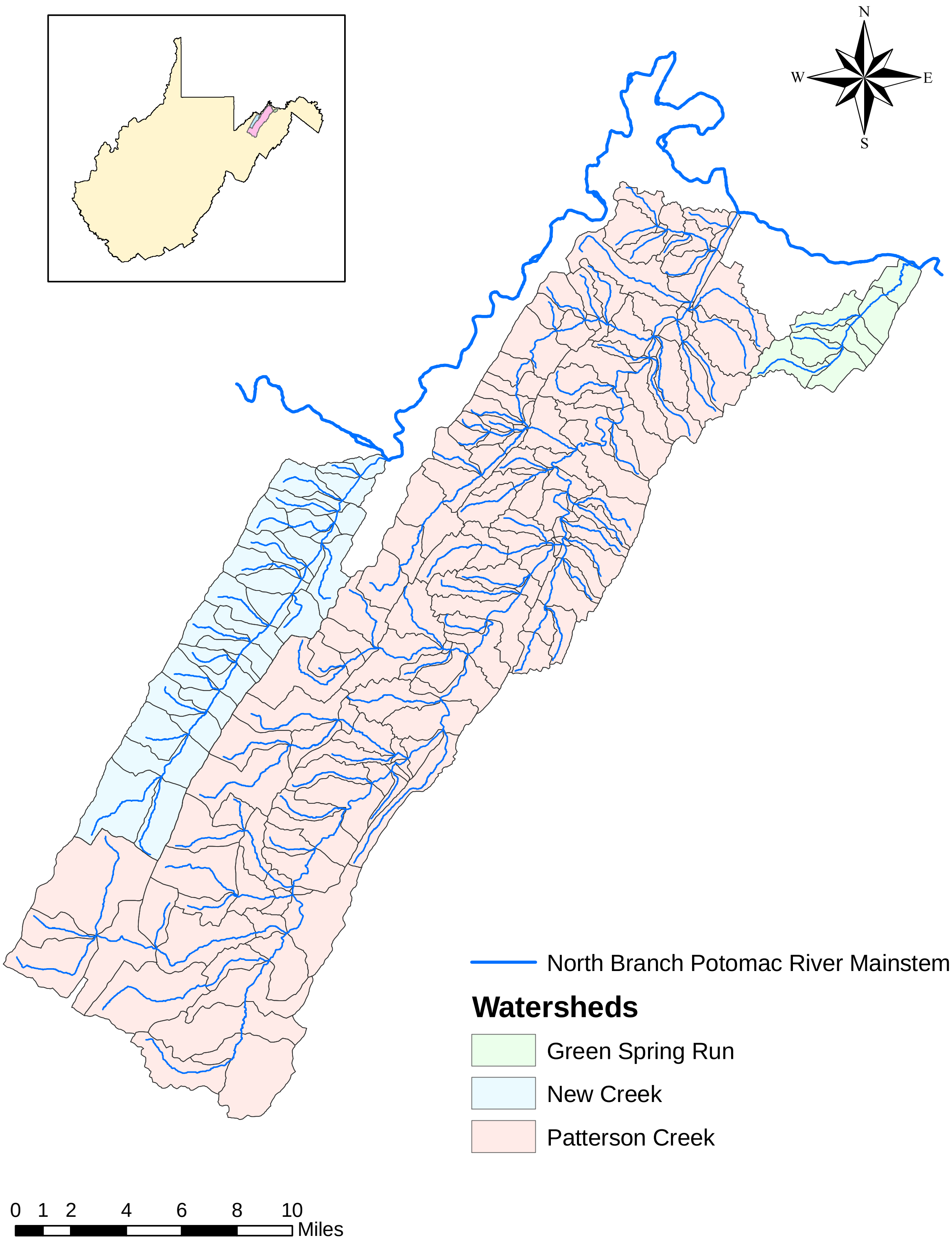


Figure 6-1. 3 TMDL watersheds and 197 subwatershed delineations

6.2.2 Fecal Coliform Configuration

Modeled landuse categories contributing bacteria via precipitation and runoff include agriculture (pasture, cropland), urban/residential pervious lands, urban/residential impervious lands, grassland, forest, barren land, and wetlands. Other sources, such as failing septic systems, straight pipes, and discharges from sewage treatment facilities, were modeled as direct, continuous-flow sources in the model.

The basis for the initial bacteria loading rates for landuses and direct sources is described in the Technical Report. The initial estimates were further refined during the model calibration. A variety of modeling tools were used to develop the fecal coliform bacteria TMDLs, including the MDAS, and a customized spreadsheet to determine the fecal loading from failing residential septic systems identified during source tracking efforts by the WVDEP. Section 5.2.1 describes the process of assigning flow and fecal coliform concentrations to failing septic systems.

