Amendment to the Mercer County Water Quality Management Plan

Total Maximum Daily Load for Phosphorus to Address

HUC: 02040105240030-01
Miry Run Watershed
WMA 11
Northwest Water Region

Proposed:	February 5, 2007
Established:	July 25, 2007
Approved:	October 1, 2007
Adopted:	

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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 the list of impaired waterbodies. On October 4, 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). The *2004 Integrated List of Waterbodies* Sublist 5 identifies the segment of Miry Run identified in Table 1, as impaired with respect to phosphorus, as indicated by the presence of phosphorus concentrations in excess of standards.

The Department has recently proposed the *New Jersey 2006 Integrated Water Quality Monitoring and Assessment Report*, including the *2006 Integrated List of Waterbodies*, which identifies impairments based on Hydrologic Unit Code (HUC 14) assessment units rather than discrete monitoring locations. This change in assessment methodology allows establishment of a stable base of assessment units for which the attainment or non-attainment status of all designated uses within each subwatershed or assessment unit will be identified. Tables 1 and 2 below show the listing as it appeared on the both the 2004 and the proposed 2006 Integrated Lists. A Total Maximum Daily Load (TMDL) is required to be developed for each impairment listed on Sublist 5. A TMDL is developed to identify all the contributors of a pollutant of concern and the load reductions necessary to meet the Surface Water Quality Standards (SWQS) relative to that pollutant. This TMDL is established to address the phosphorus impairment in the waterbody identified in Table 1 and 2. Other listed parameters will be addressed in subsequent TMDL evaluations.

Table 1. Phosphorus Impaired Stream Segment in the Miry Run Watershed identified in the 2004 *Integrated List of Waterbodies* addressed in this Report

TMDL Number	WMA	Station Name/Waterbody	Site ID	Sublist	Proposed Action
1	11	Miry Run at Rt 533 at Mercerville	01463850	5	TMDL

Table 2. Assessment Unit identified in the proposed New Jersey 2006 *Integrated List of Waterbodies* addressed in this Report

TMDL Number	WMA	Assessment Unit Name	Assessment Unit ID	Use Impairment	Impaired Parameters	Proposed Action
1	11	Miry Run (Assunpink Cr)	02040105240030-01	Aquatic Life (general)	Total Phosphorus, pH, Dissolved Oxygen	TMDL for Phosphorus

This TMDL report includes implementation strategies to achieve SWQS for phosphorus, including an additional measure that will be included in the municipal stormwater permits for municipalities within the affected watersheds, which will require adoption of a fertilizer management ordinance. The TMDL in this report is established and will be adopted by the Department as an amendment 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.

1.0 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 Water Quality Monitoring and Assessment Report* combines these two assessments and, in the *Integrated List of Waterbodies*, 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 *New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report* the water quality impairments were identified by segment name and pollutant(s) or non-attained designated use responsible for the finding that the segment was impaired. Each segment was assessed using the data from one or more discrete monitoring locations that were determined to be representative of the water quality in that segment. This impaired segment delineation method was changed in 2006.

The proposed *New Jersey 2006 Integrated Water Quality Monitoring and Assessment Report* now identifies impairments based on designated use attainment and then lists the parameters responsible for the non-attainment of the designated use. The assessments are conducted for each of the seven categories of designated use, which include aquatic life, recreational use (primary and secondary contact), drinking water, fish consumption, shellfish harvesting (if applicable), agricultural water supply use and industrial water supply use. As shown in Table 2 above, the *2006 Integrated Water Quality Monitoring and Assessment Report* identifies the Assessment Unit Miry Run (Assunpink Creek) as being in a non-attainment status for the Aquatic Life designated use. The parameters which resulted in this non-attainment status were total phosphorus, dissolved oxygen and pH. The assessment unit did not meet the established Surface Water Quality Standards set for each parameter.

This report establishes one TMDL that addresses the phosphorus impairment in the Miry Run (Assunpink Creek) Assessment Unit, ID# 02040105240030-01. This TMDL includes management approaches to reduce phosphorus loadings from various sources in order to attain applicable Surface Water Quality Standards (SWQS) for phosphorus. As a result of this TMDL, phosphorus will be removed as a basis of impairment in the next listing cycle. In addition to the phosphorus impairment, the Miry Run (Assunpink Creek) Assessment Unit, ID# 02040105240030-01 is also listed for the pollutants dissolved oxygen and pH. These parameters will be addressed in future TMDLs. In September 2003, USEPA approved a fecal coliform TMDL for the segment identified as Miry Run at Rt. 533 at Mercerville (01463850), which is now within the subject assessment unit.

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 waterbody can assimilate without violating surface water quality standards and allocates that loading 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).

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 TMDL in this report addresses the following items in the May 20, 2002 guidance 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. Waste load 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.

2.0 POLLUTANT OF CONCERN, APPLICABLE SURFACE WATER QUALITY STANDARDS, AND AREA OF INTEREST

2.1 Pollutant of Concern

The pollutant of concern for this TMDL is phosphorus. For the assessment unit identified in Tables 3 and 4, phosphorus concentrations exceeded New Jersey's SWQS, found at N.J.A.C. 7-9B. This waterbody has a medium priority ranking on the 2004 *Integrated List of Waterbodies* and a high priority on the proposed 2006 *Integrated List of Waterbodies*.

Table 3. Waterbody Listed for Phosphorus Impairment as it Appears on the Adopted 2004 Integrated List of Waterbodies:

TMDL Number	WMA	Station Name/Waterbody	Site ID	County(s)	Impaired River Miles
1	11	Miry Run at Rt. 533 at Mercerville	01463850	Mercer	10.1
Total Impaired River Miles:					10.1

Table 4. Waterbody Listed for Phosphorus Impairment as it Appears on the Proposed New Jersey 2006 Integrated Water Quality Monitoring and Assessment Report:

TMDL Number	WMA	Assessment Unit Name	Assessment Unit ID	HUC area (acres)
1	11	Miry Run (Assunpink Cr)	02040105240030-01	7911.4

2.2 Applicable Surface Water Quality Standards

The Miry Run assessment unit is classified as FW2-Non Trout, Category Two. As stated in N.J.A.C. 7:9B-1.14(c) of the SWQS for Fresh Water 2 (FW2) waters, the standards for phosphorus are as follows:

> Phosphorus, Total (mg/l):
>
> i. Lakes: Phosphorus as total P shall not exceed 0.05 in any lake, pond, reservoir, or in a tributary at the point where it enters such bodies of water, except where site-specific criteria are developed pursuant to N.J.A.C. 7:9B-1.5(g)3.
>
> ii. Streams: Except as necessary to satisfy the more stringent criteria in paragraph i. above or where site-specific criteria are developed pursuant to N.J.A.C. 7:9B1.5(g)3, phosphorus as total P shall not exceed 0.1 in any stream, unless it can be demonstrated that total P is not a limiting nutrient and will not otherwise render the waters unsuitable for the designated uses.

Also as stated in N.J.A.C. 7:9B-1.5(g)2:

> Nutrient policies are as follows:
>
> Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, abnormal diurnal fluctuations in dissolved oxygen or pH, changes to the composition of aquatic ecosystems, or otherwise render the waters unsuitable for the designated uses.

In all FW2 waters, the designated uses are (NJAC 7:9B-1.12):

> 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.

2.3 Area of Interest

Watershed Management Area (WMA) 11, or the Central Delaware Tributaries Watershed Management Area, covers a 272 square miles area and includes all or parts of 24 municipalities within Hunterdon, Mercer, and Monmouth Counties. The northern section of WMA 11 is located within the Highlands

Region, while the southern and eastern sections are located within the Inner Coastal Plain, and the remaining of central sections are primarily within the Piedmont physiographic province. Land uses in this area range from agricultural to urban. Population over the past 10 years has greatly increased. The associated development has stressed water resources and impacted water quality. 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).

Miry Run is part of the Assunpink Watershed. Located in Mercer County, it includes portions of Hamilton Township, Washington Township, and West Windsor Township. Miry Run is 30.3 miles long and flows westerly, primarily through urban areas, into the Assunpink Creek and eventually into the Delaware River. 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 Road at Whitehead Mills Pond. The Miry Run watershed, as shown in Figure 1, covers 12 square miles. Miry Run, along with 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.

The 2004 *Integrated List of Waterbodies* lists one phosphorus impaired segment in the Miry Run watershed. This TMDL addresses 10.1 impaired river miles within the Northwest Water Region. Based on the detailed county hydrography stream coverage, approximately 30.3 overall stream miles are affected by the TMDLs due to the fact that implementation plans cover entire watersheds, not just impaired waterbody segments. The spatial extent of the impaired segment and HUC 14, as well as, the land use in the affected drainage area, are depicted in Figure 1 and Figure 2.

