YELLOW CREEK WATERSHED TMDL

Bedford and Blair Counties

Prepared for:

Pennsylvania Department of Environmental Protection

September, 2011

TABLE OF CONTENTS

FIGURES

TABLES

ATTACHMENTS

TMDL SUMMARIES

1. The impaired stream segments addressed by this Total Maximum Daily Load (TMDL) are located in Woodbury, South Woodbury, North Woodbury, Bloomfield, and Taylor Townships in Bedford and Blair Counties, Pennsylvania. The stream segments drain approximately 85.02 square miles as part of State Water Plan subbasin 11D. The aquatic life existing uses for Yellow Creek, including its tributaries, are high quality cold water fisheries and migratory fishes (25 Pa. Code Chapter 93).

2. Pennsylvania's 2008 303(d) list identified 188.10 miles within the Yellow Creek Watershed as impaired by nutrients and sediment from agricultural land use practices. The listings were based on data collected in 2002 through the Pennsylvania Department of Environmental Protection's (PADEP's) Surface Water Monitoring Program. In order to ensure attainment and maintenance of water quality standards in the Yellow Creek Watershed, mean annual loadings for sediment and phosphorus will need to be limited 36,099.7610 pounds per day (lbs/day) and 26.5570 lbs/day, respectively.

   The major components of the Yellow Creek Watershed TMDL are summarized below.

Yellow Creek Watershed Components	**Sediment (lbs/day)**	**Phosphorus (lbs/day)**
TMDL (Total Maximum Daily Load)	36,099.7610	26.5570
WLA (Wasteload Allocation)	43.7278	4.3728
MOS (Margin of Safety)	3,609.9761	2.6557
LA (Load Allocation)	32,446.0571	19.5285

3. Mean annual sediment and phosphorus loadings are estimated at 66,120.6778 lbs/day and 45.5079 lbs/day, respectively. To meet the TMDL, the sediment and phosphorus loadings will require reductions of 45 percent and 42 percent, respectively.

4. There is one point source addressed in these TMDL segments. The South Woodbury Township Wastewater Treatment Plant discharges suspended solids and phosphorus, and is included in the wasteload allocation (WLA).

5. The adjusted load allocation (ALA) is the actual portion of the load allocation (LA) distributed among nonpoint sources receiving reductions, or sources that are considered controllable. Controllable sources receiving allocations are hay/pasture, cropland, developed lands, and streambanks. The sediment and phosphorus TMDL includes a nonpoint source ALA of 30,955.5347 lbs/day and 3.9073 lbs/day, respectively. Sediment and phosphorus loadings from all other sources, such as forested, wetlands, groundwater, and septic systems were maintained at their existing levels. Allocations of sediment and phosphorus to controllable nonpoint sources, or the ALA, for the Yellow Creek Watershed TMDL are summarized below.

Yellow Creek: Adjusted Load Allocations for Sources of Sediment and Phosphorus			
Pollutant	**Allocated Loading (lbs/day)**	**Adjusted Load Allocation (lbs/day)**	**% Reduction**
Sediment	36,099.7610	30,955.5347	14
Phosphorus	26.5570	3.9073	85

6. Ten percent of the Yellow Creek Watershed sediment TMDL was set-aside as a margin of safety (MOS). The MOS is that portion of the pollutant loading that is reserved to account for any uncertainty in the data and computational methodology used for the analysis. The MOS for the sediment and phosphorus TMDL is 3,609.9761 lbs/day and 2.6557 lbs/day, respectively.

7. The continuous simulation model used for developing the Yellow Creek Watershed TMDL considers seasonal variation through a number of mechanisms. Daily time steps are used for weather data and water balance calculations. The model requires specification of the growing season and hours of daylight for each month. The model also considers the months of the year when manure is applied to the land. The combination of these actions accounts for seasonal variability.

WATERSHED BACKGROUND

The Yellow Creek Watershed is approximately 85.02 square miles in area. The headwaters of Yellow Creek are located inside the southern portion of Blair County, a few miles north of Woodbury, Pa. The watershed is located on the U.S. Geological Survey (USGS) 7.5 minute quadrangles of Roaring Spring, Martinsburg, New Enterprise, Hopewell, Everett East, and Everett West, Pa. The stream flows southwest to its confluence with the Raystown Branch Juniata River. The major tributaries to Yellow Creek include Beaver Creek, Hickory Bottom Creek, Potter Creek, Three Springs Run, and several unnamed tributaries (UNTs). Smaller towns include Loysburg, Woodbury, Sunny Side, Eichelbergertown, Marine City, Yellow Creek, Salemville, Brumbaugh, Lafayetteville, Bakers Station, Waterside, and New Enterprise. State Routes 36, 867, 868, and 869 travel throughout the majority of the watershed. Numerous township roads also provide access to the Yellow Creek Watershed and its tributaries.

The TMDL watershed is located within the Appalachian Mountain Section of the Ridge and Valley physiographic province. The highest elevations are located in the southwestern portion of the watershed. The total change in elevation in the watershed is approximately 1,978 feet from the headwaters to the mouth.

The majority of the rock type in the upland portions of the watershed is dolomite (60 percent), predominantly associated with the Bellefonte and Axemann Formation, Nittany and Stonehenge/Larke Formation, and Gatesburg Formation (Figure 1). The remaining rock types found in the watershed are limestone, shale, and sandstone (40 percent combined), predominantly associated with the Warrior Formation, Coburn Formation, Reedsville Formation, Bald Eagle Formation, and Juniata Formation.

The Hagerstown-Duffield-Clarksburg series is the predominant soil type in the TMDL watershed. This soil is listed as a heavy-silt-loam soil and is mostly associated in the undulating slopes on upland valleys of the watershed (Figure 2). Other dominant soils in the watershed consist of Morrison-Murrill-Hublersburg and Hazleton-Dekalb-Buchanan.

Based on GIS datasets created in 2001, land use values were calculated for the TMDL watershed. Agriculture was the dominant land use at approximately 52 percent (Figure 3). Forested land uses account for approximately 43 percent of the watershed. Developed areas are 5 percent of the watershed, covering low-intensity residential and transitional. Riparian buffer zones are nearly nonexistent (Figure 4) in some of the agricultural lands. Livestock also have unlimited access to streambanks in certain parts of the watershed, resulting in streambank trampling and severe erosion. Some contiguous forested tracts remain in the watershed.