6.3 Hydrology Calibration

Hydrology and water quality calibration were performed in sequence because water quality modeling is dependent on an accurate hydrology simulation. Typically, hydrology calibration involves a comparison of model results with instream flow observations from USGS flow gauging stations throughout the watershed. USGS gauging station 01604500 Patterson Creek near Headsville, WV was the only USGS flow gauging station in the modeled portion of the North Branch Potomac watershed with adequate data records for hydrology calibration.

Hydrology calibration was based on observed data from that station and the landuses present in the watersheds from January 1, 2003 to October 31, 2006. Key considerations for hydrology calibration included the overall water balance, the high- and low-flow distribution, storm flows, and seasonal variation. The hydrology was validated for the time period of January 1, 1999 to November 30, 2008. As a starting point, many of the hydrology calibration parameters originated from the USGS Scientific Investigations Report 2005-5099 (Atkins, 2005). Final adjustments to model hydrology were based on flow measurements obtained during WVDEP's pre-TMDL monitoring in the North Branch Potomac watershed. A detailed description of the hydrology calibration and a summary of the results and validation are presented in the Technical Report.

6.4 Water Quality Calibration

After the model was configured and calibrated for hydrology, the next step was to perform water quality calibration. The goal of water quality calibration was to refine model parameter values to reflect the unique characteristics of the watershed so that model output would predict field conditions as closely as possible. Both spatial and temporal aspects were evaluated through the calibration process.

The water quality was calibrated by comparing modeled versus observed pollutant concentrations. The water quality calibration consisted of executing the MDAS model, comparing the model results to available observations, and adjusting water quality parameters within reasonable ranges. Initial model parameters for fecal coliform bacteria were derived from previous West Virginia TMDL studies, storm sampling efforts, and literature values. Available monitoring data in the watershed were identified and assessed for application to calibration. Monitoring stations with observations that represented a range of hydrologic conditions, and source types were selected. The time-period for water quality calibration was selected based on the availability of the observed data and their relevance to the current conditions in the watershed.

WVDEP also conducted storm monitoring on Shrewsbury Hollow in Kanawha State Forest, Kanawha County, West Virginia. The data gathered during this sampling episode was used in the calibration of fecal coliform and to enhance the representation of background conditions from undisturbed areas. The results of the storm sampling fecal coliform calibration are shown in Figure 6-2.

