Anderson Run

Watershed Based Plan

Submitted by

West Virginia Conservation Agency

June 2019

Watershed Based Plan for Anderson Run

HUC8: 02070001

HUC12: 020700010602

AN-Code: WVPSB-18

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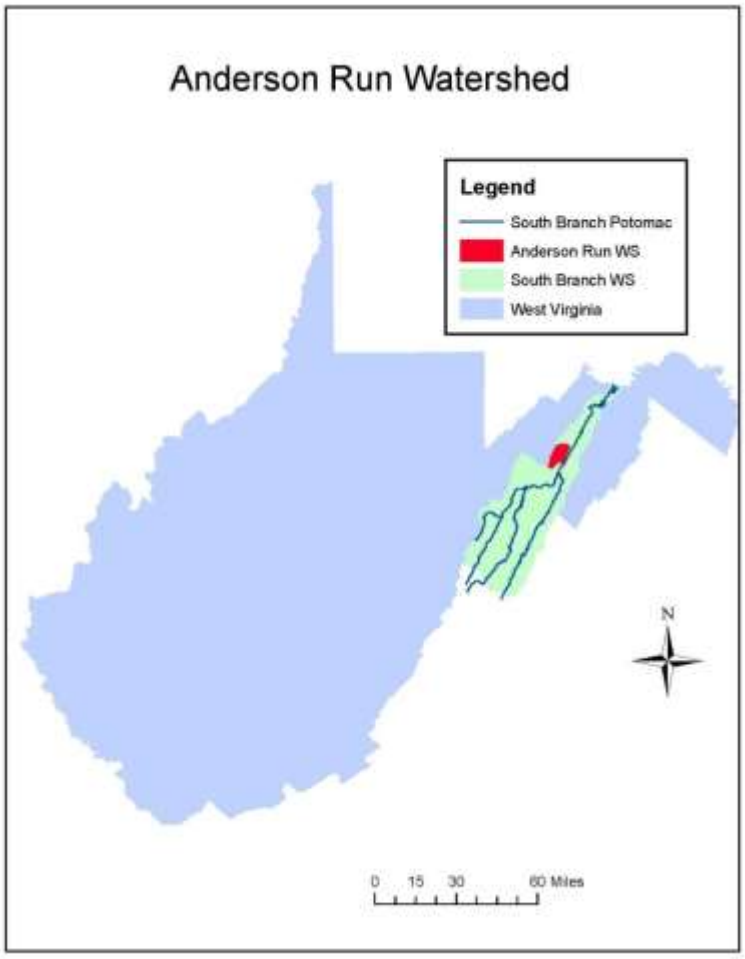
INTRODUCTION

The purpose of this watershed-based plan is to define the problems, resources, costs and course of action necessary to restore the impaired streams of the Anderson Run watershed to full compliance with water quality standards. Following this watershed-based plan will implement the Total Daily Maximum Load (TMDL) set for these streams by the WV Department of Environmental Protection (DEP).



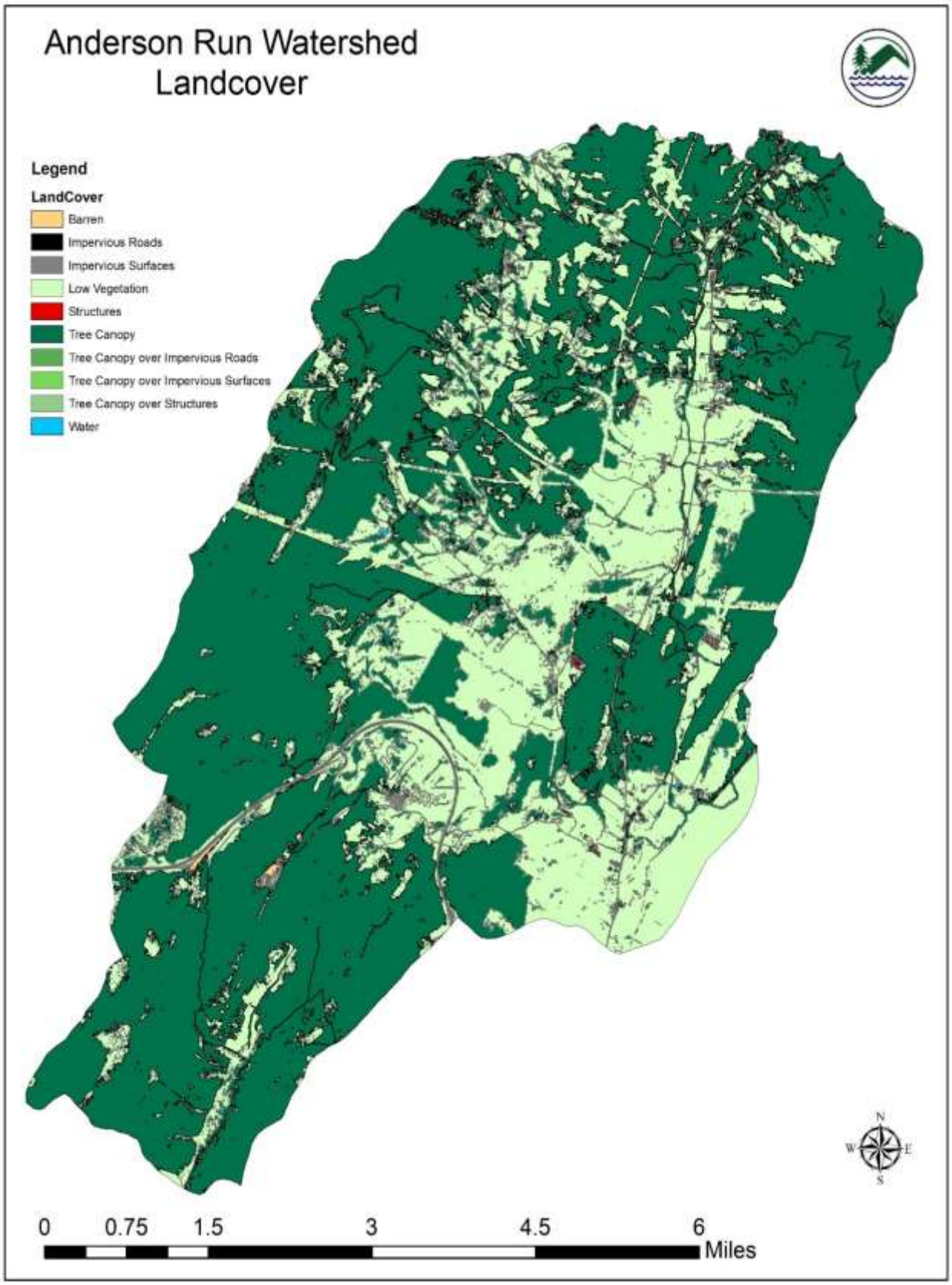
Anderson Run is a stream that empties into the South Branch of the Potomac approximately six miles north of the city of Moorefield, WV. It enters the South Branch just before the river enters The Trough, a locally well-known area favored by canoeists and fishermen. The Trough is also known for its nesting Bald Eagles, a highlight for passengers on the tourist train the Silver Eagle. The watershed includes Anderson Run and Mudlick Run as the two largest streams with smaller tributaries of Turnmill Run, Long Hollow, Toombs Hollow, Walnut Bottom and several small unnamed tributaries. The entire watershed comprises 25,908 acres in the northwest corner of Hardy County. The community of Old Fields is the only town in the watershed. But, there are several housing developments within the watershed.