Figure 1. Spatial Extent of Miry Run Impaired Segment and Affected Drainage Area, WMA 11

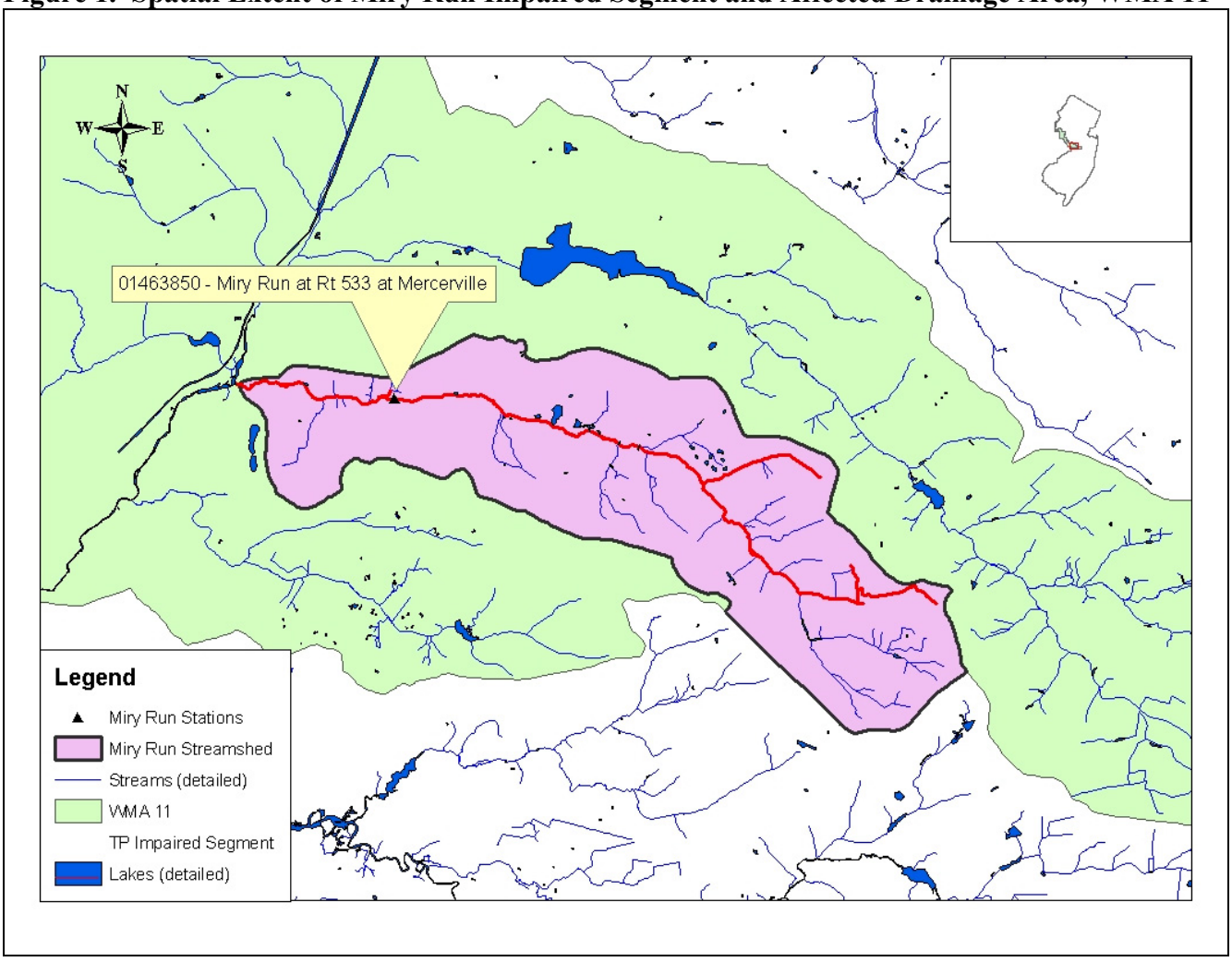
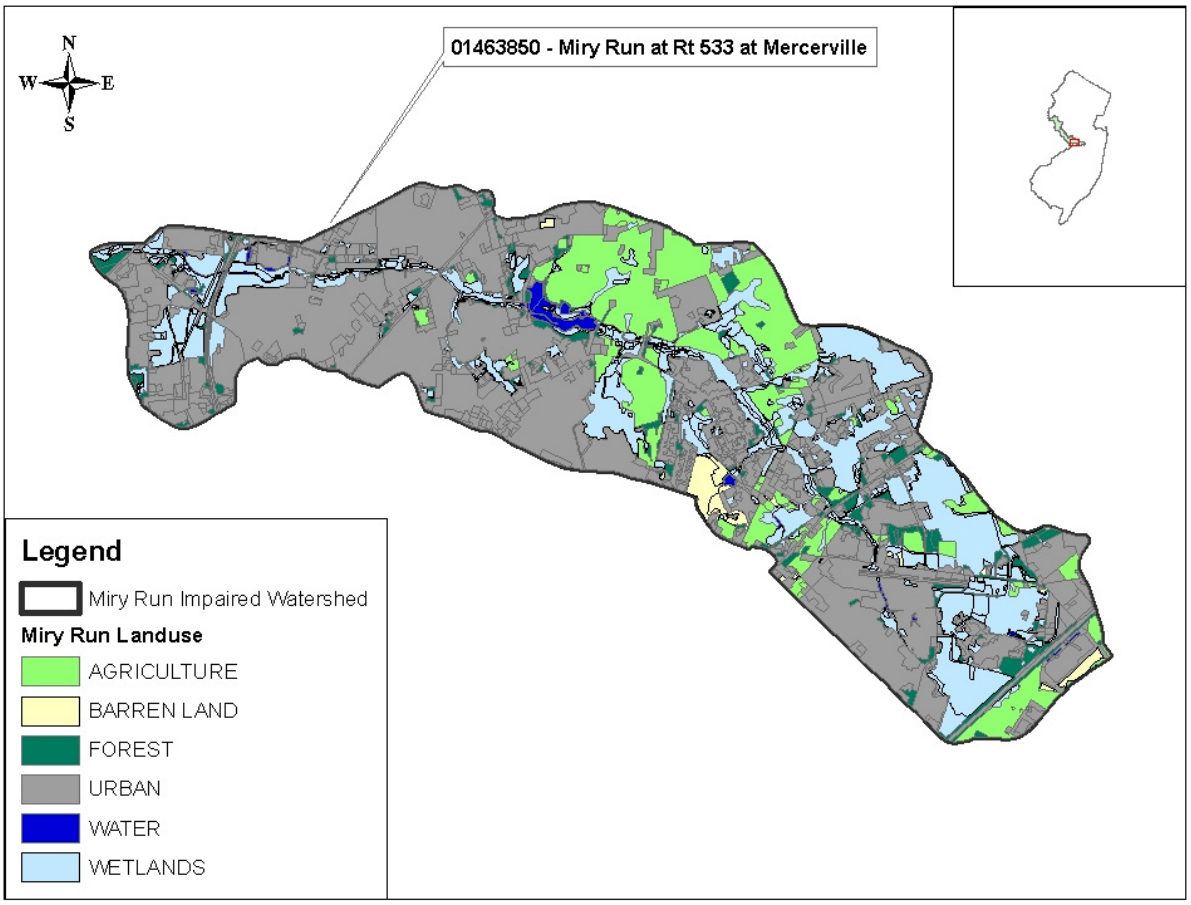


Figure 2. Land Uses in the Miry Run Watershed



Data Sources

Geographic Information System (GIS) data from the Department was used extensively to describe the Miry Run Watershed characteristics. In concert with the USEPA's November 2001 listing guidance, the Department is using Reach File 3 (RF3) from the 2004 Integrated Report to represent rivers, stream, lakes and lakesheds (watersheds of the lakes). The following is general information regarding the data used to describe the watershed management area:

- Land use/Land cover was taken from: "NJDEP 2002 Land use/Land cover Update for New Jersey (DRAFTS)", published 03/08/2005 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information Systems (BGIS), 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

- 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 NJDEP, New Jersey Geological Survey (NJGS). Online at: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/dephuc14.zip

- "NJDEP 11 Digit Hydrologic Unit Code delineations for New Jersey (DEPHUC11)", published 4/5/2000 by NJDEP, New Jersey Geological Survey (NJGS). Online at: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/dephuc11.zip

- "NJPDES Surface Water Discharges in New Jersey, (1:12,000)", published 09/12/2002 and updated in 2005 by NJDEP, Environmental Regulation (ER), Division of Water Quality (DWQ), Bureau of Point Source 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

- "NJDEP Surface Water Quality Standards of New Jersey", published 11/2003 by NJDEP, Division of Land Use Management, Bureau of Freshwater & Biological Monitoring. Online at: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/swqs.zip

- "Hydrological Features of New Jersey Feature Map Service, New Jersey State Plane NAD83", published 2005 by New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). Online at: Live Data and Maps (ArcIMS Feature Service) - Server=http://njgin.state.nj.us; Service=NJ_Hydrology_FS; ServiceType=feature

- "Municipal, County and State Boundaries of New Jersey Feature Map Service, New Jersey State Plane NAD83", published 2004 by New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). Online at: Live Data and Maps (ArcIMS Feature Service) Server=http://njgin.state.nj.us; Service=NJ_GovtBounds_FS; ServiceType=feature

- "Water Quality Management Areas", created 3/2002 by NJDEP, Water Assessment Team (WAT). Unpublished.