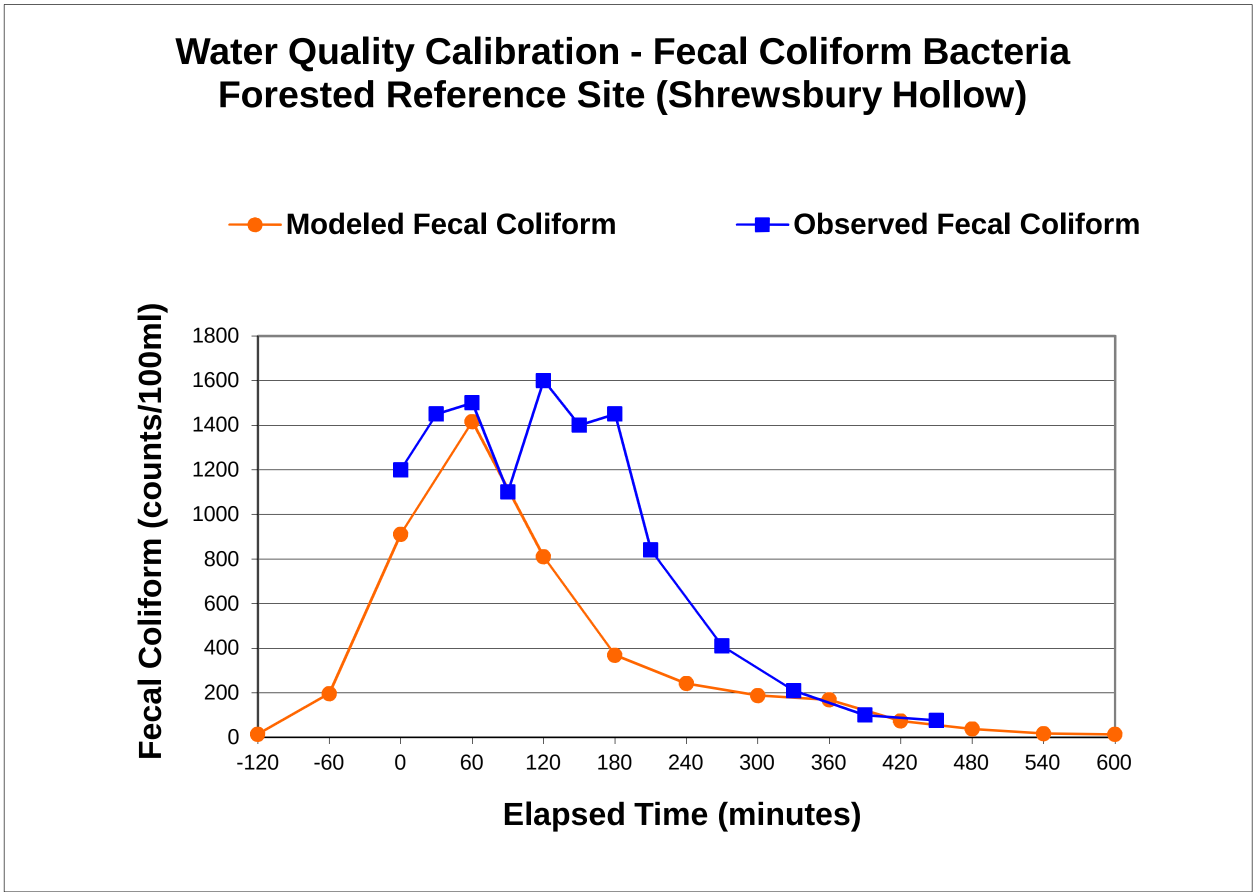


Figure 6-2. Shrewsbury Hollow fecal coliform observed data

6.5 Allocation Strategy

As explained in Section 2, a TMDL is composed of the sum of individual WLAs for point sources, LAs for nonpoint sources, and natural background levels. In addition, the TMDL must include a MOS, implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. TMDLs can be expressed in terms of mass per time or other appropriate units. Conceptually, this definition is denoted by the equation:

TMDL = sum of WLAs + sum of LAs + MOS

To develop the TMDLs for the impairments listed in Table 3-3 of this report, the following approach was taken:

- Define TMDL endpoints
- Simulate baseline conditions
- Assess source loading alternatives
- Determine the TMDL and source allocations

6.5.1 TMDL Endpoints

TMDL endpoints represent the water quality targets used to quantify TMDLs and their individual components. West Virginia’s numeric fecal coliform bacteria water quality criteria and an explicit five percent MOS were used to identify endpoints for TMDL development.

The five percent explicit MOS was used to counter uncertainty in the modeling process. Long-term water quality monitoring data were used for model calibration. Although these data represented actual conditions, they were not of a continuous time series and might not have captured the full range of instream conditions that occurred during the simulation period. The explicit five percent MOS also accounts for those cases where monitoring might not have captured the full range of instream conditions. The TMDL endpoints are displayed in Table 6-2.

Table 6-2. TMDL endpoints

Water Quality Criterion	Designated Use	Criterion Value	TMDL Endpoint
Fecal Coliform	Water Contact Recreation and Public Water Supply	200 counts / 100 mL (Monthly Geometric Mean)	190 counts / 100 mL (Monthly Geometric Mean)
Fecal Coliform	Water Contact Recreation and Public Water Supply	400 counts / 100 mL (Daily, 10% exceedance)	380 counts / 100 mL (Daily, 10% exceedance)

TMDLs are presented as average daily loads that were developed to meet TMDL endpoints under a range of conditions observed throughout the year. Analysis of available data indicated that critical conditions occur during both high- and low-flow events. To appropriately address the low- and high-flow critical conditions, the TMDLs were developed using continuous simulation (modeling over a period of several years that captured precipitation extremes), which inherently considers seasonal hydrologic and source loading variability.

6.5.2 Baseline Conditions and Source Loading Alternatives

The calibrated model provides the basis for performing the allocation analysis. The first step is to simulate baseline conditions, which represent existing nonpoint source loadings and point sources loadings at permit limits. Baseline conditions allow for an evaluation of instream water quality under the highest expected loading conditions.

Baseline Conditions for MDAS

The MDAS model was run for baseline conditions using hourly precipitation data for a representative six year simulation period (January 1, 1998 through December 31, 2003). The precipitation experienced over this period was applied to the landuses and pollutant sources as they existed at the time of TMDL development. Predicted instream concentrations were compared directly with the TMDL endpoints. This comparison allowed for the evaluation of the magnitude and frequency of exceedances under a range of hydrologic and environmental conditions, including dry periods, wet periods, and average periods. Figure 6-4 presents the annual rainfall totals for the years 1990 through 2008 at the Moorefield (WV6163) weather station in West Virginia. The years 1998 to 2003 are highlighted to indicate the range of precipitation conditions used for TMDL development in the North Branch Potomac watershed.