The watershed lies completely within the Ridge and Valley Province of eastern West Virginia. The province is characterized by long, narrow ridge lines with steep valley sides and relatively narrow valley bottoms. However, by West Virginia standards the South Branch is a wide and relatively flat valley bottom. The Anderson Run watershed lies entirely within the South Branch valley with its headwaters forming on a front range of hills called Patterson Creek Mountain instead of on the higher and steeper Allegheny mountains. This means that the general topography of the watershed is more gently sloping than the average watershed in the region. This makes the watershed favorable for agriculture and home building.

Since the completion of the TMDL Hardy County and Anderson Run have gone through some land use changes the most significant being the completion of Corridor H, US route 48, through the county. Corridor H passes through Anderson Run. This four-lane highway is expected to increase development and facilitate improved transportation for agricultural products. The Hardy County Water Resources Assessment (HCWRA), developed in 2004 for the Hardy County Commission, predicted a 12% rise in population from the 2000 census using a model from West Virginia University (WVU). The county saw a rise in population from 1990 to 2000 of over 15%. Population increases have occurred throughout the Eastern Panhandle region due to it being near to the Washington D.C metro area. In the Anderson Run watershed the land use changes have included 2 new housing developments and the development of a law enforcement training center. The primary economic activity within the watershed is agriculture mostly poultry and beef production.

Table 1. Land uses

Anderson Run Landcover		
Landcover	Acres	Percent Cover
Tree Canopy	16,565.2	64.1%
Low Vegetation	8,697.0	33.7%
Impervious Surfaces	235.3	0.9%
Impervious Roads	127.9	0.5%
Tree Canopy over Impervious Roads	78.8	0.3%
Structures	59.1	0.2%
Barren	33.8	0.1%
Water	20.0	0.1%
Tree Canopy Over Structures	9.8	0.0%
Tree Canopy Over Impervious Surfaces	8.0	0.0%


Anderson Run Watershed
Landcover
Legend
LandCover
Barren
Impervious Roads
Impervious Surfaces
Low Vegetation
Structures
Tree Canopy
Tree Canopy over Impervious Roads
Tree Canopy over Impervious Surfaces
Tree Canopy over Structures
Water
N
W
E
S
0
0.75
1.5
3
4.5
6
Miles

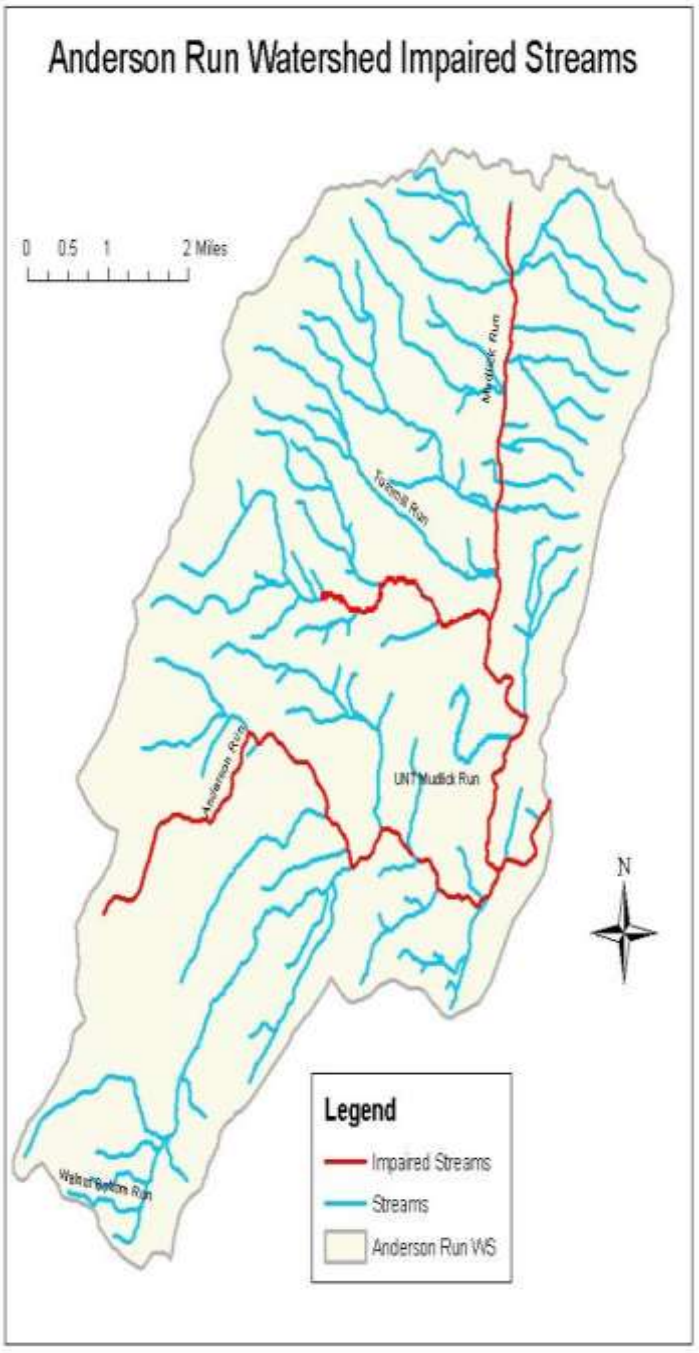
Per the HCWRA, the average annual temperature for the area is approximately 51.3 F with monthly extremes ranging from approximately 28.6 F in January to approximately 72.4 F, in July.