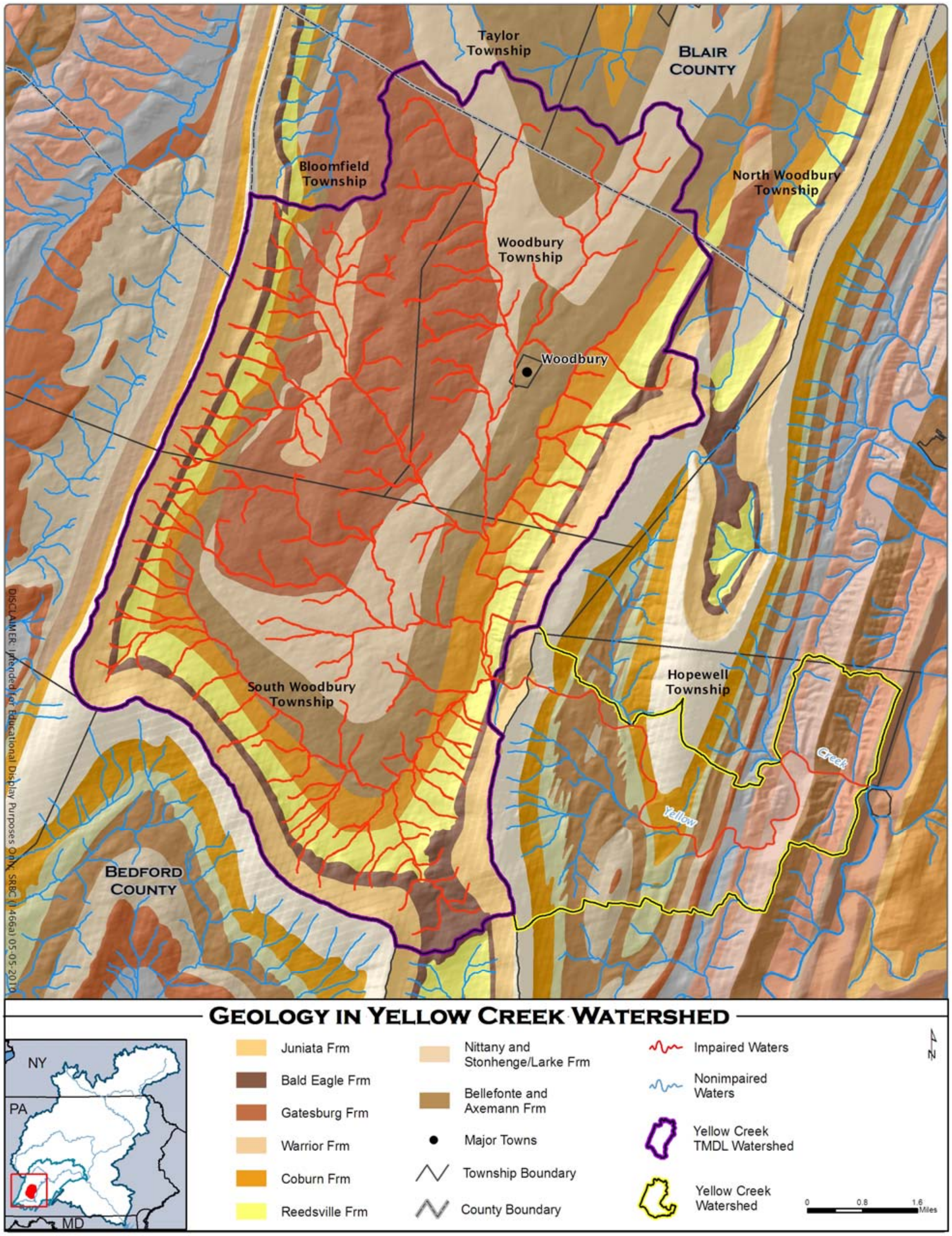


Figure 1. Geology Map of Yellow Creek Watershed

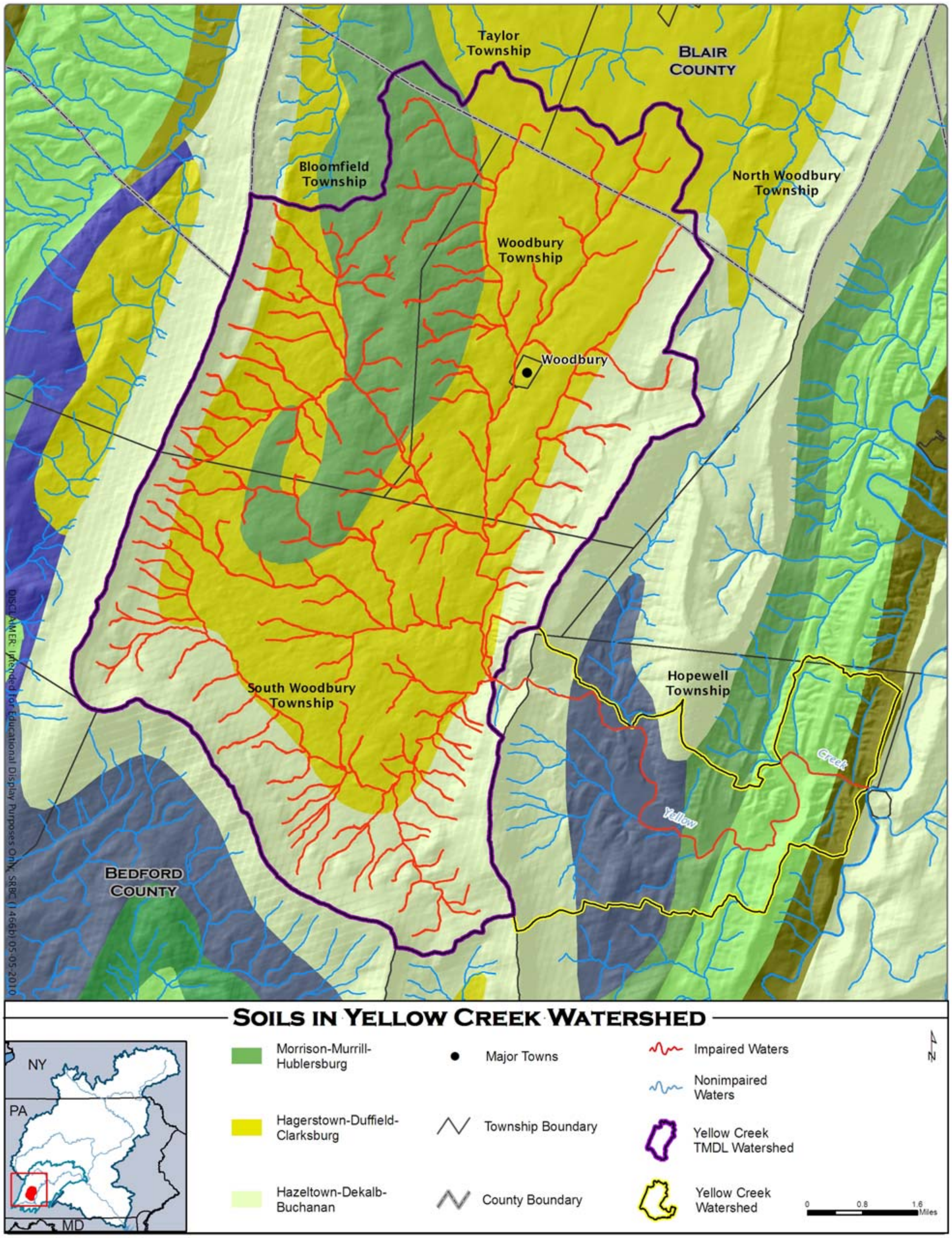


Figure 2. Soils Map of Yellow Creek Watershed

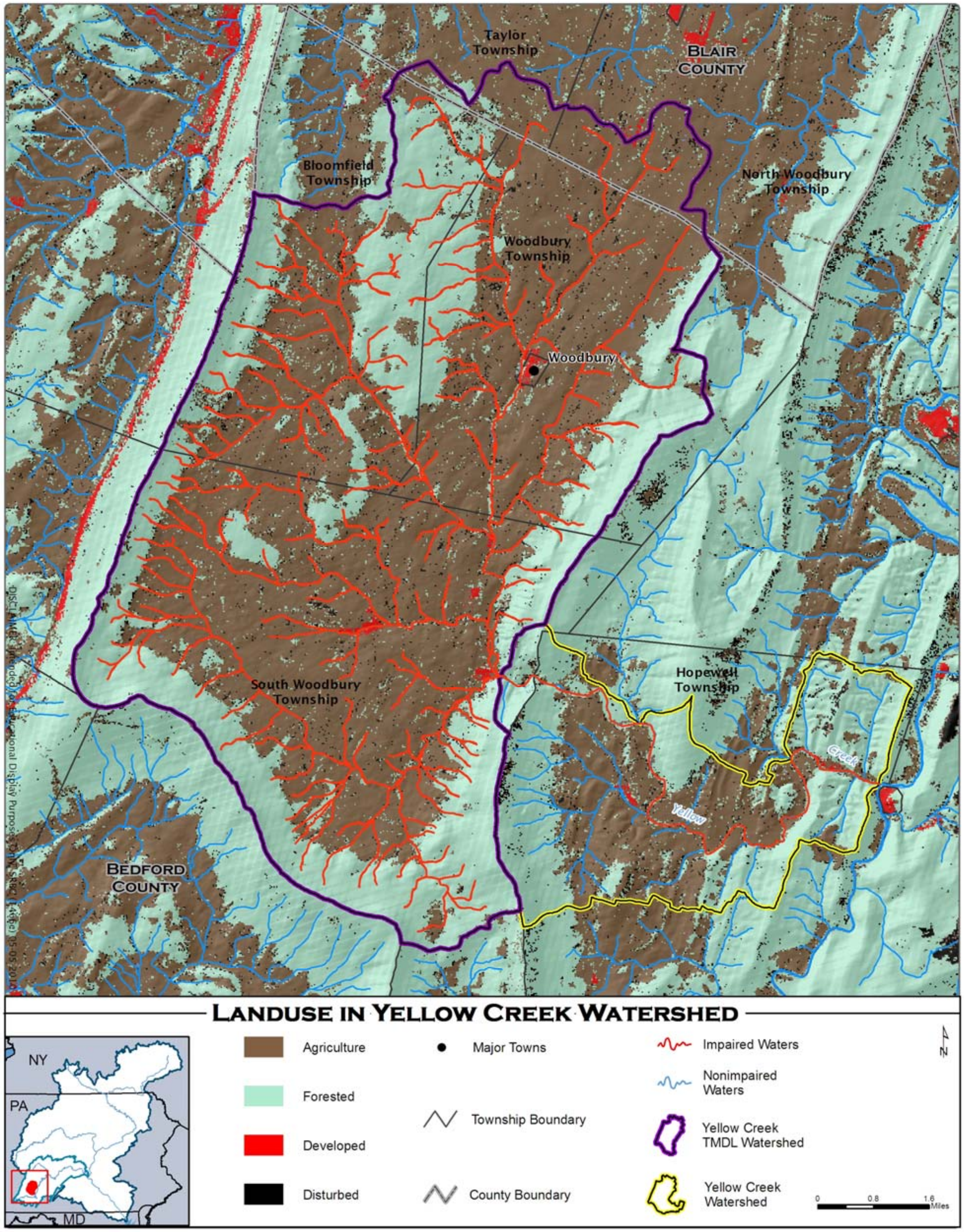


Figure 3. Land Use Map of Yellow Creek Watershed

Figure 4. Evidence of Lack of Riparian Vegetation and Presence of Streambank Erosion in the Yellow Creek Watershed

Surface Water Quality

Pennsylvania's 2008 303(d) list(s) identified 188.10 miles of the Yellow Creek Watershed as impaired by siltation and organic enrichment/low D.O. emanating from agricultural practices (Table 1).

Table 1. Integrated Water Quality Monitoring and Assessment Report Listed Segments

State Water Plan (SWP) Subbasin: 11D				
HUC: 02050303 – Raystown				
Watershed – Yellow Creek Watershed				
Source	**EPA 305(b) Cause Code**	**Miles**	**Designated Use**	**Use Designation**
Agriculture	Siltation	188.10	HQ-CWF, MF	Aquatic Life
Agriculture	Nutrients	57.07	HQ-CWF, MF	Aquatic Life

*For detailed information, please refer to Attachment H.

In general, soil erosion is a major problem in the Yellow Creek Watershed. Unrestricted access of livestock to streams results in trampled streambanks, excessive stream sedimentation, increased nutrient levels, and sparse streamside buffers and riparian vegetation. Large areas of row crops and use of conventional tillage, as well as unrestricted cattle access to streams, combine to leave the soil vulnerable to erosion. Many of the streams in the subbasin are extremely muddy for several days after summer thunderstorms. The resulting high sediment can make water unfit to drink, smother aquatic life and fish eggs, clog fish gills, and block sunlight into the creeks and rivers. Runoff from road construction also can be an additional, although temporary, source of stream sedimentation and increased nutrient levels.

APPROACH TO TMDL DEVELOPMENT

Pollutants & Sources

Nutrients and sediment have been identified as the pollutants causing designated use impairments in the Yellow Creek Watershed, with the source listed as agricultural practices. At present, there is only one point source that contributes to suspended-solid and phosphorus loading in the watershed. The South Woodbury Township Wastewater Treatment Plant discharges approximately 43.7278 lbs/day of suspended solids and 4.3728 lbs/day of phosphorus. The remaining sources are nonpoint in nature, and are found throughout the watershed.

As stated in previous sections, the land use is dominantly agriculture. Pasture and croplands extend right up to the streambanks with little to no riparian buffer zones present. Livestock have unlimited access to streambanks throughout most of the watershed. Based on visual observations, streambank erosion is severe in most reaches of the streams.

TMDL Endpoints

In an effort to address the sediment and nutrients problem found in the Yellow Creek Watershed, a TMDL was developed to establish loading limits for sediment and nutrients. The TMDL is intended to address sediment and nutrient impairments from developed land uses that were first identified in Pennsylvania's 2008 303(d) list, as well as other nonpoint sources such as agriculture. The decision to use phosphorus load reductions to address nutrient enrichment is based on an understanding of the relationship between nitrogen, phosphorus, and organic enrichment in stream systems. Elevated nutrient loads from human activities (nitrogen and phosphorus in particular) can lead to increased productivity of aquatic plants and other organisms, resulting in the degradation of water quality conditions through the depletion of dissolved oxygen in the water column (Novotny and Olem, 1994; Hem, 1983). In aquatic ecosystems, the quantities of trace elements are typically plentiful; however, nitrogen and phosphorus may be in short supply. The nutrient that is in the shortest supply is called the limiting nutrient because its relative quantity affects the rate of production (growth) of aquatic biomass. If the limiting nutrient load to a waterbody can be reduced, the available pool of nutrients that can be utilized by plants and other organisms will be reduced and, in general, the total biomass can subsequently be decreased as well (Novotny and Olem, 1994). In most efforts to control the eutrophication processes in waterbodies, emphasis is placed on the limiting nutrient. However, this is not always the case. For example, if nitrogen is the limiting nutrient, it still may be more efficient to control phosphorus loads if the nitrogen originates from difficult to control sources, such as nitrates in groundwater.

In most freshwater systems, phosphorus is the limiting nutrient for aquatic growth. In some cases, however, the determination of which nutrient is the most limiting is difficult. For this reason, the ratio of the amount of nitrogen to the amount of phosphorus is often used to make this determination (Thomann and Mueller, 1987). If the nitrogen/phosphorus (N/P) ratio is less than 10, nitrogen is limiting. If the N/P ratio is greater than 10, phosphorus is the limiting nutrient. For the Yellow Creek Watershed, the average N/P ratio is approximately 29, which indicates that phosphorus is the limiting nutrient. Controlling the phosphorus loading to the Yellow Creek Watershed will limit plant growth, thereby helping to eliminate use impairments currently being caused by excess nutrients.

Reference Watershed Approach

The TMDL developed for the Yellow Creek Watershed addresses sediment and nutrients. Because neither Pennsylvania nor the U.S. Environmental Protection Agency (USEPA) has instream numerical water quality criteria for sediment and phosphorus, a method was developed to implement the applicable narrative criteria. The method for these types of TMDLs is termed the "Reference Watershed Approach." Meeting the water quality objectives specified for this TMDL will result in the impaired stream segment attaining its designated uses.

The Reference Watershed Approach compares two watersheds: one attaining its uses and one that is impaired based on biological assessments. Both watersheds ideally have similar land use/cover distributions. Other features such as base geologic formation should be matched to the extent possible; however, most variations can be adjusted for in the model. The objective of the process is to reduce the loading rate of pollutants in the impaired stream segment to a level equivalent to the loading rate in the nonimpaired, reference stream segment. This load reduction will result in conditions favorable to the return of a healthy biological community to the impaired stream segments.

Selection of the Reference Watershed

In general, three factors are considered when selecting a suitable reference watershed. The first factor is to use a watershed that the PADEP has assessed and determined to be attaining water quality standards. The second factor is to find a watershed that closely resembles the impaired watershed in physical properties such as land cover/land use, physiographic province, and geology/soils. Finally, the size of the reference watershed should be within 20-35 percent of the impaired watershed area. The search for a reference watershed for the Yellow Creek Watershed to satisfy the above characteristics was done by means of a desktop screening using several GIS coverages, including the Multi-Resolution Land Characteristics (MRLC), Landsat-derived land cover/use grid, Pennsylvania's streams database, and geologic rock types.

Clover Creek was selected as the reference watershed for developing the Yellow Creek Watershed TMDL. Clover Creek is located just northeast of Woodbury, in Bedford County, Pa. (Figure 5). The watershed is located in State Water Plan subbasin 11A, a tributary to Frankstown Branch Juniata River, and protected uses include aquatic life and recreation. The tributary is currently designated as high quality cold water fisheries (25 Pa. Code Chapter 93). Based on PADEP assessments, Clover Creek is currently attaining its designated uses. The attainment of designated uses is based on sampling done by PADEP as part of its State Surface Water Assessment Program.

Drainage area, location, and other physical characteristics of the impaired segments of the Yellow Creek Watershed were compared to the Clover Creek Watershed (Table 2). Agricultural land is a dominant land use category in the Yellow Creek Watershed (52 percent) and Clover Creek (40 percent). The geology, soils, and precipitation in both are also similar (Table 2).