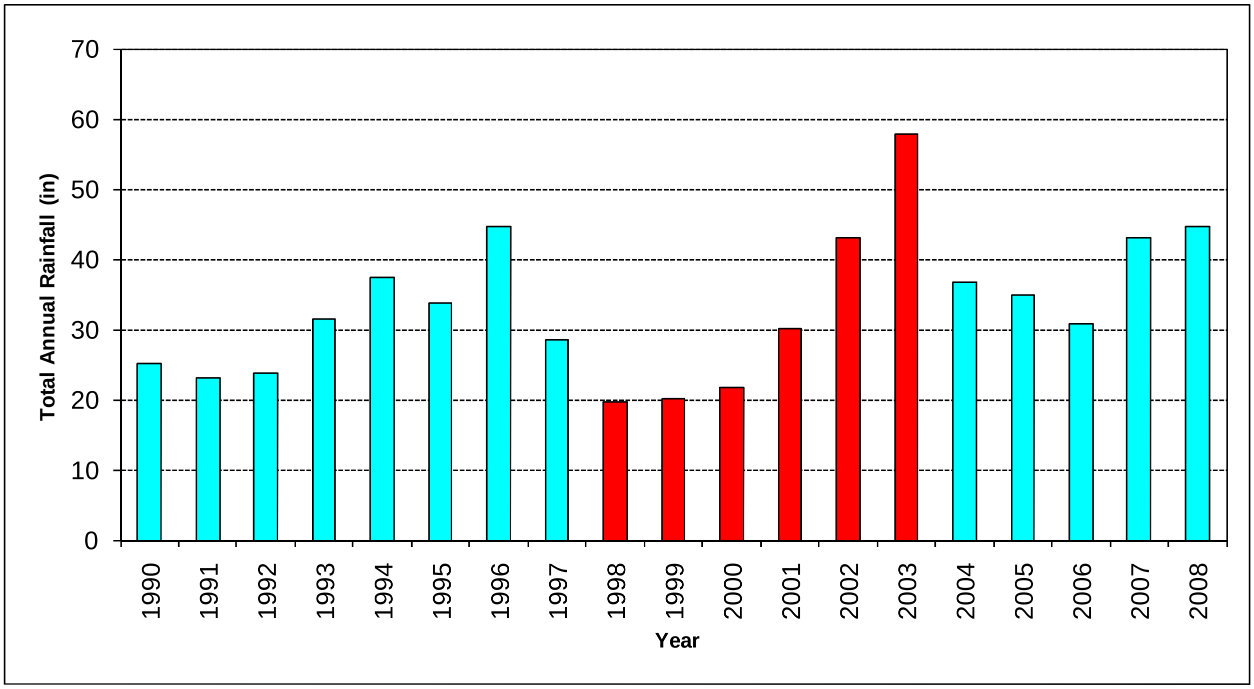


Figure 6-4. Annual precipitation totals for the Moorefield (WV6163) weather station

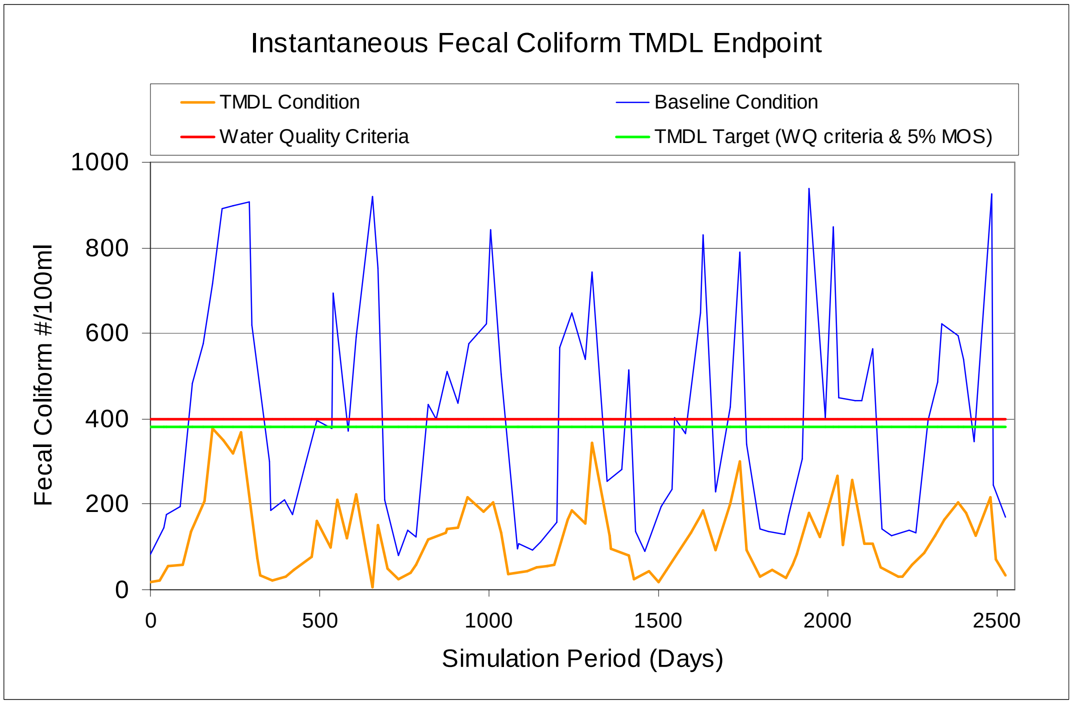
Effluents from sewage treatment plants were represented under baseline conditions as continuous discharges, using the design flow for each facility and the monthly geometric mean fecal coliform effluent limitation of 200 counts/100 mL.