The average annual precipitation for the area is 34.12 inches with the maximum of 3.44 inches in the month of July and the minimum of 2.01 inches in the month of February. Data from the Roanoke, Virginia National Weather Service Office indicate the area experiences approximately 23.0 inches of snowfall per year, usually during the December to March winter season.

Anderson Run was initially placed on the 1996 303(d) list of water quality impaired streams. Mudlick Run and an unnamed tributary of Mudlick Run was placed on the 303(d) list in 1998. The cause of impairment was listed as fecal coliform bacteria. Since then, new TMDLs were developed for Anderson Run and its tributaries in 2015 for fecal coliform bacteria and iron.

The TMDL identified organic enrichment and sedimentation as significant stressors. The data used to list Anderson Run on 303(d) list was collected by the U.S. Geological Survey (USGS) in 1994 – 1995. After that the watershed has been sampled by the W.V. Department of Environmental Protection (DEP) and the W.V. Department of Agriculture (WVDA).

WVDA has done the most extensive monitoring with three stations starting in October 1998 and continuing to August 2005. The WVDA resumed monitoring the watershed and increased the number of stations to seven in March 2011 and continues to monitor those stations. The DEP also monitored the watershed in 2011 in preparation for a new TMDL. The new TMDL was approved by EPA in April 2015



The city of Moorefield with Patterson Creek Mountain directly behind it and the Allegheny Mountains visible in the distance. Anderson Run is to the right, out of view of the photograph, but this does show the topography of the watershed. - Hardy County Water Resources Assessment, 2004

CAUSES AND SOURCES

Section 303(d) of the federal Clean Water Act requires states to identify waterbodies that do not meet water quality standards and to develop appropriate TMDLs. A Total Maximum Daily Load (TMDL) establishes the maximum allowable pollutant loading for a waterbody to achieve compliance with established water quality standards. It also distributes the load among pollutant sources establishing load reduction goals from each source.

Data obtained from pre-TMDL monitoring was compiled, and the impaired waters were modeled to determine baseline conditions and the gross pollutant reductions needed to achieve water quality standards. A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS) that accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving stream. TMDLs can be expressed in terms of mass per time or other appropriate units. TMDLs are calculated by the following equation:

TMDL = sum of WLAs + sum of LAs + MOS

The determination of impaired waters involves comparing instream conditions to applicable water quality standards. West Virginia's water quality standards are codified at Title 47 of the *Code of State Rules* (CSR), Series 2, titled *Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards*: Water quality standards consist of three components: designated uses; narrative and/or numeric water quality criteria necessary to support those uses; and an antidegradation policy.

In the Anderson Run watershed, water quality does not meet the fecal coliform criteria to support the designated use of contact recreation, nor does it meet the iron criteria to support the designated use of aquatic life.

TABLE 2. TMDL development

TMDL Watershed	Stream Name	NHD Code	Trout	DO	Fe	FC
Anderson Run	Anderson Run	WV-PSB-62			M	X
Anderson Run	Mudlick Run	WV-PSB-62-C			X	X
Anderson Run	UNT/Mudlick Branch RM 4.62	WV-PSB-62-C-12			M	
Anderson Run	UNT/Mudlick Run RM 5.61	WV-PSB-62-C-15			M	
Anderson Run	UNT/Mudlick Run RM 5.63	WV-PSB-62-C-16			M	
Anderson Run	UNT/Mudlick Run RM 2.88	WV-PSB-62-C-3			M	X
Anderson Run	UNT/UNT RM 1.62/Mudlick Run RM 2.88	WV-PSB-62-C-3-B				X
Anderson Run	Turnmill Run	WV-PSB-62-C-4			X	X
Anderson Run	UNT/Mudlick Run RM 3.62	WV-PSB-62-C-6			M	
Anderson Run	UNT/Anderson Run RM 3.30	WV-PSB-62-I			M	
Anderson Run	Walnut Bottom Run	WV-PSB-62-J			M	X

Note:
RM river mile
UNT unnamed tributary
DO Dissolved Oxygen
Fe iron impairment
FC fecal coliform bacteria impairment
M Impairment determined via modeling
Trout Trout Stream

In excess, iron can be harmful to aquatic life and human health. The chronic aquatic life criterion for warm water fishery streams and wetlands is 1.5 mg/l, for trout waters is 1.0 mg/l, and for public water supply is 1.5 mg/l. Anderson Run and its tributaries would be considered warm water fisheries, therefore the 1.5 mg/l standard applies.

Iron impairments are also attributable to both point and nonpoint sources. Nonpoint sources of iron include roads, oil and gas operations, timbering, agriculture, urban/residential land disturbance and streambank erosion. Iron point sources include the permitted discharges from quarries and stormwater contributions from industrial and construction sites. The presence of individual source categories and their relative significance also varies by sub watershed. Because iron is a naturally-occurring element that is present in soils, the iron loading from many of the identified sources is associated with sediment contributions. (TMDL)

Fecal coliform is not considered a human health risk but is an indicator of fecal matter in a water sample. There are more than 150 potentially harmful to human pathogens found in livestock manure which account of 90% of waterborne diseases in humans. (USEPA 2003) The water quality standard for human health from 47 CSR, Series 2, *Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards* is: "Human Health Criteria Maximum allowable level of fecal coliform content for Primary Contact Recreation (either MPN [most probable number] or MF [membrane filter counts/test]) shall not exceed 200/100 mL as a monthly geometric mean based on not less than 5 samples per month; nor to exceed 400/100 mL in more than 10 percent of all samples taken during the month."

To gather data for the 2015TMDL, DEP sampled the Anderson Run watershed in 2011. Each station was sampled five times during the year. The DEP employs a methodology for listing and developing a TMDL for a stream for fecal coliform when 10% of instantaneous samples exceed 400 counts/100 ml. As Table 3 illustrates, all stations sampled exceeded a limit of 10% of samples above 400 cfu/100ml criteria. WVDA has compiled data through 2017 – see Appendix A

Typically, if an ample data set exists and exceedances of chronic aquatic life protection and/or human health protection criteria occur more than 10 percent of the time, the water is identified as impaired. If the rate of West Virginia Draft 2016 Section 303(d) List West Virginia Draft 2016 Section 303(d) List 5 exceedance demonstrated is less than or equal to 10 percent, then the water is meeting the designated use under evaluation.

