Amendment to the
Mercer County Water Quality Management Plan,
Northeast Water Quality Management Plan,
Upper Delaware Water Quality Management Plan,
Upper Raritan Water Quality Management Plan, and
Sussex County Water Quality Management Plan

Total Maximum Daily Loads for Fecal Coliform to Address 10 Streams in the Northwest Water Region

Watershed Management Area 1

(Honey Run, Lopatcong Creek, Musconetcong River, Paulins Kill and Pohatcong Creek)

Watershed Management Area 11

(Hakihokake Creek, Jacobs Creek and Wickecheoke)

Proposed:	May 2, 2005
Established:	August 19, 2005
Approved:	September 15, 2005
Adopted:	

New Jersey Department of Environmental Protection
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1.0 Executive Summary

In accordance with Section 305(b) and 303(d) of the Federal Clean Water Act (CWA), the State of New Jersey, Department of Environmental Protection (Department) developed the *2004 Integrated List of Waterbodies* addressing the overall water quality of the State's waters and, in Sublist 5, identifying impaired waterbodies for which Total Maximum Daily Loads (TMDLs) may be necessary. On August 9, 2004, the Department adopted the *2004 Integrated List of Waterbodies* as an amendment to the Statewide Water Quality Management Plan, pursuant to the Water Quality Planning Act at N.J.S.A.58:11A-7 and the Statewide Water Quality Management Planning rules at N.J.A.C. 7:15-6.4(a). In the Northwest Water Region, the *2004 Integrated List of Waterbodies* Sublist 5 identifies 10 impairments with respect to pathogens, as indicated by the presence of fecal coliform concentrations in excess of standards. TMDLs have been developed addressing fecal coliform impairment in the waterbodies identified in Table 1.

Table 1 Stream segments in the Northwest Water Region identified on the *2004 Integrated List of Waterbodies.*

Impairment Number	WMA	Station Name/Waterbody	Site ID	Sublist	Proposed Action
1	01	Honey Run near Hope	01445900	5	Establish TMDL
2	01	Lopatcong Creek at Main St in Phillipsburg	DRBCNJ0028	5	Establish TMDL
3	01	Musconetcong River at Lockwood	01455801	5	Establish TMDL
4	01	Paulins Kill at Warbasse Junction Rd near Lafayette	01443250	5	Establish TMDL
5	01	Pohatcong Creek at River Rd Bridge	DRBCNJ0027	5	Establish TMDL
6	11	Hakihokake Creek at Bridge St Bridge in Milford	DRBCNJ0023	5	Establish TMDL
7	11	Jacobs Creek above Rt. 29	DRBCNJ0003	5	Establish TMDL
8, 9, 10	11	Wickecheoke Creek at Croton, Wickecheoke	01461220,	5	Establish TMDL

Impairment Number	WMA	Station Name/Waterbody	Site ID	Sublist	Proposed Action
		Creek at Stockton, Wickecheoke Creek near Sergenstville	01461300 & DRBCNJ0012, 01461282		

As stated in N.J.A.C. 7:9B-1.14(c) of the New Jersey Surface Water Quality Standards (SWQS), "Fecal coliform levels shall not exceed a geometric average of 200 CFU/100 ml nor should more than 10 percent of the total sample taken during any 30-day period exceed 400 CFU/100 ml in FW2 waters." Using ambient water quality data monitoring conducted by USGS/NJDEP and the stakeholder data during water years 1998-2002, summer and all season geometric means were determined for each Category 5 listed waterbody. Given the two surface water quality criteria of 200 CFU/100 ml and 400 CFU/100 ml in FW2 waters, computations were necessary for both criteria and resulted in two values for percent reduction for each waterbody. The higher (more stringent) percent reduction value was selected as the TMDL, which was then allocated among the sources. Nonpoint and stormwater point sources are the primary contributors to fecal coliform loads in these waterbodies and can include storm-driven loads transporting fecal coliform from sources such as geese, farm operations, and domestic pets to the receiving water. Nonpoint sources can also include inputs from sources such as malfunctioning sewage conveyance systems and failing or inappropriately located septic systems. Contributions from domestic wastewater treatment plants are a de minimus portion of the total load because disinfection requirements impose an end-of-pipe concentration significantly below the surface water quality standards. This TMDL report includes implementation strategies to achieve SWQS for fecal coliform. The TMDLs in this report have been proposed as amendments to the appropriate area wide water quality management plan in accordance with N.J.A.C. 7:15-3.4(g). This TMDL report was developed consistent with the United States Environmental Protection Agency's (USEPA's) May 20, 2002 guidance document entitled: "Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992," (Sutfin, 2002) which describes the statutory and regulatory requirements for approvable TMDLs.

2.0 Introduction

In accordance with Section 303(d) of the Federal Clean Water Act (CWA) (33 U.S.C. 1315(B)), the State of New Jersey is required biennially to prepare and submit to the USEPA a report that identifies waters that do not meet or are not expected to meet SWQS after implementation of technology-based effluent limitations or other required controls. This report is commonly referred to as the 303(d) List. In accordance with Section 305(b) of the CWA, the State of New Jersey is also required biennially to prepare and submit to the USEPA a report addressing the overall water quality of the State's waters. This report is commonly referred to as the 305(b) Report or the Water Quality Inventory Report. The *Integrated List of Waterbodies* combines these two assessments and assigns waterbodies to one of five sublists. Sublists 1 through 4 include waterbodies that are generally unimpaired (Sublist 1 and 2), have limited assessment or data availability (Sublist 3), are impaired due to pollution rather than pollutants or have had a TMDL or other enforceable management measure approved by

EPA (Sublist 4). Sublist 5 constitutes the traditional 303(d) list for waters impaired or threatened by one or more pollutants, for which a TMDL may be required. In the Northwest Water Region, the *2004 Integrated List of Waterbodies* currently identifies 10 impaired segments.

A TMDL represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint sources of pollutants of concern, natural background and surface water withdrawals. A TMDL quantifies the amount of a pollutant a water body can assimilate without violating a state's water quality standards and allocates that load capacity to known point and nonpoint sources in the form of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety (MOS).

This report establishes 10 TMDLs that address fecal coliform impairment in 84.1 river miles with respect to the waterbodies identified in Table 2. These TMDLs include management approaches to reduce fecal coliform loadings from various sources in order to attain applicable surface water quality standards for fecal coliform. With respect to the fecal coliform impairment, the waterbodies will be moved to Sublist 4 following approval of the TMDL by EPA. In addition to the above listed fecal coliform impairments, Honey Run near Hope (01445900) is listed for dissolved oxygen and the Musconetcong River at Lockwood (01455801) is listed for phosphorus and temperature. Paulins Kill at Warbasse Junction Rd near Lafayette (01443250) is listed for dissolved oxygen and phosphorus and Pohatcong Creek at River Rd Bridge (DRBCNJ0027) is listed for phosphorus. Hakihokake Creek at Bridge St Bridge in Milford (DRBCNJ0023) is listed for pH and temperature and Jacobs Creek above Rt. 29 (DRBCNJ0003) is listed for pH. In the Wickecheoke Creek watershed, the Wickecheoke Creek at Stockton (01461300 & DRBCNJ0012) is listed for phosphorus and temperature. These waterbodies will remain of Sublist 5 with respect to these pollutants and will be addressed in future TMDLs.

Recent EPA guidance (Sutfin, 2002) describes the statutory and regulatory requirements for approvable TMDLs, as well as additional information generally needed for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations. The Department believes that the TMDLs in this report address the following items in the May 20, 2002 guideline document:

1. Identification of waterbody(ies), pollutant of concern, pollutant sources and priority ranking.
2. Description of applicable water quality standards and numeric water quality target(s).
3. Loading capacity – linking water quality and pollutant sources.
4. Load allocations.
5. Wasteload allocations.
6. Margin of safety.
7. Seasonal variation.
8. Reasonable assurances.
9. Monitoring plan to track TMDL effectiveness.
10. Implementation (USEPA is not required to and does not approve TMDL implementation plans).

11. Public Participation.

This report establishes 10 TMDLs that address fecal coliform impairment in waterbodies identified in Table 2. These TMDLs include management approaches to reduce loadings of fecal coliform from various sources in order to attain applicable surface water quality standards for fecal coliform. With respect to the fecal coliform impairment, the waterbodies will be moved to Sublist 4 following approval of the TMDLs by USEPA.

3.0 Pollutant of Concern and Area of Interest

The pollutant of concern for these TMDLs is pathogens, the presence of which is indicated by elevated concentrations of fecal coliform bacteria. Fecal coliform concentrations were found to exceed New Jersey's SWQS, published at N.J.A.C. 7-9B et seq., for the segments in the Northwest Water Region identified in Table 2. All of these waterbodies have a high priority ranking.

Table 2 Waterbodies listed for fecal coliform impairment in the Northwest Water Region for which TMDLs are required.

TMDL Number	WMA	Station Name/Waterbody	Site ID	County(s)	River Miles
1	01	Honey Run near Hope	01445900	Warren	11.4
2	01	Lopatcong Creek at Main St in Phillipsburg	DRBCNJ0028	Warren	3.2
3	01	Musconetcong River at Lockwood	01455801	Sussex, Morris	2.0
4	01	Paulins Kill at Warbasse Junction Rd near Lafayette	01443250	Sussex	3.0
5	01	Pohatcong Creek at River Rd Bridge	DRBCNJ0027	Warren	16.4
6	11	Hakihokake Creek at Bridge St Bridge in Milford	DRBCNJ0023	Hunterdon	8.0
7	11	Jacobs Creek above Rt. 29	DRBCNJ0003	Mercer	2.1
8, 9, 10	11	Wickecheoke Creek at Croton, Wickecheoke Creek at Stockton, Wickecheoke Creek near Sergenstville	01461220, 01461300 & DRBCNJ0012, 01461282	Hunterdon	38.0
Total River Miles:					**84.1**

Applicable Water Quality Standards

As stated in N.J.A.C. 7:9B-1.14(c) of the New Jersey SWQS, the following are the criteria for freshwater fecal coliform:

> "Fecal coliform levels shall not exceed a geometric average of 200 CFU/100 ml nor should more than 10 percent of the total samples taken during any 30-day period exceed 400 CFU/100 ml in FW2 waters."

All of the waterbodies covered under these TMDLs have a FW2 classification (NJAC 7:9B-1.12). The designated uses, i.e. surface water uses, both existing and potential, that have been established by the Department for waters of the State, for all of the waterbodies in the Northwest Water Region is as stated below:

In all FW2 waters, the designated uses are:

1. Maintenance, migration and propagation of the natural and established aquatic biota;
2. Primary and secondary contact recreation;
3. Industrial and agricultural water supply;
4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
5. Any other reasonable uses.

Description of the Northwest Water Region

The Northwest Region includes three management areas in the northwest part of New Jersey. All or parts of the following counties are included within this region: Sussex, Warren, Hunterdon, Mercer, Morris and Monmouth counties. This region offers recreational and scenic opportunities such as fishing, camping, skiing, boating, and hiking.

Watershed Management Area 1

The Upper Delaware Watershed, WMA 1, is located in the northwest portion of New Jersey and is approximately 746 square miles in total area. It includes portions of Sussex, Morris, Hunterdon, and all of Warren Counties. WMA 1 includes areas that are among the most pristine in New Jersey. Fifty-four municipalities, in four counties, make up WMA 1. It is contained within the Valley and Ridge and Highlands physiographic provinces, with well-defined mountain ridges running in a southwest to northeast direction. WMA 1 is made up of 17 sub-basins that can be grouped and described as follows:

Flat Brook Watershed - This sub-basin includes Shimers Brook, Clove Brook, Van Campen's Brook, Dunnfield Creek, and Stony Brook. This group and its tributaries drain an area of 130 square miles in Sussex and Warren Counties. Other major water features include Little Flat Brook, Parker Brook, Tilghman Brook, and several small lakes and ponds. Most of the surface waters of the Flat Brook drainage area within High Point State Park, Stokes State Forest, and all tributaries to the Flat Brook are in the Delaware Water Gap National Recreation Area are classified as FW1. The remainder of this sub-basin has an FW2 classification for TP and TM. This watershed group encompasses 83,384 acres. Up until the establishment of the Delaware Water Gap National Recreation Area, a significant amount of cropland could be found within the Flat Brook and Little Flat Brook valleys. Most of the formerly agricultural land is now in various stages of natural succession.

Paulins Kill Watershed - This sub-basin includes Trout Brook, Delawanna Brook, and Stony Brook. This group and its tributaries drain an area of 197 square miles. The Paulins Kill is 39 miles long and major tributaries include Yards Creek, Blair Creek, Morses Brook, and Culver Brook. All of the surface waters of the Paulins Kill drainage area are classified as FW2, largely for NT and TM with a portion at Lafayette for TP (C1). Numerous lakes and ponds are found throughout the watershed, the largest of these being Culvers Lake, Swartswood

Lake, Lake Owassa, Paulins Kill Lake, and Yards Creek Reservoir. This watershed group encompasses 125,846 acres. Land cover within this region is primarily forested (52.5%) with significant agricultural (17%) and scattered suburban development (13.8%) located mostly proximate to the Rt. 94 corridor.

Pequest River Watershed - This sub-basin includes Bear Creek, Beaver Brook, Trout Brook, and Furnace Brook. This group and its tributaries drain an area of 157 square miles in Sussex and Warren counties. The Pequest River is 32 miles long. Most of the Pequest River and tributaries are FW2 waters for TM and NT. The northwesterly tributaries, which include a portion located within the Whittingham Wildlife Management Area are classified as FW1(TM). There are many small lakes and ponds within the watershed with the majority located in the Pequest headwaters. The larger impoundments are Mountain Lake, Allamuchy Pond, and Wawayanda Lake. This watershed group encompasses 100,542 acres. Land cover within this region is primarily forested (48.1%) and agricultural (21.2%). A significant portion has been developed/urbanized (12.2%). The most heavily forested areas are within Jenny Jump State Forest, a portion of Allamuchy State Park, Pequest Wildlife Management Area, and Whittingham Wildlife Management Area. Notably, Bear Swamp, an extensive area of wetlands, is located in the upper Pequest watershed.

Pohatcong-Lopatcong Creek Watershed - This sub-basin includes Buckhorn Creek and Pophandusing Brook. This group and its tributaries drain an area of 106 square miles entirely in Warren County. From its headwaters in Independence Township, the Pohatcong Creek flows 28 miles to the Delaware River below Phillipsburg. Major tributaries along with the listed streams include Brass Castle Creek, Shabbecong Creek, and Merrill Creek. The Pohatcong Creek surface waters are classified mainly as FW2-TP (C1), while the Lopatcong Creek drainage area is classified as FW2 for TM and NT, except the Allens Mill, Phillipsburg, and Uniontown (tributary) portions classified for TP (C1). The 650-acre Merrill Creek Reservoir is the largest impoundment in this watershed. This watershed group encompasses 67,925 acres. Land cover in this region is predominantly cropland (36.6%) with forested (35.7%) areas concentrated in the upper watershed as well as along the prominent ridges that parallel the valley. Urban developed land is significant, however (18.5%).

Musconetcong Watershed - This sub-basin drains an area of 156 square miles. For its entire length, the Musconetcong River forms the boundary between Morris and Sussex; Hunterdon and Warren; and Morris and Warren counties. This river flows 42 miles to the Delaware River at Riegelsville. Major tributaries include Lubbers Run, Mine Brook, Hances Brook, and several smaller streams. FW2-TP (C1) is the classification for all tributaries of the Musconetcong River, except for that portion of the river from Lake Hopatcong Dam to the Delaware River, which is classified as FW2-TM. The larger impoundments are located in the upper watershed and include Lake Hopatcong, Lake Musconetcong, Cranberry Lake, Lake Lackawanna, and Cranberry Reservoir. This watershed group encompasses 99,550 acres. The Musconetcong watershed contains two distinct regions. The upper Musconetcong watershed is primarily forested with significant development occurring along the shores of many of the lakes. The lower Musconetcong watershed is primarily agricultural land with forested areas concentrated along the ridges. The single largest center of employment in the Upper

Delaware, the International Trade Zone in Mt. Olive Township, is located in this watershed. Combined, the two regions consist primarily of forest (49.5%), urban land (19.5%), and cropland (17.8%).