Source Loading Alternatives

Simulating baseline conditions allowed for the evaluation of each stream's response to variations in source contributions under a variety of hydrologic conditions. This sensitivity analysis gave insight into the dominant sources and the mechanisms by which potential decreases in loads would affect instream pollutant concentrations. The loading contributions from the various existing sources were individually adjusted; the modeled instream concentrations were then evaluated.

Multiple allocation scenarios were run for the impaired waterbodies. Successful scenarios achieved the TMDL endpoints under all flow conditions throughout the modeling period. The averaging period and allowable exceedance frequency associated with West Virginia water quality criteria were considered in these assessments. In general, loads contributed by sources that had the greatest impact on instream concentrations were reduced first. If additional load reductions were required to meet the TMDL endpoints, less significant source contributions were subsequently reduced.

Figure 6-5 shows an example of model output for a baseline condition and a successful TMDL scenario.



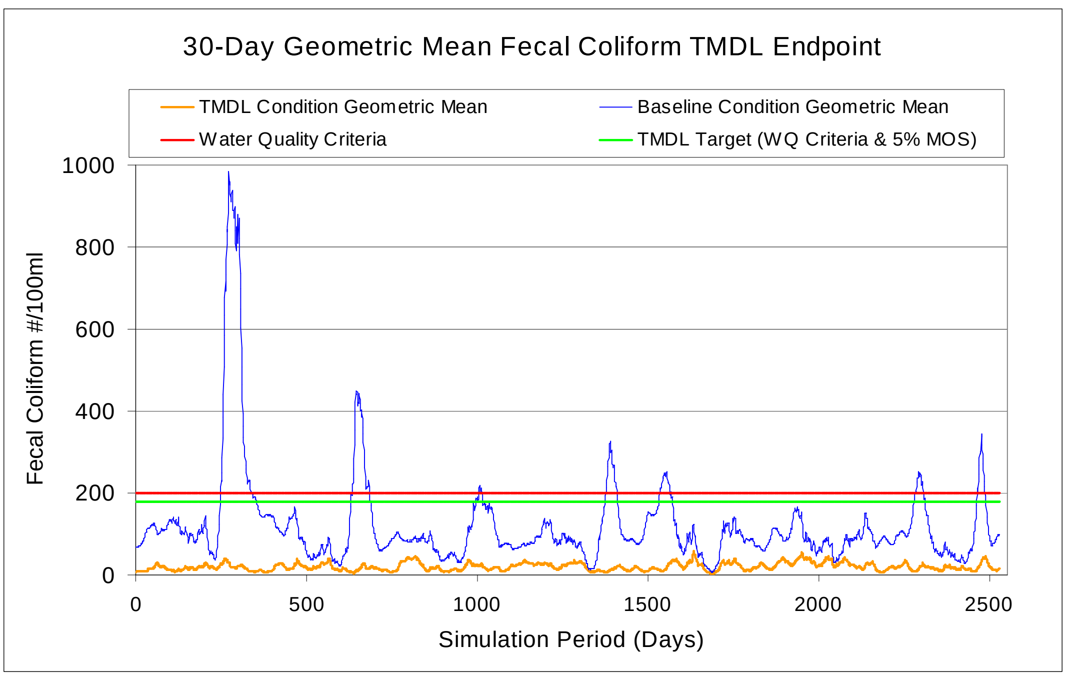


Figure 6-5. Examples of baseline and TMDL conditions (instantaneous and geometric mean) for fecal coliform bacteria

6.7 TMDLs and Source Allocations

6.7.1 Fecal Coliform Bacteria TMDLs

TMDLs and source allocations were developed for impaired steams and their tributaries on a subwatershed basis throughout the watershed. A top-down methodology was followed to develop these TMDLs and allocate loads to sources. Headwaters were analyzed first because their loading affects downstream water quality. Loading contributions were reduced from applicable sources in impaired headwaters until criteria were attained at the subwatershed outlet. The loading contributions of unimpaired headwaters and the reduced loadings for impaired headwaters were then routed through downstream waterbodies. Using this method, contributions from all sources were weighted equitably and ensured cumulative load endpoints were met at the most downstream subwatershed for each impaired stream. Reductions in sources affecting impaired headwaters ultimately led to improvements downstream and effectively decreased necessary loading reductions from downstream sources. Nonpoint source reductions did not result in allocated loadings less than natural conditions. The following general methodology was used when allocating loads to fecal coliform bacteria sources:

- The effluents from all NPDES permitted sewage treatment plants were set at the permit limit (200 counts/100 mL monthly geometric mean)
- Because West Virginia Bureau for Public Health regulations prohibit the discharge of raw sewage into surface waters, all illicit discharges of human waste (from failing septic systems and straight pipes) were reduced by 100 percent in the model
- If further reduction was necessary, non-point source loadings from agricultural lands and residential areas were subsequently reduced until in-stream water quality criteria were met

Wasteload Allocations (WLAs)
WLAs were developed for all facilities permitted to discharge fecal coliform bacteria, as described below.