3.0 SOURCE ASSESSMENT

In order to evaluate and characterize phosphorus loadings in the impaired segment addressed in this TMDL, and thus propose proper management responses, source assessments are needed. Source assessments include identifying the types of sources and their relative contributions to phosphorus loadings, in both time and space variables.

3.1 Assessment of Point Sources

For the purposes of TMDL development, point sources include domestic and industrial wastewater treatment plants that discharge to surface water, as well as stormwater discharges subject to regulation under the National Pollutant Discharge Elimination System (NPDES). This includes facilities with individual or general industrial stormwater permits and Tier A municipalities and state and county facilities regulated under the New Jersey Pollutant Discharge Elimination System (NJPDES) municipal stormwater permitting program. Stormwater point sources, like nonpoint sources, derive their pollutant load from runoff from land surfaces and load reduction is accomplished through BMPs. The distinction is that stormwater point sources are regulated under the Clean Water Act.

There is one existing treatment facility with a point source discharge to surface water located in the Miry Run watershed. This facility, the Congoleum Corporation (NJ0004537), is a combined non-contact cooling water and stormwater permit. The Congoleum Corporation does not have any phosphorus inputs in their non-contact cooling water and does not use phosphorus in its manufacturing process. Therefore, total phosphorus generated from this facility will be adequately addressed though the land use loading approach used for other regulated stormwater sources. Also within the Miry Run Watershed, a NJPDES permit application was submitted to the Department for the Mercer County Community College (NJ0139831). The application is for commingled non-contact cooling water and facility stormwater. Currently, Mercer County Community College has a general stormwater permit under NJPDES permit no. NJG0154113. Both the general stormwater permit and the activity described in the permit application are adequately addressed through the land use approach used for other regulated stormwater sources. Other point sources contributing phosphorus loads within the affected drainage area include the Tier A municipalities listed in Appendix B. Stormwater point sources, like stormwater nonpoint sources, derive their pollutant loads from runoff from land surfaces and load reduction is accomplished through the use of best management practices (BMPs). The distinction is that stormwater point sources are regulated under the Clean Water Act (under the MS4 program). The regulated stormwater point sources are or will be addressed through the management practices required through the discharge permits.

3.2 Assessment of Nonpoint Sources

For the purposes of TMDL development, potential nonpoint sources include: stormwater discharges that are not subject to regulation under NPDES, such as Tier B municipalities, which are regulated under the NJPDES municipal stormwater permitting program; direct stormwater runoff from land surfaces; malfunctioning sewage conveyance systems, failing or inappropriately located septic systems; and direct contributions from wildlife, livestock and pets. Wildlife, particularly geese, are a known source within the watershed. A sizeable goose population is associated with the open meadow areas, depicted as agricultural land use, which surrounds a lake, all of which is within a county park. The land use in this area appears as agricultural on the land use/land cover maps, but is not managed as an agricultural use, wherein phosphorus loads would be added through fertilization. Therefore,

applying the agricultural loading coefficient adequately accounts for the goose population associated with this land use. There are no Tier B municipalities located in the affected drainage area.

The phosphorus loads in the affected watersheds are contributed by stormwater point sources and nonpoint sources. These loads are effectively estimated using loading coefficients for land uses present in the watersheds. Therefore, watershed loads for total phosphorus were estimated using the Unit Areal Load (UAL) methodology, which applies pollutant export coefficients obtained from literature sources to the land use patterns within the watershed, as described in USEPA's Clean Lakes Program guidance manual (Reckhow, 1979b). Land uses were determined using the Department's GIS system from the 1995/1997 land use coverage and are summarized in Table 5. The Department reviewed phosphorus export coefficients from an extensive database, refer to Appendix A, and selected the land use categories and values shown in Table 6. Existing loads based on these land uses and coefficients are presented below in Section 5.0 TMDL Calculations.

Table 5. River miles, Watershed size, and Area (by Anderson Land Use Classification) affected by phosphorus impairments in Miry Run Watershed, WMA 11

River miles and drainage area	**Miry Run**
Sublist 5 impaired river miles	10.1
Total river miles within watershed and included in the implementation plan	30.3
Watershed size in acres	7911.42
Landuse/Landcover	**Acres (% of LU/LC)**
Medium / high density residential	1950.23 (24.7%)
Low density / rural residential	1120.59 (14.2%)
Commercial	271.34 (3.4%)
Industrial	136.15 (1.7%)
Mixed urban / other urban	968.06 (12.2%)
Agricultural	1098.82 (13.9%)
Forest, wetland, water	2259.35 (28.5%)
Barren land	106.88 (1.4%)

Table 6. Phosphorus export coefficients (unit Areal Loads)

Land use / land cover	LU/LC codes*	UAL (kg TP/ha/yr)
Mixed density residential	1100	1.2
Medium / high density residential	1110, 1120, 1150	1.6
Low density / rural residential	1130, 1140	0.7
Commercial	1200	2.0
Industrial	1300, 1500	1.7
Mixed urban / other urban	other urban codes	1.0
Agricultural	2000	1.5
Forest, Wetland, Water	1750, 1850, 2140, 2150, 4000, 6000, 5000, 8000	0.1
Barren land	7000	0.5
Units:	1 hectare (ha) = 2.47 acres 1 kilogram (kg) = 2.2 pounds (lbs) 1 kg/ha/yr = 0.89 lbs/acre/yr	

*LU/LC code is an attribute of the land use coverage that provides the Anderson classification code for the land use. The Anderson classification system is a hierarchical system based on four digits. The four digits represent one to four levels of classification, the first digit being the most general and the fourth digit being the most specific description.