Table 3 River miles, Watershed size, and Anderson Land Use classification for five Sublist 5 segments, listed for fecal coliform, in WMA 1

	Segment ID				
	01445900	DRBCNJ0028	01455801	01443250	DRBCNJ0027
Sublist 5 impaired river miles (miles)	11.4	3.2	2.0	3.0	16.4
Total river miles within the delineated watershed and included in the implementation plan (miles)	19.527	16.46	12.425	24.041	93.165
Watershed sizes (acres)	7244	12645	5090	7588	37212
Land use/Land cover					
Agriculture	33.4%	37.4%	0.8%	16.3%	33.3%
Barren Land	0.1%	3.6%	4.1%	0.7%	0.4%
Forest	38.9%	24.4%	58.2%	26.7%	40.4%
Urban	11.7%	31.0%	23.3%	28.7%	16.4%
Water	1.6%	1.4%	1.9%	3.5%	2.5%
Wetlands	14.3%	2.2%	11.7%	24.0%	7.1%

Figure 1 Spatial extent of Sublist 5 segments for which TMDLs are being developed in WMA 1

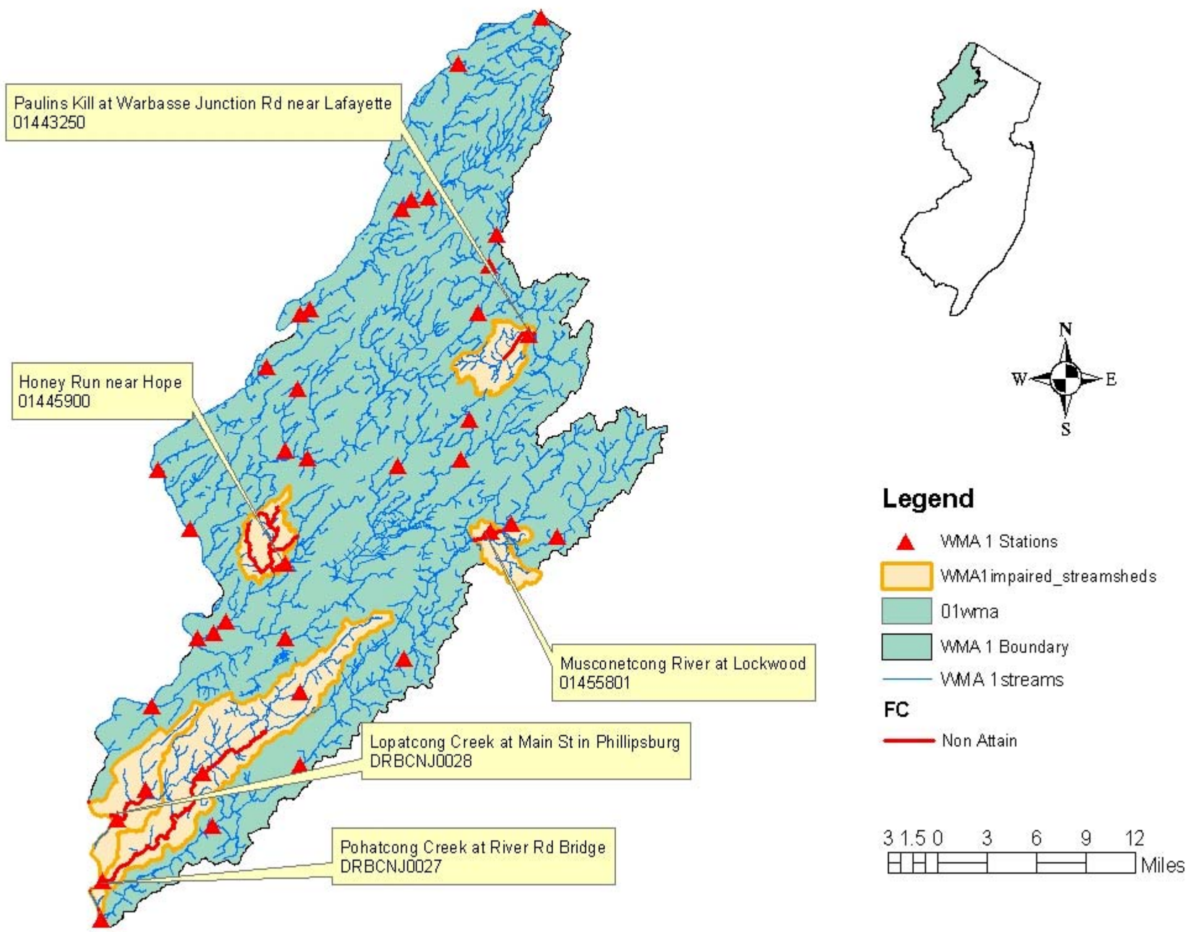


Figure 2 Spatial extent of the Land Use for Honey Run near Hope (01445900)

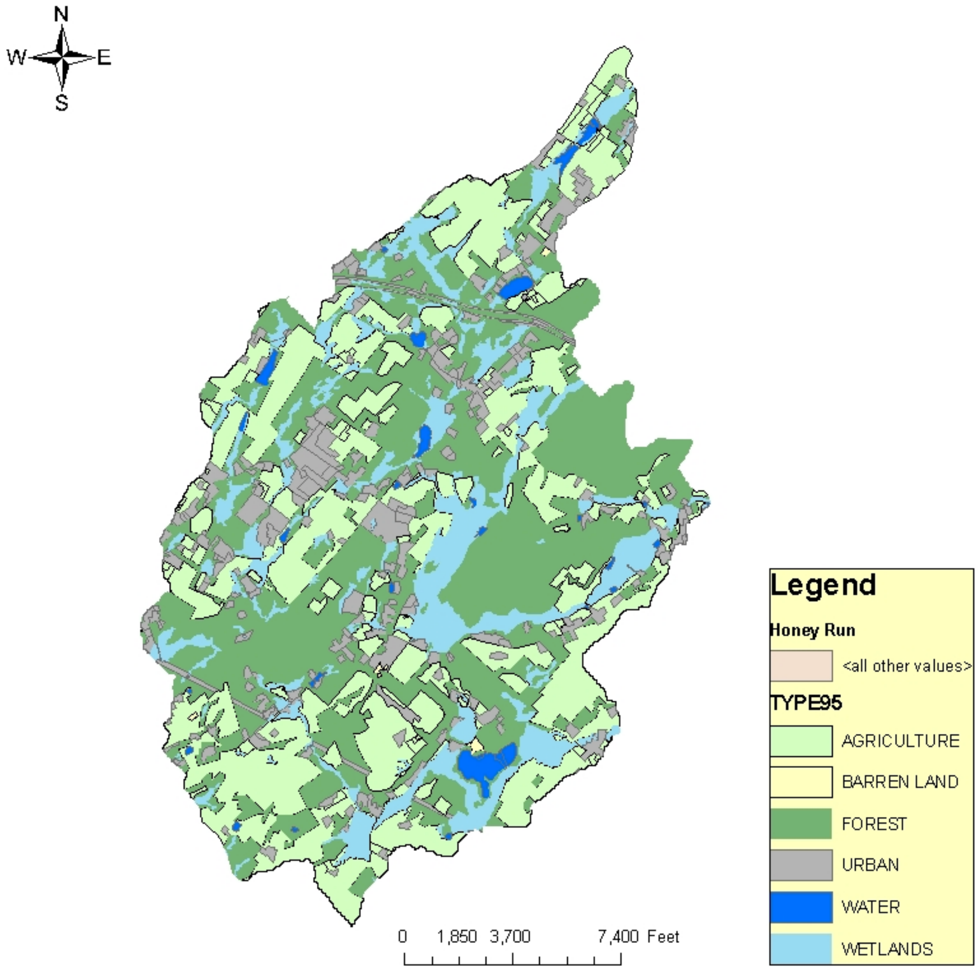

N
W
E
S
0
1,850
3,700
7,400
Feet
Legend
Honey Run
<all other values>
TYPE95
AGRICULTURE
BARREN LAND
FOREST
URBAN
WATER
WETLANDS

Figure 3 **Spatial extent of the Land Use for Lopatcong Creek at Main St in Phillipsburg (DRBCNJ0028)**

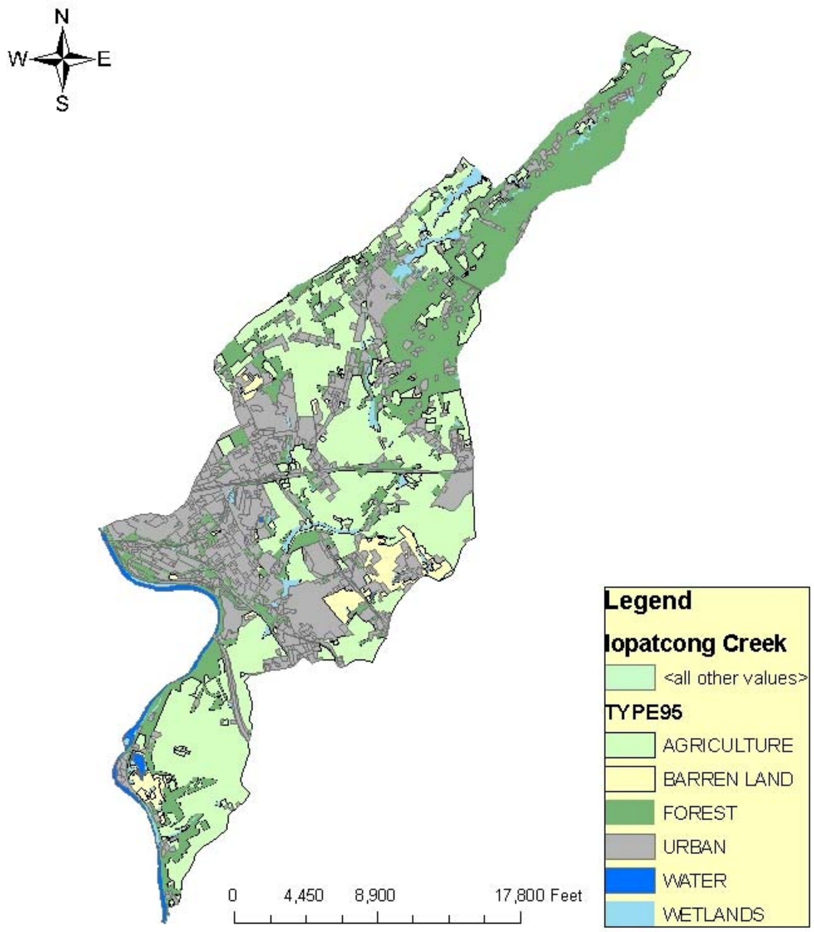


Figure 4 Spatial extent of the Land Use for Musconetcong River at Lockwood (01455801)

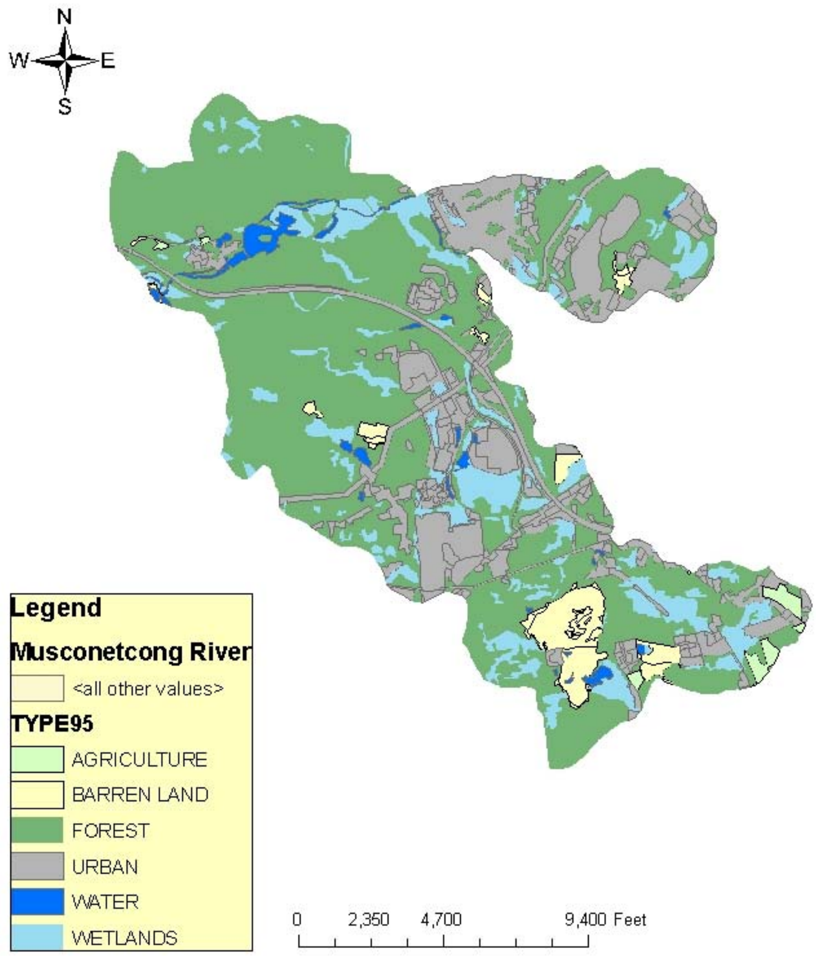

N
W
E
S
Legend
Musconetcong River
<all other values>
TYPE95
AGRICULTURE
BARREN LAND
FOREST
URBAN
WATER
WETLANDS
0
2,350
4,700
9,400 Feet

Figure 5 Spatial extent of the Land Use for Paulins Kill at Warbasse Junction Rd near Lafayette (01443250)

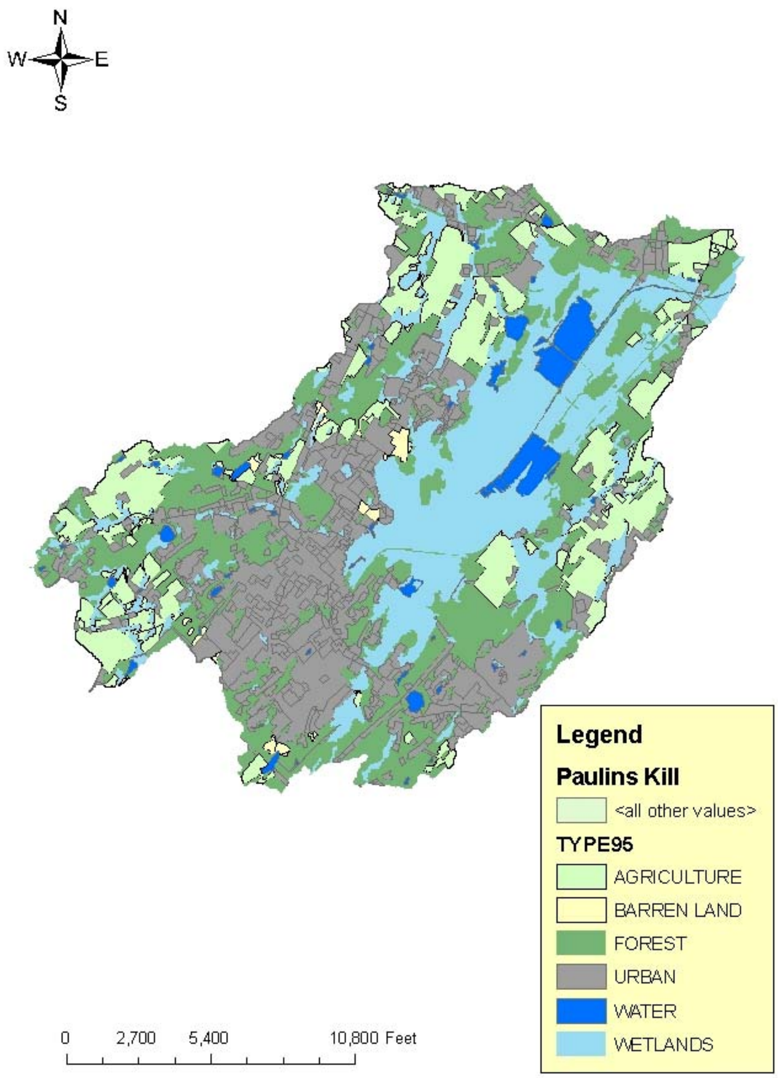
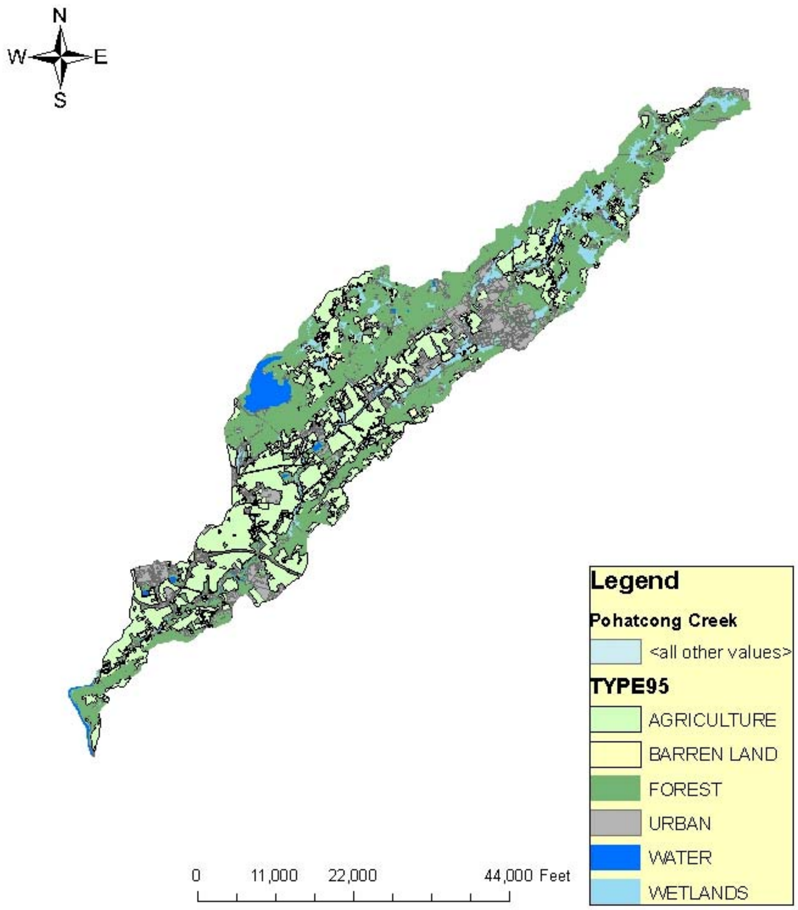


Figure 6 Spatial extent of the Land Use for Pohatcong Creek at River Rd Bridge (DRBCNJ0027)



Watershed Management Area 11

The Central Delaware Tributaries, or WMA 11, is 272 square miles in area and includes all or parts of 24 municipalities within Hunterdon, Mercer, and Monmouth County. The northern section of the Central Delaware Tributaries is located within the Highlands Region, while the southern and eastern sections are located within the Inner Coastal Plain, and the remaining central sections of are primarily within the Piedmont physiographic province. The following information was adapted from the Regional Planning Partnership Settings Report of the Central Delaware Tributaries, released in November 2001 (Regional Planning Partnership, 2001).

The **Hakihokake/Harihokake/Nishisakawick Creek** watershed drainage basin is 63 square miles. Located in the northern part of Hunterdon County, it includes Milford and Frenchtown Boroughs, Kingwood, Holland and Alexandria Townships. The Hakihokake Creek is approximately 6.25 miles long. The creek's headwaters begin at 820 ft. in the Musconetcong Mountains in forested wetlands in Holland and Alexandria Townships and run southwest through Sweet Hollow and Little York gently dropping 710 feet to the Delaware River at Milford Borough (110 feet above sea level). The Harihokake is approximately 7.5 miles long. Its headwaters begin at 740 ft from springs in the Musconetcong Mountains in Alexandria Township. On its way south it passes through Mt. Pleasant slowly dropping 630 feet to the Delaware River. The Nishisakawick is approximately 7.5 miles long. Its headwaters begin at 720 ft in forested wetlands in Alexandria Township and it flows through Camp Marudy Lake, past Camp Marudy, and through Everittstown on its way southwest past farms and developed land slowly dropping 610 feet to the Delaware River at Frenchtown Borough.

The **Little Nishisakawick** springs from wetlands in Kingwood Township at 480 ft and flows approximately 4 miles southwest through mostly agricultural land gently dropping 370 feet to the Delaware River.

Copper Creek is approximately 3.5 miles long and rises at 480 ft from wetlands and a lake near Baptistown in Kingwood Township. It flows southwest to enter the Delaware River.

Warford Creek is 2.5 miles long and rises at 460 ft near Barbertown in Kingwood Township. It travels southwest to the Delaware River opposite Treasure Island.

The **Lockatong Creek/Wickecheoke Creek** watershed drainage basin is 55 square miles. Located in Central Hunterdon County, it includes all of or portions of Franklin Township, Delaware Township, Raritan Township, and Kingwood Township. The Lockatong Creek is thirteen miles long and rises from springs and wetlands near Quakertown in Franklin Township. It flows south through farms and woodlands in Franklin, Kingwood and Delaware Townships falling 500 feet in elevation before emptying into the D&R Canal (and Delaware River). It drains a 27.8 sq. mi. watershed. The Wickecheoke is 14 miles long and rises from wetlands in Franklin and Raritan Townships, flowing south through Delaware and

Kingwood Townships to the D&R Canal and Delaware River at Prallsville Mills in Stockton. The Wickecheoke drains a 26.57 sq. mi. watershed.