Ample data sets are defined as sets with 20 or more distinct observations. If fewer than 20 samples per station or representative area exist and three or more values exceed a criterion value, then the water is identified as impaired. For this scenario (three observed violations), if additional non-exceeding monitoring results were available that would increase the data set size to 20 observations, a greater than 10 percent exceedance frequency would still exist. (2016 draft 303 (d) list)

In the TMDL development effort, modeling at baseline conditions demonstrated additional pollutant impairments to those identified via monitoring. The prediction of impairment through modeling is validated by applicable federal guidance for 303(d) listing. WVDEP could not perform water quality monitoring and source characterization at frequencies or sample location resolution enough to comprehensively assess water quality under the terms of applicable water quality standards, and modeling was needed to complete the assessment. Where existing pollutant sources were confidently predicted to cause noncompliance with a particular criterion, the subject water was characterized as impaired. In the 2016 TMDL's project model predicted impairments were determine only for total iron water quality criteria.

TABLE 3. Fecal coliform data summary (Source: WVDEP)

Fecal coliform Water Quality Data Summary- TMDL								
Stream Name	Station Code	NHD Code	Mile Point	#Samples	Geometric Mean (cfu/100 mL)	Average (cfu/100 mL)	%> 200 cfu/100 mL	% > 400 cfu/100 mL
Turnmill Run	PSB-00028-0	WV-PSB-62-C-4	0	5	531	566	100%	60%
UNT/Mudlick Run RM 2.88	PSB-00344-0.1	WV-PSB-62-C-3	0.1	5	98	1576	60%	40%
Mudlick Run	PSB-00024-0.4	WV-PSB-62-C	0.4	5	1031	6118	60%	40%
UNT/Mudlick Run RM 2.88	PSB-00344-0.75	WV-PSB-62-C-3	0.75	5	57	490	40%	20%
Mudlick Run	PSB-00024-3.1	WV-PSB-62-C	3.1	5	907	2502	100%	80%
Anderson Run	PSB-00022-3.8	WV-PSB-62	3.8	5	1046	2298	80%	60%
Mudlick Run	PSB-00024-5.4	WV-PSB-62-C	5.4	5	34	764	80%	60%

TABLE 4. Iron data summary (Source: WVDEP)

Iron Water Quality Data Summary- TMDL									
Stream Name	Station Code	NHD Code	Mile Point	#Samples	Min	Max	#Samples > 1 mg/l	#Samples > 1.5 mg/l	Average (mg/L)
Turnmill Run	PSB-00028-0	WV-PSB-62-C-4	0	5	0.12	2.99	1	1	0.75
UNT/Mudlick Run RM 2.88	PSB-00344-0.1	WV-PSB-62-C-3	0.1	4	0.2	1.12	1	0	0.94
Mudlick Run	PSB-00024-0.4	WV-PSB-62-C	0.4	4	0.12	14.1	1	1	2.97
UNT/Mudlick Run RM 2.88	PSB-00344-0.75	WV-PSB-62-C-3	0.75	5	0.02	1.24	1	0	0.42
Mudlick Run	PSB-00024-3.1	WV-PSB-62-C	3.1	5	0.14	10.9	1	1	1.82
Anderson Run	PSB-00022-3.8	WV-PSB-62	3.8	5	0.13	0.7	0	0	0.27
Mudlick Run	PSB-00024-5.4	WV-PSB-62-C	5.4	5	0.06	5.63	1	1	0.42

By far the agency that has done the most monitoring in the Anderson Run watershed has been the WVDA. Beginning in October 1998 until August 2005 the WVDA took 1522 samples not including duplicates for quality control. Then starting again in July 2011, they resumed sampling and added AR04-07. Eight parameters are sampled and evaluated including: temperature, dissolved oxygen, pH, conductivity, total phosphorus, ammonia-nitrogen, nitrate- nitrogen and fecal coliform.

The results of the WVDA sampling efforts for the entire Potomac drainage in West Virginia were summed up in their *Potomac Headwaters Water Quality Report 1998 – 2008*.The summary of WVDA's sampling during that period showed that nitrate, phosphorus and fecal coliform levels remained relatively steady. Fecal coliform levels increased as the sampling went downstream showing the cumulative impacts of pollutant loading. At AR03 45% of the samples were above the 200 cfu/100ml and 28% were above 400 cfu/100ml. WVDA will consider adding iron to their list of parameters that are analyzed.

In addition to fecal coliform, nutrients are a concern as well. No water quality standards for nutrients have been approved for West Virginia but as a part of the Chesapeake Bay watershed nutrient reporting is important. Again, the WVDA had done the most extensive monitoring for nutrients in Anderson Run. Per the *Potomac Headwaters Water Quality Report 1998 – 2008* for phosphorus "The overall median from 1998 to 2005 was 0.0219mg/L. Total phosphorus slightly increased throughout the eight years. (pg. 35) For nitrate; "Nitrate-n levels moderately increased from 1998 to 2005. A spike in nitrate concentrations during mid 2002 was probably due to low flow conditions. Nitrate-n levels at AR03 are increasing though at a different rate compared to sites AR01 and AR02." (pg. 37). WVDA site locations and sub-watersheds can be viewed in Figure 1A on the next page.