4.0 WATER QUALITY ANALYSIS

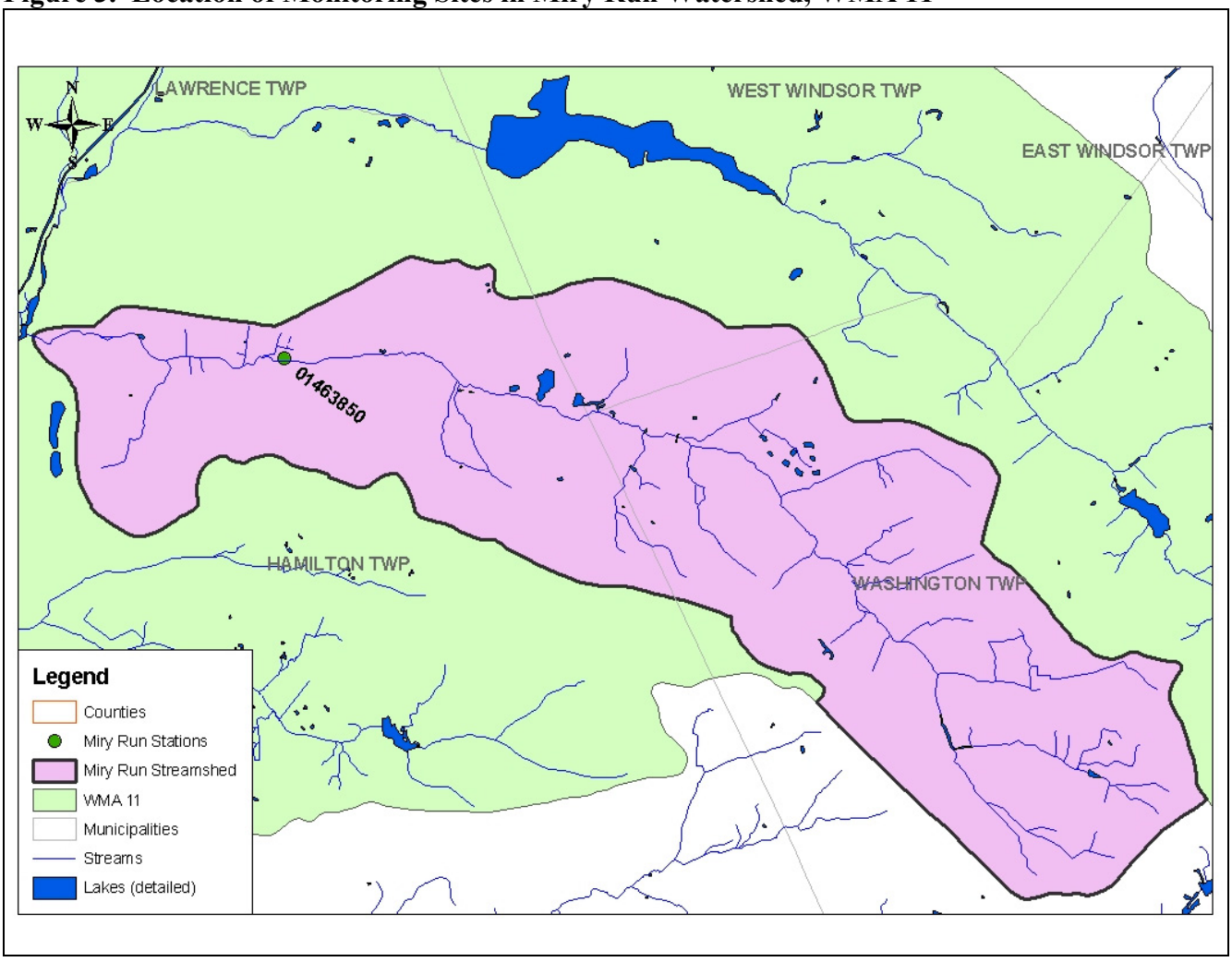
4.1 Impaired Segment Data

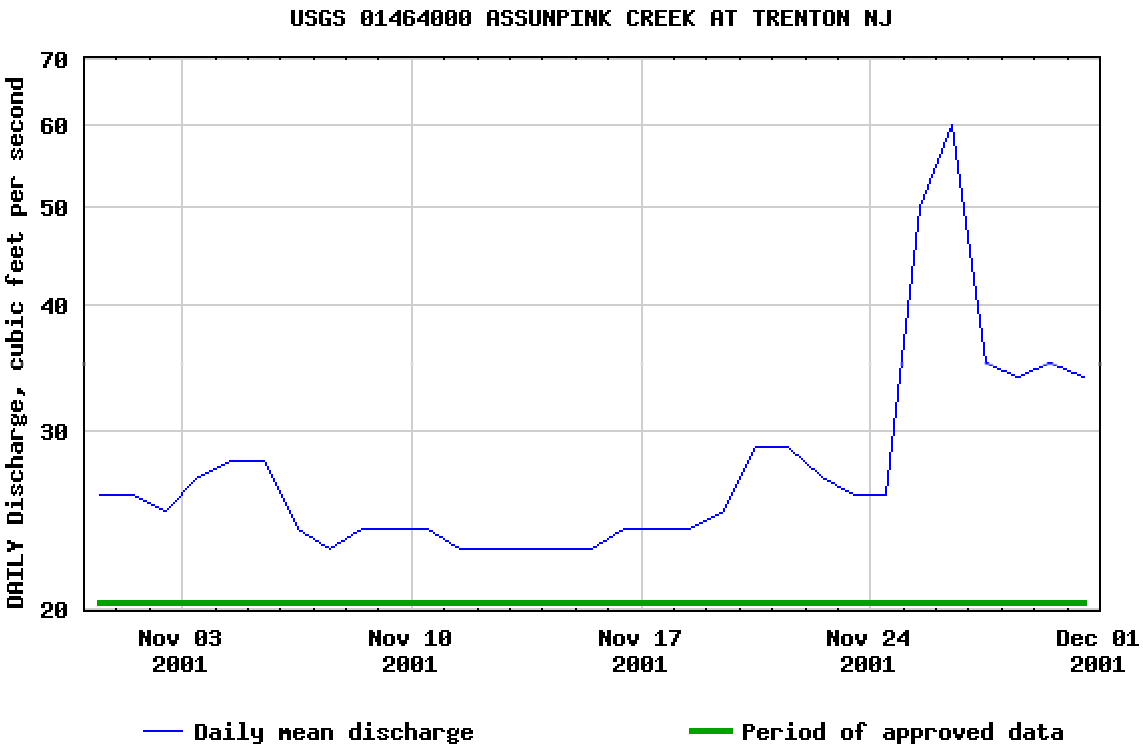
The United States Geological Survey (USGS) in collaboration with the Department has collected monitoring data at USGS Station (01463850), Miry Run at Rt 533 at Mercerville, from November 25, 1997 to August 17, 2004. Through the monitoring period, total phosphorus exceeded the SWQS of 0.1 mg/L on 3 occasions. Table 7 summarizes data collected and Figure 3 shows the monitoring station location. Data values are presented in Appendix C. Of the three exceedances (see Table 8), two occurred during low flow conditions. This does not initially appear to be consistent with nonpoint source dominance. However, the stream is flashy and the exceedances occur after a precipitation event punctuating an otherwise low flow period. This suggests that runoff containing accumulated load was delivered to the stream as the result of the precipitation event, after which the stream quickly returned to the low flow condition. The graphs below illustrate this phenomenon.

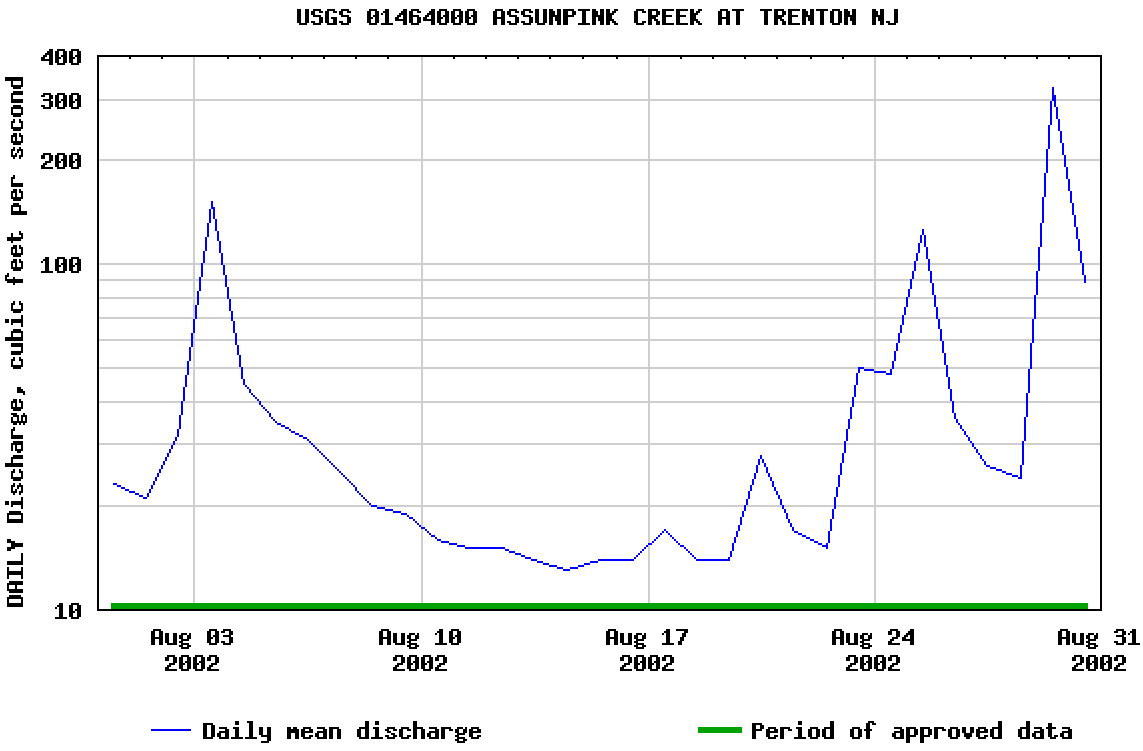
Table 7. Summary of Total Phosphorus sampling data for Miry Run in WMA 11

Water Quality Sample Locations	Site Number	# of samples	Average (mg/L)	% exceeding 0.10 mg/L
Miry Run at Rt 533 at Mercerville	01463850	28	0.07	10.7

Figure 3. Location of Monitoring Sites in Miry Run Watershed, WMA 11







4.2 Seasonal Variation/Critical Conditions

The application of a flow-integrated regression technique for determining loading reductions for impaired segments works well in watersheds that exhibit most of the loading exceedances from nonpoint and stormwater point sources of pollution. The analytical technique used to calculate this TMDL represents the entire range of flows and all seasons for which the total phosphorus data were collected. Since the technique uses data from annual monitoring programs, seasonal variation and critical conditions are incorporated into the analysis by assessing the loadings over the entire range of flows. Therefore, the method implicitly represents all seasonal meteorological and hydrological conditions. The loading reduction calculated to attain SWQS will do so under all conditions, according to the data available.