The 22 mile long Delaware and Raritan feeder Canal begins its intake from the Delaware River opposite Bulls Island at Raven Rock (six miles north of Lambertville) and joins the main canal at Trenton. From Trenton it travels east seven miles before leaving the Central Delaware Tributaries and entering the Millstone River watershed management area (WMA 10) on its way to the Raritan River.

Alexauken Creek/Moore Creek/Jacobs Creek watershed drainage is 63 square miles, located in Southern Hunterdon County, and includes all of or parts of the following municipalities: Stockton Borough, West Amwell Township, Lambertville City, Hopewell Township, Pennington Borough, and Ewing Township. The Alexauken is approximately five miles long and runs southwest through forest and farmland from its headwaters at 220ft in West Amwell, through a small lake in East Amwell. It parallels the Black River and Western Railroad until it enters the Delaware above Lambertville at Holcombe Island. Swan Creek is approximately one mile long from its reservoirs to Lambertville where it crosses under Route 29 before entering the Delaware River. Moores Creek is approximately 5.25 miles long rising from a lake southwest of Coopers Corners in Hopewell. It runs through West Amwell Township through forest and agricultural land back into Hopewell Township to drain into the Delaware River. Jacobs Creek also has its headwaters in Hopewell and Pennington and flows west of Pennington Mountain 7.5 miles through forest, agricultural and developed land into Somerset where it enters the Delaware River.

Fiddlers Creek is separated from Moores Creek by Strawberry Hill and Baldpate Mountain (475 ft). It rises south of Ackers Corners at 220 ft and empties into the D&R Canal just north of Titusville (at 40 ft above sea level).

Woolsey Brook rises in Pennington and after flowing southwest joins Jacobs Creek just north of Somerset.

Airport Brook begins north of exit 3 on I-95 and runs three miles west passing Mercer County Airport to join Jacobs Creek north of Somerset.

Gold Run begins at a small lake in Ewing and runs two miles southwest passing the State School for the Deaf and enters the Delaware River south of Lower Ferry Road.
Seven dischargers are located in the watershed

The **Assunpink Creek** above the Shipetaukin rises in forested wetlands in Roosevelt and Millstone Townships. It is joined by the New Sharon Branch as it travels northwest through Washington, West Windsor, and Lawrence Townships where the Shipetaukin Creek joins it. As it travels farther northwest away from the wetlands of the Assunpink Wildlife Management Area, past Central Mercer County Park, and Bear Swamp to Whitehead Mill Pond the landscape becomes increasingly urbanized.

The **New Sharon Branch** rises at 110 ft from a small lake in Upper Freehold and runs 5 miles northwest through New Sharon to wetlands around Carsons Mills where it joins the Assunpink.

The **Shipetaukin Creek** rises at 210 ft in Hopewell near Van Kirk Road and runs five and one half miles southeast before joining the Assunpink Creek at Whitehead Mills Pond.

Bridegroom Run starts in West Windsor near Edinburg and runs two miles west before it joins the Assunpink Creek in Central Mercer County Park.

The two largest lakes in the Central Delaware Tributaries are found in this watershed: the 227-acre Assunpink Lake and a 270-acre unnamed lake (both created by dams).

Miry Run (rising from wetlands in Washington Township) and the West Branch of the Shabakunk Creek (Ewing), the Shabakunk Creek (Hopewell), and the Little Shabakunk Creek (Lawrence) contribute to the Assunpink Creek as it flows southwest through Lawrence Township and Trenton to the Delaware River. In total the Assunpink Creek is about 25 miles long. This part of the Central Delaware Tributaries is highly urbanized with the Assunpink channeled with concrete sides for flood control purposes.

The **Little Shabakunk Creek** begins in Lawrence Township near Bunkerhill Road and travels east 3.5 miles before entering the Assunpink Creek north of East Trenton Heights.

The **Shabakunk Creek** begins near Twin Pine Airport in Hopewell and travels 7.5 miles in total through Ewing Township (picking up flow from the two artificial lakes Ceva Lake and Sylvia Lake) before entering Lawrence Township and flowing through Colonial Lake (another artificial lake) on its way to join the Assunpink Creek at Whitehead Mills Pond.

The **West Branch of the Shabakunk Creek** begins north of Rambling Creek Park in Ewing Township then travels for five miles south then east into Lawrence Township where it joins the Shabakunk Creek west of Route 206.

Pond Run starts in Hamilton Square and runs four miles west through Veterans County Park, Bromley Park and railyards before joining the Assunpink Creek just north of Olden Avenue.

Miry Run rises in Washington Township north of the Trenton Robbinsville airport and runs 7.5 miles northwest through wetlands north of Hamilton Square to join the Assunpink Creek just east of Whitehead Rd. at Whitehead Mills Pond.

Table 4 River miles, Watershed size, and Anderson Land Use classification for three Sublist 5 segments, listed for fecal coliform, in WMA 11.

	Segment ID		
	DRBCNJ0023	**DRBCNJ0003**	**01461220, 01461300 & DRBCNJ0012, 01461282**
Sublist 5 impaired river miles (miles)	8.0	2.1	38.0
Total river miles within the delineated watershed and included in the implementation plan (miles)	39.364	14.124	44.739
Watershed sizes (acres)	11101	4997	17146
Land use/Land cover			
Agriculture	28.7%	33.8%	38.8%
Barren Land	0.1%	0.4%	0.1%
Forest	40.5%	28.1%	31.7%
Urban	20.7%	32.1%	10.4%
Water	0.3%	0.5%	0.4%
Wetlands	9.7%	5.1%	18.6%

Figure 7 Spatial extent of Sublist 5 segments for which TMDLs are being developed in WMA 11

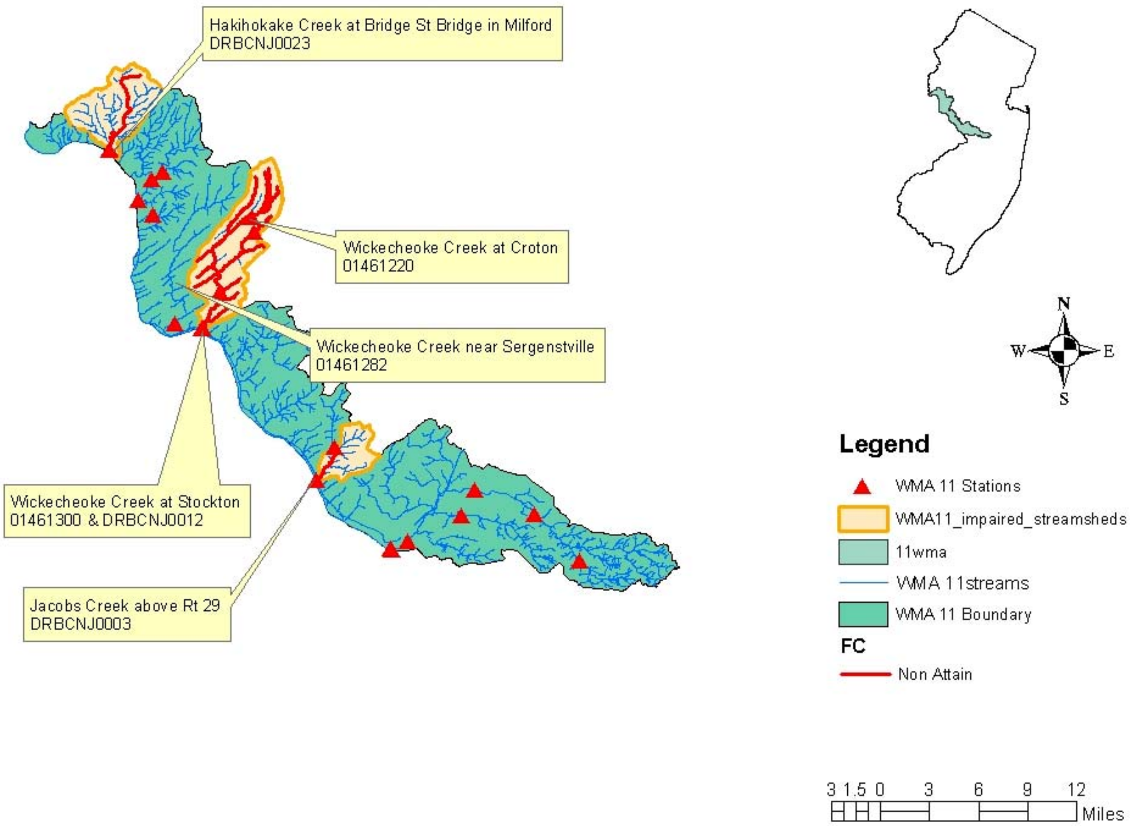


Figure 8 Spatial extent of the Land Use for Hakihokake Creek at Bridge St Bridge in Milford (DRBCNJ0023)

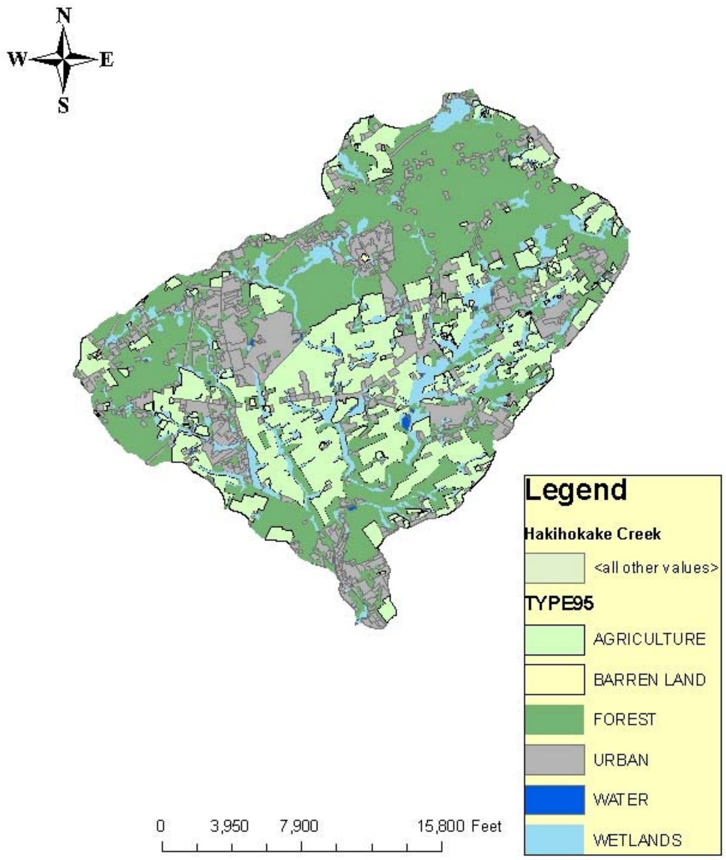


Figure 9 Spatial extent of the Land Use for Jacobs Creek above Rt. 29 (DRBCNJ0003)

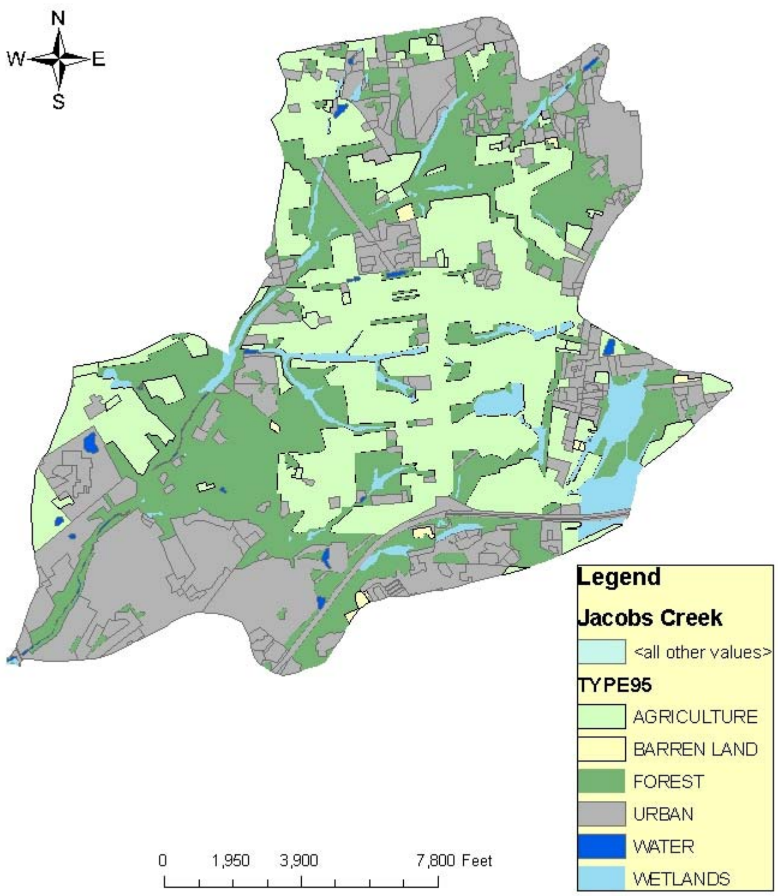
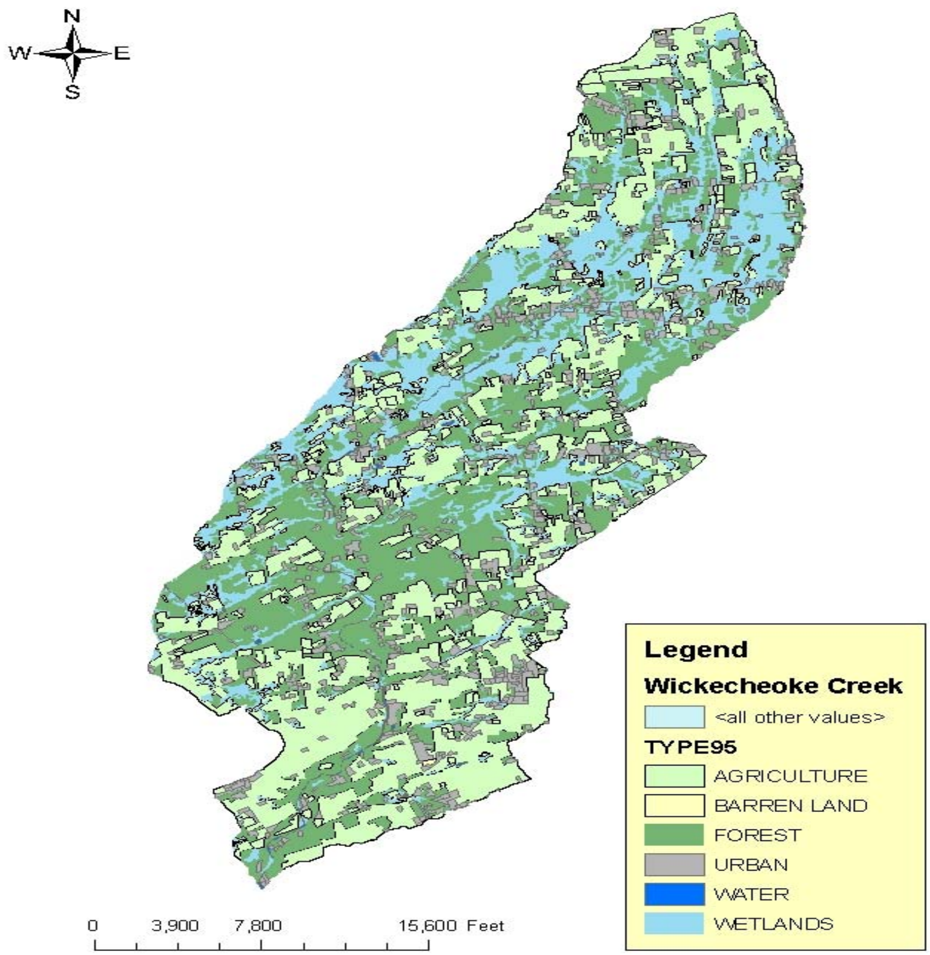


Figure 10 **Spatial extent of the Land Use for Wickecheoke Creek at Croton (01461220), Wickecheoke Creek at Stockton (01461300 & DRBCNJ0012), Wickecheoke Creek near Sergenstville (01461282)**



Data Sources

The Department's Geographic Information System (GIS) was used extensively to describe the Northwest watershed characteristics. The following is general information regarding the data used to describe the watershed management area:

- Land use/Land cover was taken from: "NJDEP 1995/97 Land use/Land cover Update for New Jersey (by WMA)", published 12/01/2000 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), and delineated by watershed management area.

- "NJDEP 2004 Integrated Report Results for Non-Tidal Rivers", published 6/2004 by NJDEP, Watershed Assessment Group (WAT). Online at: http://www.state.nj.us/dep/gis/digidownload/images/ir2004/ir_river_conventionals2004.gif

- County Boundaries: Published 01/23/2003 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), "NJDEP County Boundaries for the State of New Jersey." Online at: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/stco.zip

- Detailed stream coverage of New Jersey: Published 11/01/1998 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA). "NJDEP Streams of New Jersey (1:24000)." Online at: http://www.state.nj.us/dep/gis/strmshp.html

- NJDEP 14 Digit Hydrologic Unit Code delineations for New Jersey (DEPHUC14), published 4/5/2000 by Department of Environmental Protection (NJDEP), New Jersey Geological Survey (NJGS). Online at: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/dephuc14.zip

- NJDEP Digital Elevation Grid for New Jersey (10 meter) published 10/01/2004 by NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information Systems (BGIS). Online at: http://www.nj.gov/dep/gis/wmalattice.html

- "NJPDES Surface Water Discharges in New Jersey, (1:12,000)", published 09/12/2002 by NJDEP, Environmental Regulation (ER), Division of Water Quality (DWQ), Bureau of PointSource Permitting - Region 1 (PSP-R1). Online at: http://depnet/gis/digidownload/images/statewide/njpdesswd.gif

- "NJDEP 2004 Integrated Report Stations on Non-Tidal Rivers (Conventionals and Toxics)", published 6/2004 by NJDEP, Water Assessment Team (WAT). Online at: http://www.state.nj.us/dep/gis/digidownload/images/ir2004/ir_stations_river2004.gif

4.0 Source Assessment

In order to evaluate and characterize fecal coliform loadings in the waterbodies of interest in these TMDLs, and thus develop proper management responses, source assessments are warranted. Source assessments include identifying the types of sources and their relative contributions to fecal coliform loadings, in both time and space variables.