Figure 1A. Anderson Run sub-watersheds and stream codes

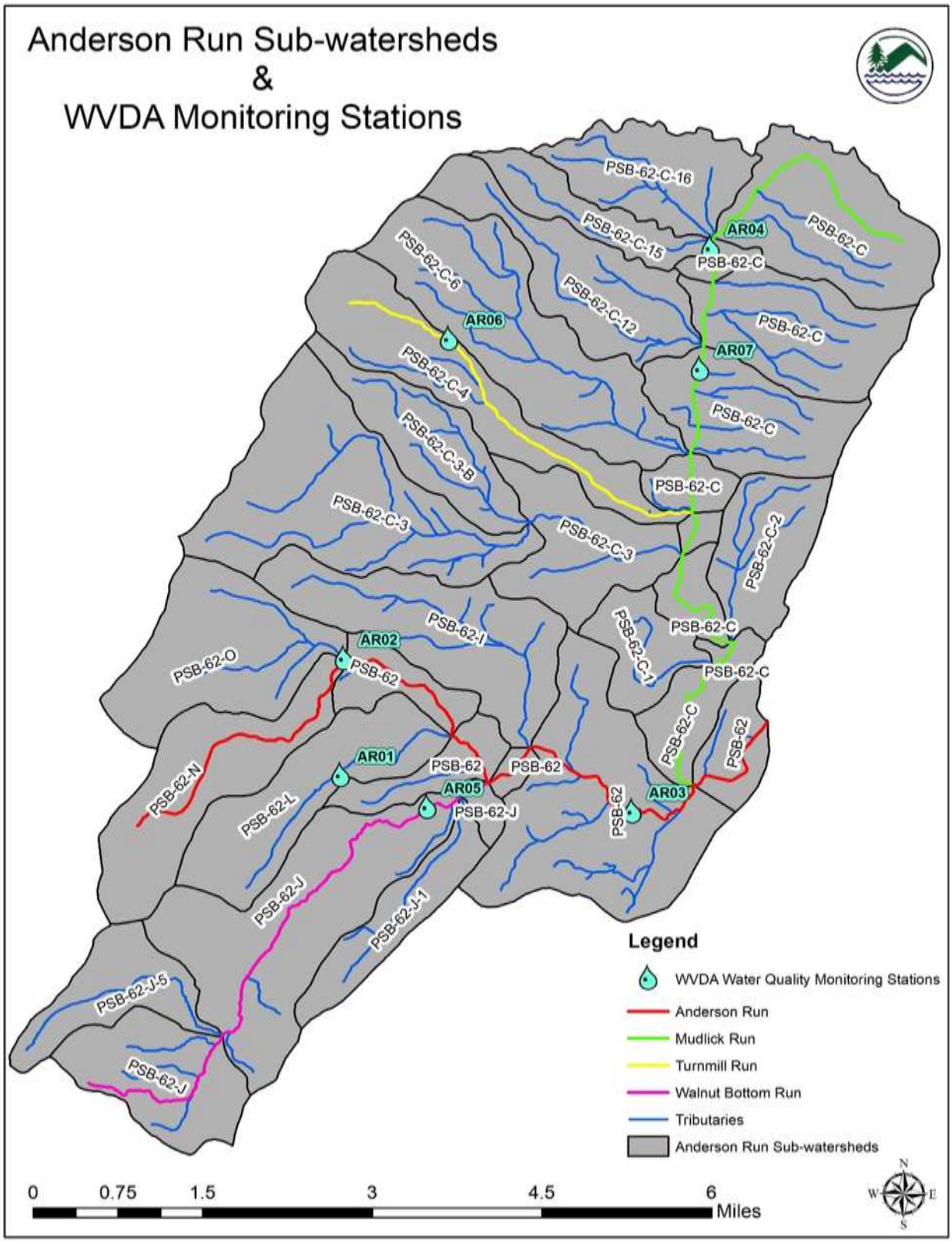


FIGURE 1B. Anderson Run SWC Identification Numbers

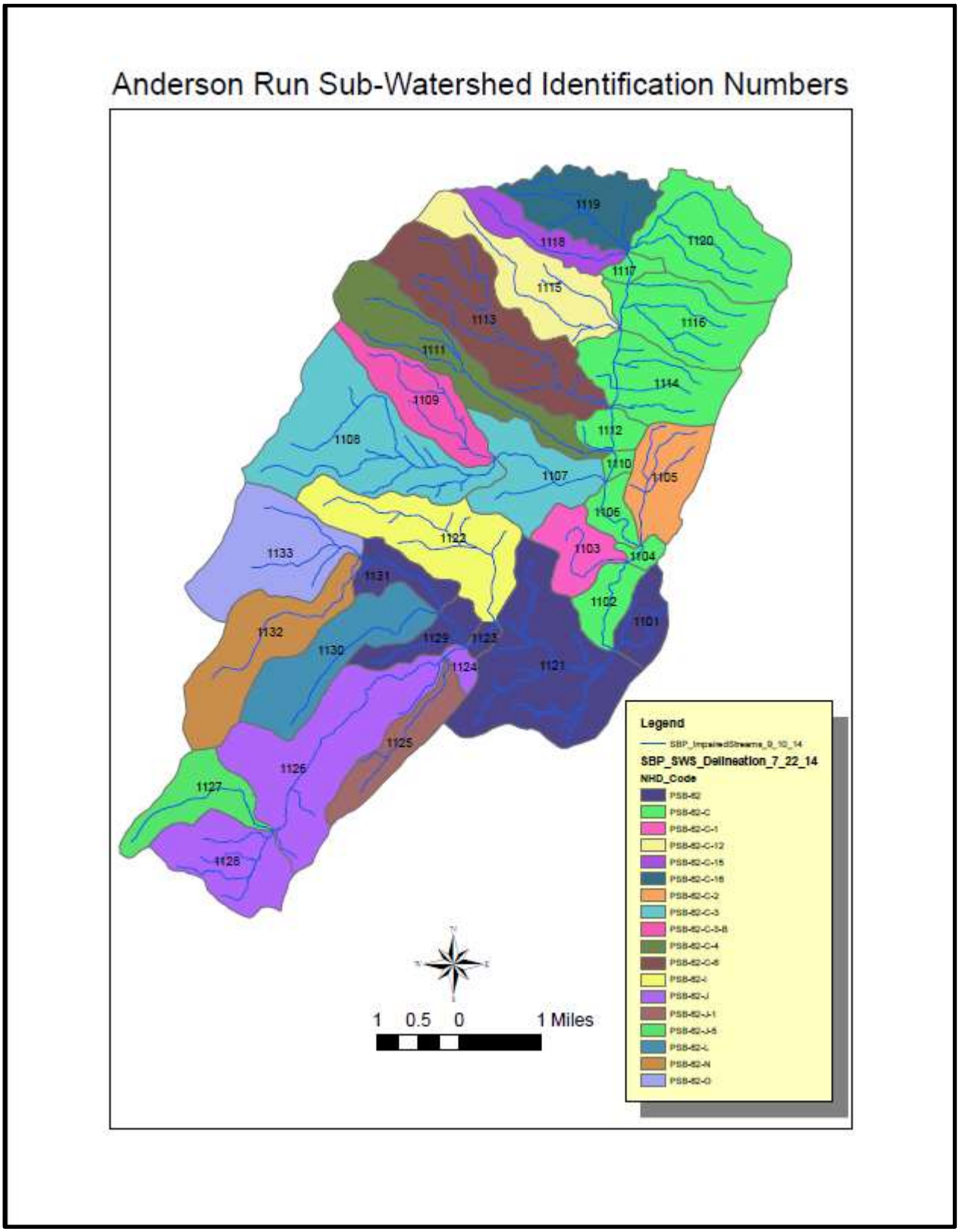


TABLE 5: Anderson Run fecal coliform TMDL

Anderson Run Watershed Fecal Coliform TMDLs (Average Annual)