Sewage Treatment Plant Effluents
The fecal coliform effluent limitations for NPDES permitted sewage treatment plants are more stringent than water quality criteria; therefore, all effluent discharges from sewage treatment facilities were given wasteload allocations equal to existing monthly fecal coliform effluent limitations of 200 counts/100 mL.

Load Allocations (LAs)
Fecal coliform LAs are assigned to the following source categories:

- Pasture/Cropland
- On-site Sewage Systems — loading from all illicit discharges of human waste (including failing septic systems and straight pipes)

- Residential — loading associated with urban/residential runoff
- Background and Other Nonpoint Sources — loading associated with wildlife sources from all other landuses (contributions/loadings from wildlife sources were not reduced)

6.7.2 Seasonal Variation

Seasonal variation was considered in the formulation of the modeling analysis. Continuous simulation (modeling over a period of several years that captured precipitation extremes) inherently considers seasonal hydrologic and source loading variability**.** The fecal coliform concentrations simulated on a daily time step by the model were compared with TMDL endpoints. Allocations that met these endpoints throughout the modeling period were developed.

6.7.3 Critical Conditions

A critical condition represents a scenario where water quality criteria are most susceptible to violation. Analysis of water quality data for the impaired streams addressed in this effort shows high pollutant concentrations during both high- and low-flow thereby precluding selection of a single critical condition. Both high-flow and low-flow periods were taken into account during TMDL development by using a long period of weather data that represented wet, dry, and average flow periods.

Nonpoint source loading is typically precipitation-driven and impacts tend to occur during wet weather and high surface runoff. During dry periods little or no land-based runoff occurs, and elevated instream pollutant levels may be due to point sources (Novotny and Olem, 1994). Also, failing on-site sewage systems (categorized as nonpoint sources but represented as continuous flow discharges) often have an associated low-flow critical condition, particularly where such sources are located on small receiving waters.

6.7.4 TMDL Presentation

The TMDLs for fecal coliform bacteria impairments are shown in Table 7-1 of this report. The TMDLs for fecal coliform bacteria are presented in average number of colonies per day. All TMDLs were developed to meet TMDL endpoints under a range of conditions observed over the modeling period. TMDLs and their components are also presented in the allocation spreadsheets associated with this report. The filterable spreadsheets also display detailed source allocations that allow comparison of pollutant loadings among categories and facilitate implementation.

The fecal coliform bacteria WLAs for sewage treatment plant effluents are presented both as annual average loads, for comparison with other pollutant sources, and equivalent allocation concentrations. The prescribed concentrations are the operable allocations for NPDES permit implementation.

7.0 TMDL RESULTS

Table 7-1. Fecal coliform bacteria TMDLs

Stream Code	Stream Name	LA (counts/day)	WLA (counts/day)	MOS (counts/day)	TMDL (counts/day)
WV-PNB-2	Green Spring Run	1.97E+10	NA	1.04E+09	2.08E+10
WV-PNB-31	New Creek	1.08E+11	NA	5.66E+09	1.13E+11
WV-PNB-31-A	UNT/New Creek RM 1.30	1.10E+09	NA	5.78E+07	1.16E+09
WV-PNB-31-D	Stony Run	3.60E+09	NA	1.89E+08	3.79E+09
WV-PNB-31-G	Block Run	6.01E+09	NA	3.16E+08	6.32E+09
WV-PNB-31-H	UNT/New Creek RM 4.26	8.62E+09	NA	4.54E+08	9.07E+09
WV-PNB-31-K	King Run	2.80E+09	NA	1.47E+08	2.95E+09
WV-PNB-14	Patterson Creek	4.28E+11	5.61E+09	2.28E+10	4.57E+11
WV-PNB-14-B	Plum Run	1.19E+10	1.25E+09	6.90E+08	1.38E+10
WV-PNB-14-F-2	UNT/Painter Run RM 0.9	2.26E+09	NA	1.19E+08	2.37E+09
WV-PNB-14-I	Horseshoe Creek	2.24E+10	3.26E+08	1.20E+09	2.39E+10
WV-PNB-14-AI	Cabin Run	4.15E+10	NA	2.19E+09	4.37E+10
WV-PNB-14-AI-7	Pargut Run	8.11E+09	NA	4.27E+08	8.54E+09
WV-PNB-14-AL	UNT/Patterson Creek RM 16.25	7.51E+09	9.85E+07	4.01E+08	8.01E+09
WV-PNB-14-AW	Beaver Run	1.39E+10	NA	7.31E+08	1.46E+10
WV-PNB-14-BV	Mill Creek	3.32E+10	3.79E+07	1.75E+09	3.50E+10
WV-PNB-14-CH	Elliber Run	5.28E+09	NA	2.78E+08	5.56E+09
WV-PNB-14-CK	Mikes Run	2.67E+10	NA	1.40E+09	2.81E+10
WV-PNB-14-DM	North Fork/Patterson Creek	4.24E+10	NA	2.23E+09	4.47E+10

Stream Code	Stream Name	LA (counts/day)	WLA (counts/day)	MOS (counts/day)	TMDL (counts/day)
WV-PNB-14-DM-13	Elklick Run	1.57E+10	NA	8.25E+08	1.65E+10
WV-PNB-14-DM-14	UNT/North Fork RM 8.37/Patterson Creek	5.83E+09	NA	3.07E+08	6.13E+09
WV-PNB-14-DQ	Middle Fork/Patterson Creek	1.08E+10	NA	5.71E+08	1.14E+10

NA = not applicable; UNT = unnamed tributary.