Assessment of Point Sources other than Stormwater

Wastewater treatment plant discharges within the spatial extent for these TMDLs are listed in Appendix A. Sewage treatment plants, whether municipal or industrial, are required to disinfect effluent prior to discharge and to meet surface water quality criteria for fecal coliform in their effluent. In addition, New Jersey's Surface Water Quality Standards at N.J.A.C. 7:9B-1.5(c)4 reads "No mixing zones shall be permitted for indicators of bacterial quality including, but not limited to, fecal coliforms and enterococci." This mixing zone policy is applicable to both municipal and industrial sewage treatment plants.

Since sewage treatment plants routinely achieve essentially complete disinfection (less than 20 CFU/100ml), the requirement to disinfect results in fecal coliform concentrations well below the criteria and permit limit. The percent of the total point source contribution is an insignificant fraction of the total load. Consequently, these fecal coliform TMDLs will not impose any change in current practices for wastewater treatment plants and will not result in changes to existing effluent limits.

Assessment of Nonpoint and Stormwater Point Sources

Nonpoint and stormwater point sources include runoff from various land uses that transport fecal coliform from sources such as geese, farms, and domestic pets to the receiving water. Nonpoint sources also include inputs that do not depend on precipitation events such as failing sewage conveyance systems, and failing or inappropriately located septic systems. Stormwater point sources are distinguished from nonpoint sources that derive from stormwater in that they are regulated under the NJPDES program. For Hakihokake Creek, the Phase II MS4 program is currently limited to public education and control of stormwater from new development and redevelopment through ordinances.

5.0 Water Quality Analysis

Relating pathogen sources to in-stream concentrations is distinguished from quantifying that relationship for other pollutants given the inherent variability in population size and dependence not only on physical factors such as temperature and soil characteristics, but also on less predictable factors such as re-growth media. Since fecal coliform loads and concentrations can vary many orders of magnitude over short distances and over time at a single location, dynamic model calibrations can be very difficult to calibrate. Options available to control non-point sources of fecal coliform typically include measures such as goose management strategies, pet waste ordinances, agricultural conservation management plans, and septic system replacement and maintenance. Given these considerations, detailed water quality modeling may not provide adequate insight or guidance toward the development of implementation plans for fecal coliform reductions.

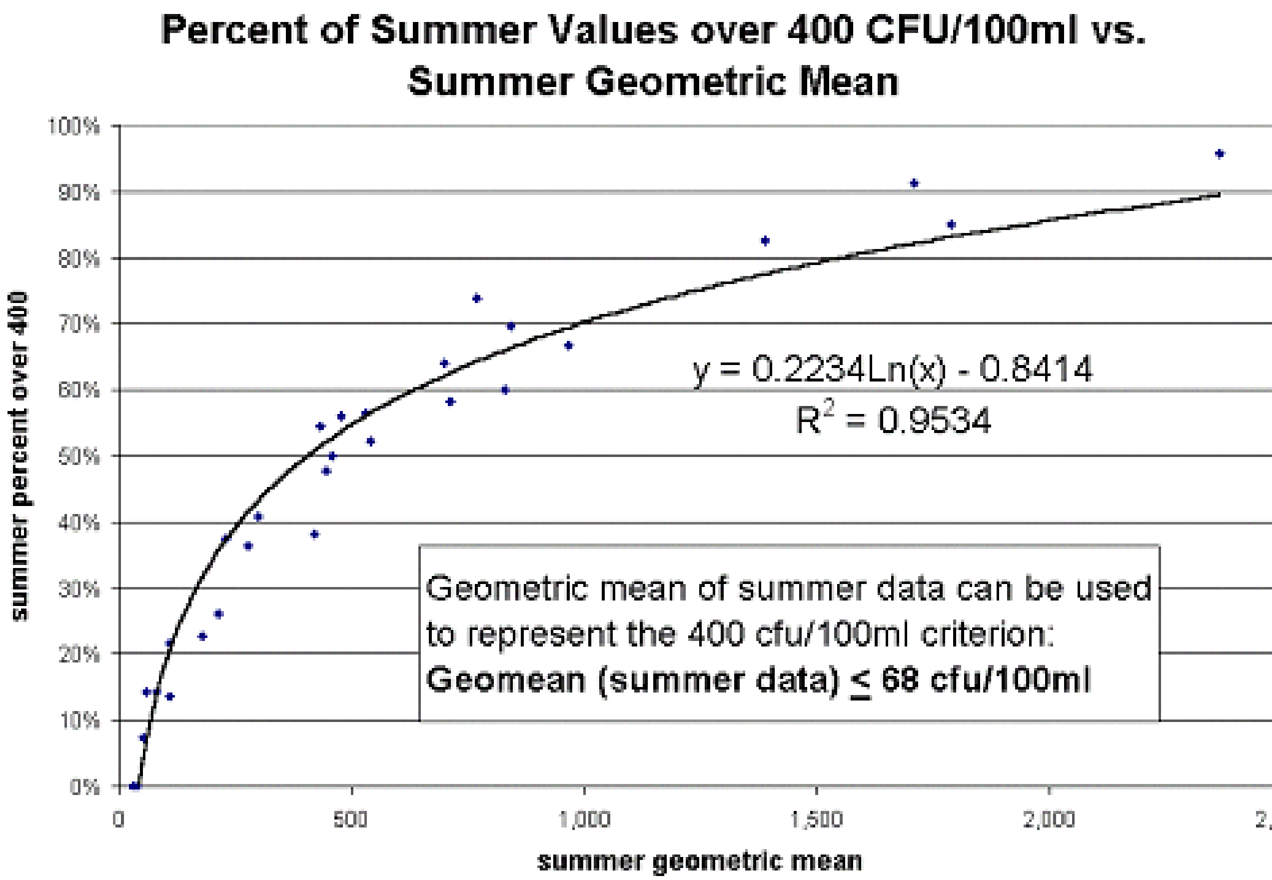
As described in EPA guidance, a TMDL identifies the loading capacity of a waterbody for a particular pollutant. EPA regulations define loading capacity as the greatest amount of loading that a waterbody can receive without violating water quality standards (40 C.F.R. 130.2). The loadings are required to be expressed as either mass-per-time, toxicity, or other appropriate measures (40 C.F.R. 130.2(i)). For these TMDLs, the load capacity is expressed as a concentration set to meet the state water quality standard. For bacteria, it is appropriate and justifiable to express the components of a TMDL as percent reduction based on concentration. The rationale for this approach is that:

- expressing a bacteria TMDL in terms of concentration provides a direct link between existing water quality and the numeric target;
- using concentration in a bacteria TMDL is more relevant and consistent with the water quality standards, which apply for a range of flow and environmental conditions; and
- follow-up monitoring will compare concentrations to water quality standards.

Given the two criteria of 200 CFU/100 ml and 400 CFU/100 ml in FW2 waters, computations were necessary for both criteria and resulted in two- percent reduction values. The higher percent reduction value was applied in the TMDL so that both the 200 CFU/100 ml and 400 CFU/100 ml criteria were satisfied.

To satisfy the 200 CFU/100ml criteria, the geometric mean of all available data between water years 1994-2002 was compared to an adjusted target concentration. The adjusted target accounts for an explicit margin of safety and is equal to 200 minus the margin of safety. A calculation incorporating all available data is generally conservative since most samples are taken during the summer when fecal coliform is generally higher. A geometric mean of summer data was used to develop a percent reduction to satisfy the 400 CFU/100 ml criteria. A summer geometric mean can be used to represent the 400 criteria by regressing the percent over 400 CFU/100 ml against the geometric mean (Figure 3). Thus, each data point on Figure 3 represents all the data from one individual monitoring station. Sites with 20 or more summer data points were used to develop this regression, in order to make use of more significant values for percent exceedance. A statewide regression was used rather than regional regressions because the regression shape was not region-specific and the strength of the correlation was highest when all statewide data were included. The resulting regression has an r-squared value of 0.9534. Solving for X when Y is equal to 10% yields a geometric mean threshold of 68 CFU/100ml. This means that, using summer data, a geometric mean of 68 can be used to represent the 400 CFU/100ml criterion. Since the geometric mean is a more reliable statistic than percentile when limited data are available, 68 CFU/100ml was used to represent the 400 CFU/100ml criterion for all sites. The inclusion of all data from summer months (May through September) to compare with the 30-day criterion is justified because summer represents the critical period when primary and secondary contact with water bodies is most prevalent. A more detailed justification for using summer data can be found in the discussion of seasonal variation and critical conditions.

Figure 11 Percent of summer values over 400 CFU/100ml as a function of summer geometric mean values



y = 0.2234Ln(x) - 0.8414
Equation 1

$R^2 = 0.9534$

Geometric mean, and summer geometric mean, and percent reductions were determined at each location for both criteria using Equations 2 through 4. To satisfy the 200 CFU/100ml criteria, equations 2 and 3 were applied. Equations 2 and 4 were used in satisfying the 400 CFU/100ml criteria.

$$Geometric\ Mean\ \ for\ 200CFU\ \ criteria = \sqrt[n]{y_1 y_2 y_3 y_4 \ldots . y_n} \quad \text{Equation 2}$$

Where:
y = sample measurement
n = total number of samples

$$200\ CFU\ \ criteria\ \ Percent\ \text{Re}duction = \frac{(Geometric\ mean - (200 - e))}{Geometric\ mean} \times 100\ \% \quad \text{Equation 3}$$

$$400\ CFU\ \ criteria\ \ Percent\ \text{Re}duction = \frac{(SummerGeometric\ mean - (68 - e))}{SummerGeometric\ mean} \times 100\ \% \quad \text{Equation 4}$$

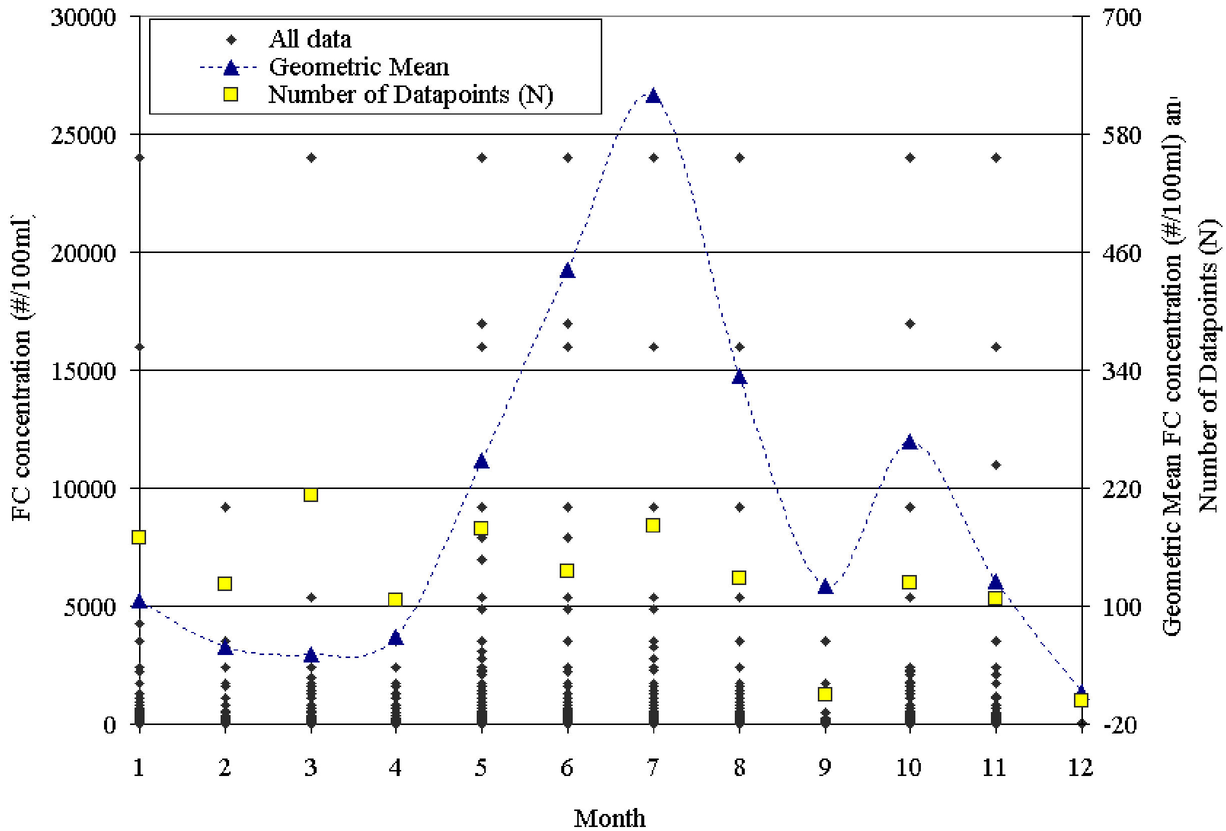
where:
e = (margin of safety)

This percent reduction can be applied to nonpoint and stormwater point sources as a whole or be apportioned to categories of nonpoint and stormwater point sources within the study area. The extent to which nonpoint and stormwater point sources have been identified or need to be identified varies by study area based on data availability, watershed size and complexity, and pollutant sources.

Seasonal Variation/Critical Conditions

These TMDLs will attain applicable surface water quality standards year round. The approach outlined in this paper is conservative given that in most cases fecal coliform data were collected during the summer months, a time when in-stream concentrations are typically the highest. This relationship is evidenced when calculating, on a monthly basis, the geometric mean of fecal coliform data collected statewide. Statewide fecal coliform geometric means during water years 1994-1997 were compared on a month basis and are shown in Figure 4. The 1994-1997 period was chosen for this analysis so that the significance of the number of individual data points for any given month was minimized. During the 1994-1997 period year-round sampling for fecal coliform was conducted by sampling four times throughout the year. Following 1997, the fecal coliform sampling protocol was changed to five samples during a 30-day period in the summer months. As evident in Figure 4, higher monthly geometric means are observed between May and September with the highest values occurring during mid-summer. This relationship is also evident when using the entire 1994-2002 dataset or datasets from individual water years. Given this relationship, summer is considered the critical period for violating fecal coliform SWQS and, as such, sampling during this period is considered adequate for meeting year round protections and designated uses.

Figure 12 Statewide monthly fecal coliform geometric means during water years 1994-1997 using USGS/NJDEP data.



Margin of Safety

A Margin of Safety (MOS) is provided to account for "lack of knowledge concerning the relationship between effluent limitations and water quality" (40 CFR 130.7(c)). For these TMDLs calculations, both an implicit and explicit Margin of Safety (MOS) are incorporated. Implicitly, a MOS is inherent in the estimates of current pollutant loadings, the targeted water quality goals (New Jersey's SWQS) and the allocations of loading. This was accomplished by taking conservative assumptions throughout the TMDL evaluation and development. Examples of some of the conservative assumptions include treating fecal coliform as a conservative substance, applying the fecal coliform criteria to stormwater point sources, and applying the fecal coliform criteria to the stream during all weather conditions. Fecal coliforms decay in the environment (i.e. outside the fecal tract) relatively rapidly, yet this analysis assumes a linear relationship between fecal load and instream concentration.

An explicit MOS is provided by incorporating a confidence level multiplier associated with log-normal distributions in the calculation of the load reduction for both the 200 and 400 standards. Using this method, the 200 and 400 targets are reduced based on the number of data points and the variability within each data set. For these TMDLs, a confidence level of 90% was used in calculating the MOS. As a result, and as identified in Appendix B, the target value will be different for each stream segment or grouped segments. The explicit margin of safety is calculated using the following steps:

1- FC data (x) will transformed to Log form data (y),
2- the mean of the Log- transformed data (y) is determined, $\bar{y}$
3- Determine the standard deviation of the Log-transformed data, S_y using the following equation:

$$S_y = \sqrt{\frac{\sum_i (y_i - \bar{y})^2}{N-1}}$$

4- Determine the Geometric mean of the FC data (GM)
5- Determine the standard deviation of the mean (standard error of the mean), $s_{\bar{y}}$, using the following equation:

$$s_{\bar{y}} = \frac{s_y}{\sqrt{N}}$$

6- For the 200 standard ($x_{standard}$), $y_{standard}$ = Log(200)= 2.301, thus for a confidence level of 90%, the target value will be the lower confidence limit (n= -1.64), $y_{target} = y_{std} - n \cdot s_{\bar{y}}$, for example, the 200 criteria: y_{target} = 2.301- n* $s_{\bar{y}}$
7- The target value for x, $x_{target} = 10^{y\ target}$
8- The margin of safety (e) therefore will be e = $x_{standard}$ - x_{target}
9- Finally, the load reduction = $\frac{GM - x_{target}}{GM} \cdot 100\%$, for example the 200 criteria will be defined as: $\frac{(GM - (200 - e))}{GM} \cdot 100\%$

The 400 criteria would be defined as: $\frac{(GM - (68 - e))}{GM} \cdot 100\%$

6.0 TMDL Calculations

Because these TMDLs are calculated based on ambient water quality data, the allocations are provided in terms of percent reductions. In the same way, the loading capacity of each stream is expressed as a function of the current load:

$LC = (1 - PR) \times L_o$, where

LC = loading capacity for a particular stream;
PR = percent reduction as specified in Table 6;
L_o = current load.

Wasteload Allocations and Load Allocations

Wastewater discharges in the segments for which TMDLs are being established are a de minimus source, as discussed previously, and the WLA calls for a zero percent reduction and will be expressed as the existing effluent limit of 200 CFU/100 ml as a monthly geometric mean and 400 CFU/100 ml as a weekly geometric mean. WLAs are established for NJPDES-regulated stormwater, while LAs are established for all stormwater sources that are not subject to NJPDES regulation, and for all nonpoint sources. Both WLAs and LAs are expressed as percentage reductions for particular stream segments. Stormwater point sources receiving a WLA are distinguished from areas receiving a LA on the basis of land use.

This distribution of loading capacity between WLAs and LAs is consistent with recent EPA guidance that clarifies existing regulatory requirements for establishing WLAs for stormwater discharges (Wayland, November 2002). Stormwater discharges are captured within the runoff sources quantified according to land use, as described previously. Distinguishing between regulated and unregulated stormwater is necessary in order to express WLAs and LAs numerically; however, "EPA recognizes that these allocations might be fairly rudimentary because of data limitations and variability within the system" (Wayland, November 2002, p.1). Therefore allocations are established according to source categories as shown in Table 5. This demarcation between WLAs and LAs based on land use source categories is not perfect, but it represents the best estimate defined as narrowly as data allow. The Department acknowledges that there may be stormwater sources in the residential, commercial, industrial and mixed urban runoff source categories that are not NJPDES-regulated. Nothing in these TMDLs shall be construed to require the Department to regulate a stormwater source under NJPDES that would not already be regulated as such, nor shall anything in these TMDLs be construed to prevent the Department from regulating a stormwater source under NJPDES.