5.0 TMDL CALCULATIONS

A regression technique, derived from a load duration method (Stiles 2002), was developed by the Department for data-limited TMDLs where nonpoint and stormwater point sources are predominant. For this technique, linear regression is used to develop a flow-integrated relationship between measured pollutant concentrations and the associated flows at a single monitoring site. The method, known as the Flow-Integrated Reduction of Exceedances (FIRE), provides an accurate estimation of the load that will not cause an exceedance of the water quality standard. The FIRE method is applied over the entire range of flows, eliminating the need to establish a single target flow to estimate an average annual loading reduction. For this approach, calculated phosphorus loads based on actual data are plotted against corresponding flows. The regression relationship between the load and flow for exceedances of the SWQS is established and the regression line drawn. The target load line corresponding with the TP concentration of 0.1 mg/L is plotted on the same graph with the linear exceedance regression line (Equation 1). For this technique, a zero-intercept for the regression line is assumed. The zero intercept is within the 95 percent confidence interval, so the zero intercept cannot be rejected as the point of origin. In addition, given the predominance of stormwater driven sources, at zero flow there would be zero load. Given lines with a common intercept, the difference between the slopes of the two lines provides the percent load reduction needed to attain SWQS (Equation 2). The resultant percent reduction is the same whether the y-axis is expressed as pounds per day, pounds per year, or as metric units of kilograms per day or per year.

A Margin of Safety (MOS) must be provided to account for "lack of knowledge concerning the relationship between effluent limitations and water quality" (40 CFR 130.7(c)). A MOS accounts for uncertainty in the loading estimates, physical parameters and the model itself. The MOS, as described in USEPA guidance (Sutfin, 2002), can be either explicit or implicit (i.e., addressed through conservative assumptions used in establishing the TMDL). For this TMDL calculation, an explicit MOS has been incorporated as described below.

The margin of safety is calculated by taking the difference between the exceedance regression line and the 95 percent confidence limit for the regression (Equation 3). The percent load reduction needed to attain the SWQS is applied to the existing load to obtain the target load. The load associated with margin of safety is then reserved and the remaining load is allocated to the various land-use source categories (Appendix D).

For Miry Run at Rt. 533 at Mercerville, Station # 01463850, the regression results are presented in Tables 8 and 9, and Figure 4 below.

Table 8. Phosphorus Exceedances at Station ID Miry Run at Rt. 533 at Mercerville

Station Number	Date	Flow (cfs)	TP (mg/L)
01463850	8/3/2000	25	0.119
01463850	11/26/2001	0.25	0.42
01463850	8/6/2002	0.06	0.184

Figure 4. Estimated Percent Reduction for the Station ID Miry Run at Rt. 533 at Mercerville Using a Regression Method

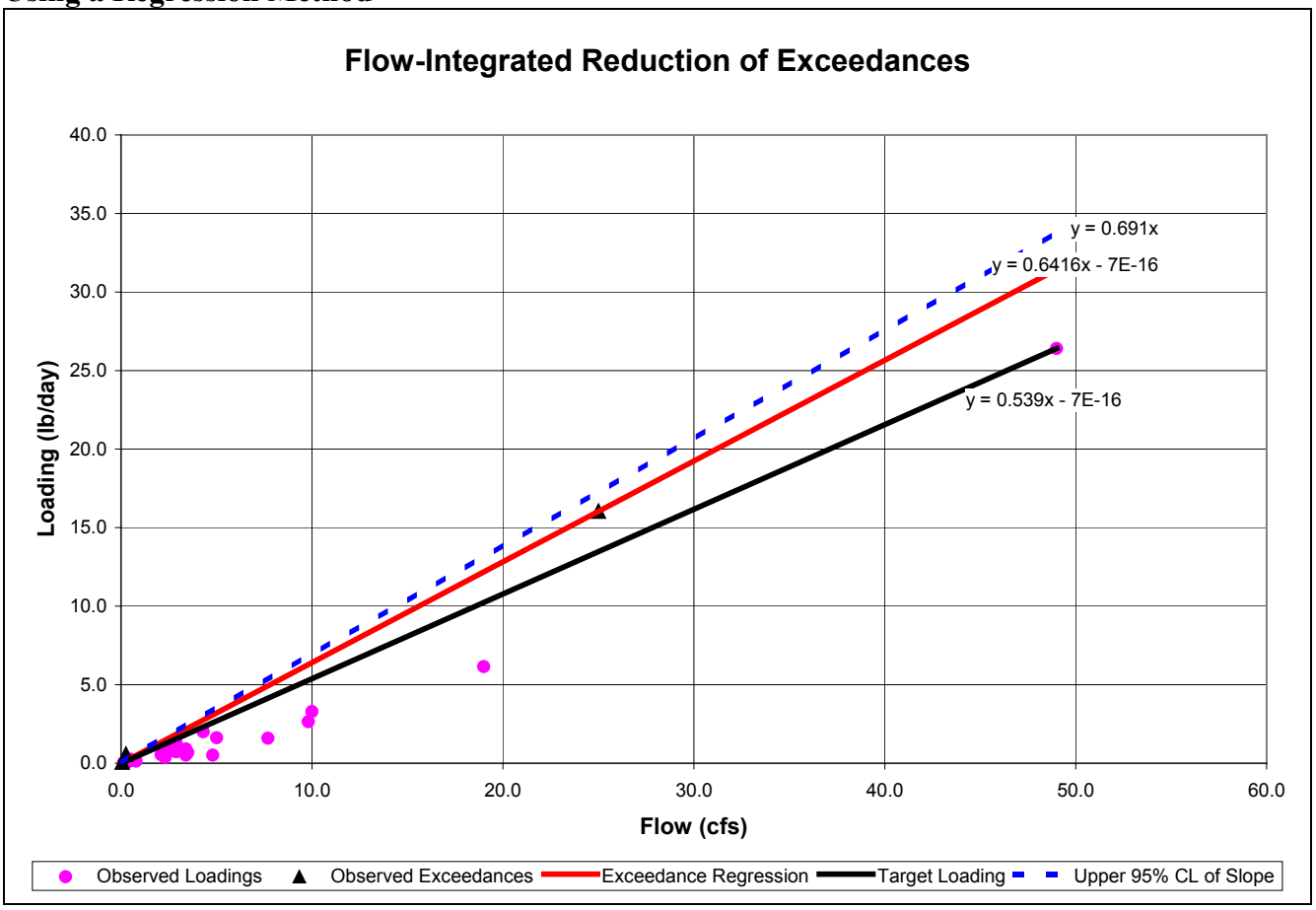


Table 9. Summary Output for Exceedances at Miry Run at Rt. 533 at Mercerville, Station # 01463850

Results from Regression Analysis		
Target Loading Slope	=	0.5390
Exceedance Regression Slope	=	0.6416
Upper 95% Confidence Limit of Exceedance Slope	=	0.6910

To achieve SWQSs within the impaired Miry Run at Rt. 533 at Mercerville, Station # 01463850, the required reductions are as follows:

Equation 1

Target Load (lb/day) for the given TP SWQS:

Target Load = 0.1 mg/L x 5.39 x flow (cfs)

Equation 2

Percent TP Loading Reduction based on regression line (from Figure 4):

$$(1-\frac{0.539}{0.6416})x100\% = 0.1599x100\% = 15.99\%$$

Equation 3

The portion of the reduction attributed to MOS is calculated as follows:

$$\text{MOS} = (1-\frac{0.6416}{0.6910})x100\% = 0.0714x100\% = 7.14\%$$

To determine the TMDL for the stream segment, the target load is calculated as shown above. The load that corresponds to the MOS is calculated and then subtracted from the target load. The result is the allocable load. Loads from some land uses, specifically forest, wetland, water and barren land, are generally not adjusted because there are few measures that can be applied to runoff from these sources to reduce the loads generated. As a result, existing loads from these sources are equal to the future loads. Therefore, in order to achieve the TMDL, the load reduction from land uses for which reduction measures are more reasonably applied must be increased proportionally. The procedure to do this is described in more detail in Appendix D.