"Scientific notation" is a method of writing or displaying numbers in terms of a decimal number between 1 and 10 multiplied by a power of 10. The scientific notation of 10,492, for example, is 1.0492 $\times 10^4$ or 1.0492E+4.

Table 7-2. Biological TMDLs

Stream Code	Stream Name	Biological Stressor	Parameter	LA	WLA	MOS	TMDL	Units
WV-PNB-14-I	Horseshoe Creek	Organic Enrichment	Fecal Coliform	2.24E+10	3.26E+08	1.20E+09	2.39E+10	counts/day
WV-PNB-14-AI	Cabin Run	Organic Enrichment	Fecal Coliform	4.15E+10	NA	2.19E+09	4.37E+10	counts/day
WV-PNB-14-AI-7	Pargut Run	Organic Enrichment	Fecal Coliform	8.11E+09	NA	4.27E+08	8.54E+09	counts/day
WV-PNB-14-AL	UNT/Patterson Creek RM 16.25	Organic Enrichment	Fecal Coliform	7.51E+09	9.85E+07	4.01E+08	8.01E+09	counts/day
WV-PNB-14-BV	Mill Creek	Organic Enrichment	Fecal Coliform	3.32E+10	3.79E+07	1.75E+09	3.50E+10	counts/day
WV-PNB-14-DQ	Middle Fork/Patterson Creek	Organic Enrichment	Fecal Coliform	1.08E+10	NA	5.71E+08	1.14E+10	counts/day
WV-PNB-31	New Creek	Organic Enrichment	Fecal Coliform	1.08E+11	NA	5.66E+09	1.13E+11	counts/day
WV-PNB-31-H	UNT/New Creek RM 4.26	Organic Enrichment	Fecal Coliform	8.62E+09	NA	4.54E+08	9.07E+09	counts/day

NA = not applicable; “Scientific notation” is a method of writing or displaying numbers in terms of a decimal number between 1 and 10 multiplied by a power of 10. The scientific notation of 10,492, for example, is 1.0492×10^4 or 1.0492E+4.

8.0 FUTURE GROWTH

8.1 Fecal Coliform Bacteria

Specific fecal coliform bacteria future growth allocations are not prescribed. The absence of specific future growth allocations does not prohibit new development in the watersheds of streams for which fecal coliform bacteria TMDLs have been developed, or preclude the permitting of new sewage treatment facilities.

In many cases, the implementation of the TMDLs will consist of providing public sewer service to unsewered areas. The NPDES permitting procedures for sewage treatment facilities include technology-based fecal coliform effluent limitations that are more stringent than applicable water quality criteria. Therefore, a new sewage treatment facility may be permitted anywhere in the watershed, provided that the permit includes monthly geometric mean and maximum daily fecal coliform limitations of 200 counts/100 mL and 400 counts/100 mL, respectively. Furthermore, WVDEP will not authorize construction of combined collection systems nor permit overflows from newly constructed collection systems.

9.0 PUBLIC PARTICIPATION

9.1 Public Meetings

Informational public meetings were held on May 31, 2007 and October 19, 2010 at the Mineral County Health Department. The May 31, 2007 meeting occurred prior to pre-TMDL stream monitoring and pollutant source tracking and included a general TMDL overview and a presentation of planned monitoring and data gathering activities. The October 19, 2010 meeting occurred prior to allocation of pollutant loads and provided a description of the status of TMDL development. A public meeting was held to present the draft TMDLs on May 31, 2011 at the Mineral County Health Department in Keyser, West Virginia. The meeting began at 6:30 PM. and provided information to stakeholders intended to facilitate comments on the draft TMDLs.

9.2 Public Notice and Public Comment Period

The availability of draft TMDLs was advertised in various local newspapers on May 12, 2011. Interested parties were invited to submit comments during the public comment period, which began on May 12, 2011 and ended on June 10, 2011. WVDEP did not receive any comments on the draft TMDLs. The electronic documents are posted on the WVDEP's internet site at http://www.dep.wv.gov/WWE/watershed/TMDL/Pages/default.aspx

10.0 REASONABLE ASSURANCE

Reasonable assurance for maintenance and improvement of water quality in the affected watershed rests primarily with two programs. The NPDES permitting program is implemented by WVDEP to control point source discharges. The West Virginia Watershed Network is a cooperative nonpoint source control effort involving many state and federal agencies, whose task is protection and/or restoration of water quality.