Table 5 Distribution of WLAs and LAs among source categories

Source category	**TMDL allocation**
Nonpoint and Stormwater Sources	
medium / high density residential	WLA
low density / rural residential	WLA
commercial	WLA
industrial	WLA
Mixed urban / other urban	WLA
agricultural	LA
forest, wetland, water	LA
barren land	LA

Table 6 identifies the required percent reduction necessary for each stream segment or group of segments to meet the fecal coliform SWQS. The reductions reported in these tables include a margin of safety factor and represent the higher percent reduction (more stringent) required of the two criteria. Reductions that are required under each criteria are located in Appendix B. In all cases, the 400 CFU/100ml criteria was the more stringent of the two criteria, thus values reported in Table 6 were equal to the percent required to meet the 400 CFU/100ml criteria.

Table 6 TMDLs for fecal coliform-impaired stream segments in the Northwest Water Region as identified in Sublist 5 of the 2004 Integrated List of Waterbodies. The reductions reported in this table represent the higher, or more stringent, percent reduction required of the two fecal coliform criteria.

TMDL Number	WMA	303(d) Category 5 Segments	Water Quality Stations	Station Names	Wasteload Allocation/Load Allocation (LA) and Margin of Safety (MOS)				
					Summer N	Summer geometric mean CFU/100ml	MOS as a percent of the target concentration	Percent reduction without MOS	Percent reduction with MOS
1	1	01445900	01445900	Honey Run near Hope	10	570	51%	88%	94%
2	1	DRBCNJ0028	DRBCNJ0028	Lopatcong Creek at Main St in Phillipsburg	8	198	66%	66%	88%
3	1	01455801	01455801	Musconetcong River at Lockwood	46	256	27%	73%	81%
4	1	01443250	01443250	Paulins Kill at Warbasse Junction Rd near Lafayette	10	831	42%	92%	95%
5	1	DRBCNJ0027	DRBCNJ0027	Pohatcong Creek at River Rd Bridge	29	544	41%	88%	93%
6	11	DRBCNJ0023	DRBCNJ0023	Hakihokake Creek at Bridge St Bridge in Milford	8	86	74%	21%	80%
7	11	DRBCNJ0003	DRBCNJ0003	Jacobs Creek above Rt. 29	7	196	45%	65%	81%
8, 9, 10	11	01461220, 01461300, & DRBCNJ0012, 01461282	01461220, 01461300 & DRBCNJ0012, 01461282	Wickecheoke Creek at Croton, Wickecheoke Creek at Stockton, Wickecheoke Creek near Sergenstville	77	167	23%	59%	69%

[1] MOS as a percent of target is equal to: $\frac{e}{200\ CFU/100ml}$ or $\frac{e}{68\ CFU/100ml}$ where "e" is defined as the term in Section 5.0.

Reserve Capacity

Reserve capacity is an optional means of reserving a portion of the loading capacity to allow for future growth. Reserve capacities are not included at this time. The loading capacity of each stream is expressed as a function of the current load, and both WLAs and LAs are expressed as percentage reductions for particular stream segments. Therefore, the percent reductions from current levels must be attained in consideration of any new sources that may accompany future development. Strategies for source reduction will apply equally well to new development as to existing development.

7.0 Follow - up Monitoring

In association with the Water Resources Division of the U.S. Geological Survey, the NJDEP has cooperatively operated the Ambient Stream Monitoring Network (ASMN) in New Jersey since the 1970s. The ASMN currently includes approximately 115 stations that are routinely monitored on a quarterly basis. Bacteria monitoring, as part of the ASMN network, is conducted five times during a consecutive 30-day summer period each year. The data from this network has been used to assess the quality of freshwater streams and percent load reductions. The ASMN will remain a principal source of fecal coliform monitoring to determine the effectiveness of implementing these TMDLs. In addition the Department will undertake microbial source trackdown where needed, as discussed under Implementation.

8.0 Implementation

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint and stormwater sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint and stormwater source pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives" (USEPA, 1993).

Development of effective management measures depends on accurate source assessment. Fecal coliform is contributed to the environment from a number of categories of sources including human, domestic or captive animals, agricultural practices, and wildlife. Fecal coliform from these sources can reach waterbodies directly, through overland runoff, or through sewage or stormwater conveyance facilities. Each potential source will respond to one or more management strategies designed to eliminate or reduce that source of fecal coliform. Each management strategy has one or more entities that can take lead responsibility to effect the strategy. Various funding sources are available to assist in accomplishing the management strategies. The Department will address the sources of impairment through systematic source trackdown, matching strategies with sources, selecting responsible entities and aligning available resources to effect implementation.

For example, the stormwater discharged to the impaired segments through "small municipal separate storm sewer systems" (MS4s) are regulated under the Department's Phase II

NJPDES stormwater rules for the Municipal Stormwater Regulation Program. Under those rules and associated general permits, many municipalities (and various county, State, and other agencies) in the Northwest Region are required to implement various control measures that should substantially reduce bacteria loadings, including measures to eliminate "illicit connections" of domestic sewage and other waste to the MS4, adopt and enforce a pet waste ordinance, prohibit feeding of unconfined wildlife on public property, clean catch basins, perform good housekeeping at maintenance yards, and provide related public education and employee training. For Hakihokake Creek, the Phase II MS4 program is currently limited to public education and control of stormwater from new development and redevelopment.

Sewage conveyance facilities are potential sources of fecal coliform in that equipment failure or operational problems may result in the release of untreated sewage. These sources, once identified, can be eliminated through appropriate corrective measures that can be effected through the Department's enforcement authority.

Inadequate on-site sewage disposal can also be a source of fecal coliform. Systems that were improperly designed, located or maintained may result in surfacing of effluent and illicit remedies such as connections to storm sewers or streams add human waste directly to waterbodies. Once these problems have been identified through local health departments, sanitary surveys or other means, alternatives to address the problems can be evaluated and the best solution implemented.

The Department has committed a portion of its CWA 319(h) pass through grant funds to assist municipalities in meeting Phase II requirements. In addition, The New Jersey Environmental Infrastructure Financing Program, which includes New Jersey's State Revolving Fund, provides low interest loans to assist in correction of water quality problems related to stormwater and wastewater management.

Other wildlife contributions include significant deer populations that have been identified as a potential fecal coliform source in the impaired watersheds. The forested and low-density residential areas that provide deer habitat can be found in close proximity to the impaired stream segments. Deer have been evaluated in fecal coliform TMDLs by other States (e.g. Alabama and South Carolina) and could be a fecal coliform source in New Jersey.

Agricultural activities are another example of potential sources of fecal coliform. Possible contributors are direct contributions from livestock permitted to traverse streams and stream corridors, manure management from feeding operations, or use of manure as a soil fertilizer/amendment. Implementation of conservation management plans and best management practices are the best means of controlling agricultural sources of fecal coliform. Several programs are available to assist farmers in the development and implementation of conservation management plans and best management practices. The Natural Resource Conservation Service is the primary source of assistance for landowners in the development of resource management pertaining to soil conservation, water quality improvement, wildlife habitat enhancement, and irrigation water management. The USDA Farm Services Agency performs most of the funding assistance. All agricultural technical assistance is coordinated through the locally led Soil Conservation Districts. The funding programs include:

- **The Environmental Quality Incentive Program (EQIP)** is designed to provide technical, financial, and educational assistance to farmers/producers for conservation practices that address natural resource concerns, such as water quality. Practices under this program include integrated crop management, grazing land management, well sealing, erosion control systems, agri-chemical handling facilities, vegetative filter strips/riparian buffers, animal waste management facilities and irrigation systems.

- **The Conservation Reserve Program (CRP)** is designed to provide technical and financial assistance to farmers/producers to address the agricultural impacts on water quality and to maintain and improve wildlife habitat. CRP practices include the establishment of filter strips, riparian buffers and permanent wildlife habitats. This program provides the basis for the Conservation Reserve Enhancement Program (CREP).

- **The Conservation Reserve Enhancement Program** The New Jersey Departments of Environmental Protection and Agriculture, in partnership with the Farm Service Agency and Natural Resources Conservation Service, signed a $100 million dollar CREP agreement. The program matches $23 million of State money with $77 million from the Commodity Credit Corp. within USDA. Through CREP, financial incentives are offered for agricultural landowners to voluntarily implement conservation practices on agricultural lands. NJ CREP will be part of the USDA's Conservation Reserve Program (CRP). There will be a ten-year enrollment period, with CREP leases ranging between 10-15 years. The State intends to augment this program thereby making these leases permanent easements. The enrollment of farmland into CREP in New Jersey is expected to improve stream health through the installation of water quality conservation practices on New Jersey farmland.

Management strategies are summarized as follows:

Source Category	**Responses**	**Potential Responsible Entity**	**Funding options**
Human Sources			
Inadequate (per design, operation, maintenance, location, density) on-site disposal systems	Confirm inadequate condition; evaluate and select cost effective alternative, such as rehabilitation or replacement of systems, or connection to centralized treatment system	Municipality, MUA, RSA	CWA 604(b) for confirmation of inadequate condition; Environmental Infrastructure Financing Program for construction of selected option

Inadequate or improperly maintained stormwater facilities; illicit connections	Measures required under Phase II Stormwater permitting program including any additional measures determined in the future to be needed through TMDL process	Municipality, State and County regulated entities, stormwater utilities	CWA 319(h)
Malfunctioning sewage conveyance facilities	Identify through source trackdown	Owner of malfunctioning facility—compliance issue	User fees
Domestic/captive animal sources			
Pets	Pet waste ordinances	Municipalities for ordinance adoption and compliance	
Horses, livestock, zoos	Confirm through source trackdown: SCD/NRCS develop conservation management plans	Property owner	EQIP, CRP, CREP
Agricultural practices	Confirm through source trackdown; SCD/NRCS develop conservation management plans	Property owner	EQIP, CRP, CREP
Wildlife			
Nuisance concentrations, e.g. resident Canada geese	Feeding ordinances; Goose Management BMPs	Municipalities for ordinance; Community Plans for BMPs	CBT, CWA 319(h)
Indigenous wildlife	Confirm through trackdown; consider revising designated uses	State	NA

Source Trackdown

Efforts to identify sources include visual assessments and planned track-down monitoring, where appropriate.

<u>Pathogen Indicators and Microbial Source Tracking:</u>

Advances in microbiology and molecular biology have produced several methodologies that discriminate among sources of fecal coliform and thus more accurately identify pathogen sources. The numbers of pathogenic microbes present in polluted waters are few and not readily isolated nor enumerated. Therefore, analyses related to the control of these pathogens must rely upon indicator microorganisms. The commonly used pathogen indicator organisms are the coliform groups of bacteria, which are characterized as gram-negative, rod-shaped bacteria. Coliform bacteria are suitable indicator organism because they are generally not found in unpolluted water, are easily identified and quantified, and are generally more numerous and more resistant than pathogenic bacteria (Thomann and Mueller, 1987).

Tests for fecal organisms are conducted at an elevated temperature (44.5°C), where the growth of bacteria of non-fecal origin is suppressed. While correlation between indicator organisms and diseases can vary greatly, as seen in several studies performed by the EPA and others, two indicator organisms *Esherichia coli* (*E. coli*) and enterococci species showed stronger correlation with incidence of disease than fecal coliform (USEPA, 2001). Recent advances have allowed for more accurate identification of pathogen sources. A few of these methods, including, molecular, biochemical, and chemical are briefly described in the following paragraph.

Molecular (genotype) methods are based on the unique genetic makeup of different strains, or subspecies, of fecal bacteria (Bowman et al, 2000). An example of this method includes "DNA fingerprinting" (i.e., a ribotype analysis which involves analyzing genomic DNA from fecal *E. coli* to distinguish human and non-human specific strains of *E. coli*.). Biochemical (phenotype) methods include those based on the effect of an organism's genes actively producing a biochemical substance (Graves et al., 2002; Goya et al 1987). An example of this method is multiple antibiotic resistance (MAR) testing of fecal *E. coli*. In MAR testing, *E. coli* are isolated from fecal samples and exposed to 10-15 different antibiotics. In theory, *E. coli* originating from wild animals should show resistance to a smaller number of antibiotics than *E. coli* originating from humans or pets. Given this general trend, MAR patterns or '"signatures" can be defined for each class of *E. coli* species. Chemical methods are based on finding chemical compounds associated with human wastewater, and useful in determining if the sources are human or non-human. Such methods measure the presence of optical brighteners, which are contained in all laundry detergents, and soap surfactants in the water column. Unlike the optical brightener method, the measurement of surfactants may allow for some quantification of the source.

MST methods have already been successfully employed at the Department in the past decade. Since 1988, the Department has worked cooperatively with the University of North Carolina in developing and determining the application of RNA coliphage as a pathogen indicator. This research was funded through USEPA and Hudson River Foundation grants. These studies showed that the RNA coliphages are useful as an indicator of fecal contamination, particularly in chlorinated effluents and that they can be serotyped to distinguish human and animal fecal contamination. Through these studies, the Department has developed an extensive database of the presence of coliphages in defined contaminated areas (point human, non-point human, point animal, and non-point animal).

More recently, the Department has established a MST methodolgy that utilizes both genotype (genotyping of F+RNA coliphages) and phenotype (MAR testing) tests. The results of these tests are collectively evaluated to best determine sources of fecal contamination. The Bureau's methodology includes evaluation of long-term microbial results as well as data (GIS Land use coverage, aerial photographs, visual assessments) of actual and potential sources, stormwater monitoring to delineate location of major sources and the use of MAR and F+ coliphage in conjunction with conventional microbial indicators. This methodology has been successfully applied in several areas including; Seaside Park, Long Swamp, Atlantic City, and Parvin State Park. This methodology will be utilized on select TMDL segments as indicated.

<u>Visual Assessment:</u>

Through the watershed management process and the New Jersey Watershed Ambassadors Program, visual surveys of the impaired segment watersheds were conducted to identify potential sources of fecal coliform. Watershed partners, who are intimately familiar with local land use practices, were able to share information relative to potential fecal coliform sources. The New Jersey Watershed Ambassadors Program is a community-oriented AmeriCorps environmental program designed to raise awareness about watershed issues in New Jersey. Through this program, AmeriCorps members are placed in watershed management areas across the state to serve their local communities. Watershed Ambassadors monitor the rivers of New Jersey through visual assessments and biological assessment volunteer monitoring programs. Supplemental training is provided to prepare the members to perform river assessments on the fecal impaired segments. Each member is provided with detailed maps of the impaired segments within their watershed management area. The Department worked with and through watershed partners and AmeriCorps members to conduct visual assessments in March/April 2005.

The Department reviewed monitoring data, visual assessments, other information supplied by watershed partners, load duration curves, and aerial photography of the impaired segments to formulate segment specific strategies. Segment specific monitoring strategies in combination with generic strategies appropriate to the sources in each segment will lead to reductions in fecal coliform loads in order to attain SWQS.

Segment Specific Recommendations

Watershed Management Area 1

Honey Run near Hope (Site ID #01445900)

This segment's primary land uses are field, forest, agriculture, and residential. Potential sources of fecal coliform include: drainage from tributaries (Muddy Brook/Buckaloo Creek) containing waterfowl; horses and other livestock; septic tanks in older development on steep slopes; and Swayze Mill Park recreational area near a large pond in proximity to Honey Run.

Monitoring: fecal coliform to narrow the scope and source of impairment; Coliphage and MAR to differentiate human, domestic and wildlife sources. Strategies: prioritize for EQIP funds to install agriculture BMPs; Phase II stormwater program.

Lopatcong Creek at Main St in Phillipsburg (Site ID #DRBCNJ0028)

This segment's primary land uses are commercial, agriculture, and residential. The segment includes fairgrounds, a golf course, and an animal hospital. Thus, domestic animals and wildlife are possible sources contributing to fecal coliform. There is an outfall pipe with an unknown drainage source present in the higher density recreational/housing areas in Phillipsburg along Lock St. that should be investigated. Monitoring: fecal coliform survey to narrow the scope and source of impairment; Coliphage and MAR to differentiate human, domestic and wildlife sources. Strategies: prioritize for EQIP funds to install agriculture BMPs; Phase II stormwater program.

Musconetcong River at Lockwood (Site ID #01455801)

Primary land uses in this area are forest and residential. A potential source contributing to fecal coliform is the abundance of wildlife existing in this area, in addition to residential runoff. Monitoring: fecal coliform sampling is recommended in order to confirm and refine the extent of impairment. Strategies: Phase II stormwater program.

Paulins Kill at Warbasse Junction Rd near Lafayette (Site ID #01443250)

Primary land uses in this area are forest, wetlands, agriculture, and residential. Potential sources contributing to fecal coliform include wildlife and livestock from farm production. Monitoring: fecal coliform survey to narrow the scope and sources of impairment. Strategies: prioritize for EQIP funds to install agriculture BMPs; Phase II stormwater program.

Pohatcong Creek at River Rd. Bridge (Site ID #DRBCNJ0027)

This segment's primary land uses include rural, agriculture, residential and a wildlife preserve. Within two miles upstream of its confluence with the Delaware River, several farms containing livestock are located within close proximity of the stream. A farm near the intersection of Creek Rd. and Mountain Rd., which houses livestock, contains an outfall draining into a stormwater inlet that leads directly into the Pohatcong. There are also a large chicken operation in the vicinity of Edison Rd. and Asbury Broadway Rd. and several farms with livestock enclosures upstream from this point. Pohatcong Creek Park contains a large population of waterfowl. There is also residential housing on septic systems in this area located in the floodplain, very close to the waterway. Monitoring: fecal coliform survey to narrow the scope and sources of impairment; Coliphage and MAR to differentiate human, domestic and wildlife sources. Strategies: prioritize for EQIP funds to install agriculture BMPs; Phase II stormwater program.

Watershed Management Area 11

Hakihokake Creek at Bridge St Bridge in Milford (Site ID #DRBCNJ0023)

This segment's primary land uses are forest, rural, and residential. Potential sources of fecal coliform include: several houses containing septic systems, an outhouse approximately ten feet from the stream, wildlife, including excessive populations of deer and bear, and farms containing horses and cows. Monitoring: fecal coliform to narrow the scope and source of impairment; Coliphage and MAR to differentiate human, domestic and wildlife sources. Strategies: prioritize for EQIP funds to install agriculture BMPs.

Jacobs Creek above Rt. 29 (Site ID #DRBCNJ0003)

This segment's primary land uses are residential, commercial, and agriculture. Possible sources contributing to fecal coliform may be septic systems from houses in residential areas, horses grazing in fields containing a drainage ditch to the stream, and a vast geese population in fields and corporate lawns of Merrill Lynch and Janssen Pharmaceuticals. Monitoring: fecal coliform to narrow the scope and source of impairment. Strategies: prioritize for EQIP funds to install agriculture BMPs; organize local community based goose management programs; Phase II stormwater program.