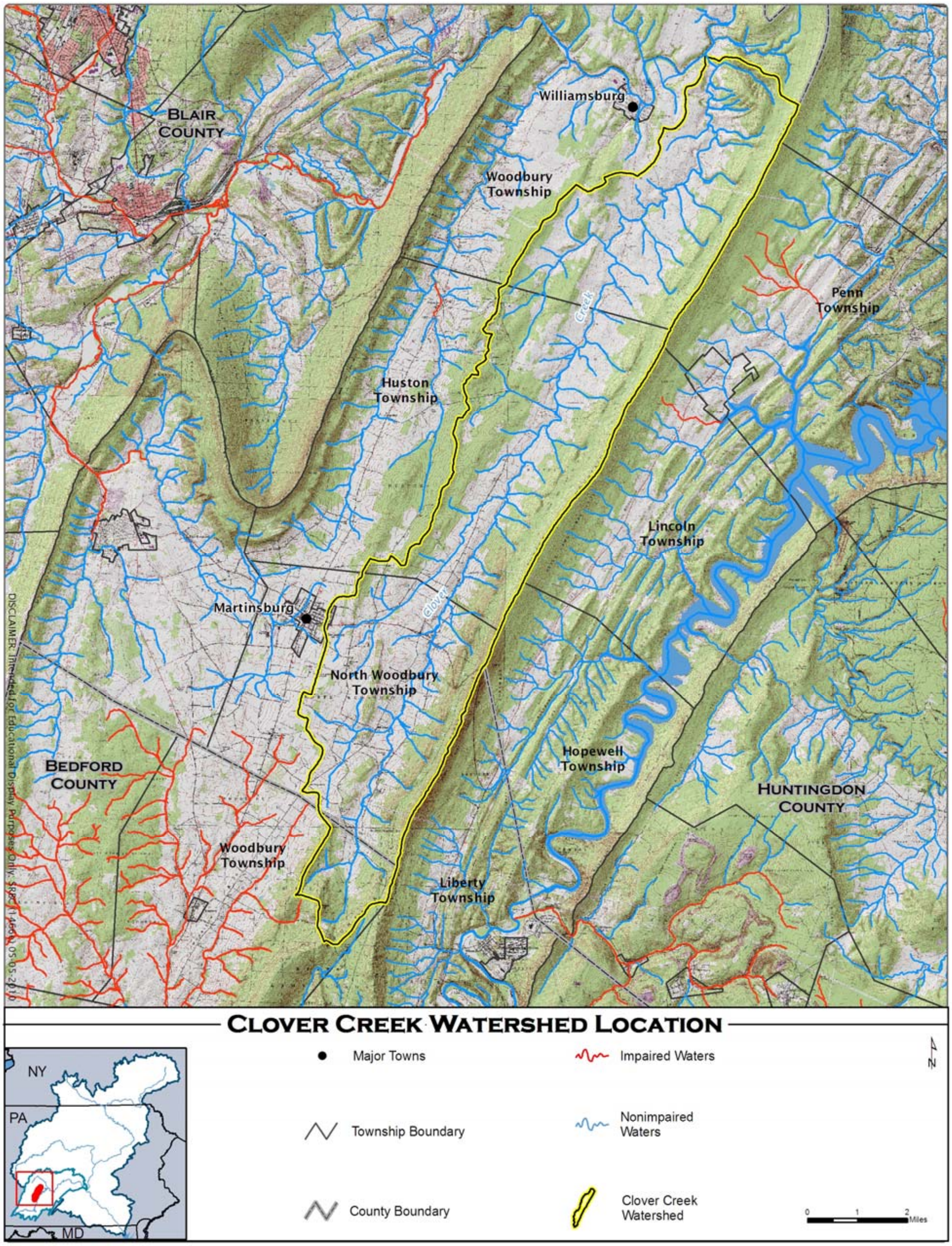


Figure 5. Location Map for Reference Watershed Clover Creek

Table 2. Comparison Between Yellow Creek Watershed and Clover Creek Watershed

Attribute	Watershed	
	Yellow Creek TMDL Watershed	**Clover Creek**
Physiographic Province	Appalachian Mountain Section: Ridge and Valley (100%)	Appalachian Mountain Section: Ridge and Valley (100%)
Area (mi^2)	69.2	50.1
Land Use	Agriculture (51.65%) Development (5.00%) Forested (43.36%)	Agriculture (39.50%) Development (2.91%) Forested (57.59%)
Geology	Bellefonte and Axemann Frm (15%) Nittany and Stonehenge/Larke Frm (15%) Gatesburg Frm (30%) Warrior Frm (5%) Coburn Frm (10%) Reedsville Frm (10%) Bald Eagle Frm (5%) Juniata Frm (10%)	Bellefonte and Axemann Frm (15%) Nittany and Stonehenge/Larke Frm (20%) Gatesburg Frm (25%) Warrior Frm (5%) Coburn Frm (10%) Reedsville Frm (10%) Bald Eagle Frm (5%) Juniata Frm (10%)
Soils	Morrison-Murrill-Hublersburg (15%) Hagerstown-Duffield-Clarksburg (50%) Hazleton-Dekalb-Buchanan (35%)	Morrison-Murrill-Hublersburg (15%) Hagerstown-Duffield-Clarksburg (45%) Hazleton-Dekalb-Buchanan (40%)
Dominant HSG	Morrison-Murrill-Hublersburg A (2%) B (87%) C (11%) D (0%) Hagerstown-Duffield-Clarksburg A (0%) B (36%) C (60%) D (4%) Hazleton-Dekalb-Buchanan A (2%) B (45%) C (53%) D (0%)	Morrison-Murrill-Hublersburg A (2%) B (87%) C (11%) D (0%) Hagerstown-Duffield-Clarksburg A (0%) B (36%) C (60%) D (4%) Hazleton-Dekalb-Buchanan A (2%) B (45%) C (53%) D (0%)
K Factor	Morrison-Murrill-Hublersburg (0.22) Hagerstown-Duffield-Clarksburg (0.32) Hazleton-Dekalb-Buchanan (0.18)	Morrison-Murrill-Hublersburg (0.22) Hagerstown-Duffield-Clarksburg (0.32) Hazleton-Dekalb-Buchanan (0.18)
20-Yr. Ave. Rainfall (in)	40.5	40.5
20-Yr. Ave. Runoff (in)	0.21	0.19

Watershed Assessment and Modeling

The TMDL for the impaired segments of the Yellow Creek Watershed was developed using the ArcView Generalized Watershed Loading Function model (AVGWLF) as described in Attachment C. The AVGWLF model was used to establish existing loading conditions for the impaired segments of the Yellow Creek Watershed and the Clover Creek reference watershed. All modeling inputs have been attached to this TMDL as Attachments D and E. SRBC staff visited the watershed in the winter and spring of 2010. The field visits were conducted to get a better understanding of existing conditions that might influence the AVGWLF model. General observations of the individual watershed characteristics include:

Yellow Creek Watershed

- Reset P factor for cropland (0.45) and hay/pasture (0.45) land uses to 0.68 and 0.68, while forested (0.52) and wetlands (0.10) remained unchanged. These changes were made to account for the lack of riparian buffer zones, streambank fencing, and stable streambanks.
- Reset C factor for cropland (0.42) and hay/pasture (0.03) land uses to 0.63 and 0.045, while forested (0.002) and wetlands (0.01) remained unchanged. These changes were made to account for the lack of general management practices such as no-till farming and increased presence of erosion through lack vegetative cover.

The AVGWLF model produced information on watershed size, land use, nutrients, and sediment loading. The sediment and nutrient loadings represent an annual average over a 24-year period, from 1975 to 1998, and for the Yellow Creek Watershed and Clover Creek Watershed, respectively. This information was then used to calculate existing unit area loading rates for the two watersheds. Acreage and sediment loading information for both the impaired watershed and the reference watershed are shown in Tables 3 and 4, respectively.

Table 3. Existing Sediment and Phosphorus Loads for the Yellow Creek Watershed

Pollutant Source	Acreage	Phosphorus Mean Annual Loading (lbs/day)	Phosphorus Unit Area Loading (lbs/ac/day)	Sediment Mean Annual Loading (lbs/day)	Sediment Unit Area Loading (lbs/ac/day)
HAY/PAST	16,153.3	9.1123	0.0006	5,860.9315	0.3628
CROPLAND	6,706.4	19.6928	0.0029	31,107.8904	4.6385
FOREST	19,111.1	0.8424	0.0000	1,446.4658	0.0757
WETLAND	79.1	0.0020	0.0000	0.3288	0.0042
Turf_Grass	27.2	0.0107	0.0004	19.0137	0.6990
TRANSITION	12.4	0.0499	0.0040	82.2466	6.6328
LO_INT_DEV	2,142.4	0.3375	0.0002	345.7534	0.1614
HI_INT_DEV	29.7	0.0568	0.0019	19.5616	0.6586
Streambank	-	0.5983	-	27,194.7582	-
Groundwater	-	10.2775	-	-	-
Septic System	-	0.1550	-	-	-
Point Source	-	4.3728	-	43.7278	-
TOTAL	44,261.6	45.5079	0.0010	66,120.6678	1.4939

Table 4. Existing Sediment and Phosphorus Loads for the Clover Creek Watershed

Pollutant Source	Acreage	Phosphorus Mean Annual Loading (lbs/day)	Phosphorus Unit Area Loading (lbs/ac/day)	Sediment Mean Annual Loading (lbs/day)	Sediment Unit Area Loading (lbs/ac/day)
HAY/PAST	10,249.9	5.3915	0.0005	2,894.7397	0.2824
CROPLAND	2,411.7	4.8401	0.0020	6,548.2740	2.7152
FOREST	18,419.2	1.5931	0.0001	2,967.4521	0.1611
WETLAND	37.1	0.0010	0.0000	0.1644	0.0044
LO_INT_DEV	931.6	0.1467	0.0002	184.3288	0.1979
Streambank	-	0.2980	-	13,545.9012	-
Groundwater	-	6.9764	-	-	-
Septic System	-	0.1050	-	-	-
TOTAL	32,049.5	19.3519	0.0006	26,140.8601	0.8156

TMDLS

The targeted TMDL value for the Yellow Creek Watershed was established based on current loading rates for sediment and phosphorus in the Clover Creek reference watershed. Biological assessments have determined that Clover Creek is currently attaining its designated uses.

Reducing the loading rate of sediment and phosphorus in the Yellow Creek Watershed to levels equivalent to those in the reference watershed will provide conditions favorable for the reversal of current use impairments.

Background Pollutant Conditions

There are two separate considerations of background pollutants within the context of this TMDL. First, there is the inherent assumption of the reference watershed approach that because of the similarities between the reference and impaired watershed, the background pollutant contributions will be similar. Therefore, the background pollutant contributions will be considered when determining the loads for the impaired watershed that are consistent with the loads from the reference watershed. Second, the AVGWLF model implicitly considers background pollutant contributions through the soil and the groundwater component of the model process.

Targeted TMDLs

The targeted TMDL value for sediment was determined by multiplying the total area of the Yellow Creek Watershed (44,261.6 acres) by the appropriate unit-area loading rate for the Clover Creek reference watershed (Table 5). The existing mean annual loading of sediment and phosphorus to Yellow Creek Watershed (66,120.6778 lbs/day and 45.5079 lbs/day, respectively) will need to be reduced by 45 and 42 percent, respectively, to meet the targeted TMDL of 36,099.7610 lbs/day and 26.5570 lbs/day, respectively.

Table 5. Targeted TMDL for the Yellow Creek Watershed

Pollutant	Area (ac)	Unit Area Loading Rate Clover Creek Reference Watershed (lbs/ac/day)	Targeted TMDL for Yellow Creek (lbs/day)
Sediment	44,261.6	0.8156	36,099.7610
Phosphorus	44,261.6	0.0006	26.5570

Targeted TMDL values were used as the basis for load allocations and reductions in the Yellow Creek Watershed, using the following two equations:

1. TMDL = WLA + LA + MOS
2. LA = ALA + LNR

where:

TMDL = Total Maximum Daily Load
WLA = Waste Load Allocation (point sources)
LA = Load Allocation (nonpoint sources)
ALA = Adjusted Load Allocation
LNR = Loads not Reduced

Waste Load Allocation

The WLA portion of the TMDL equation is the total loading of a pollutant that is assigned to point sources. Reviewing the PADEP's permitting files identified one point source discharge for sediment and phosphorus in the watershed.