Watershed	Stream Code	Stream Name	Baseline LA (counts/yr)	LA (counts/ yr)	TMDL (counts/ yr)	Load Reduction	Percent Reduction
Anderson Run	WV-PSB-62	Anderson Run	1.46E+14	3.39E+13	3.57E+13	1.10E+14	75.57%
Anderson Run	WV-PSB-62-C	Mudlick Run	6.62E+13	1.69E+13	1.78E+13	4.84E+13	73.12%
Anderson Run	WV-PSB-62-J	Walnut Bottom Run	2.32E+13	6.88E+12	7.24E+12	1.60E+13	68.81%
Anderson Run	WV-PSB-62-C-3	UNT/Mudlick Run RM 2.88	1.24E+13	3.87E+12	4.08E+12	8.35E+12	67.19%
Anderson Run	WV-PSB-62-C-4	Turnmill Run	4.30E+12	1.28E+12	1.35E+12	2.95E+12	68.59%
Anderson Run	WV-PSB-62-C-3-B	UNT/UNT RM 1.62/Mudlick Run RM 2.88	1.32E+12	7.95E+11	8.37E+11	4.85E+11	36.69%
		TOTAL	**2.54E+14**	**6.36E+13**	**6.70E+13**	**1.87E+14**	**73.58%**

SOURCES AND EXPECTED LOAD REDUCTIONS

The TMDL calls for a 77% reduction in fecal coliform to restore Anderson Run to water quality standards. The TMDL is determined by the following formula: TMDL = sum of WLAs + sum of LAs + MOS. The TMDL is a load allocation that expresses what can enter the stream. Load reduction (LR) targets are determined by subtracting the TMDL from baseline load (BL) levels:

LR= BL – TMDL

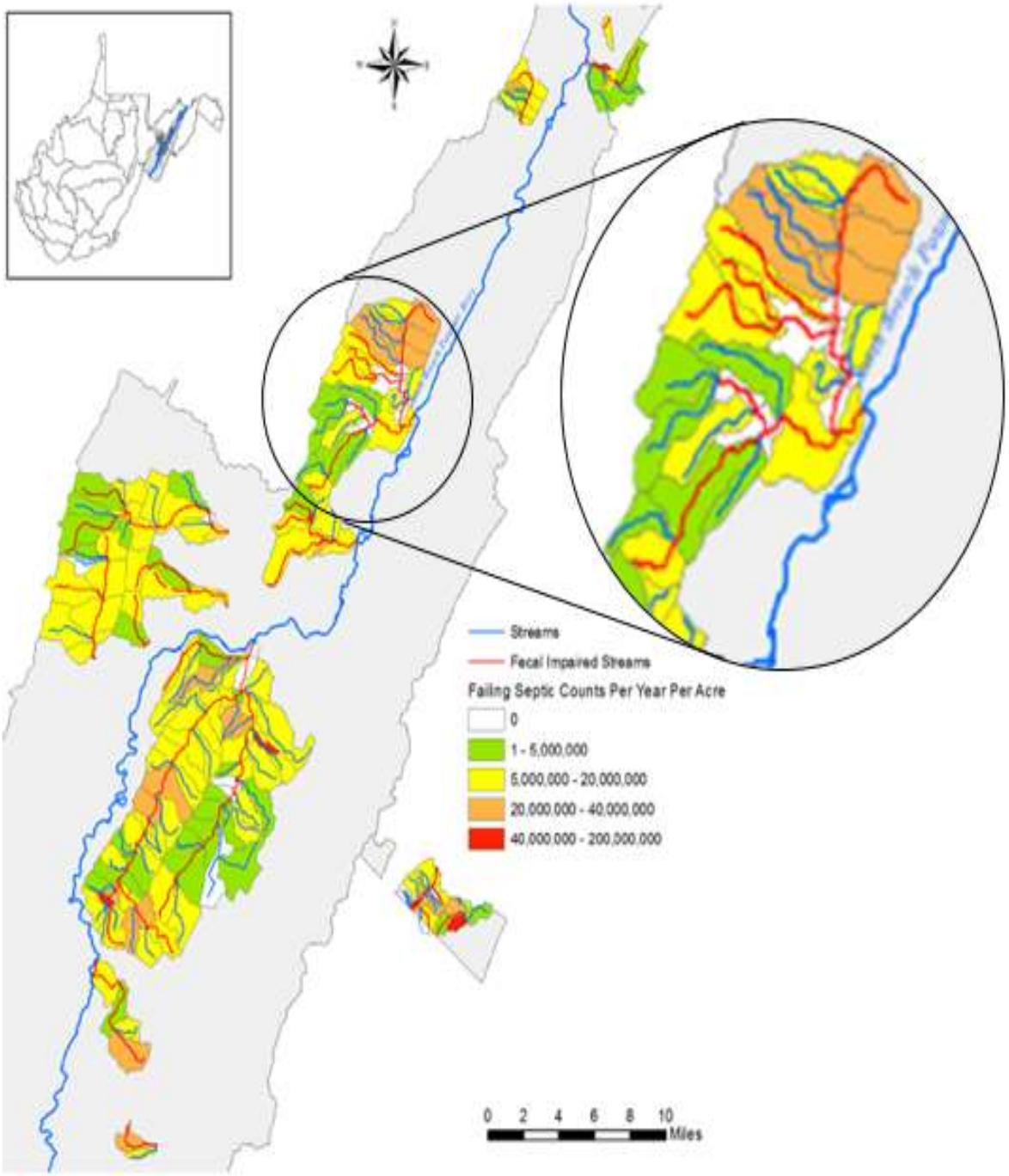
LR is the accumulated reductions from practices installed during the implementation process. As such, it becomes the primary criteria for tracking environmental results.

The 2015 TMDL identifies pasture and failing onsite sewer systems (septic systems) as the sole sources of fecal coliform bacteria impairment in the watershed, with pasture accounting for over 99% of the fecal coliform reduction required.