Wickecheoke Creek at Croton (Site ID #01461220), Wickecheoke Creek at Stockton (Site ID #01461300 & DRBCNJ0012), and Wickecheoke Creek near Sergenstville (Site ID #01461282)

Primary land uses in this area are forest, wetlands, and agriculture. Potential sources of fecal coliform include wildlife and livestock from agriculture production. Monitoring: fecal coliform survey to narrow the scope of impairment. Strategies: prioritize for EQIP funds to install agriculture BMPs.

Short Term Management Strategies

Short term management measures include projects recently completed, underway and planned, which will address sources of fecal coliform load. Pertinent projects in the Northwest are as follows:

WMA 1

- North Jersey RC & D, NRCS received a 319 (h) grant during SFY 01 in the amount of $412,000.00. The project will include a dam removal, as well as a buffer planning and stream bank restoration on the Lopatcong at the Agway in Phillipsburg. In addition, this grant included a buffer planting on the Paulinskill at Footbridge Park in Blairstown. Future work, in regards to this grant, will include a stream bank restoration at a site in Greenwich Township along the Pohatcong. This project is scheduled to be finished June of 2006.

WMA 11

- The New Jersey Water Supply Authority (NJWSA) received a 319 (h) grant during SFY 05 in the amount of $77,970.00 to develop a watershed restoration and protection plan for the Lockatong and Wickecheoke Creek watershed. NJWSA will compile existing information and data, as well as complete additional field sampling to characterize the area. The plan will include watershed-based technical standards, educational efforts, remedial projects and other implementation methods as necessary. Ordinances will be identified, adapted and recommended for adoption by the municipalities as appropriate. The plan will emphasize opportunities to link assistance programs of farm preservation and other approaches to reduce pollutant loads from agricultural operations.

9.0 Reasonable Assurance

With the implementation of follow-up monitoring, source identification and source reduction as described in general and for each segment, the Department has reasonable assurance that New Jersey's Surface Water Quality Standards will be attained for fecal coliform.

The Department's ambient monitoring network will be the means to determine if the strategies identified have been effective. Where trackdown monitoring has been recommended, the results of this monitoring as well as ambient monitoring will be evaluated to determine if additional strategies for source reduction are needed.

10.0 Public Participation

The Water Quality Management Planning Rules NJAC 7:15-7.2 require the Department to initiate a public process prior to the development of each TMDL and to allow public input to the Department on policy issues affecting the development of the TMDL. Further, the Department shall propose each TMDL as an amendment to the appropriate areawide water quality management plan in accordance with procedures at N.J.A.C. 7:15-3.4(g). As part of the public participation process for the development and implementation of the TMDLs for fecal coliform in the Northwest Water Region, the Department worked collaboratively with a series of stakeholder groups as part of the Department's ongoing watershed management efforts.

The Department shared the Department's TMDL process through a series of presentations and discussions with the WMA 1, WMA 2, and WMA 11 PAC and TAC members. In June 2002 the Department gave a presentation on the New Jersey 2002 Integrated List of Waterbodies and the Water Quality Monitoring and Assessment Methodology to the Upper Delaware Watershed Project Work Group (WMA 1), and also encouraged submittal of any comments. On January 29, 2003 a presentation was given to the project Upper Delaware Project Work Group on the expedited TMDL process.

Various presentations on TMDL development were given to the Characterization and Assessment Committee (TAC) for WMA 11. Presentations included: Introduction to TMDLs, May 23, 2002; 2002 Integrated List and Methodology, May 23, 2002; and Fecal Coliform Expedited TMDLs, November 7, 2002. WMA 11 PAC also received the Fecal Coliform Expedited TMDL presentation on December 9, 2002.

Additionally, beginning in March of 2005, GIS maps, including aerial photographs as well as USGS topographical maps of each segment were made available on the Department's website for review and comment. Interested parties had the opportunity to supply the Department with information about each TMDL segment via e-mail. The Department specifically solicited information regarding potential sources and/or current non point sources of pollution reduction projects within the impaired streamsheds.

Additional input was received through the NJ EcoComplex (NJEC). The NJEC consists of a review panel of New Jersey University professors whose role is to provide comments on the Department's technical approaches for development of TMDLs and management strategies. The New Jersey Statewide Protocol for Developing Fecal TMDLs was presented to NJEC on August 7, 2002 and was subsequently reviewed and approved. The protocol was also presented at the SETAC Fall Workshop on September 13, 2002 and met with approval.

Amendment Process

In accordance with N.J.A.C. 7:15–7.2(g), these TMDLs have been proposed and will be adopted by the Department as amendments to the Mercer County Water Quality Management Plan, Northeast Water Quality Management Plan, Upper Delaware Water Quality Management Plan, Upper Raritan Water Quality Management Plan, and Sussex County Water Quality Management Plan.

The notice proposing the TMDLs was published on May 2, 2005 in the New Jersey Register and the Star Ledger. The TMDL documents were made available at the Department, upon request by mail, and on the Department's website. The Department conducted a non-adversarial public hearing on June 20, 2005. The public comment period ended on July 5, 2005.

Department initiated changes include the following:

1. The New Jersey Environmental Management System (NJEMS), which contains NJPDES permitted facility information evaluated during TMDL development, has been listed under "Data Sources". This has been added to the document.
2. The priority ranking and other impairments in the subject stream segments that are not addressed in this TMDL have been noted in the document.

Two comment letters were received on the TMDLs. Seven people attended the public hearing; none testified.

The following people submitted written comments on the proposal:

Jennifer A. Murphy, Staff Attorney and David J. Jablonski, Intern
Mid-Atlantic Environmental Law Center
c/o Widener University School of Law
4601 Concord Pike, P.O. Box 7474
Wilmington, Delaware 19803

Barbara Sachau
15 Elm Street
Florham Park, New Jersey 07932

A summary of comments to the proposal, and the Department's Responses to those comments follow. The number(s) in brackets at the end of each comment corresponds to the commenter(s) listed above.

Comment 1.
The Department does not indicate that it developed the Northwest Water Region (NWWR) TMDL with the USEPA's guidance document, "Protocol for Developing Pathogen TMDLs", First Edition, January 2001, USEPA Document Number EPA 841-R-00-002, ("Pathogen Protocol"). The Department does not express a rationale for not using the Pathogen Protocol. The Pathogen Protocol is the more specific guidance document, and should have been utilized in the development of the NWWR TMDL. (1)

Response 1.
The USEPA guidance document "Protocol for Developing Pathogen TMDLs" establishes an organizational framework for states to utilize in the development of pathogen TMDLs. The Department did utilize this guidance in the development of New Jersey's statewide protocol for fecal coliform TMDLs. This document is included as a reference in Section 10.0 of the NWWR TMDL.

Comment 2.
The NWWR TMDL does not contain an analysis of the sampling data used to construct the NWWR TMDL. The proposed TMDL does not distinguish between the 10 stream segments in any manner regarding sampling data and the SWQS exceedances evidenced by that sampling data. At the least, the NWWR TMDL should be more specific as to; the date and time of sampling events, the location of sampling events, (including which stream segment and the sample location in that stream segment), the type of samples collected for each sampling; date, the sampling methods employed, the method(s) of analysis and the detected concentration of the sample. (1)

Response 2.
All data used in the TMDL process is publicly accessible through the internet at http://waterdata.usgs.gov/nj/nwis/qw. All water quality data for each stream segment was fully assembled prior to performing the calculations found in Section 5.0 Water Quality Analysis of the TMDL document. This analysis was done for each segment separately. The sampling information has been added to the document as an appendix for added

convenience. The Department performs an analysis of all available water quality data for assessed waters statewide to determine compliance with the Surface Water Quality Standards biennially to compile the Integrated Water Quality Monitoring and Assessment Report. The methods the Department used to develop the 2004 Integrated List of Water Bodies are described in detail in the 2004 Integrated Water Quality Monitoring and Assessment Methods Document. All water bodies that appear on Sublist 5 of the Integrated List have been assessed relative to the New Jersey Surface Water Quality Standards and found to be in non-attainment of the standards.

Comment 3.

The NWWR TMDL does not contain a rationale as to why the Department decided to group these 10 stream segments under the same TMDL. Each of these waterbodies is in a different County, and both are in different watershed management areas (NWWR TMDL, p. 8, 13). The Department has not addressed the relevant and pertinent issues within each of these impaired Watersheds, which would support the Department's decision to propose one TMDL for both stream segments. (1)

Response 3.

To clarify, the Department is proposing separate TMDLs for each of the impaired segments, based on the water quality data relevant to each. For convenience of review and to avoid unnecessary duplication, considering the application of the same approved TMDL method on multiple streams, the Department has grouped the impaired segments by water region in a single document. Tailoring of strategies for addressing each of the impaired segments, taking into account unique characteristics of each segment, is reflected in the section "Segment Specific Recommendations".

Comment 4.

The Department does not specify whether any of the 11 point source dischargers identified within impaired watersheds, (NWWR TMDL, Appendix A, p. 38), has "routinely achieved essentially complete disinfection". NWWR TMDL, p. 16. The Department provides no analysis regarding the facilities' operational history or their locations. The Department does not specify whether these point sources have an effluent limitation for fecal coliform. NWWR TMDL, p. 16. The Department offers absolutely no support for its statement, "[t]he percent of the total point source contribution is an insignificant fraction of the total load". NWWR TMDL, p. 16. The NWWR TMDL is inadequate because there is no meaningful analysis of the 11 identified point sources, two of which are labeled "major" discharges, (NWWR TMDL, Appendix A, p. 38), and their impact on the 10 stream segments. (1)

Response 4.

In Sections 4.0 Source Assessment and 6.0 TMDL Calculations of the RWR TMDL, the Department identifies 11 wastewater treatment plants within the impaired watersheds, other than stormwater, which discharge to the impaired segments. Two are minor industrial discharges and nine are domestic treatment works, all of which contribute a de minimus load. The WLA is expressed as a 0% reduction. For clarity, the existing effluent limit for domestic treatment works has been added to the text and a map of the discharge locations has been added to the appendices. The noted discharges and municipal stormwater point sources are the only point sources, as this term is applied in TMDL development, in the impaired segments. WLAs are established for stormwater discharges subject to regulation under the Clean Water Act. In accordance with EPA guidance discussed in the document, stormwater point sources receive a WLA expressed as a percentage reduction for particular stream segments on the basis of land use. The Department recognizes sewage conveyances and septic malfunctions as potential sources of fecal coliform in Section 4.0 Source Assessment and in Section 8.0 Implementation, but is not aware of any actual malfunctions. This potential would be as the result of a malfunction, not by design. The Department investigates reports of noncompliance with NJPDES permits, illegal point and nonpoint discharges, and accidental discharges. These discharges are not considered ongoing point sources that warrant a WLA; rather, they are ephemeral events that are promptly addressed through compliance and enforcement measures as they occur. Segment specific recommendations include track down monitoring, as appropriate, to identify if any human sources, eg, malfunctioning conveyance systems or septic systems, are actually present. If such sources are found to exist, they will be referred for appropriate compliance measures and/or management measures. With regard to permitting of septic systems, Chapter 199 establishes requirements for septic system design and installation. Permitting for these systems is a local function, except that the Department certifies designs for development that includes 50 or more reality improvements.

Comment 5.
The Department mischaracterizes nonpoint sources of pathogen impairment by including sanitary sewer overflows (SSOs) as a nonpoint source of pathogen impairment. The Department contends that nonpoint sources include "inputs" that are not dependent on precipitation events including Sanitary Sewer Overflows (SSOs), (NWWR TMDL, p. 16). (1)

Response 5.
The commenter is correct that sanitary sewer overflows are point sources. However, there are no legally existing SSOs in New Jersey. Any discharge from a sanitary sewer line would be an event that is subject to compliance and enforcement action, and is, therefore, not characterized as an on-going point source. To avoid any confusion, the Department has revised the language in the TMDL document.

Comment 6.
The NWWR TMDL does not provide any location-specific sources of pathogen impairment in the 10 stream segments, nor does the NWWR TMDL provide a sufficient level of detail of the specific land uses and land cover present within the impaired stream watersheds. The Department has identified the following possible sources of pathogen impairment; failing sewage conveyances systems, SSOs, failing or inappropriately located septic systems, geese, wildlife, farms and domestic pets (NWWR TMDL, p.13). The Department does not discuss where or to what extent these sources are located within the impaired watersheds or spatially related to the rivers themselves. The Department should use a more detailed land use breakdown in the TMDL. (1)

Response 6.

The Department disagrees. Location specific information regarding sources is provided in the Segment Specific Recommendations section of the TMDL document. Further, the implementation plan describes the process by which, through the watershed restoration plans for priority segments, more detailed work plans for restoration will be developed. The land use classification system used in the TMDL document contains the most current land use information to assess sources. Land use is not used in these TMDLs to quantify pollutant loadings and, therefore, a more detailed analysis is not warranted.

Comment 7.

The Department does not discuss whether domestic or industrial wastewater sludge or other solid wastes are being land applied within the impaired watersheds. (1)

Response 7.

No dedicated domestic or industrial wastewater sludge land application sites are present within the impaired watersheds.

Comment 8.

The Department defines stormwater point sources, and distinguishes NJPDES permitted stormwater discharges from nonpoint sources, but does not indicate if any NJPDES stormwater point sources are within any of the 10 stream segments. The Department states, "stormwater discharged to the impaired segments through 'small municipal separate storm sewer systems' (MS4s) are regulated under the Department's Phase II Municipal Stormwater Regulation Program" (NWWR TMDL, p. 26-27). The Department has failed to identify the location of these MS4s within the impaired watersheds. In addition, the Department indicates does not specify when Phase II measures will be effective. The MS4 program should be fast tracked for these ten areas in order to actually implement the reductions through MS4 permits. (1)

Response 8.

With regard to MS4s, the Department has supplied the Tier A and Tier B classifications for the municipalities within the areas affected by the TMDLs as an appendix. All 566 municipalities within the State are assigned regulated as either Tier A or Tier B. Tier A municipalities are located within the more densely populated regions of the state or have drainage to the coast. Tier B municipalities are more rural and in non-coastal regions. Both Tier A and Tier B municipalities have NJPDES permits, but only Tier A municipalities are considered point sources under the Clean Water Act. This is explained in the TMDL report. Also explained are Statewide Basic Requirements (SBRs) applicable to each tier. More detail regarding the municipal stormwater permitting program can be found at the Department's website at njstormwater.org. The TMDL report explains that stormwater point sources are addressed by assigning a percent reduction as a WLA to land uses that are deemed equivalent to the areas regulated as point sources. Therefore, the location of these point sources is the urban land use area given in Figures 2, 3, 4, 5, 6, 8, 9, and 10 in the TMDL report. The implementation schedule for the municipal stormwater permitting program has already been set forth in rules and can be found at www.njstormwater.org. The Department believes that this schedule is sufficiently aggressive and would note that the requirements, such as street sweeping and inlet cleanout, are now operative.

Comment 9.

The Department contends, "[r]elating pathogen sources to in-stream concentrations is distinguished from quantifying that relationship for other pollutants given the inherent variability in population size and dependence not only on physical factors such as temperature and soil characteristics, but also on less predictable factors such as re-growth media" (NWWR TMDL, p. 16). The Department further contends the above facts warrant using "a concentration set to meet the state water quality standard" to express load capacity (NWWR TMDL, p. 17). The Department is essentially proposing to establish the loading capacity for the 10 streams as the SWQS. This is inadequate because the purpose of the TMDL is to ensure compliance with the SWQS. In addition, this method requires a less detailed analysis of the sources of pathogen impairment, and broader, less specific, decision-making regarding reductions in the identified sources of pathogen impairment. This is evidenced by the broad, generalized nature of the NWWR TMDL as a whole. The Department should allocate more resources to the source assessment portion of the TMDL. (1)

Response 9.

While the purpose of a TMDL is to identify the load of a pollutant that can be assimilated by a waterbody and still attain surface water quality standards and support designated uses, allocate that loading capacity to point sources, nonpoint sources and a margin of safety, the means to achieve the standards is through implementation of management measures that will result in the necessary load reductions. The Department believes that the technical approach used to establish the loading capacity should consider the uncertainties (gaps and variability) in the data, the ability to model and predict concentration response relative to loadings, and the predictability of achieving a load reduction from applying a given management measure. The approach used in these TMDLs is appropriate to the parameter being addressed, including the variability and unpredictability of sources and effectiveness of management measures. The inclusion of both an implicit and explicit Margin of Safety (MOS) as part of the TMDL calculation is a reflection of the uncertainties and provides for reasonable assurance that the standard will be met. EPA has accepted this TMDL approach in over 170 previously approved TMDLs. With regard to identification and implementation of management measures, the Department has gathered information on the impaired segments. Detailed stream characterization information has been gathered from many useful sources including: solicited public input, stream-walks conducted by Department-trained AmeriCorps members, and field visits. This information, as well as the generic approaches that apply to source types wherever they are found to exist, is the basis for the preliminary implementation plan, which includes a plan for source trackdown and identification, as needed. Through its watershed management initiative, the Department is developing detailed watershed restoration workplans for each stream segment with a TMDL, on a priority basis. These workplans take the preliminary implementation plan to the next level and are the basis for targeting available funds, as discussed in the TMDL report, to effect specific projects to achieve load reductions. The Department believes it is more effective in achieving water quality improvement to devote resources to implementation measures than to attempt to precisely quantify and model fecal coliform loads.

Comment 10.

The Department does not provide a discussion regarding why it chose to focus solely on bacteria when discussing the load capacity being expressed as a concentration (NWWR TMDL, p. 17). The Department does not discuss viruses or protozoa, generally grouped under the pathogen heading. (1)

Response 10.

Waterbodies are listed as impaired when a water quality standard or designated use is not attained. TMDLs are then prepared to determine the load reductions of a pollutant necessary to attain the standard/designated use. The TMDL for fecal coliform does not discuss other pathogens, such as viruses or protozoa, because the SWQS are expressed in terms of fecal coliform and there are no standards for specific pathogens, such as viruses or protozoa. The Department assesses streams for sanitary quality by using fecal coliform because it is a widely accepted indicator of the sanitary quality of the water. As stated in EPA Protocol for Developing Pathogen TMDLs, pathogenic organisms present in polluted water are few and difficult to isolate; therefore, an indicator organism is chosen because it is more easily sampled and measured. Indicator organisms are assumed to indicate the presence of all human pathogenic organisms.

Comment 11.