The South Woodbury Township Wastewater Treatment Plant discharges treated sewage effluent into the streams covered by this TMDL, permit numbers PA00088226. The instantaneous maximums for suspended solids and phosphorus are 20.0 mg/L and 2.0 mg/L, respectively, which was included in the AVGWLF modeling runs for determining existing conditions. The design flow for the South Woodbury Township Wastewater Treatment Plant is 0.262 mgd (million gallons per day). Based on the instantaneous maximums for this facility, the potential for sediment and phosphorus loads if the South Woodbury Township Wastewater Treatment Plant capacities were fully utilized is 43.7278 lbs/day and 4.3728 lbs/day, respectively. This loading rate based on the design capacities of the plant is used in the final TMDL allocations (WLA).

Margin of Safety

The MOS is that portion of the pollutant loading that is reserved to account for any uncertainty in the data and computational methodology used for the analysis. For this analysis, the MOS is explicit. Ten percent of the targeted TMDLs for sediment and phosphorus were reserved as the MOS. Using 10 percent of the TMDL load is based on professional judgment and will provide an additional level of protection to the designated uses of Yellow Creek Watershed. The MOS used for the sediment and phosphorus TMDLs is shown below.

Yellow Creek Watershed:

MOS (sediment) = 36,099.7610 lbs/day (TMDL) x 0.1 = 3,609.9761 lbs/day

MOS (phosphorus) = 26.5570 lbs/day (TMDL) x 0.1 = 2.6557 lbs/day

Adjusted Load Allocation

The ALA is the actual portion of the LA distributed among those nonpoint sources receiving reductions. It is computed by subtracting those nonpoint source loads that are not being considered for reductions (loads not reduced or LNR) from the LA. Sediment and phosphorus reductions were made to the hay/pasture, cropland, developed areas (sum of LO_INT_DEV, and TRANSITION), streambanks, and WLA. Those land uses/sources for which existing loads were not reduced (FOREST, WETLANDS, Groundwater, and Septic Systems) were carried through at their existing loading values (Table 6).

Table 6. Load Allocations, Loads not Reduced, and Adjusted Load Allocation for Yellow Creek Watershed

Component	Sediment (lbs/day)	Phosphorus (lbs/day)
Load Allocation	32,446.0571	19.5570
Loads not Reduced	1,490.5224	15.6497
FOREST	1,446.4658	0.8424
WETLANDS	0.3288	0.0020
Groundwater	-	10.2775
Septic Systems	-	0.1550
Adjusted Load Allocation	30,955.5347	3.9073

TMDLs

The sediment TMDL established for the Yellow Creek Watershed consists of a LA, ALA, and MOS. The individual components of the TMDL are summarized in Table 7.

Table 7. Waste Load Allocation, Load Allocations, Loads not Reduced, and Adjusted Load Allocation for Yellow Creek Watershed

Component	Sediment (lbs/day)	Phosphorus (lbs/day)
TMDL (Total Maximum Daily Load)	36,099.7610	26.5570
MOS (Margin of Safety)	3,609.9761	2.6557
WLA (Waste Load Allocation)	43.7278	4.3728
LA (Load Allocation)	32,446.0571	19.5285
LNR (Loads not Reduced)	1,490.5224	15.6497
ALA (Adjusted Load Allocation)	30,955.5347	3.9073

CALCULATION OF SEDIMENT LOAD REDUCTIONS

The ALA established in the previous section represents the annual total sediment and phosphorus loads that are available for allocation between contributing sources in the Yellow Creek Watershed. The ALA for sediment and phosphorus was allocated between agriculture, developed areas, and streambanks. LA and reduction procedures were applied to the entire Yellow Creek Watershed using the Equal Marginal Percent Reduction (EMPR) allocation method (Attachment F). The LA and EMPR procedures were performed using MS Excel, and results are presented in Attachment G.

In order to meet the sediment and phosphorus TMDL, the load currently emanating from controllable sources must be reduced (Table 7). This can be achieved through reductions in current sediment and phosphorus loadings from cropland, from hay/pasture, developed areas, and streambanks (Table 8).

Table 8. Sediment and Phosphorus Load Allocations and Reductions for Yellow Creek Watershed

Pollutant Source	Acres	Unit Area Loading Rate (lbs/ac/day)		Pollutant Loading (lbs/day)		% Reduction
		Current	Allowable	Current	Allowable (LA)	
Sediment						
Hay/Pasture	16,153.30	0.3628	0.1743	5,860.9315	2,815.8776	52
Cropland	6,706.40	4.6385	2.2208	31,107.8904	14,893.5850	52
Developed	2,2110.70	0.2110	0.1014	466.5753	224.1655	52
Streambanks	-	-	-	27,194.7582	13,065.6892	52
Total				64,630.1554	30,0999.3173	52
Phosphorus						
Hay/Pasture	16,153.30	0.0006	0.0002	9.1123	3.8783	57
Cropland	6,706.40	0.0029	0.0006	19.6928	3.8783	80
Developed	2,2110.70	0.0002	0.0001	0.4549	0.2138	53
Streambanks	-	-	-	0.5983	0.2812	53
Total				29.8583	8.2516	72

CONSIDERATION OF CRITICAL CONDITIONS

The AVGWLF model is a continuous simulation model which uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment loads based on the daily water balance accumulated to monthly values. Therefore, all flow conditions are taken into account for loading calculations. Because there is generally a significant lag time between the introduction of sediment to a waterbody and the resulting impact on beneficial uses, establishing these TMDLs using average annual conditions is protective of the waterbody.

CONSIDERATION OF SEASONAL VARIATIONS

The continuous simulation model used for these analyses considers seasonal variation through a number of mechanisms. Daily time steps are used for weather data and water balance calculations. The model requires specification of the growing season and hours of daylight for each month. The model also considers the months of the year when manure is applied to the land. The combination of these actions by the model accounts for seasonal variability.

RECOMMENDATIONS FOR IMPLEMENTATION

TMDLs represent an attempt to quantify the pollutant load that may be present in a waterbody and still ensure attainment and maintenance of water quality standards. The Yellow Creek Watershed TMDL identifies the necessary overall load reductions for sediment and phosphorus currently causing use impairments and distributes those reduction goals to the appropriate nonpoint sources. Reaching the reduction goals established by this TMDL will only occur through Best Management Practices (BMPs). BMPs that would be helpful in lowering the amounts of sediment and phosphorus reaching Yellow Creek include the following: streambank stabilization and fencing; riparian buffer strips; strip cropping; conservation tillage; stormwater retention wetlands; and heavy use area protection, among many others.

Active groups in the watershed include the Yellow Creek Coalition, which is comprised of three Trout Unlimited chapters: Fort Bedford Chapter, Mount Laurel Chapter, and John Kennedy Chapter, and the Bedford and Blair County Conservation Districts. The coalition has implemented stream bank fencings, fish habitat structures, and stream side cleanups on an annual basis. The conservation districts have worked closely with the local communities in offering information of riparian buffers and rental of no-till equipment to limit runoff in the watershed.

The Natural Resources Conservation Service maintains a *National Handbook of Conservation Practices* (NHCP), which provides information on a variety of BMPs. The NHCP is available online at http://www.ncg.nrcs.usda.gov/nhcp_2.html. Many of the practices described in the handbook could be used in the Yellow Creek Watershed to help limit sediment and phosphorus impairments. Determining the most appropriate BMPs, where they should be installed, and actually putting them into practice, will require the development and implementation of restoration plans. Development of any restoration plan will involve the gathering of site-specific information regarding current land uses and existing conservation practices. This type of assessment has been ongoing in the Yellow Creek Watershed, and it is strongly encouraged to continue.

By developing a sediment and phosphorus TMDL for the Yellow Creek Watershed, PADEP continues to support design and implementation of restoration plans to correct current use impairments. PADEP welcomes local efforts to support watershed restoration plans. For more information about this TMDL, interested parties should contact the appropriate watershed manager in PADEP's Southcentral Regional Office (717-705-4700).

PUBLIC PARTICIPATION

A notice of availability for comments on the draft Yellow Creek Watershed TMDL was published in the Pa. Bulletin on June 5, 2010, and *Bedford Gazette* and *Altoona Mirror* newspapers on June 1, 2010, to foster public comment on the allowable loads calculated. A public meeting was held on June 23, 2010, at the South Woodbury Township building to discuss the proposed TMDL. The public participation process (which ended on July 5, 2010) was provided for the submittal of comments. Comments and responses are summarized in Attachment I. There were no public comments received for the TMDL.

Notice of final TMDL approval will be posted on the PADEP's web site.

REFERENCES

Commonwealth of Pennsylvania. 2001. Pennsylvania Code. Title 25 Environmental Protection. Department of Environmental Protection. Chapter 93. Water Quality Standards. Harrisburg, Pa.

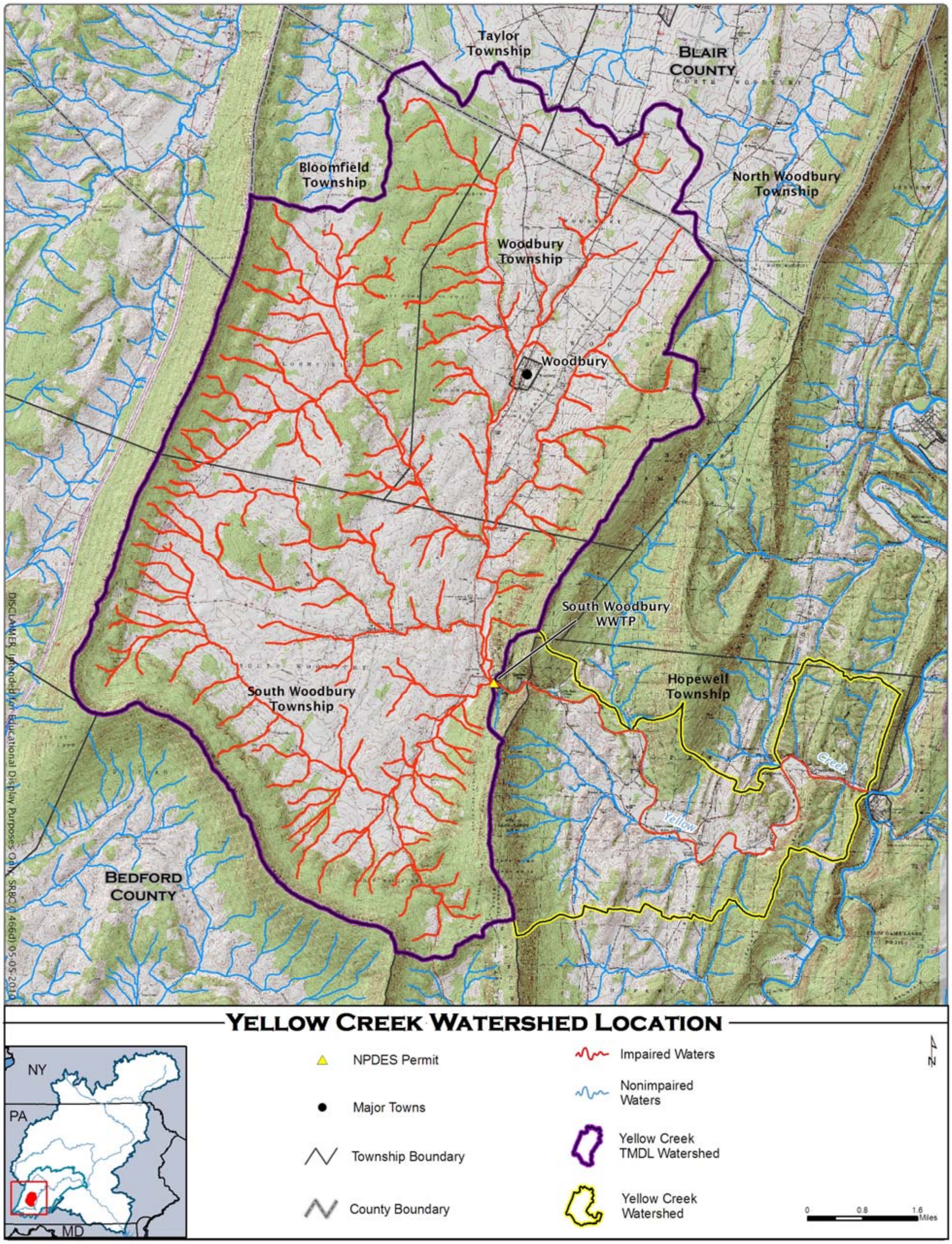
Hem, J.D. 1983. Study and Interpretation of the Chemical Characteristics of Natural Water. U.S. Geological Survey Water Supply Paper 1473.