5.1 Wasteload Allocations and Load Allocations

Waste Load Allocations (WLAs) are established for all point sources, while Load Allocations (LAs) are established for nonpoint sources, as these terms are defined in Section 3.0 Source Assessment. For point sources other than stormwater, individual WLAs are assigned. For stormwater point sources, both WLAs and LAs are expressed as percent reductions based on land use for particular stream segments, and are differentiated as discussed below.

Stormwater discharges can be a point source or a nonpoint source, depending on NPDES regulatory jurisdiction, yet the suite of measures to achieve reduction of loads from stormwater discharges is the same, regardless of this distinction. Stormwater point sources receiving a WLA are distinguished from stormwater generating 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 10. 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 this TMDL 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 this TMDL be construed to prevent the Department from regulating a stormwater source under NJPDES.

Table 10. Distribution of WLAs and LAs among stormwater source categories

Source category	TMDL allocation
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

Wasteload allocations (WLA) and load allocations (LA) for sources within the drainage area of the impaired segment in WMA 11 are presented in Table 11, and shown in Figures 5 and 6.

Table 11. TMDL Calculations for the Miry Run at Rt. 533 at Mercerville, Station # 01463850

	Current Load	LOAD CAPACITY			
	kg TP/yr (lbs/yr)	kg TP/yr (lbs/yr)	kg TP/day (lbs TP/day*)	% of LC	% reduction
Allocation of Loading Capacity					
Point Sources other than Stormwater	NA				
Nonpoint and Stormwater Sources					
Medium / high density residential	1262.81 (2778.182)	988.32 (2174.304)	1.23 (2.71)	37.9%	22%
Low density / rural residential	317.45 (698.39)	248.45 (546.59)	0.30 (0.68)	9.5%	22%
Commercial	219.62 (483.164)	171.88 (378.136)	0.21 (0.47)	6.6%	22%
Industrial	93.67 (206.074)	73.31 (161.282)	0.09 (0.20)	2.8%	22%
Mixed urban / other urban	391.77 (861.894)	306.62 (674.564)	0.38 (0.84)	11.7%	22%
Agricultural	667.04 (1467.488)	522.05 (1148.51)	0.65 (1.43)	20.0%	22%
Forest, wetland, water	91.44 (201.168)	91.44 (201.168)	0.11 (0.25)	3.5%	0%
Barren land	21.63 (47.586)	21.63 (47.586)	0.03 (0.06)	0.8%	0%
Margin of Safety	N/A	186.70 (410.74)	0.23 (0.51)	7.2%	0%
Total:	3065.43 (6743.946)	2610.39 (5742.858)	3.25 (7.15)	100%	N/A

*Daily TMDLs were calculated by dividing the annual load values by 365 days/year. The daily loads are based on the TMDL not exceeding the calculated annual load.

Figure 5. Current Load for the Miry Run impaired watershed

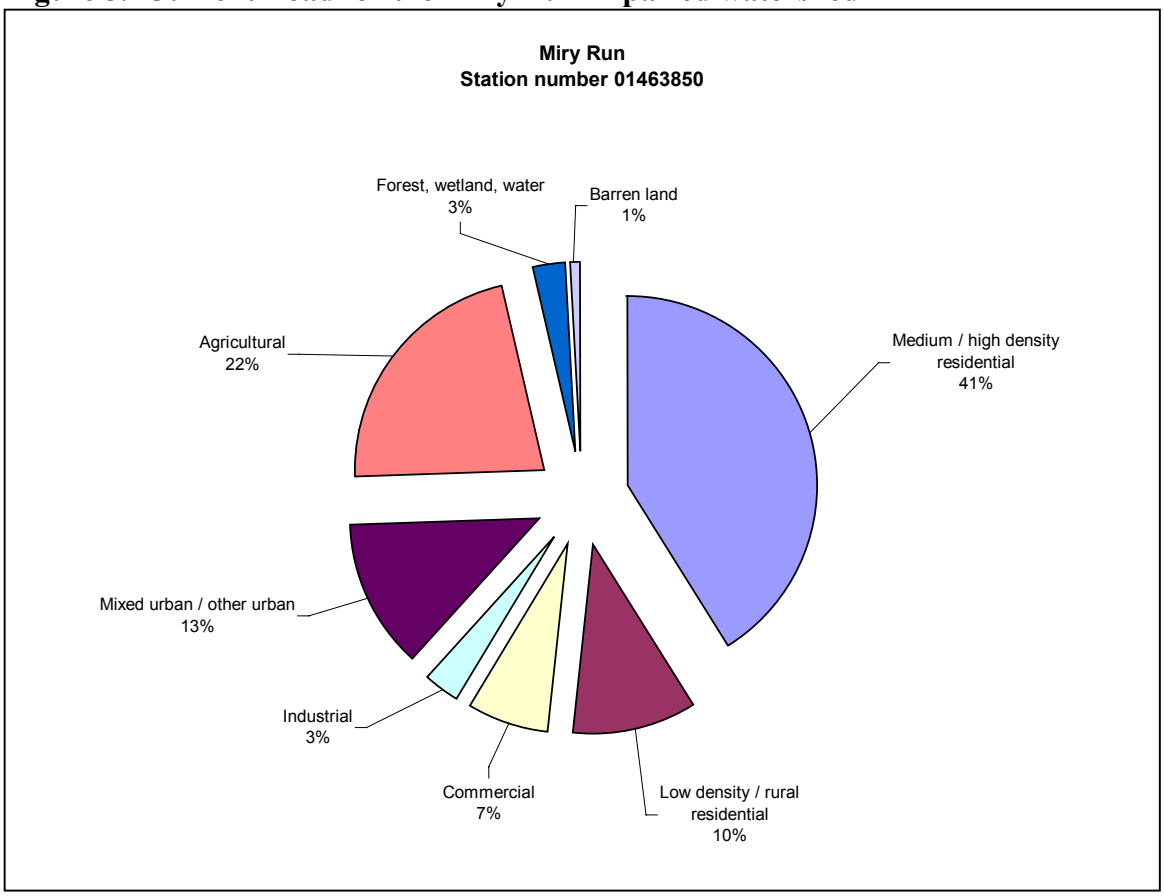
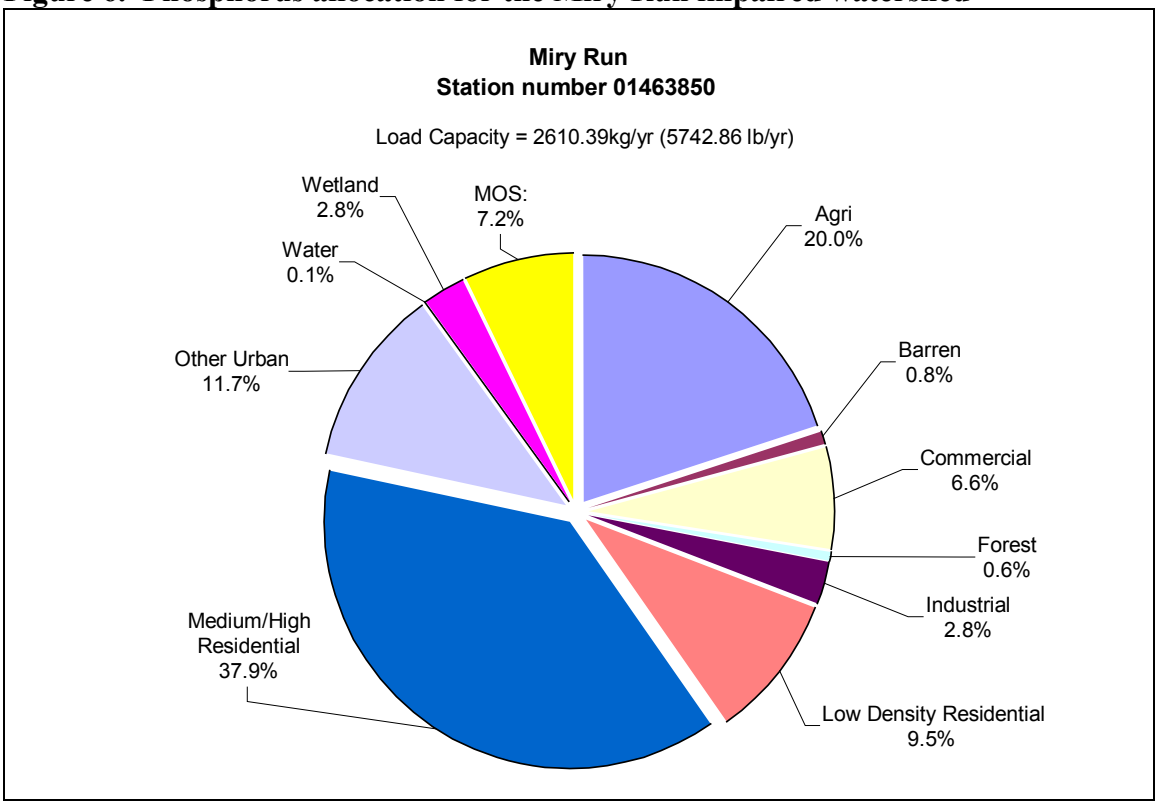


Figure 6. Phosphorus allocation for the Miry Run impaired watershed



5.2 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.