The Department does not provide sufficient detail on the relationship between the proposed percent reductions, the assigned WLAs and LAs and the eight source categories listed in Table 5 (NWWR TMDL, p. 24). In addition, the Department does not adequately explain how the percent reductions, the assigned WLAs and LAs and the calculated MOS will result in the ten stream segments meeting the SWQS in the future. The implementation plan proposed by the Department for the NWWR TMDL is insufficient because it lacks the specificity required to implement the purpose of the TMDL process, which is to ensure the attainment of the established water quality standards. (1)

Response 11.

The TMDL approach employed here does not attempt to model the relationship between load and concentration as previously explained. The Department's strategy is to reduce the nonpoint and stormwater point sources to the extent practicable using BMPs, based on the reasonable initial assumption that, if sources are controlled, SWQS will be attained. If, through follow up monitoring, it is determined that SWQS are not met, then, in accordance with the adaptive management paradigm, the Department will identify additional measures, such as stormwater management retrofits, that will be implemented in order to attain SWQS.

Comment 12.

There is no information provided regarding where the 115 monitoring stations in the Ambient Stream Monitoring Network (ASMN) program are in relation to the impaired stream segments.

In addition, the Department does not provide a link between the follow-up monitoring and the verification of attainment of the established percent reductions for the identified sources of pathogen impairment. (1)

Response 12.
Figures 1 and 2 in the TMDL report identify the locations of the monitoring stations within the impaired segments that were used to assess the segments, resulting in placement on Sublist 5 of the Integrated List. The ASMN program was used to compile the list of impaired waterbodies and will be used to evaluate SWQS attainment in the future. If the ASMN monitoring data demonstrates compliance with the SWQS, then TMDL implementation will be deemed successful and the waterbody will be place on Sublist 1. The follow-up monitoring discussed in the implementation section is intended for relative source identification to inform targeting management measures, not for effectiveness evaluation.

Comment 13.
The Department does not indicate why it has not been identifying and preventing unauthorized discharges from the wastewater collection systems in the impaired watersheds prior to the proposal of this TMDL. (1)

Response 13.
While the Department does not explicitly state it in the document, the Department and the entities maintaining the wastewater collection systems routinely respond to unauthorized discharges as they are identified.

Comment 14.
The Department offers no timeframe when they intend to implement the proposed management strategies in the impaired watersheds or when the fecal coliform SWQS for the impaired streams will be attained. (1)

Response 14.
The elements of the plan for attaining the SWQS will proceed over time and may be adjusted, as needed, through adaptive management, to respond to results of the ambient monitoring program, which will be assessed at least every two years, until attainment of SWQS is demonstrated. The Department is currently engaged in source track down efforts for the fecal coliform TMDLs established in 2003. Plans are being developed to expand this project to carry out the track down monitoring for the current suite of proposed fecal coliform TMDLs. Once the data are available from the current and expanded monitoring projects they will be assessed and will inform further development and/or refinement of management measures to implement the TMDLs. In addition, it should be noted that the measures required under the municipal stormwater permitting program are currently operative. Further, the Department is continually working through its watershed management initiative to implement nonpoint source reduction strategies within the 20 watershed management areas, consistent with established TMDLs, using available resources. The TMDL documents provide the basis upon which regulatory action can be taken to implement management strategies. The Department has been and continues to target available resources, like the

319(h) grant program, Corporate Business Tax (CBT) revenues, and allied grant programs for agricultural areas (EQIP, CRP and CREP) to address fecal coliform sources in the impaired segments for which TMDLs were completed. Follow up monitoring will determine where efforts need to be stepped up or redirected to attain SWQS. For example, if it is determined that additional measures are needed to address stormwater sources subject to the municipal stormwater permitting rules, these measures will become requirements under the general permits issued by the Department. Finally, the TMDL process and adoption of the TMDLs as amendments to the applicable area-wide Water Quality Management Plans (WQMPs) is significant because it assures that plan amendments and permitting throughout the Department are consistent with the TMDLs. For example, implementation of septic management districts may be required through wastewater management plan updates where septic system sources are identified.

Comment 15.

It is unclear why the segment specific sources of pathogen impairment were not identified and discussed under section 4.0 "Source Assessment". The Department should have identified these sources under that section, and allocated WLAs or LAs to them as appropriate. The Department states, "[e]fforts to identify sources include visual assessments and planned track-down monitoring, where appropriate" (NWWR TMDL, p. 29). The Department does not provide an explanation as to its rationale for not conducting these activities prior to proposing the NWWR TMDL. In addition, the Department will need to elaborate on its course of action, if the source track-down efforts result in findings contrary to the NWWR TMDL or shows the NWWR TMDL is inadequate. (1)

Response 15.

WLAs and LAs have been established for each category of source, by land use. As the management measures to be applied are land use related, this is the appropriate levelof detail for the WLAs and LAs. Detailed stream characterization information was gathered from many useful sources including: solicited public input, stream-walks conducted by Department-trained AmeriCorps members, and field visits. The Department relied on these information resources to tailor the segment specific recommendations in the implementation section. The data collected through track-down monitoring is intended and will be evaluated and used to inform implementation decisions. The Department's ambient monitoring network will be an on-going means to determine if SWQS have been and continue to be maintained or if adaptive management will direct refinement/enhancement of management measures.

Comment 16.

There is too much focus on birds and wildlife as the polluters, when the pollution should be attributed to the large human population in this state, and on factories and farming practices. Stormwater inlets should be cleaned up and pet waste collected. Wildlife and birds should be removed from this TMDL. (2)

Response 16.

The Department agrees that human sources, stormwater, pet waste and agriculture are among the sources of fecal coliform found in the waterbodies and has included them in the TMDL, but cannot ignore the wildlife sources as contributing to the fecal coliform present in the waterbodies. Wildlife populations in general are not a focus of implementation strategies. Overpopulation of certain wildlife species resulting from human activities, such as populations of Canada Geese, is a locally significant source of fecal contamination.

Comment 17. The Department should provide a greater level of detail as to why, "strategies for source reduction will apply equally well to new development as to existing development", in particular, the Department needs to discuss how it intends to implement the source reductions to new development in the impaired watersheds. (1)

Response 17. New development is expected to contribute a de minimus load relative to the existing land use it replaces. This is because stormwater associated with newly developed areas will be controlled by the new stormwater management control requirements, and, in MS4 regulated areas, by the requirements in the municipal stormwater permitting rules. This is expected to effectively avoid increases in storm driven sources.

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Appendix A: NJPDES Permitted Surface Discharges Located in the TMDLs' Project Areas

WMA	Station #	NJPDES	Facility Name	Discharge Type[a]	Receiving waterbody	WLA: de minimus source
1	DRBCNJ0028	NJ0004049	Phillipsburg Commerce Park	IMJ	Lopatcong Creek via unnamed trib	0% reduction
1	DRBCNJ0028	NJ0024716	Phillipsburg STP	MMJ	Lopatcong Creek	0% reduction
1	1455801	NJ0127850	Certified Aggregates Inc	IMI	Musconetcong River via ditch	0% reduction
1	1443250	NJ0024163	Big 'N' Shopping Center STP	MMI	Paulins Kill via unnamed trib	0% reduction
1	1443250	NJ0050580	Hampton Commons Wastewater Facility	MMI	Paulins Kill River via unnamed trib	0% reduction
1	1443250	NJ0020184	Town of Newton	MMJ	Moores Creek	0% reduction
1	DRBCNJ0027	NJ0020711	Warren Co Technical School STP	MMI	Pohatcong Creek	0% reduction
1	DRBCNJ0027	NJ0021113	Washington Borough WWTP	MMI	Pohatcong Creek	0% reduction
11	DRBCNJ0023	NJ0021890	Milford Sewer Utility	MMI	Hakihokake Creek	0% reduction
11	DRBCNJ0023	NJ0140619	Holland Twp Municipal Garage	IMI	Hakihokake Creek via unnmd trib & strm swr	0% reduction
11	01461220, 01461300 & DRBCNJ0012, 01461282	NJ0027561	Delaware Twp MUA	MMI	Wickecheoke Creek via unnamed trib	0% reduction

[a] "MMI" indicates a Municipal Minor discharge and "MMJ" indicates a Municipal Major discharge. "IMI" indicates a Industrial Minor discharge and "IMJ" indicates a Industrial Major discharge.

Appendix B: TMDL Calculations

Load Allocation (LA) and Margin of Safety (MOS)															
				200 FC/100ml Standard					400 FC/400ml Standard						
WMA	**303(d) Category 5 Segments**	**Water Quality Stations**	**Station Names**	N (# of values)	Geometric mean CFU/100ml	MOS as a percentage of the target concentration	Percent reduction without MOS	Percent reduction with MOS	Summer N	Summer geometric mean CFU/100 ml	MOS as a percentage of the target concentration	Percent reduction without MOS	Percent reduction with MOS	**Wasteload Allocation (WLA)**	**Period of records used in analysis**
1	01445900	01445900	Honey Run near Hope	10	570	51%	65%	83%	10	570	51%	88%	94%	94%	8/1/01-8/7/02
1	DRBCNJ0028	DRBCNJ0028	Lopatcong Creek at Main St in Phillipsburg	8	198	66%	-1%	66%	8	198	66%	66%	88%	88%	7/22/99-6/7/00
1	01455801	01455801	Musconetcong River at Lockwood	86	131	27%	-53%	-12%	46	256	27%	73%	81%	81%	7/14/76-10/17/91
1	01443250	01443250	Paulins Kill at Warbasse Junction Rd near Lafayette	10	831	42%	76%	86%	10	831	42%	92%	95%	95%	7/5/01-6/5/02
1	DRBCNJ0027	DRBCNJ0027	Pohatcong Creek at River Rd Bridge	29	544	41%	63%	78%	29	544	41%	88%	93%	93%	7/1/99-9/25/02
11	DRBCNJ0023	DRBCNJ0023	Hakihokake Creek at Bridge St Bridge in Milford	8	86	74%	-132%	40%	8	86	74%	21%	80%	80%	8/2/99-9/28/00
11	DRCBNJ0003	DRBCNJ0003	Jacobs Creek above Rt. 29	7	196	45%	-2%	44%	7	196	45%	65%	81%	81%	7/20/99-6/5/00
11	01461220, 01461300 & DRBCNJ0012, 01461282	01461220, 01461300, DRBCNJ0012, 01461282	Wickecheoke Creek at Croton, Wickecheoke Creek at Stockton, Wickecheoke	10	126	23%	-59%	-23%	77	167	23%	59%	69%	69%	2/6/80-8/6/02

			Creek near Sergenstville												

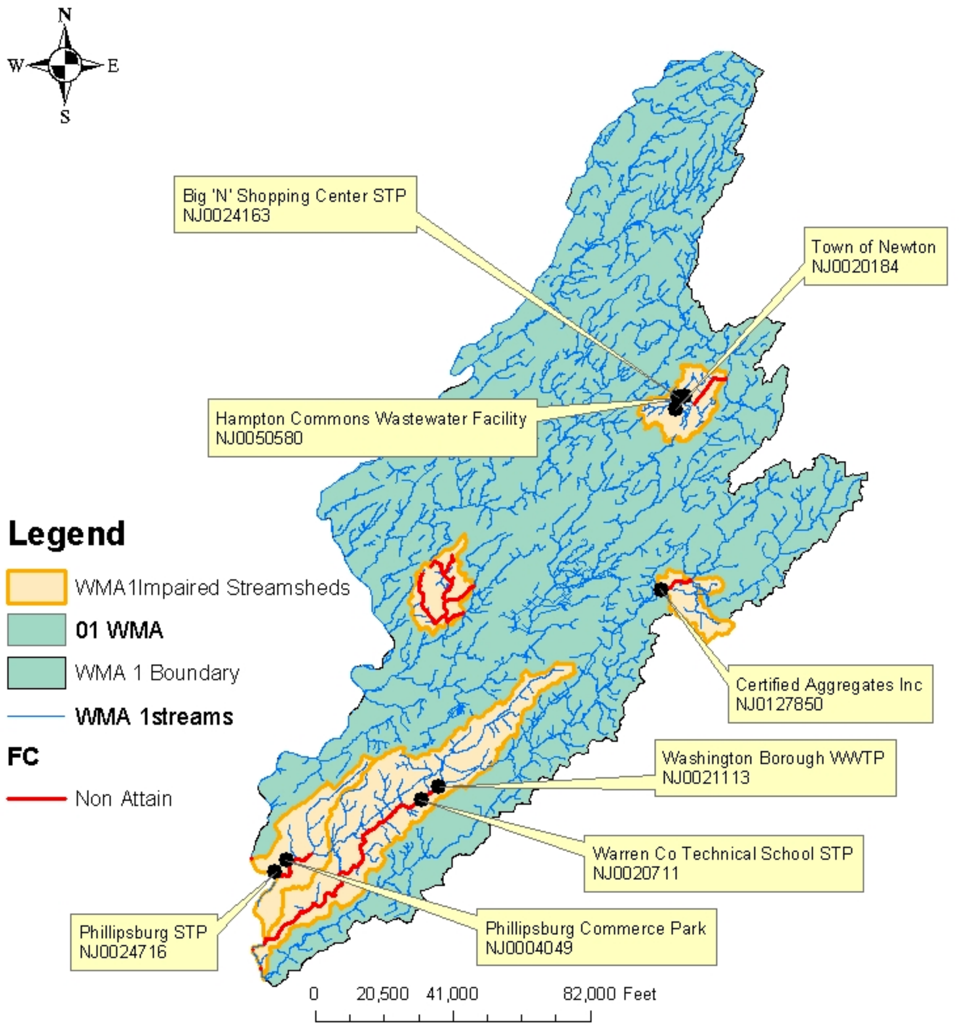
Appendix C: Tier A / Tier B Municipalities in Affected Drainage Areas

Station Name	Municipality	Discharge Type	NJPDES Permit No.
Honey Run near Hope	Blairstown	Tier B	NJG0153648
	Hope	Tier B	NJG0153001
	Knowlton	Tier B	NJG0153621
Lopatcong Creek at Main St in Phillipsburg	Harmony	Tier B	NJG0153061
	Lopatcong	Tier A	NJG0148881
	Phillipsburg	Tier A	NJG0149128
	Pohatcong	Tier A	NJG0149420
	Alpha Boro	Tier A	NJG0148334
	Greenwich	Tier A	NJG0151009
Musconetcong River at Lockwood	Byram	Tier A	NJG0149209
	Mount Olive	Tier A	NJG0148326
	Roxbury	Tier A	NJG0152641
	Stanhope	Tier A	NJG0151301
	Netcong	Tier A	NJG0151084
Paulins Kill at Warbasse Junction Rd near Lafayette	Hampton	Tier B	NJG0154644
	Lafayette	Tier B	NJG0151939

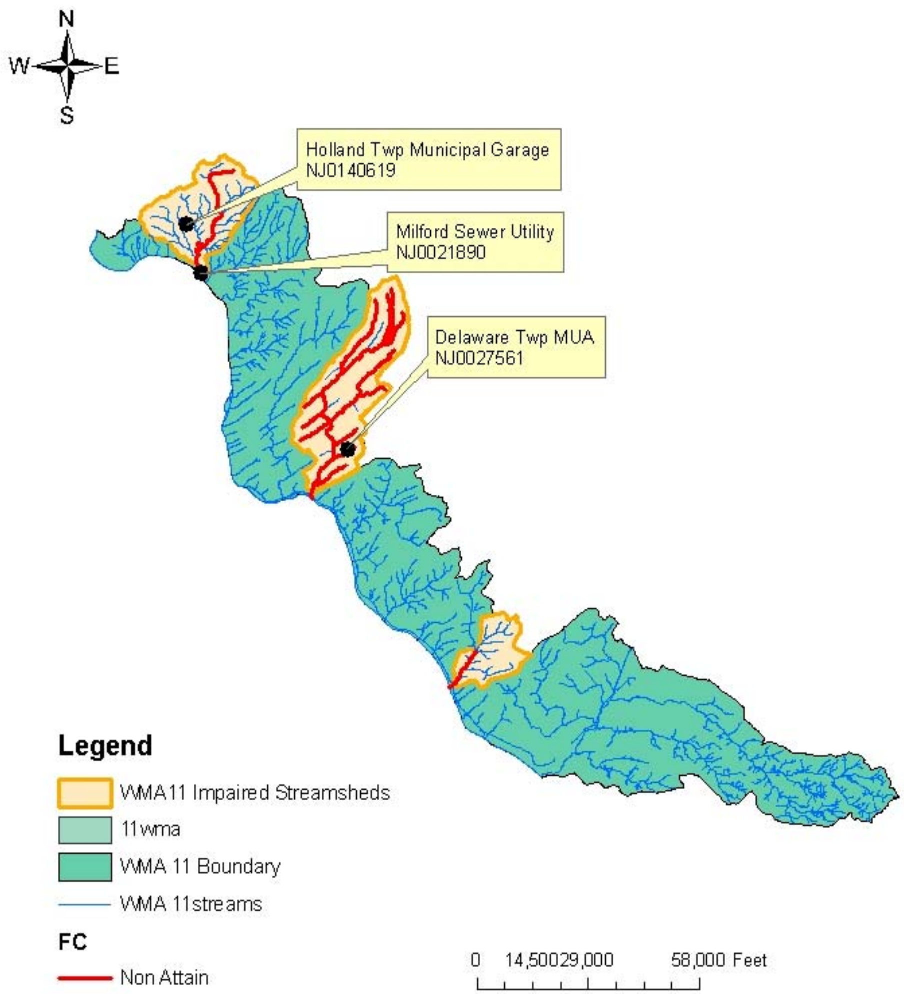
	Fredon	Tier B	NJG0152790
	Andover Twp	Tier A	NJG0153290
	Newton	Tier A	NJG0149969
Pohatcong Creek at River Rd Bridge	Pohatcong	Tier A	NJG0149420
	Alpha Boro	Tier A	NJG0148334
	Greenwich	Tier A	NJG0151009
	Harmony	Tier B	NJG0153061
	Lopatcong	Tier A	NJG0148881
	Franklin	Tier A	NJG0151025
	Washington	Tier A	NJG0149004
	Washington Boro	Tier B	NJG0147729
	Mansfield	Tier A	NJG0152633
	Independence	Tier A	NJG0153087
	White Twp	Tier B	NJG0149683
Hakihokake Creek at Bridge St Bridge in Milford	Alexandria	Tier B	NJG0149659
	Holland	Tier B	NJG0148024
	Union	Tier B	NJG0152978
	Bethlehem	Tier B	NJG0153010
	Milford Boro	Tier B	NJG0148211
Jacobs Creek above Rt. 29	Hopewell	Tier A	NJG0150622
	Ewing	Tier A	NJG0154393
	Pennington	Tier A	NJG0153141
Wickecheoke Creek at Croton	Franklin	Tire A	NJG0151025
	Raritan	Tier A	NJG0149241