TABLE 6. Load Reduction targets for the Anderson Run watershed

Land use	Baseline Load (counts/yr)	Allocated Load (counts/yr)	Reduction Required	Percent Reduction Required	Percent of Total Reduction Required from Land use
Pasture	1.19E+14	7.66E+12	1.12E+14	94%	99.68%
Onsite Sewer Systems	3.63E+11	0.00E+00	3.63E+11	100%	0.32%
Cropland	1.23E+11	1.23E+11	0.00E+00	0%	0.00%
Baseline and Other NPS	2.26E+13	2.26E+13	0.00E+00	0%	0.00%
Residential	3.53E+12	3.53E+12	0.00E+00	0%	0.00%
Totals	**1.46E+14**	**3.39E+13**	**1.12E+14**	**77%**	

The TMDL included Figure 2 that illustrates sub watersheds with a higher fecal coliform load from septics.



The following table illustrates fecal coliform load reductions required of failing onsite sewer systems in each unique stream code within the Anderson Run Watershed. It is sorted to show the stream codes in order from the highest required reduction to the lowest, indicating the top three greatest needs in Mudlick Run, UNT/Mudlick Run RM 3.62, and UNT/Mudlick Branch RM 4.62.

TABLE 7. Fecal coliform reductions required from sewer systems

Stream Name	Stream Code	Onsite Sewer Systems Baseline Load & Required Reduction (counts/yr)	Onsite Sewer Systems Allocated Load (counts/yr)	Onsite Sewer Systems Percent Reduction
Mudlick Run	WV-PSB-62-C	1.05E+11	0.00E+00	100%
UNT/Mudlick Run RM 3.62	WV-PSB-62-C-6	4.88E+10	0.00E+00	100%
UNT/Mudlick Branch RM 4.62	WV-PSB-62-C-12	3.08E+10	0.00E+00	100%
Turnmill Run	WV-PSB-62-C-4	2.09E+10	0.00E+00	100%
Anderson Run	WV-PSB-62	2.00E+10	0.00E+00	100%
UNT/UNT RM 1.62/Mudlick Run RM 2.88	WV-PSB-62-C-3-B	1.75E+10	0.00E+00	100%
Walnut Bottom Run	WV-PSB-62-J	1.62E+10	0.00E+00	100%
UNT/Mudlick Run RM 5.63	WV-PSB-62-C-16	1.45E+10	0.00E+00	100%
UNT/Mudlick Run RM 5.61	WV-PSB-62-C-15	1.11E+10	0.00E+00	100%
UNT/Anderson Run RM 4.41	WV-PSB-62-L	9.09E+09	0.00E+00	100%
Long Hollow	WV-PSB-62-O	6.96E+09	0.00E+00	100%
UNT/Mudlick Run RM 1.65	WV-PSB-62-C-2	6.26E+09	0.00E+00	100%
Toombs Hollow	WV-PSB-62-N	5.73E+09	0.00E+00	100%
UNT/Anderson Run RM 3.30	WV-PSB-62-I	5.13E+09	0.00E+00	100%
UNT/Mudlick Run RM 1.32	WV-PSB-62-C-1	3.18E+09	0.00E+00	100%
UNT/Walnut Bottom Run RM 3.80	WV-PSB-62-J-5	2.09E+09	0.00E+00	100%
UNT/Walnut Bottom Run RM 0.31	WV-PSB-62-J-1	1.55E+09	0.00E+00	100%
UNT/Mudlick Run RM 2.88	WV-PSB-62-C-3	0.00E+00	0.00E+00	0%

All newer homes must receive a permit from the county health department and the DEP. Regulations for septic field construction must be followed and the county sanitarian must inspect the site. It should be assumed that all newer homes follow health department regulations and are contributing less to the contamination of the streams.

Similarly, the following table illustrates fecal coliform load reductions required of pasture in each unique stream code within the Anderson Run Watershed. It is sorted to show the stream codes in order from the highest **reduction requirements** to the lowest, indicating the top three greatest need in UNT/Anderson Run RM 3.30, Anderson Run, and Walnut Bottom Run.

TABLE 8. Fecal coliform reductions required from pasture

Stream Name	Stream Code	Pasture Baseline Load (counts/yr)	Pasture Allocated Load (counts/yr)	Total Reduction Required from Pasture	Pasture Percent Reduction
UNT/Anderson Run RM 3.30	WV-PSB-62-I	2.01E+13	1.01E+12	1.91E+13	95.0%
Anderson Run	WV-PSB-62	1.74E+13	1.30E+12	1.61E+13	92.5%
Walnut Bottom Run	WV-PSB-62-J	1.69E+13	1.46E+12	1.54E+13	91.4%
Mudlick Run	WV-PSB-62-C	1.58E+13	9.82E+11	1.48E+13	93.8%
UNT/Mudlick Run RM 3.62	WV-PSB-62-C-6	9.32E+12	1.86E+11	9.13E+12	98.0%
UNT/Mudlick Run RM 2.88	WV-PSB-62-C-3	7.27E+12	3.64E+11	6.91E+12	95.0%
UNT/Mudlick Branch RM 4.62	WV-PSB-62-C-12	5.76E+12	1.15E+11	5.65E+12	98.0%
Toombs Hollow	WV-PSB-62-N	5.90E+12	2.95E+11	5.61E+12	95.0%
UNT/Mudlick Run RM 5.63	WV-PSB-62-C-16	3.87E+12	1.94E+11	3.68E+12	95.0%
Long Hollow	WV-PSB-62-O	3.85E+12	1.92E+11	3.65E+12	95.0%
Turnmill Run	WV-PSB-62-C-4	3.15E+12	1.58E+11	2.99E+12	95.0%
UNT/Anderson Run RM 4.41	WV-PSB-62-L	2.20E+12	1.10E+11	2.09E+12	95.0%
UNT/Mudlick Run RM 1.32	WV-PSB-62-C-1	2.13E+12	1.07E+11	2.02E+12	95.0%
UNT/Mudlick Run RM 5.61	WV-PSB-62-C-15	1.91E+12	9.53E+10	1.81E+12	95.0%
UNT/Walnut Bottom Run RM 0.31	WV-PSB-62-J-1	1.02E+12	4.65E+11	5.55E+11	54.4%
UNT/UNT RM 1.62/Mudlick Run RM 2.88	WV-PSB-62-C-3-B	5.37E+11	2.68E+10	5.10E+11	95.0%
UNT/Mudlick Run RM 1.65	WV-PSB-62-C-2	4.15E+11	2.07E+10	3.94E+11	95.0%
UNT/Walnut Bottom Run RM 3.80	WV-PSB-62-J-5	8.83E+11	5.29E+11	3.55E+11	40.1%

The 2015 TMDL identifies sedimentation from stream bank erosion as the primary source of iron in the watershed, accounting for almost 91% of the total reduction required. Erosion from pasture, harvested forest, unpaved roads, barren land, cropland, and urban residential land uses also contribute to the iron impairment and require reductions. Iron reduction requirements are greatest in Anderson Run, Mudlick Run, and Walnut Bottom Run as illustrated in the following table.