6.0 FOLLOW-UP MONITORING

The Water Resources Division of the U.S. Geological Survey and the Department have 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. A second ambient monitoring network, the Department's Supplemental Ambient Surface Water Network (100 stations), has improved spatial coverage for water quality monitoring in New Jersey. The data from this these networks have been used to assess the quality of freshwater streams for the purpose of identifying impairments. The ambient networks will be the means to determine the effectiveness of TMDL implementation and the need for additional management strategies.

7.0 IMPLEMENTATION PLAN

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).

The Department recognizes that TMDLs alone are not sufficient to restore impaired stream segments. The TMDL establishes the required pollutant reduction targets while the implementation plan identifies some of the regulatory and non-regulatory tools to achieve the reductions, matches management measures with sources, and suggests responsible entities for non-regulatory tools. This provides a basis for aligning available resources to assist with implementation activities. Projects proposed by the State, local government units and other stakeholders that would implement the measures identified within the impaired watershed are a priority for available State (for example, CBT) and federal (for example, 319(h)) funds. In addition, the Department's ongoing watershed management initiative will develop detailed watershed restoration plans for impaired stream segments in a priority order that will identify more specific measures to achieve the identified load reductions.

Urban and agricultural land use sources are the focus for implementation of load reductions. Urban land use will be addressed primarily by stormwater regulation, including an additional measure for fertilizer management. Land uses that are identified as agricultural land uses in this watershed are predominantly a county park that supports a significant goose population. This portion of the agricultural land use will respond to goose management strategies. Remaining agricultural land use will be addressed by implementation of conservation management practices tailored to each farm. These and other proposed measures are discussed further below.

7.1 Stormwater Measures

The stormwater facilities subject to regulation under NPDES in this watershed must be assigned WLAs. The WLAs for these point sources are expressed in terms of the required percent reduction for nonpoint sources and are applied to the land use categories that correspond to the areas regulated under industrial and municipal stormwater programs. The BMPs required through stormwater permits, including the additional measure discussed below, are generally expected to achieve the required load reductions. The success of these measures will be assessed through follow up monitoring. As needed through adaptive management, other additional measures may need to be identified and included in stormwater permits. Follow up monitoring or watershed restoration plans may determine that other additional measures are required, which would then be incorporated into municipal stormwater permits. Additional measures that may be considered include, for example, more frequent street sweeping and inlet cleaning, or retrofit of stormwater management facilities to include nutrient removal. A more detailed discussion of stormwater source control measures follows.

On February 2, 2004 the Department promulgated two sets of stormwater rules: The Phase II New Jersey Pollutant Discharge Elimination System (NJPDES) Stormwater Rules, N.J.A.C. 7:14A also known as the Municipal Stormwater Regulation Program, and the Stormwater Management Rules, N.J.A.C. 7:8

The NJPDES rules for the Municipal Stormwater Regulation Program require municipalities, highway agencies, and regulated "public complexes" to develop stormwater management programs consistent with the NJPDES permit requirements. The stormwater discharged through "municipal separate storm sewer systems" (MS4s) is regulated under the Department's stormwater rules. Under these rules and associated general permits, Tier A municipalities are required to implement various control measures that should substantially reduce phosphorus loadings in the impaired watersheds. These control measures include adoption and enforcement of a pet waste disposal ordinance, prohibiting the feeding of unconfined wildlife on public property, street sweeping, cleaning catch basins, performing good housekeeping at maintenance yards, and providing related public education and employee training. These basic requirements will provide for a measure of load reduction from existing development.

Where the affected watershed contains a high percentage of agricultural land uses, a significant reduction in nonpoint sources of phosphorus can be achieved through the implementation of agricultural BMPs. Where the affected watershed contains a small percentage of agricultural land uses, and a high percentage of urban land uses, an additional measure to reduce the phosphorus load from landscape maintenance in the form of a fertilizer management ordinance will be required in order to effectively reduce the phosphorus load originating from the urban land uses.

In the Miry Run watershed, it was determined that the fertilizer management ordinance is required based on the guidelines provided above. Therefore, all municipalities with contributory drainage area into the impaired stream segments of the Miry Run will be required to adopt an ordinance as an additional measure consistent with a model ordinance provided by the Department. This model ordinance has been posted on http://www.nj.gov/dep/watershedmgt/. The additional measure is as follows:

Fertilizer Management Ordinance

Minimum Standard – Municipalities identified in Appendix B shall adopt and enforce a fertilizer management ordinance, consistent with the model ordinance provided by the Department.

Measurable Goal - Municipalities identified in Appendix B shall certify annually that they have met the Fertilizer Management Ordinance minimum standard.

Implementation - Within 6 months from adoption of the TMDL, municipalities identified in Appendix B shall have fully implemented the Fertilizer Management Ordinance minimum standard.

The adopted Stormwater Management rules establish statewide minimum standards for stormwater management in new development, which help ensure that future development does not contribute additional phosphorus loads. The Stormwater Management Rules are currently implemented through the Residential Site Improvement Standards (RSIS) and the Department's Land Use Regulation Program (LURP) in the review of permits such as freshwater wetlands, stream encroachment, CAFRA, and Waterfront Development.

The Stormwater Management Rules focus on the prevention and minimization of stormwater runoff and pollutants in the management of stormwater. The rules require every project to evaluate methods to prevent pollutants from becoming available to stormwater runoff and to design the project to minimize runoff impacts from new development through better site design, also known as low impact development. Some of the issues that are required to be assessed for the site are the maintenance of existing vegetation, minimizing and disconnecting impervious surfaces, and pollution prevention techniques. In addition, performance standards are established for recharge of stormwater to address existing groundwater that contributes to baseflow and aquifers, to prevent increases to flooding and erosion, and to provide water quality treatment through stormwater management measures for TSS and nutrients.

7.2 Other Measures

Generic management strategies for nonpoint source categories, beyond those that will be implemented under the municipal stormwater regulation program, and responses are summarized below.

Table 12. Nonpoint source management measures

Source Category	Responses	Potential Responsible Entity	Possible Funding options
Human Sources	Septic system management programs	Municipalities, residents, watershed stewards, property owner	319(h), State sources
Non-Human Sources	Goose management programs, riparian buffer restoration	Municipalities, residents, watershed stewards, property owner	319(h), State sources
Agricultural practices	Develop and implement conservation plans or resource management plans	Property owner	EQIP, CRP, CREP

Human and Non-Human measures

Where septic system service areas are located in close proximity to impaired waterbodies, septic surveys should be undertaken to determine if there are improper effluent disposal practices that need to be corrected. Septic system management programs should be implemented in municipalities with septic system service areas to ensure proper design, installation and maintenance of septic systems. The drainage area for this report is sewered, therefore, this source is not an issue. Where resident goose populations are excessive, community based goose management programs should be supported. Through stewardship programs, areas such as commercial/corporate lawns should be converted to alternative landscaping that minimizes goose habitat and areas requiring intensive landscape maintenance. Where existing developed areas have encroached on riparian buffers, riparian buffer restoration projects should be undertaken where feasible. In the Miry Run stream segment, goose population is concentrated around a lake located towards the middle of the stream segment. Goose management and riparian buffer restoration efforts should be prioritized in this portion of the watershed.

Agricultural measures

Several programs are available to assist farmers in the development and implementation of conservation management plans and resource management plans. 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).