	Kingwood	Tier B	NJG0152706
	Delaware	Tier B	NJG0150673
Wickecheoke Creek at Stockton	Franklin	Tier A	NJG0151025
	Raritan	Tier A	NJG0149241
	Kingwood	Tier B	NJG0152706
	Delaware	Tier B	NJG0150673
Wickecheoke Creek near Sergenstville	Franklin	Tier A	NJG0151025
	Raritan	Tier A	NJG0149241
	Kingwood	Tier B	NJG0152706
	Delaware	Tier B	NJG0150673

Appendix D: Dischargers in WMA 1 that are of interest for fecal coliform



Appendix E: Dischargers in WMA 11 that are of interest for fecal coliform



Appendix F: Sampling Data

Honey Run near Hope fecal coliform data (01445900)

USGS	Sampling Station	Date	Time	Results CFU/100 ml
USGS	1445900	8/1/2001	10:10	50
USGS	1445900	8/8/2001	9:15	490
USGS	1445900	8/15/2001	11:00	790
USGS	1445900	8/22/2001	10:30	700
USGS	1445900	8/29/2001	10:20	5400
USGS	1445900	7/10/2002	10:10	300
USGS	1445900	7/17/2002	10:22	230
USGS	1445900	7/24/2002	10:20	3000
USGS	1445900	7/31/2002	10:20	1400
USGS	1445900	8/7/2002	10:20	170

Lopatcong Creek at Main St in Phillipsburg fecal coliform data (DRBCNJ0028)

DRBC	Sampling Station	Date	Year	Results CFU/100 ml
DRBC	DRBCNJ0028	07/22/99	1999	80.0
DRBC	DRBCNJ0028	07/01/99	1999	13.0
DRBC	DRBCNJ0028	08/05/99	1999	
DRBC	DRBCNJ0028	08/19/99	1999	196.0
DRBC	DRBCNJ0028	07/26/00	2000	2000.0
DRBC	DRBCNJ0028	08/09/00	2000	
DRBC	DRBCNJ0028	09/13/00	2000	1480.0
DRBC	DRBCNJ0028	09/29/00	2000	
DRBC	DRBCNJ0028	06/21/00	2000	420.0
DRBC	DRBCNJ0028	07/12/00	2000	460.0
DRBC	DRBCNJ0028	08/23/00	2000	20.0
DRBC	DRBCNJ0028	06/07/00	2000	

Musconetcong River at Lockwood fecal coliform data (01455801)

USGS	Sampling	Date	Time	Results

	Station			CFU/100 ml
USGS	1455801	7/14/1976	10:00	230
USGS	1455801	8/9/1976	11:15	50
USGS	1455801	9/15/1976	12:00	330
USGS	1455801	10/18/1976	11:30	20
USGS	1455801	11/30/1976	11:30	50
USGS	1455801	8/1/1977	11:45	20
USGS	1455801	9/19/1977	11:40	1100
USGS	1455801	10/31/1977	12:00	9200
USGS	1455801	1/30/1978	12:30	1300
USGS	1455801	3/21/1978	11:45	630
USGS	1455801	4/17/1978	11:40	20
USGS	1455801	5/8/1978	11:55	16000
USGS	1455801	6/12/1978	11:20	2530
USGS	1455801	1/23/1979	12:10	70
USGS	1455801	3/27/1979	11:45	20
USGS	1455801	5/24/1979	11:45	5400
USGS	1455801	10/9/1979	12:45	20
USGS	1455801	2/28/1980	9:00	50
USGS	1455801	4/21/1980	13:00	20
USGS	1455801	6/4/1980	10:40	490
USGS	1455801	7/15/1980	11:00	230
USGS	1455801	8/13/1980	10:45	110
USGS	1455801	9/30/1980	11:40	170
USGS	1455801	1/29/1981	11:15	20
USGS	1455801	3/24/1981	11:30	20
USGS	1455801	5/20/1981	12:30	20
USGS	1455801	7/7/1981	12:30	110
USGS	1455801	8/3/1981	12:00	20
USGS	1455801	10/5/1981	11:45	330
USGS	1455801	1/27/1982	12:30	20
USGS	1455801	4/5/1982	12:00	20
USGS	1455801	6/9/1982	11:00	1300
USGS	1455801	7/13/1982	11:30	170

USGS	1455801	8/16/1982	11:45	70
USGS	1455801	10/27/1982	12:20	20
USGS	1455801	1/18/1983	11:45	20
USGS	1455801	3/17/1983	12:15	20
USGS	1455801	5/18/1983	12:15	170
USGS	1455801	7/12/1983	12:15	70
USGS	1455801	8/2/1983	12:00	130
USGS	1455801	9/22/1983	12:45	1100
USGS	1455801	1/25/1984	11:45	80
USGS	1455801	3/21/1984	11:45	20
USGS	1455801	5/16/1984	11:45	20
USGS	1455801	7/11/1984	12:00	20
USGS	1455801	8/7/1984	12:00	330
USGS	1455801	9/27/1984	12:00	700
USGS	1455801	1/24/1985	11:45	20
USGS	1455801	3/19/1985	12:15	20
USGS	1455801	5/22/1985	11:45	70
USGS	1455801	7/8/1985	12:00	170
USGS	1455801	8/12/1985	11:45	490
USGS	1455801	11/20/1985	12:00	80
USGS	1455801	2/5/1986	12:15	20
USGS	1455801	3/24/1986	12:00	20
USGS	1455801	5/21/1986	12:30	490
USGS	1455801	7/15/1986	12:15	170
USGS	1455801	8/5/1986	12:00	220
USGS	1455801	10/15/1986	12:15	110
USGS	1455801	2/25/1987	12:15	20
USGS	1455801	4/1/1987	12:15	790
USGS	1455801	5/26/1987	12:30	330
USGS	1455801	7/16/1987	12:00	330
USGS	1455801	8/26/1987	12:15	80
USGS	1455801	11/4/1987	13:00	20
USGS	1455801	2/3/1988	12:00	20
USGS	1455801	5/12/1988	10:45	230
USGS	1455801	6/2/1988	12:45	230
USGS	1455801	7/5/1988	12:00	460

USGS	1455801	8/15/1988	12:00	1300
USGS	1455801	10/26/1988	11:00	130
USGS	1455801	1/24/1989	12:00	220
USGS	1455801	4/20/1989	13:30	80
USGS	1455801	6/20/1989	10:45	70
USGS	1455801	7/18/1989	12:15	170
USGS	1455801	8/31/1989	11:15	3500
USGS	1455801	11/28/1989	10:30	220
USGS	1455801	3/1/1990	12:15	20
USGS	1455801	7/24/1990	13:30	1300
USGS	1455801	8/7/1990	12:00	5400
USGS	1455801	10/29/1990	13:20	130
USGS	1455801	2/6/1991	12:30	40
USGS	1455801	3/26/1991	12:45	20
USGS	1455801	6/24/1991	12:30	230
USGS	1455801	8/7/1991	10:45	80
USGS	1455801	10/17/1991	12:30	5400

Paulins Kill at Warbasse Junction Rd near Lafayette fecal coliform data (01443250)

USGS	Sampling Station	Date	Time	Results CFU/100 ml
USGS	1443250	7/5/2001	10:40	490
USGS	1443250	7/11/2001	11:05	2200
USGS	1443250	7/18/2001	10:50	790
USGS	1443250	7/25/2001	11:30	460
USGS	1443250	8/1/2001	11:15	790
USGS	1443250	5/8/2002	10:45	400
USGS	1443250	5/15/2002	10:15	3000
USGS	1443250	5/22/2002	11:35	170
USGS	1443250	5/29/2002	10:25	5000
USGS	1443250	6/5/2002	10:45	500

Pohatcong Creek at River Rd Bridge fecal coliform data (DRBCNJ0027)

DRBC	Sampling Station	Date	Year	Results CFU/100 ml
DRBC	DRBCNJ0027	07/01/99	1999	880.0
DRBC	DRBCNJ0027	07/22/99	1999	2400.0
DRBC	DRBCNJ0027	08/05/99	1999	
DRBC	DRBCNJ0027	08/19/99	1999	320.0
DRBC	DRBCNJ0027	08/09/00	2000	
DRBC	DRBCNJ0027	07/12/00	2000	30.0
DRBC	DRBCNJ0027	07/26/00	2000	550.0
DRBC	DRBCNJ0027	09/13/00	2000	1180.0
DRBC	DRBCNJ0027	06/21/00	2000	510.0
DRBC	DRBCNJ0027	08/23/00	2000	380.0
DRBC	DRBCNJ0027	06/07/00	2000	
DRBC	DRBCNJ0027	09/29/00	2000	
DRBC	DRBCNJ0027	07/26/01	2001	21200.0
DRBC	DRBCNJ0027	06/21/01	2001	770.0
DRBC	DRBCNJ0027	08/09/01	2001	355.0
DRBC	DRBCNJ0027	08/22/01	2001	550.0
DRBC	DRBCNJ0027	09/12/01	2001	310.0
DRBC	DRBCNJ0027	09/26/01	2001	3910.0
DRBC	DRBCNJ0027	07/12/01	2001	1380.0
DRBC	DRBCNJ0027	05/24/01	2001	3500.0
DRBC	DRBCNJ0027	06/07/01	2001	760.0
DRBC	DRBCNJ0027	05/10/01	2001	300.0
DRBC	DRBCNJ0027	07/26/01	2001	22320.0
DRBC	DRBCNJ0027	05/09/02	2002	400.0
DRBC	DRBCNJ0027	05/23/02	2002	600.0
DRBC	DRBCNJ0027	06/04/02	2002	300.0
DRBC	DRBCNJ0027	06/20/02	2002	620.0
DRBC	DRBCNJ0027	07/10/02	2002	40.0
DRBC	DRBCNJ0027	07/24/02	2002	460.0
DRBC	DRBCNJ0027	08/07/02	2002	280.0
DRBC	DRBCNJ0027	08/21/02	2002	230.0

DRBC	DRBCNJ0027	09/12/02	2002	420.0
DRBC	DRBCNJ0027	09/25/02	2002	4.0

Hakihokake Creek at Bridge St Bridge in Milford (DRBCNJ0023)

DRBC	Sampling Station	Date	Year	Results CFU/100 ml
DRBC	DRBCNJ0023	08/02/99	1999	
DRBC	DRBCNJ0023	08/24/99	1999	1.0
DRBC	DRBCNJ0023	07/06/99	1999	264.0
DRBC	DRBCNJ0023	07/27/99	1999	9.0
DRBC	DRBCNJ0023	07/11/00	2000	190.0
DRBC	DRBCNJ0023	09/12/00	2000	40.0
DRBC	DRBCNJ0023	08/08/00	2000	
DRBC	DRBCNJ0023	07/25/00	2000	760.0
DRBC	DRBCNJ0023	06/20/00	2000	670.0
DRBC	DRBCNJ0023	08/22/00	2000	330.0
DRBC	DRBCNJ0023	09/28/00	2000	

Jacobs Creek above Rt. 29 (DRBCNJ0003)

DRBC	Sampling Station	Date	Year	Results CFU/100 ml
DRBC	DRBCNJ0003	07/20/99	1999	1240.0
DRBC	DRBCNJ0003	08/17/99	1999	228.0
DRBC	DRBCNJ0003	06/29/99	1999	144.0
DRBC	DRBCNJ0003	08/02/99	1999	
DRBC	DRBCNJ0003	09/11/00	2000	140.0
DRBC	DRBCNJ0003	07/10/00	2000	240.0
DRBC	DRBCNJ0003	07/24/00	2000	50.0
DRBC	DRBCNJ0003	08/21/00	2000	160.0
DRBC	DRBCNJ0003	08/07/00	2000	
DRBC	DRBCNJ0003	09/27/00	2000	
DRBC	DRBCNJ0003	06/05/00	2000	

Wickecheoke Creek at Croton fecal coliform data (01461220)

Sampling Station	Date	Results CFU/100 ml
01461220	06/08/99	170
01461220	06/16/99	2400
01461220	06/22/99	170
01461220	06/24/99	330

Wickecheoke Creek at Stockton fecal coliform data (01461300)

USGS	Sampling Station	Date	Time	Results CFU/100 ml
USGS	1461300	2/6/1980	11:00	20
USGS	1461300	4/29/1980	10:30	1700
USGS	1461300	6/4/1980	12:45	700
USGS	1461300	7/16/1980	13:00	1800
USGS	1461300	8/20/1980	13:00	9200
USGS	1461300	10/1/1980	11:15	330
USGS	1461300	2/2/1981	12:30	24000
USGS	1461300	3/26/1981	13:30	20
USGS	1461300	6/3/1981	12:00	790
USGS	1461300	7/23/1981	11:00	490
USGS	1461300	8/26/1981	12:00	50
USGS	1461300	9/29/1981	9:45	130
USGS	1461300	2/25/1982	10:30	20
USGS	1461300	3/25/1982	13:45	20
USGS	1461300	6/2/1982	12:00	790
USGS	1461300	7/26/1982	11:30	60
USGS	1461300	8/26/1982	11:00	170
USGS	1461300	10/13/1982	13:15	20
USGS	1461300	1/27/1983	12:15	20
USGS	1461300	4/13/1983	11:30	50
USGS	1461300	6/9/1983	14:00	20
USGS	1461300	7/28/1983	11:00	20

USGS	1461300	8/24/1983	11:45	20
USGS	1461300	10/13/1983	10:15	490
USGS	1461300	1/18/1984	10:15	20
USGS	1461300	4/9/1984	11:30	20
USGS	1461300	5/21/1984	13:30	460
USGS	1461300	7/19/1984	13:45	2400
USGS	1461300	8/8/1984	13:45	230
USGS	1461300	9/24/1984	12:30	330
USGS	1461300	2/7/1985	12:00	20
USGS	1461300	4/17/1985	12:15	20
USGS	1461300	6/13/1985	11:20	20
USGS	1461300	7/24/1985	12:30	130
USGS	1461300	8/15/1985	11:45	130
USGS	1461300	10/24/1985	13:30	2400
USGS	1461300	2/4/1986	13:30	170
USGS	1461300	3/20/1986	13:30	20
USGS	1461300	5/20/1986	13:30	110
USGS	1461300	7/24/1986	11:45	80
USGS	1461300	8/7/1986	13:30	50
USGS	1461300	10/8/1986	14:00	40
USGS	1461300	1/29/1987	13:30	90
USGS	1461300	5/21/1987	12:30	20
USGS	1461300	7/28/1987	14:15	20
USGS	1461300	8/17/1987	11:00	330
USGS	1461300	10/8/1987	12:30	60
USGS	1461300	2/18/1988	12:15	60
USGS	1461300	3/30/1988	12:00	80
USGS	1461300	5/18/1988	11:00	1400
USGS	1461300	7/11/1988	12:30	170
USGS	1461300	8/22/1988	10:30	20
USGS	1461300	10/11/1988	11:30	20
USGS	1461300	2/8/1989	12:15	20
USGS	1461300	4/4/1989	11:45	130
USGS	1461300	5/22/1989	12:15	40
USGS	1461300	7/10/1989	12:30	130
USGS	1461300	8/2/1989	13:00	50

USGS	1461300	11/15/1989	13:30	20
USGS	1461300	3/1/1990	10:30	20
USGS	1461300	7/31/1990	11:45	110
USGS	1461300	8/16/1990	12:00	90
USGS	1461300	11/14/1990	13:00	140
USGS	1461300	2/4/1991	14:00	20
USGS	1461300	4/8/1991	12:00	20
USGS	1461300	5/20/1991	14:00	20

Wickecheoke Creek at Stockton fecal coliform data (DRBCNJ0012)

DRBC	Sampling Station	Date	Year	Results CFU/100 ml
DRBC	DRBCNJ0012	07/06/99	1999	128.0
DRBC	DRBCNJ0012	07/27/99	1999	200.0
DRBC	DRBCNJ0012	08/02/99	1999	
DRBC	DRBCNJ0012	08/24/99	1999	57.0
DRBC	DRBCNJ0012	07/10/00	2000	80.0
DRBC	DRBCNJ0012	06/19/00	2000	90.0
DRBC	DRBCNJ0012	08/07/00	2000	
DRBC	DRBCNJ0012	08/21/00	2000	330.0
DRBC	DRBCNJ0012	09/11/00	2000	310.0
DRBC	DRBCNJ0012	07/24/00	2000	1360.0
DRBC	DRBCNJ0012	06/05/00	2000	
DRBC	DRBCNJ0012	09/27/00	2000	
DRBC	DRBCNJ0012	08/07/01	2001	160.0
DRBC	DRBCNJ0012	09/25/01	2001	1040.0
DRBC	DRBCNJ0012	07/24/01	2001	65.0
DRBC	DRBCNJ0012	05/08/01	2001	54.0
DRBC	DRBCNJ0012	06/19/01	2001	500.0
DRBC	DRBCNJ0012	08/21/01	2001	50.0
DRBC	DRBCNJ0012	05/22/01	2001	7820.0
DRBC	DRBCNJ0012	07/10/01	2001	200.0
DRBC	DRBCNJ0012	09/17/01	2001	130.0
DRBC	DRBCNJ0012	06/05/01	2001	580.0

DRBC	DRBCNJ0012	07/10/01	2001	250.0
DRBC	DRBCNJ0012	05/07/02	2002	76.0
DRBC	DRBCNJ0012	05/21/02	2002	140.0
DRBC	DRBCNJ0012	06/05/02	2002	48.0
DRBC	DRBCNJ0012	06/18/02	2002	92.0
DRBC	DRBCNJ0012	07/09/02	2002	12.0
DRBC	DRBCNJ0012	07/23/02	2002	190.0
DRBC	DRBCNJ0012	08/06/02	2002	110.0
DRBC	DRBCNJ0012	08/20/02	2002	0.0
DRBC	DRBCNJ0012	09/10/02	2002	72.0
DRBC	DRBCNJ0012	09/24/02	2002	12.0

Wickecheoke Creek near Sergenstville fecal coliform data (01461282)

USGS	Sampling Station	Date	Time	Results CFU/100 ml
USGS	1461282	7/12/2001	9:30	490
USGS	1461282	7/19/2001	11:00	1100
USGS	1461282	7/26/2001	9:00	20
USGS	1461282	7/26/2001	10:00	3500
USGS	1461282	7/26/2001	10:30	790
USGS	1461282	7/26/2001	11:00	130
USGS	1461282	8/2/2001	9:30	50
USGS	1461282	8/9/2001	10:30	1700
USGS	1461282	7/9/2002	10:06	230
USGS	1461282	7/16/2002	10:31	110
USGS	1461282	7/25/2002	10:20	70
USGS	1461282	8/6/2002	11:07	500