Novotny, V. and H. Olem. 1994. Water Quality: Prevention, Identification, and Management of Diffuse Pollution. Van Nostrand Reinhold, N.Y.

Thomann, R.V. and J.A. Mueller. 1987. Principles of Surface Water Quality Modeling and Control. Harper & Row, N.Y.

Attachment A

Yellow Creek Watershed Impaired Waters


Taylor Township
BLAIR COUNTY
Bloomfield Township
North Woodbury Township
Woodbury Township
Woodbury
South Woodbury WWTP
Hopewell Township
South Woodbury Township
BEDFORD COUNTY
Yellow
Creek
DISCLAIMER: Intended for Educational Display Purposes Only. SRBC (1466d) 05-05-2010
YELLOW CREEK WATERSHED LOCATION
NY
PA
MD
NPDES Permit
Major Towns
Township Boundary
County Boundary
Impaired Waters
Nonimpaired Waters
Yellow Creek TMDL Watershed
Yellow Creek Watershed
0
0.8
1.6
Miles
N

Attachment B

Information Sheet for the Yellow Creek Watershed TMDL

What is being proposed?
Total Maximum Daily Load (TMDL) plans have been developed to improve water quality in the Yellow Creek Watershed.

Who is proposing the plans? Why?
The Pennsylvania Department of Environmental Protection (PADEP) is proposing to submit the plans to the U.S. Environmental Protection Agency (USEPA) for review and approval as required by federal regulation. In 1995, USEPA was sued for not developing TMDLs when Pennsylvania failed to do so. PADEP has entered into an agreement with USEPA to develop TMDLs for certain specified waters over the next several years. This TMDL has been developed in compliance with the state/USEPA agreement.

What is a TMDL?
A TMDL sets a ceiling on the pollutant loads that can enter a waterbody so that it will meet water quality standards. The Clean Water Act requires states to list all waters that do not meet their water quality standards even after pollution controls required by law are in place. For these waters, the state must calculate how much of a substance can be put in the water without violating the standard, and then distribute that quantity to all the sources of the pollutant on that waterbody. A TMDL plan includes waste load allocations for point sources, load allocations for nonpoint sources, and a margin of safety. The Clean Water Act requires states to submit their TMDLs to USEPA for approval. Also, if a state does not develop the TMDL, the Clean Water Act states that USEPA must do so.

What is a water quality standard?
The Clean Water Act sets a national minimum goal that all waters be “fishable” and “swimmable.” To support this goal, states must adopt water quality standards. Water quality standards are state regulations that have two components. The first component is a designated use, such as “warm water fishes” or “recreation.” States must assign a use or several uses to each of their waters. The second component relates to the instream conditions necessary to protect the designated use(s). These conditions or “criteria” are physical, chemical, or biological characteristics such as temperature and minimum levels of dissolved oxygen, and maximum concentrations of toxic pollutants. It is the combination of the “designated use” and the “criteria” to support that use that make up a water quality standard. If any criteria are being exceeded, then the use is not being met and the water is said to be in violation of water quality standards.

What is the purpose of the plans?
The Yellow Creek Watershed is impaired due to sediment and phosphorus emanating from agricultural runoff. The plans include a calculation of the loading for sediment and phosphorus that will correct the problem and meet water quality objectives.

Why was the Yellow Creek Watershed selected for TMDL development?
In 2008, PADEP listed segments of the Yellow Creek Watershed under Section 303(d) of the federal Clean Water Act as impaired due to causes linked to sediment and phosphorus.

What pollutants do these TMDLs address?
The proposed plans provide calculations of the stream's total capacity to accept sediment and phosphorus.

Where do the pollutants come from?
The sediment and phosphorus related impairments in the Yellow Creek Watershed come from nonpoint sources of pollution, primarily overland runoff from developed areas and agricultural lands, as well as from streambank erosion.

How was the TMDL developed?
PADEP used a reference watershed approach to estimate the necessary loading reduction of sediment and phosphorus that would be needed to restore a healthy aquatic community. The reference watershed approach is based on selecting a nonimpaired watershed that has similar land use characteristics and determining the current loading rates for the pollutants of interest. This is done by modeling the loads that enter the stream, using precipitation and land use characteristic data. For this analysis, PADEP used the AVGWLF model (the Environmental Resources Research Institute of the Pennsylvania State University's Arcview-based version of the Generalized Watershed Loading Function model developed by Cornell University). This modeling process uses loading rates in the nonimpaired watershed as a target for load reductions in the impaired watershed. The impaired watershed is modeled to determine the current loading rates and determine what reductions are necessary to meet the loading rates of the nonimpaired watershed. The reference stream approach was used to set allowable loading rates in the affected watershed because neither Pennsylvania nor USEPA has instream numerical water quality criteria for sediment and phosphorus.

How much pollution is too much?
The allowable amount of pollution in a waterbody varies depending on several conditions. TMDLs are set to meet water quality standards at the critical flow condition. For a free flowing stream impacted by nonpoint source pollution loading of sediment and phosphorus, the TMDL is expressed as an annual loading. This accounts for pollution contributions over all streamflow conditions. PADEP established the water quality objectives for sediment and phosphorus by using the reference watershed approach. This approach assumes that the impairment is eliminated when the impaired watershed achieves loadings similar to the reference watershed. Reducing the current loading rates for sediment and phosphorus in the impaired watershed to the current loading rates in the reference watershed will result in meeting the water quality objectives.

How will the loading limits be met?
Best Management Practices (BMPs) will be encouraged throughout the watershed to achieve the necessary load reductions.

How can I get more information on the TMDL?
To request a copy of the full report, contact William Brown at (717) 783-2938 between 8:00 a.m. and 3:00 p.m., Monday through Friday. Mr. Brown also can be reached by mail at the Office of Water Management, PADEP, Rachel Carson State Office Building, 400 Market Street, Harrisburg, PA 17105 or by e-mail at wbrown@state.pa.us.

How can I comment on the proposal?
You may provide e-mail or written comments postmarked no later than July 5, 2010 to the above address.

Attachment C

AVGWLF Model Overview & GIS-Based Derivation of Input Data

The TMDL for the Yellow Creek Watershed was developed using the Generalized Watershed Loading Function or GWLF model. The GWLF model provides the ability to simulate runoff, sediment, and nutrient (nitrogen and phosphorus) loadings from the watershed given variable-size source areas (e.g., agricultural, forested, and developed land). It also has algorithms for calculating septic system loads, and allows for the inclusion of point source discharge data. It is a continuous simulation model, which uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment and nutrient loads, based on the daily water balance accumulated to monthly values.

GWLF is a combined distributed/lumped parameter watershed model. For surface loading, it is distributed in the sense that it allows multiple land use/cover scenarios. Each area is assumed to be homogenous in regard to various attributes considered by the model. Additionally, the model does not spatially distribute the source areas, but aggregates the loads from each area into a watershed total. In other words, there is no spatial routing. For subsurface loading, the model acts as a lumped parameter model using a water balance approach. No distinctly separate areas are considered for subsurface flow contributions. Daily water balances are computed for an unsaturated zone as well as a saturated subsurface zone, where infiltration is computed as the difference between precipitation and snowmelt minus surface runoff plus evapotranspiration.

GWLF models surface runoff using the Soil Conservation Service Curve Number (SCS-CN) approach with daily weather (temperature and precipitation) inputs. Erosion and sediment yield are estimated using monthly erosion calculations based on the Universal Soil Loss Equation (USLE) algorithm (with monthly rainfall-runoff coefficients) and a monthly composite of KLSCP values for each source area (e.g., land cover/soil type combination). The KLSCP factors are variables used in the calculations to depict changes in soil loss erosion (K), the length slope factor (LS), the vegetation cover factor (C), and conservation practices factor (P). A sediment delivery ratio based on watershed size, transport capacity, and average daily runoff is applied to the calculated erosion for determining sediment yield for each source area. Surface nutrient losses are determined by applying dissolved nitrogen and phosphorus coefficients to surface runoff and a sediment coefficient to the yield portion for each agricultural source area. Point source discharges also can contribute to dissolved losses to the stream and are specified in terms of kilograms per month. Manured areas, as well as septic systems, can also be considered. Urban nutrient inputs are all assumed to be solid-phase, and the model uses an exponential accumulation and washoff function for these loadings. Subsurface losses are calculated using dissolved nitrogen and phosphorus coefficients for shallow groundwater contributions to stream nutrient loads, and the subsurface submodel only considers a single, lumped-parameter contributing area. Evapotranspiration is determined using daily weather data and a cover factor dependent upon land use/cover type. Finally, a water balance is performed daily using supplied or computed precipitation, snowmelt, initial unsaturated zone storage, maximum available zone storage, and evapotranspiration values. All of the equations used by the model can be viewed in GWLF Users Manual.

For execution, the model requires three separate input files containing transport-, nutrient-, and weather-related data. The transport (TRANSPRT.DAT) file defines the necessary parameters for each source area to be considered (e.g., area size, curve number, etc.), as well as global parameters (e.g., initial storage, sediment delivery ratio, etc.) that apply to all source areas. The nutrient (NUTRIENT.DAT) file specifies the various loading parameters for the different source areas identified (e.g., number of septic systems, urban source area accumulation rates, manure concentrations, etc.). The weather (WEATHER.DAT) file contains daily average temperature and total precipitation values for each year simulated.

The primary sources of data for this analysis were Geographic Information System (GIS) formatted databases. A specially designed interface was prepared by the Environmental Resources Research Institute of the Pennsylvania State University in ArcView (GIS software) to generate the data needed to run the GWLF model, which was developed by Cornell University. The new version of this model has been named AVGWLF (ArcView Version of the Generalized Watershed Loading Function).

In using this interface, the user is prompted to identify required GIS files and to provide other information related to "non-spatial" model parameters (e.g., beginning and end of the growing season, the months during which manure is spread on agricultural land, and the names of nearby weather stations). This information is subsequently used to automatically derive values for required model input parameters, which are then written to the TRANSPRT.DAT, NUTRIENT.DAT, and WEATHER.DAT input files needed to execute the GWLF model. For use in Pennsylvania, AVGWLF has been linked with statewide GIS data layers such as land use/cover, soils, topography, and physiography; and includes location-specific default information such as background nitrogen and phosphorus concentrations and cropping practices. Complete GWLF-formatted weather files also are included for 80 weather stations around the state.

The following table lists the statewide GIS data sets and provides an explanation of how they were used for development of the input files for the GWLF model.

GIS Data Sets	
DATASET	**DESCRIPTION**
Censustr	Coverage of Census data including information on individual homes septic systems. The attribute *usew_sept* includes data on conventional systems, and *sew_other* provides data on short-circuiting and other systems.
County	The County boundaries coverage lists data on conservation practices, which provides C and P values in the Universal Soil Loss Equation (USLE).
Gwnback	A grid of background concentrations of N in groundwater derived from water well sampling.
Landuse5	Grid of the MRLC that has been reclassified into five categories. This is used primarily as a background.
Majored	Coverage of major roads. Used for reconnaissance of a watershed.
MCD	Minor civil divisions (boroughs, townships, and cities).
Npdespts	A coverage of permitted point discharges. Provides background information and cross check for the point source coverage.
Padem	100-meter digital elevation model. Used to calculate landslope and slope length.
Palumrlc	A satellite image derived land cover grid that is classified into 15 different land cover categories. This dataset provides land cover loading rate for the different categories in the model.
Pasingle	The 1:24,000 scale single line stream coverage of Pennsylvania. Provides a complete network of streams with coded stream segments.
Physprov	A shapefile of physiographic provinces. Attributes *rain_cool* and *rain_warm* are used to set recession coefficient.
Pointsrc	Major point source discharges with permitted nitrogen and phosphorus loads.
Refwater	Shapefile of reference watersheds for which nutrient and sediment loads have been calculated.
Soilphos	A grid of soil phosphorus loads, which has been generated from soil sample data. Used to help set phosphorus and sediment values.
Smallsheds	A coverage of watersheds derived at 1:24,000 scale. This coverage is used with the stream network to delineate the desired level watershed.
Statsgo	A shapefile of generalized soil boundaries. The attribute *mu_k* sets the k factor in the USLE. The attribute *mu_awc* is the unsaturated available capacity, and the *muhsg_dom* is used with land use cover to derive curve numbers.
Strm305	A coverage of stream water quality as reported in Pennsylvania's 305(b) report. Current status of assessed streams.
Surfgeol	A shapefile of the surface geology used to compare watersheds of similar qualities.
T9sheds	Data derived from a PADEP study conducted at PSU with N and P loads.
Zipcode	A coverage of animal densities. Attribute *aeu_acre* helps estimate N & P concentrations in runoff in agricultural lands and over manured areas.
Weather Files	Historical weather files for stations around Pennsylvania to simulate flow.