10.1 NPDES Permitting

WVDEP's Division of Water and Waste Management (DWWM) is responsible for issuing non-mining NPDES permits within the State. As part of the permit review process, permit writers have the responsibility to incorporate the required TMDL WLAs into new or reissued permits. New facilities will be permitted in accordance with future growth provisions described in Section 8.

Both the permitting and TMDL development processes have been synchronized with the Watershed Management Framework cycle, such that TMDLs are completed just before the permit expiration/reissuance time frames. Permits for existing facilities in the North Branch Potomac watershed will be reissued beginning in July 2011.

10.2 Watershed Management Framework Process

The Watershed Management Framework is a tool used to identify priority watersheds and coordinate efforts of state and federal agencies with the goal of developing and implementing watershed management strategies through a cooperative, long-range planning effort.

The West Virginia Watershed Network is an informal association of state and federal agencies, and nonprofit organizations interested in the watershed movement in West Virginia. Membership is voluntary and everyone is invited participate. The Network uses the Framework to coordinate existing programs, local watershed associations, and limited resources. This coordination leads to the development of Watershed Based Plans to implement TMDLs and document environmental results.

The principal area of focus of watershed management through the Framework process is correcting problems related to nonpoint source pollution. Network partners have placed a greater emphasis on identification and correction of nonpoint source pollution. The combined resources of the partners are used to address all different types of nonpoint source pollution through both public education and on-the-ground projects.

Among other things, the Framework includes a management schedule for integration and implementation of TMDLs. In 2000, the schedule for TMDL development under Section 303(d) was merged with the Framework process. The Framework identifies a six-step process for developing integrated management strategies and action plans for achieving the state's water quality goals. Step 3 of that process includes "identifying point source and/or nonpoint source management strategies - or Total Maximum Daily Loads - predicted to best meet the needed [pollutant] reduction." Following development of the TMDL, Steps 5 and 6 provide for preparation, finalization, and implementation of a Watershed Based Plan to improve water quality.

Each year, the Framework is included on the agenda of the Network to evaluate the restoration potential of watersheds within a certain Hydrologic Group. This evaluation includes a review of TMDL recommendations for the watersheds under consideration. Development of Watershed Based Plans is based on the efforts of local project teams. These teams are composed of Network members and stakeholders having interest in or residing in the watershed. Team formation is based on the type of impairment(s) occurring or protection(s) needed within the watershed. In addition, teams have the ability to use the TMDL recommendations to help plan future activities. Additional information regarding upcoming Network activities can be obtained from the acting Northern Nonpoint Source Eastern Basin Coordinator, Alana Hartman (Alana.C.Hartman@wv.gov).

Currently, there are no active watershed associations in the North Branch Potomac watershed. For additional information on watershed improvement efforts, contact the above mentioned Basin Coordinator.

10.3 Public Sewer Projects

Within WVDEP DWWM, the Engineering and Permitting Branch's Engineering Section is charged with the responsibility of evaluating sewer projects and providing funding, where available, for those projects. All municipal wastewater loans issued through the State Revolving Fund (SRF) program are subject to a detailed engineering review of the engineering report, design report, construction plans, specifications, and bidding documents. The staff performs periodic on-site inspections during construction to ascertain the progress of the project and compliance with the plans and specifications. Where the community does not use SRF funds to undertake a project, the staff still performs engineering reviews for the agency on all POTWs prior to permit issuance or modification. For further information on upcoming projects, a list of funded and pending water and wastewater projects in West Virginia can be found at http://www.wvinfrastructure.com/projects/index.php.

11.0 MONITORING PLAN

The following monitoring activities are recommended:

11.1 NPDES Compliance

WVDEP's DWWM and DMR have the responsibility to ensure that NPDES permits contain effluent limitations as prescribed by the TMDL WLAs and to assess and compel compliance. Permits will contain self-monitoring and reporting requirements that are periodically reviewed by WVDEP. WVDEP also inspects treatment facilities and independently monitors NPDES discharges. The combination of these efforts will ensure implementation of the TMDL WLAs.

11.2 Nonpoint Source Project Monitoring

All nonpoint source restoration projects should include a monitoring component specifically designed to document resultant local improvements in water quality. These data may also be used to predict expected pollutant reductions from similar future projects.

11.3 TMDL Effectiveness Monitoring

TMDL effectiveness monitoring should be performed to document water quality improvements after significant implementation activity has occurred where little change in water quality would otherwise be expected. Full TMDL implementation will take significant time and resources, particularly with respect to the abatement of nonpoint source impacts. WVDEP will continue monitoring on the rotating basin cycle and will include a specific TMDL effectiveness component in waters where significant TMDL implementation has occurred.

12.0 REFERENCES

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