Conservation Reserve Enhancement Program (CREP) The New Jersey Departments of Environmental Protection and Agriculture, in partnership with the Farm Service Agency and Natural Resources Conservation Service, have signed a $100 million CREP agreement. This 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 to make 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.

8.0 REASONABLE ASSURANCE

Commitment to carry out the activities described in the implementation plan to reduce phosphorus loads provides reasonable assurance that the SWQS will be attained for phosphorus in the impaired segment. Follow-up monitoring will identify if the strategies implemented are completely, or only partially successful. It will then be determined if other management measures can be implemented to fully attain the SWQS or if it will be necessary to consider other approaches, such as other additional measures that would be required under the municipal stormwater regulation program.

9.0 PUBLIC PARTICIPATION

The Water Quality Management Planning Rules at 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 area-wide water quality management plan in accordance with procedures at N.J.A.C. 7:15-3.4(g).

For this TMDL, in January 2006, GIS maps of the impaired stream segment and associated drainage area were made available on the Department's website for review and comment. Interested parties had the opportunity to supply the Department with information about the TMDL segment via email. The Department specifically solicited information regarding potential sources and/or current nonpoint sources of pollution reduction projects within the impaired watershed. In addition, an email notification of the web posting was sent to stakeholders involved in the Department's watershed management efforts.

10.0 AMENDMENT PROCESS

In accordance with N.J.A.C. 7:15–7.2(g), this TMDL is established by the Department as an amendment to the Mercer County Water Quality Management Plan.

Notice proposing this TMDL was published on February 5, 2007 in the New Jersey Register and in a newspaper of general circulation in the affected area in order to provide the public an opportunity to review the TMDL and submit comments. In addition, an informational presentation followed by a public hearing was conducted on March 9, 2007 from 1:00 p.m. to 4:00 p.m. The presentation and public hearing took place at the New Jersey Department of Environmental Protection (NJDEP). Notice of the proposal and the public hearing was also provided to affected municipalities: Washington Township, West Windsor Township, and Hamilton Township. No comments were submitted with respect to this TMDL.

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Appendix A: Database of Phosphorus Export Coefficients

In December 2001, the Department concluded a contract with the USEPA, Region 2, and a contracting entity, TetraTech, Inc., the purpose of which was to identify export coefficients applicable to New Jersey. As part of that contract, a database of literature values was assembled that includes approximately four-thousand values accompanied by site-specific characteristics such as location, soil type, mean annual rainfall, and site percent-impervious. In conjunction with the database, the contractor reported on recommendations for selecting values for use in New Jersey. Analysis of mean annual rainfall data revealed noticeable trends, and, of the categories analyzed, was shown to have the most influence on the reported export coefficients. Incorporating this and other contractor recommendations, the Department took steps to identify appropriate export values for this TMDL by first filtering the database to include only those studies whose reported mean annual rainfall was between 40 and 51 inches per year. From the remaining studies, total phosphorus values were selected based on best professional judgement for eight land uses categories.

The sources incorporated in the database include a variety of governmental and non-governmental documents. All values used to develop the database and the total phosphorus values in this document are included in the below reference list.

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Appendix B: Municipal Stormwater Regulation Program

Municipal Stormwater Permit Types and Additional Measures

NJPDES Permit Number	Municipality	Discharge Type	Additional Measures
NJG0149004	Washington Township	Tier A	Fertilizer Management Ordinance
NJG0149977	West Windsor Township	Tier A	Fertilizer Management Ordinance
NJG0150258	Hamilton Township	Tier A	Fertilizer Management Ordinance

Appendix C: Water Quality Data

Water Quality Data for Miry Run in WMA 11

Miry Run at Rt. 533 at Mercerville, Station # 01463850		
Sample Data	**Flow (cfs)**	**Conc (mg/l)**
11/25/1997	4.8	0.02
2/12/1998	19	0.06
5/19/1998	9.8	0.05
8/13/1998	0.39	0.05
11/17/1998	0.17	0.05
2/1/1999	2.4	0.05
5/5/1999	2.3	0.03
8/4/1999	0.12	0.03
11/4/1999	3.5	0.036
2/9/2000	3.4	0.028
5/1/2000	2.9	0.046
8/3/2000	25	0.119
11/13/2000	2.3	0.035
2/15/2001	7.7	0.038
5/16/2001	0.78	0.032
8/13/2001	2.9	0.081
11/26/2001	0.25	0.42
2/4/2002	0.5	0.092
5/7/2002	0.41	0.054
8/6/2002	0.06	0.184
11/7/2002	10	0.061
2/4/2003	2.1	0.048
5/8/2003	5	0.06
8/5/2003	2.6	0.071
11/5/2003	3.4	0.05
2/4/2004	49	0.1
6/8/2004	2.6	0.068
8/17/2004	4.3	0.086

Appendix D: Methodology for Applying Percentage Reductions to Land Use Loadings

The outputs of the FIRE method establish a percent reduction needed to meet the target load (that which will attain the applicable SWQS) and a margin of safety. These values are then applied to the existing land use loadings within the impaired streamshed to determine the load allocations for various land uses.

Existing loads are determined as follows. GIS is used to determine the area in acres of each of the land uses in the impaired watershed. The loading coefficients identified in the TMDL report are applied to the acres of land use to calculate an existing load for each land use in the impaired streamshed. Existing loads for point sources, other than stormwater point sources (essentially, wastewater treatment plants), if any, in the impaired streamshed are calculated using the average flow and concentration data from the discharge monitoring reports for the facilities. This load is added to the existing TP load calculated from land use.

To calculate the overall target load the percent reduction (the difference between the target load and the exceedance regression) as determined through FIRE is applied to the total existing load. The load associated with the margin of safety as determined through FIRE (the difference between the 95% confidence interval and the exceedance regression) is then removed from the overall target load (target loading line), leaving a reduced amount of loading now available to allocate. The load from any point source discharge is calculated utilizing the full permitted flow and assigning an effluent concentration (represented below as Discharger X). This load is also removed from the potential allocable load leaving a further reduced amount of allocable load for land uses.

There are a number of land uses from which a reduction in current load is generally not taken. These land uses include Forest, Water, Wetlands, and Barren land. The current loads for these land uses as calculated for existing load are carried over entirely as a component of the future load allocations. Therefore, for these land uses, the existing load and future load are equal. The sum of the unreduced land use loads is then removed from the reduced allocable land use load leaving the final allocable land use load to be allocated among the land uses that are most amenable to load reduction (urban and agricultural). This final allocable land use load is then applied to each land use category in proportion to the amount of each land use in the watershed.

The final percent reduction is calculated by comparing the final WLA or LA for each land use to the existing loads of those land uses. Because of the adjustments made in removing the loads associated with the MOS, the unreduced land uses, and discharges, the percent reduction associated with the final allocable land use load is higher than that which appears as an output to FIRE.

Example:

Land Use	Existing Load	Percent Reduction	Allocation

Agriculture	100	88.85%	11.15
Barren	15	0%	15.00
Commercial	300	88.85%	33.45
Forest	125	0%	125.00
Low Density	40	88.85%	4.46
High Density	250	88.85%	27.88
Other Urban	15	88.85%	1.67
Water	100	0%	100.00
Wetlands	30	0%	30.00
Discharger X	25	0%	25.00
MOS			95.87
TOTAL	**1000**		**469.5**

Output from FIRE

Margin of Safety		**= 20.42%**
Target Loading		**= 46.95%**

Target Load

Target Load = 0.4695 * Existing Load
= 0.4695 * 1000
Target Load = 469.5 lb/yr

Margin of Safety

MOS = 0.2042* Target Load
= 0.2042* 469.5 lb/yr
= 95.87 lb/yr

Allocable Load

AL = Target Load – MOS
= 469.5 –95.87
= 373.63 lb/yr

Allocable Land Use Load

ALUL = AL- Future Discharge Load
= 373.6 – 25
= 348.63 lb/yr

SUM of Unreduced Land Use Loads

Unreduced Land use Load = Existing Forest + Water & Wetlands Load + Barren Land Load
= 125 + 100 + 30 + 15
= 270 kg/yr

Final Allocable Land use Load

Final Allocable Land use Load = Allocable Land use Load – Unreduced Land use Load

= 348.6 – 270
= 78.6 lb/yr

Final Percent Reduction

Final Percent Reduction = 1 – (Final allocable Land use load / Sum of existing load of reduced land uses)
= 1 – (78.6/ 15+250+40+300+100)
= 1 – (78.6/705)
= 0.8885
= 88.85 %