Attachment D

AVGWLF Model Inputs for the Yellow Creek Watershed

Yellow Creek Watershed Nutrient Input File

Runoff Coefficients by Source

Rural Runoff	Dis N mg/L	Dis P mg/L
Hay/Past	2.9	0.1
Cropland	2.9	0.1
Forest	0.19	0.006
Wetland	0.19	0.006
Turf_Grass	2.5	0.162
Transition	2.9	0.2
	0	0
	0	0
	0	0
	0	0
Manure	2.44	0.38

Urban Build-Up	N Kg/ha/d	P Kg/ha/d
Lo_Int_Dev	0.012	0.002
Hi_Int_Dev	0.101	0.011

Nitrogen and Phosphorus Loads from Point Sources and Septic Systems

Month	Point Source Loads/Discharge: Kg N	Kg P	Discharge MGD	Septic System Populations: Normal Systems	Pond Systems	Short Cir Systems	Discharge Systems
Jan	0.0	0.0	0.0	1330	0	31	0
Feb	0.0	0.0	0.0	1330	0	31	0
Mar	0.0	0.0	0.0	1330	0	31	0
Apr	0.0	0.0	0.0	1330	0	31	0
May	0.0	0.0	0.0	1330	0	31	0
Jun	0.0	0.0	0.0	1330	0	31	0
Jul	0.0	0.0	0.0	1330	0	31	0
Aug	0.0	0.0	0.0	1330	0	31	0
Sep	0.0	0.0	0.0	1330	0	31	0
Oct	0.0	0.0	0.0	1330	0	31	0
Nov	0.0	0.0	0.0	1330	0	31	0
Dec	0.0	0.0	0.0	1330	0	31	0

Groundwater (mg/L): N (mg/L)	P (mg/L)	Tile Drainage (mg/L): N	P	Sed	Per capita tank effluent: N (g/d)	P (g/d)	Growing season N/P uptake: N (g/d)	P (g/d)	Sediment: N (mg/Kg)	P (mg/Kg)
2.931	0.031	15	0.1	50	12	2.5	1.6	0.4	3000.0	489.0

Load File | Save File | Export to JPEG | Close

Yellow Creek Watershed Transport Input File

Rural LU	Area (ha)	CN	K	LS	C	P
Hay/Past	6537	75	0.29	0.617	0.045	0.68
Cropland	2714	82	0.296	0.552	0.63	0.68
Forest	7734	73	0.215	5.108	0.002	0.52
Wetland	32	87	0.31	0.185	0.01	0.1
Turf_Grass	11	58	0.22	1.334	0.12	0.3
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Bare Land	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
	0	0	0	0	0	0
Transition	5	87	0.2	0.785	0.8	0.8
Urban LU	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
Lo_Int_Dev	867	83	0.285	0.534	0.08	0.2
Hi_Int_Dev	12	93	0.32	1.948	0.08	0.2

Month	Ket	Day Hours	Season	Eros Coef	Stream Extract	Ground Extract
Jan	0.69	9.4	0	0.12	0	0
Feb	0.74	10.4	0	0.12	0	0
Mar	0.78	11.8	0	0.12	0	0
Apr	0.95	13.2	1	0.3	0	0
May	1.04	14.4	1	0.3	0	0
Jun	1.1	14.9	1	0.3	0	0
Jul	1.13	14.6	1	0.3	0	0
Aug	1.15	13.6	1	0.3	0	0
Sep	1.17	12.2	1	0.3	0	0
Oct	1.17	10.8	1	0.12	0	0
Nov	1.02	9.6	0	0.12	0	0
Dec	0.94	9.1	0	0.12	0	0

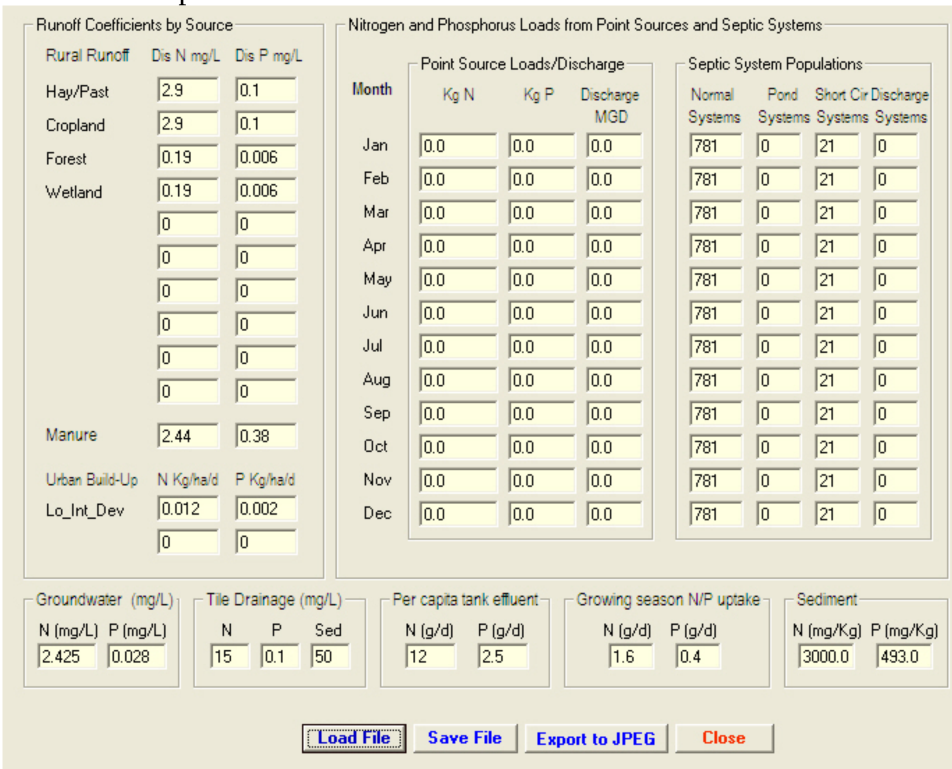
Init Unsat Stor (cm)	10	Initial Snow (cm)	0	Recess Coefficient	0.1
Init Sat Stor (cm)	0	Sed Delivery Ratio	0.096	Seepage Coefficient	0
Unsat Avail Wat (cm)	21.6598	Tile Drain Ratio	0.5	Sediment A Factor	4.8316E-04
		Tile Drain Density	0	Sed A Adjustment Factor	1

Load File | Save File | Export to JPEG | Close

Attachment E

AVGWLF Model Inputs for the Clover Creek Reference Watershed

Clover Creek Nutrient Input File



Runoff Coefficients by Source

Rural Runoff	Dis N mg/L	Dis P mg/L
Hay/Past	2.9	0.1
Cropland	2.9	0.1
Forest	0.19	0.006
Wetland	0.19	0.006
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
Manure	2.44	0.38
Urban Build-Up	N Kg/ha/d	P Kg/ha/d
Lo_Int_Dev	0.012	0.002
	0	0

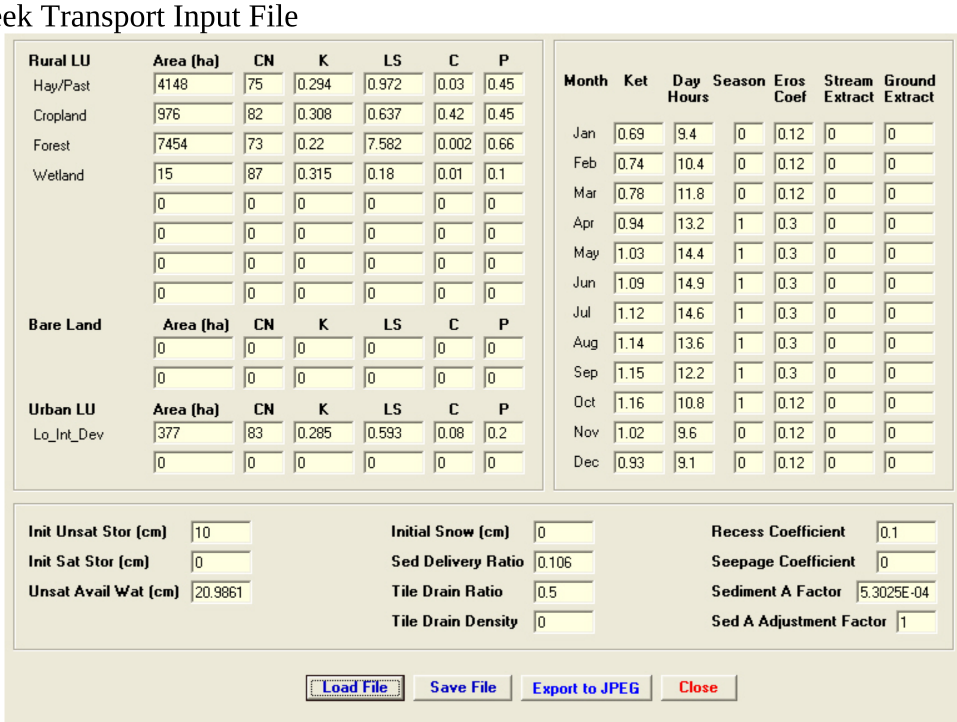
Nitrogen and Phosphorus Loads from Point Sources and Septic Systems

Month	Point Source Loads/Discharge			Septic System Populations			
	Kg N	Kg P	Discharge MGD	Normal Systems	Pond Systems	Short Cir Systems	Discharge Systems
Jan	0.0	0.0	0.0	781	0	21	0
Feb	0.0	0.0	0.0	781	0	21	0
Mar	0.0	0.0	0.0	781	0	21	0
Apr	0.0	0.0	0.0	781	0	21	0
May	0.0	0.0	0.0	781	0	21	0
Jun	0.0	0.0	0.0	781	0	21	0
Jul	0.0	0.0	0.0	781	0	21	0
Aug	0.0	0.0	0.0	781	0	21	0
Sep	0.0	0.0	0.0	781	0	21	0
Oct	0.0	0.0	0.0	781	0	21	0
Nov	0.0	0.0	0.0	781	0	21	0
Dec	0.0	0.0	0.0	781	0	21	0

Groundwater (mg/L)		Tile Drainage (mg/L)			Per capita tank effluent		Growing season N/P uptake		Sediment	
N (mg/L)	P (mg/L)	N	P	Sed	N (g/d)	P (g/d)	N (g/d)	P (g/d)	N (mg/Kg)	P (mg/Kg)
2.425	0.028	15	0.1	50	12	2.5	1.6	0.4	3000.0	493.0

Load File | Save File | Export to JPEG | Close

Clover Creek Transport Input File



Rural LU	Area (ha)	CN	K	LS	C	P
Hay/Past	4148	75	0.294	0.972	0.03	0.45
Cropland	976	82	0.308	0.637	0.42	0.45
Forest	7454	73	0.22	7.582	0.002	0.66
Wetland	15	87	0.315	0.18	0.01	0.1
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Bare Land	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
	0	0	0	0	0	0
	0	0	0	0	0	0
Urban LU	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
Lo_Int_Dev	377	83	0.285	0.593	0.08	0.2
	0	0	0	0	0	0

Month	Ket	Day Hours	Season	Eros Coef	Stream Extract	Ground Extract
Jan	0.69	9.4	0	0.12	0	0
Feb	0.74	10.4	0	0.12	0	0
Mar	0.78	11.8	0	0.12	0	0
Apr	0.94	13.2	1	0.3	0	0
May	1.03	14.4	1	0.3	0	0
Jun	1.09	14.9	1	0.3	0	0
Jul	1.12	14.6	1	0.3	0	0
Aug	1.14	13.6	1	0.3	0	0
Sep	1.15	12.2	1	0.3	0	0
Oct	1.16	10.8	1	0.12	0	0
Nov	1.02	9.6	0	0.12	0	0
Dec	0.93	9.1	0	0.12	0	0

Init Unsat Stor (cm)	10	**Initial Snow (cm)**	0	**Recess Coefficient**	0.1
Init Sat Stor (cm)	0	**Sed Delivery Ratio**	0.106	**Seepage Coefficient**	0
Unsat Avail Wat (cm)	20.9861	**Tile Drain Ratio**	0.5	**Sediment A Factor**	5.3025E-04
		Tile Drain Density	0	**Sed A Adjustment Factor**	1

Load File | Save File | Export to JPEG | Close

Attachment F

Equal Marginal Percent Reduction Method

The Equal Marginal Percent Reduction (EMPR) allocation method was used to distribute Adjusted Load Allocations (ALAs) between the appropriate contributing nonpoint sources. The load allocation and EMPR procedures were performed using the MS Excel and results are presented in Attachment G. The five major steps identified in the spreadsheet are summarized below:

1. Calculation of the TMDL based on impaired watershed size and unit area loading rate of the reference watershed.

2. Calculation of Adjusted Load Allocation based on TMDL, Margin of Safety, and existing loads not reduced.

3. Actual EMPR Process.

    a. Each land use/source load is compared with the total ALA to determine if any contributor would exceed the ALA by itself. The evaluation is carried out as if each source is the only contributor to the pollutant load of the receiving waterbody. If the contributor exceeds the ALA, that contributor would be reduced to the ALA. If a contributor is less than the ALA, it is set at the existing load. This is the baseline portion of the EMPR.
    b. After any necessary reductions have been made in the baseline, the multiple analyses are run. The multiple analyses will sum all of the baseline loads and compare them to the ALA. If the ALA is exceeded, an equal percent reduction will be made to all contributors' baseline values. After any necessary reductions in the multiple analyses, the final reduction percentage for each contributor can be computed.

4. Calculation of total loading rate of all sources receiving reductions.

5. Summary of existing loads, final load allocations, and percent reduction for each pollutant source.

Attachment G

Equal Marginal Percent Reduction Calculations for the Yellow Creek Watershed TMDL

Step 1:	TMDL Total Load				Step 2:	Adjusted LA = (TMDL total load - MOS) - uncontrollable						
	Load = loading rate in ref. * Acres in Impaired					30999.3173	30999					
	36099.7610											
	SEDIMENT LOADING											
Step 3:		Non-MS4 Daily Average Load	Load Sum	Check	Initial Adjust	Recheck	% reduction allocation	Load Reduction	Initial LA	Acres	Allowable Loading Rate	% Reduction
	Hay/Past.	5860.9315	64630.1554	good	5861	ADJUST	0.09	3045.054	2815.878	16153.30	0.174	52%
	Cropland	31107.8904		bad	30999	33522	0.48	16105.732	14893.585	6706.40	2.221	52%
	Developed	466.5753		good	467		0.01	242.410	224.166	2211.70	0.101	52%
	Streambank	27194.7582		good	27195		0.42	14129.069	13065.689			52%
	Total	64630.1554			64521.58226		1.00		30999.317			
Step 4:	All Ag. Loading Rate	0.77										
Step 5:		Acres	Allowable (Target) Loading Rate	Final LA	Current Loading Rates	Current Load	% Red.					
	Final Hay/Past. LA	16153.30	0.1743	2815.8776	0.3628	5860.9315	52%					
	Final Cropland LA	6706.40	2.2208	14893.5850	4.6385	31107.8904	52%					
	Developed	2211.70	0.1014	224.1655	0.2110	466.5753	52%					
	Streambank			13065.6892		27194.7582	52%					
	Total			30999.3173		64630.1554	52%					
	Yellow Creek											

Step 1:	TMDL Total Load				Step 2:	Adjusted LA = (TMDL total load - MOS) - uncontrollable						
	Load = loading rate in ref. * Acres in Impaired					8.2516	8					
	26.5570											
	PHOSPHORUS LOADING											
Step 3:		Non-MS4 Daily Average Load	Load Sum	Check	Initial Adjust	Recheck	% reduction allocation	Load Reduction	Initial LA	Acres	Allowable Loading Rate	% Reduction
	Hay/Past.	9.1123	29.8583	bad	8	ADJUST	0.47	4.373	3.878	16153.30	0.000	57%
	Cropland	19.6928		bad	8	9	0.47	4.373	3.878	6706.40	0.001	80%
	Developed	0.4549		good	0		0.03	0.241	0.214	2211.70	0.000	53%
	Streambank	0.5983		good	1		0.03	0.317	0.281			53%
	Total	29.858			17.556328		1.00		8.252			
Step 4:	All Ag. Loading Rate	0.00										

Step 5:		Acres	Allowable (Target) Loading Rate	Final LA	Current Loading Rates	Current Load	% Red.
	Final Hay/Past. LA	16153.30	0.0002	3.8783	0.0006	9.1123	57%
	Final Cropland LA	6706.40	0.0006	3.8783	0.0029	19.6928	80%
	Developed	2211.70	0.0001	0.2138	0.0002	0.4549	53%
	Streambank			0.2812		0.5983	53%
	Total			8.2516		29.8583	72%

Yellow Creek

Attachment H

Yellow Creek Impaired Segment Listings

Stream Name / Use Designation (Assessment ID) / Source	Cause	Date Listed	TMDL Date

Hydrologic Unit Code: 02050303 - Raystown

Beaver Creek
HUC: 02050303

Aquatic Life (4116) - 9.07 miles; 40 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

Beaver Creek (Unt 13860)
HUC: 02050303

Aquatic Life (4116) - 1.42 miles; 3 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

Beaver Creek (Unt 13861)
HUC: 02050303

Aquatic Life (4116) - 0.76 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

Beaver Creek (Unt 13862)
HUC: 02050303

Aquatic Life (4116) - 0.46 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

Beaver Creek (Unt 13863)
HUC: 02050303

Aquatic Life (4116) - 0.58 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

Beaver Creek (Unt 13864)
HUC: 02050303

Aquatic Life (4116) - 0.58 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

Beaver Creek (Unt 13865)
HUC: 02050303

Aquatic Life (4116) - 0.49 miles; 2 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Beaver Creek (Unt 13866) HUC: 02050303			
Aquatic Life (4116) - 0.69 miles; 2 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13867) HUC: 02050303			
Aquatic Life (4116) - 0.28 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13868) HUC: 02050303			
Aquatic Life (4116) - 0.74 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13869) HUC: 02050303			
Aquatic Life (4116) - 0.65 miles; 3 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13870) HUC: 02050303			
Aquatic Life (4116) - 0.37 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13871) HUC: 02050303			
Aquatic Life (4116) - 0.81 miles; 2 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13872) HUC: 02050303			
Aquatic Life (4116) - 0.80 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13873) HUC: 02050303			
Aquatic Life (4116) - 1.17 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Beaver Creek (Unt 13873) HUC: 02050303			
Aquatic Life (4116) - 1.17 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13874) HUC: 02050303			
Aquatic Life (4116) - 0.35 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13875) HUC: 02050303			
Aquatic Life (4116) - 3.04 miles; 8 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13876) HUC: 02050303			
Aquatic Life (4116) - 0.51 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13877) HUC: 02050303			
Aquatic Life (4116) - 0.42 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13878) HUC: 02050303			
Aquatic Life (4116) - 0.97 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13879) HUC: 02050303			
Aquatic Life (4116) - 0.63 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13880) HUC: 02050303			
Aquatic Life (4116) - 0.51 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Beaver Creek (Unt 13880) HUC: 02050303			
Beaver Creek (Unt 13881) HUC: 02050303			
Aquatic Life (4116) - 0.63 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13882) HUC: 02050303			
Aquatic Life (4116) - 0.49 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13883) HUC: 02050303			
Aquatic Life (4116) - 0.69 miles; 2 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13884) HUC: 02050303			
Aquatic Life (4116) - 0.61 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13885) HUC: 02050303			
Aquatic Life (4116) - 1.86 miles; 2 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Aquatic Life (13745) - 0.02 miles; 1 Segment(s)*			
Agriculture	Nutrients	2008	2021
Agriculture	Siltation	2008	2021
Beaver Creek (Unt 13886) HUC: 02050303			
Aquatic Life (4116) - 0.63 miles; 3 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13887) HUC: 02050303			
Aquatic Life (13744) - 0.04 miles; 2 Segment(s)*			

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Beaver Creek (Unt 13887) HUC: 02050303			
Aquatic Life (13744) - 0.04 miles; 2 Segment(s)*			
Agriculture	Nutrients	2008	2021
Agriculture	Siltation	2008	2021
Beaver Creek (Unt 13888) HUC: 02050303			
Aquatic Life (4116) - 1.10 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13889) HUC: 02050303			
Aquatic Life (4116) - 0.59 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13890) HUC: 02050303			
Aquatic Life (4116) - 1.31 miles; 3 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13891) HUC: 02050303			
Aquatic Life (4116) - 1.57 miles; 4 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13892) HUC: 02050303			
Aquatic Life (4116) - 0.77 miles; 2 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13893) HUC: 02050303			
Aquatic Life (4116) - 0.86 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13894) HUC: 02050303			
Aquatic Life (4116) - 0.83 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017

*Segments are defined as individual COM IDs.

Stream Name / Use Designation (Assessment ID) / Source	Cause	Date Listed	TMDL Date
Beaver Creek (Unt 13894)			
HUC: 02050303			
Aquatic Life (4116) - 0.83 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13895)			
HUC: 02050303			
Aquatic Life (4116) - 1.19 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13896)			
HUC: 02050303			
Aquatic Life (4116) - 0.95 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13897)			
HUC: 02050303			
Aquatic Life (4116) - 0.94 miles; 2 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13898)			
HUC: 02050303			
Aquatic Life (4116) - 1.24 miles; 3 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13899)			
HUC: 02050303			
Aquatic Life (4116) - 0.70 miles; 3 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13900)			
HUC: 02050303			
Aquatic Life (4116) - 0.86 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13901)			
HUC: 02050303			
Aquatic Life (4116) - 0.94 miles; 3 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Beaver Creek (Unt 13901) HUC: 02050303			
Beaver Creek (Unt 13902) HUC: 02050303			
Aquatic Life (4116) - 1.57 miles; 6 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13903) HUC: 02050303			
Aquatic Life (4116) - 1.09 miles; 5 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13904) HUC: 02050303			
Aquatic Life (4116) - 0.35 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13905) HUC: 02050303			
Aquatic Life (4116) - 0.32 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13906) HUC: 02050303			
Aquatic Life (4116) - 1.40 miles; 5 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13907) HUC: 02050303			
Aquatic Life (4116) - 0.50 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13908) HUC: 02050303			
Aquatic Life (4116) - 0.40 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Beaver Creek (Unt 13909) HUC: 02050303			
Aquatic Life (4116) - 0.92 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13910) HUC: 02050303			
Aquatic Life (4116) - 0.81 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13911) HUC: 02050303			
Aquatic Life (4116) - 0.95 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Beaver Creek (Unt 13912) HUC: 02050303			
Aquatic Life (4116) - 0.14 miles; 2 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
Hickory Bottom Creek HUC: 02050303			
Aquatic Life (4229) - 5.34 miles; 11 Segment(s)*			
Agriculture	Siltation	2004	2017
Hickory Bottom Creek (Unt 13989) HUC: 02050303			
Aquatic Life (4229) - 1.72 miles; 3 Segment(s)*			
Agriculture	Siltation	2004	2017
Hickory Bottom Creek (Unt 13991) HUC: 02050303			
Aquatic Life (4229) - 0.83 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Hickory Bottom Creek (Unt 13992) HUC: 02050303			
Aquatic Life (4229) - 1.41 miles; 3 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Hickory Bottom Creek (Unt 13993) HUC: 02050303			
Aquatic Life (4229) - 0.74 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Hickory Bottom Creek (Unt 13994) HUC: 02050303			
Aquatic Life (4229) - 0.44 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Hickory Bottom Creek (Unt 13995) HUC: 02050303			
Aquatic Life (13738) - 0.02 miles; 2 Segment(s)*			
Agriculture	Siltation	2008	2021
Hickory Bottom Creek (Unt 13996) HUC: 02050303			
Aquatic Life (4229) - 0.49 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Hickory Bottom Creek (Unt 13997) HUC: 02050303			
Aquatic Life (4229) - 0.49 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Hickory Bottom Creek (Unt 13998) HUC: 02050303			
Aquatic Life (4229) - 1.75 miles; 4 Segment(s)*			
Agriculture	Siltation	2004	2017
Aquatic Life (13739) - 0.02 miles; 1 Segment(s)*			
Agriculture	Siltation	2008	2021
Hickory Bottom Creek (Unt 13999) HUC: 02050303			
Aquatic Life (13739) - 0.05 miles; 2 Segment(s)*			
Agriculture	Siltation	2008	2021
Hickory Bottom Creek (Unt 14000) HUC: 02050303			
Aquatic Life (13739) - 0.05 miles; 2 Segment(s)*			
Agriculture	Siltation	2008	2021
Hickory Bottom Creek (Unt 14001) HUC: 02050303			
Aquatic Life (4229) - 0.76 miles; 1 Segment(s)*			

*Segments are defined as individual COM IDs.

Stream Name / Use Designation (Assessment ID) / Source	Cause	Date Listed	TMDL Date
Hickory Bottom Creek (Unt 14001) HUC: 02050303			
Aquatic Life (4229) - 0.76 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek HUC: 02050303			
Aquatic Life (4135) - 0.54 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Aquatic Life (4209) - 4.63 miles; 10 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13941) HUC: 02050303			
Aquatic Life (4209) - 0.93 miles; 3 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13942) HUC: 02050303			
Aquatic Life (4209) - 0.48 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13943) HUC: 02050303			
Aquatic Life (4209) - 0.38 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13945) HUC: 02050303			
Aquatic Life (4209) - 0.56 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13946) HUC: 02050303			
Aquatic Life (4209) - 0.55 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13947) HUC: 02050303			
Aquatic Life (4209) - 1.26 miles; 4 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13948) HUC: 02050303			
Aquatic Life (4209) - 0.78 miles; 2 Segment(s)*			

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Potter Creek (Unt 13948) HUC: 02050303			
Aquatic Life (4209) - 0.78 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13949) HUC: 02050303			
Aquatic Life (4209) - 0.13 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13950) HUC: 02050303			
Aquatic Life (4209) - 0.53 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13951) HUC: 02050303			
Aquatic Life (4209) - 0.46 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13952) HUC: 02050303			
Aquatic Life (4209) - 0.56 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13954) HUC: 02050303			
Aquatic Life (4209) - 0.51 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13955) HUC: 02050303			
Aquatic Life (4209) - 0.98 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13956) HUC: 02050303			
Aquatic Life (4209) - 0.67 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13957) HUC: 02050303			
Aquatic Life (4209) - 3.28 miles; 14 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Potter Creek (Unt 13958) HUC: 02050303			
Aquatic Life (4209) - 0.82 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13959) HUC: 02050303			
Aquatic Life (4209) - 1.66 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13960) HUC: 02050303			
Aquatic Life (4209) - 0.70 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13961) HUC: 02050303			
Aquatic Life (4209) - 0.63 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13962) HUC: 02050303			
Aquatic Life (4209) - 0.74 miles; 3 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13963) HUC: 02050303			
Aquatic Life (4209) - 0.67 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13964) HUC: 02050303			
Aquatic Life (4209) - 0.81 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13965) HUC: 02050303			
Aquatic Life (4209) - 1.23 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13966) HUC: 02050303			
Aquatic Life (4209) - 0.43 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Potter Creek (Unt 13967) HUC: 02050303			
Aquatic Life (4209) - 0.06 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13968) HUC: 02050303			
Aquatic Life (4209) - 0.82 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13969) HUC: 02050303			
Aquatic Life (4209) - 0.82 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13970) HUC: 02050303			
Aquatic Life (4209) - 0.66 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13971) HUC: 02050303			
Aquatic Life (4209) - 0.51 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13972) HUC: 02050303			
Aquatic Life (4209) - 2.61 miles; 6 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13973) HUC: 02050303			
Aquatic Life (4209) - 1.57 miles; 4 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13974) HUC: 02050303			
Aquatic Life (4209) - 1.17 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13975) HUC: 02050303			
Aquatic Life (4209) - 0.16 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Potter Creek (Unt 13976) HUC: 02050303			
Aquatic Life (4209) - 0.09 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13977) HUC: 02050303			
Aquatic Life (4209) - 0.63 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13978) HUC: 02050303			
Aquatic Life (4209) - 0.83 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13979) HUC: 02050303			
Aquatic Life (4209) - 0.52 miles; 4 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13980) HUC: 02050303			
Aquatic Life (4209) - 0.34 miles; 4 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13981) HUC: 02050303			
Aquatic Life (4209) - 0.14 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13982) HUC: 02050303			
Aquatic Life (4209) - 0.06 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13983) HUC: 02050303			
Aquatic Life (4209) - 0.13 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13984) HUC: 02050303			
Aquatic Life (4209) - 1.56 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name / Use Designation (Assessment ID) / Source	Cause	Date Listed	TMDL Date
Potter Creek (Unt 13985) HUC: 02050303			
Aquatic Life (4209) - 0.39 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13986) HUC: 02050303			
Aquatic Life (4209) - 0.64 miles; 3 Segment(s)*			
Agriculture	Siltation	2004	2017
Potter Creek (Unt 13987) HUC: 02050303			
Aquatic Life (4209) - 1.10 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run HUC: 02050303			
Aquatic Life (4211) - 3.78 miles; 14 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13916) HUC: 02050303			
Aquatic Life (4211) - 0.74 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13917) HUC: 02050303			
Aquatic Life (4211) - 0.47 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13918) HUC: 02050303			
Aquatic Life (4211) - 5.54 miles; 8 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13919) HUC: 02050303			
Aquatic Life (4211) - 0.48 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13920) HUC: 02050303			
Aquatic Life (4211) - 0.69 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Three Springs Run (Unt 13921) HUC: 02050303			
Aquatic Life (4211) - 0.44 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13922) HUC: 02050303			
Aquatic Life (4211) - 0.27 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Aquatic Life (13746) - 0.06 miles; 2 Segment(s)*			
Agriculture	Siltation	2008	2021
Three Springs Run (Unt 13923) HUC: 02050303			
Aquatic Life (4211) - 0.15 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13924) HUC: 02050303			
Aquatic Life (4211) - 0.59 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13925) HUC: 02050303			
Aquatic Life (4211) - 0.45 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13926) HUC: 02050303			
Aquatic Life (4211) - 0.47 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13927) HUC: 02050303			
Aquatic Life (4211) - 5.38 miles; 12 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13928) HUC: 02050303			
Aquatic Life (4211) - 0.76 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13929) HUC: 02050303			
Aquatic Life (4211) - 0.41 miles; 1 Segment(s)*			

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Three Springs Run (Unt 13929) HUC: 02050303			
Aquatic Life (4211) - 0.41 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13930) HUC: 02050303			
Aquatic Life (4211) - 0.61 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13931) HUC: 02050303			
Aquatic Life (4211) - 0.79 miles; 4 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13932) HUC: 02050303			
Aquatic Life (4211) - 0.81 miles; 3 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13934) HUC: 02050303			
Aquatic Life (4211) - 0.82 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13935) HUC: 02050303			
Aquatic Life (4211) - 0.62 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Three Springs Run (Unt 13936) HUC: 02050303			
Aquatic Life (4211) - 1.03 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek HUC: 02050303			
Aquatic Life (4135) - 11.79 miles; 37 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 13914) HUC: 02050303			
Aquatic Life (4135) - 1.59 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Yellow Creek (Unt 13937) HUC: 02050303			
Aquatic Life (4135) - 0.49 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 13938) HUC: 02050303			
Aquatic Life (4135) - 0.80 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 13939) HUC: 02050303			
Aquatic Life (4135) - 0.81 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14002) HUC: 02050303			
Aquatic Life (4135) - 0.47 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14003) HUC: 02050303			
Aquatic Life (4135) - 0.78 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14004) HUC: 02050303			
Aquatic Life (4135) - 2.19 miles; 4 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14005) HUC: 02050303			
Aquatic Life (4135) - 0.95 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14007) HUC: 02050303			
Aquatic Life (4135) - 4.11 miles; 9 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14008) HUC: 02050303			
Aquatic Life (4135) - 0.49 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Yellow Creek (Unt 14009) HUC: 02050303			
Aquatic Life (4135) - 1.05 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14010) HUC: 02050303			
Aquatic Life (4135) - 0.84 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14011) HUC: 02050303			
Aquatic Life (4135) - 0.62 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14012) HUC: 02050303			
Aquatic Life (4135) - 1.73 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14013) HUC: 02050303			
Aquatic Life (4135) - 0.56 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14014) HUC: 02050303			
Aquatic Life (4135) - 1.44 miles; 4 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14015) HUC: 02050303			
Aquatic Life (4135) - 1.09 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14016) HUC: 02050303			
Aquatic Life (4135) - 0.27 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14017) HUC: 02050303			
Aquatic Life (4135) - 0.42 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Yellow Creek (Unt 14018) HUC: 02050303			
Aquatic Life (4135) - 0.50 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14019) HUC: 02050303			
Aquatic Life (4135) - 1.71 miles; 6 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14021) HUC: 02050303			
Aquatic Life (4135) - 0.92 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14022) HUC: 02050303			
Aquatic Life (4135) - 0.63 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14023) HUC: 02050303			
Aquatic Life (4135) - 1.06 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14024) HUC: 02050303			
Aquatic Life (4135) - 2.01 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14025) HUC: 02050303			
Aquatic Life (4135) - 0.84 miles; 2 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14026) HUC: 02050303			
Aquatic Life (4135) - 0.36 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
Yellow Creek (Unt 14028) HUC: 02050303			
Aquatic Life (4135) - 0.49 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
Yellow Creek (Unt 14029) HUC: 02050303			
Aquatic Life (4135) - 0.66 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
zz Unknown NHD Name: 02050303001421 HUC: 02050303			
Aquatic Life (13748) - 0.15 miles; 1 Segment(s)*			
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001551 HUC: 02050303			
Aquatic Life (13741) - 0.04 miles; 2 Segment(s)*			
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001552 HUC: 02050303			
Aquatic Life (13741) - 0.06 miles; 2 Segment(s)*			
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001558 HUC: 02050303			
Aquatic Life (13741) - 0.02 miles; 1 Segment(s)*			
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001563 HUC: 02050303			
Aquatic Life (13741) - 0.16 miles; 2 Segment(s)*			
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001739 HUC: 02050303			
Aquatic Life (13747) - 0.05 miles; 1 Segment(s)*			
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001757 HUC: 02050303			
Aquatic Life (13742) - 0.11 miles; 1 Segment(s)*			
Agriculture	Nutrients	2008	2021
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001764 HUC: 02050303			
Aquatic Life (4116) - 0.04 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017

*Segments are defined as individual COM IDs.

Stream Name / Use Designation (Assessment ID) / Source	Cause	Date Listed	TMDL Date
zz Unknown NHD Name: 02050303001764 HUC: 02050303			
Aquatic Life (4116) - 0.04 miles; 1 Segment(s)*			
Agriculture	Siltation	2004	2017
zz Unknown NHD Name: 02050303001770 HUC: 02050303			
Aquatic Life (13742) - 0.11 miles; 1 Segment(s)*			
Agriculture	Nutrients	2008	2021
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001774 HUC: 02050303			
Aquatic Life (13742) - 0.05 miles; 1 Segment(s)*			
Agriculture	Nutrients	2008	2021
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001786 HUC: 02050303			
Aquatic Life (13742) - 0.17 miles; 1 Segment(s)*			
Agriculture	Nutrients	2008	2021
Agriculture	Siltation	2008	2021
zz Unknown NHD Name: 02050303001806 HUC: 02050303			
Aquatic Life (4116) - 0.07 miles; 1 Segment(s)*			
Agriculture	Nutrients	2004	2017
Agriculture	Siltation	2004	2017
zz Unknown NHD Name: 02050303001830 HUC: 02050303			
Aquatic Life (13743) - 0.04 miles; 1 Segment(s)*			
Agriculture	Nutrients	2008	2021
Agriculture	Siltation	2008	2021

Report Summary

Watershed Summary

	Stream Miles	Assessment Units	Segments (COMIDs)
Watershed Characteristics	175.13	15	456

Impairment Summary

Source	Cause	Miles	Assessment Units	Segments (COMIDs)
Agriculture	Nutrients	53.12	5	147
Agriculture	Siltation	174.39	15	451

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date
	174.39 **	**15** **	**451** **

**Totals reflect actual miles of impaired stream. Each stream segment may have multiple impairments (different sources or causes contributing to the impairment), so the sum of individual impairment numbers may not add up to the totals shown.

Use Designation Summary

	Miles	Assessment Units	Segments (COMIDs)
Aquatic Life	174.39	15	451

*Segments are defined as individual COM IDs.

Attachment I

Comment & Response Document for the Yellow Creek Watershed TMDL

No official comments were received for this TMDL.