TABLE 9. Anderson Run Watershed Iron TMDL

Anderson Run Watershed Iron TMDLs (Average Annual)

Stream Code	Stream Name	Baseline LA (lbs/yr)	TMDL (lbs/yr)	Reduction	Percent Reduction
WV-PSB-62	Anderson Run	223462	15721.3	207740.65	92.96%
WV-PSB-62-C	Mudlick Run	160377.8	7875.39	152502.36	95.09%
WV-PSB-62-J	Walnut Bottom Run	27893.28	2469.74	25423.53	91.15%
WV-PSB-62-C-3	UNT/Mudlick Run RM 2.88	17645.61	1713.36	15932.25	90.29%
WV-PSB-62-C-6	UNT/Mudlick Run RM 3.62	5722.33	904.44	4817.88	84.19%
WV-PSB-62-I	UNT/Anderson Run RM 3.30	4573.34	1276.5	3296.85	72.09%
WV-PSB-62-C-12	UNT/Mudlick Branch RM 4.62	3307.45	526.96	2780.49	84.07%
WV-PSB-62-C-4	Turnmill Run	2561.76	413.48	2148.29	83.86%
WV-PSB-62-C-16	UNT/Mudlick Run RM 5.63	2440.85	358.7	2082.14	85.30%
WV-PSB-62-C-15	UNT/Mudlick Run RM 5.61	1466.4	211.22	1255.18	85.60%
	TOTALS	449450.7	31471.11	**417,979.62**	**93.00%**

TABLE 10. Iron reductions required

Land Use	Baseline Load (lbs/yr)	Area (acres)	Allocated Load (lbs/yr)	Reduction (lbs/yr)	% Reduction	Percent of Total Reduction Required from Land use
Stream Bank Erosion	193,115.74	NA	3,070.08	190,045.66	98.41%	90.74%
Pasture	14,181.28	3,025.58	4,942.92	9,238.36	65.14%	4.41%
Harvested Forest	5,580.22	858.00	1,331.24	4,248.97	76.14%	2.03%
Unpaved Road	4,527.19	164.70	294.04	4,233.14	93.50%	2.02%
Barren Land	743.23	26.46	55.44	687.79	92.54%	0.33%
Cropland	1,006.14	220.84	362.66	643.47	63.95%	0.31%
Urban Residential	780.78	475.23	439.75	341.03	43.68%	0.16%
Oil and Gas	0.00	0.00	0.00	0.00	0.00%	0.00%
Background and Other NPS	3,527.38	20,610.78	3,527.38	0.00	0.00%	0.00%
TOTALS	**223,461.95**	**4,770.82**	**14,023.52**	**209,438.43**	**93.72%**	**100%**

TABLE 11. Sediment reductions required

Iron to TSS Conversion Table		
Land Use	**Total TSS Reduction (lbs)**	**Total TSS Reduction (tons)**
Stream Bank Erosion	4945052	2473
Pasture	240575	120
Harvested Forest	108576	54
Unpaved Road	104338	52
Barren Land	16012	8
Cropland	17338	9
Urban Residential	8535	4
Oil and Gas	0	0
Back group and Other NPS	0	0
TOTALS	**5440427**	**2720**

According to data from the USDA ARS (Agricultural Research Service), cattle produce between 5.4E+9 to 2.1E+10. The medium figure of 1.35E+10 of this range will be used in this watershed-based plan for calculating potential load reductions of individual conservation plans. Example calculation: if a conservation plan restricts 100 head of cattle from a stream and the plan is 95% efficient, then 100 head X 1.35E+10 X .95 = 1.28E+12 counts per year load reduction. The load per animal may vary depending on the species associated with the conservation plan. A chart provided from the USDA ARS will be used to determine the load that will be used when tracking progress throughout this plan. The TMDL provided the data regarding bacteria loads per household within the individual sub watersheds. This total reduction required divided by the load per household was calculated to determine the number of onsite sewer systems in each sub watersheds that would need to be rehabilitated in order to reach the required load reduction.

TABLE 12. Fecal Coliform Production by Species

USDA ARS Data Regarding Bacteria Production by Species Per Year				
Humans	2.00E+09		Pig	8.90E+09
Chickens	2.40E+08		Sheep	1.8E+10 to 3.7E+10
Cow	5.4E+9 to 2.1E+10		Lamb	1.50E+10
Calf	1.00E+10		Turkey	1.30E+08
Duck	1.10E+10			

The TMDL also provided date regarding the total number acres of pasture land, cropland, and other landscapes that would need to be addressed for sheet erosion and/or gully erosion issues to reach accomplish the required load reduction for Iron. In order to keep tract of the Iron load reduction throughout this plan, a baseline load of X lbs. of iron per ton of soil will be used. This will be a figure based on the soil analysis of the individual farms associated with the watershed-based plan. For example, if the Revised Universal Soil Loss Equation indicates that 5 tons of soil has been saved by implementing a conservation plan and the soil analysis indicates that the field contains 2 lbs. of iron per ton, 10 lbs. of iron will be the load reduction associated with those management measures.

Also, within the TMDL, each stream in the sub watersheds associated with this plan were evaluated to determine the severity of erosion and potential need for re-establishing stable vegetation cover (i.e. restoration). Streams were given a score of 1-3, with 1 being the best with the least potential for erosion

and 3 being the worst with the most potential for erosion. Since the TMDL did not provide any specifics to quantify potential sedimentation from index, it is assumed that a stream with a score of 1 requires no attention, a stream with a score of 2 requires attention on 50% of its length, and a stream with a score of 3 requires attention on 100% of its length. This index was used to calculate the total footage of streambank work what would be required to meet the TMDL for sedimentation. Stream lengths were provided by the TMDL.

Table 13. Required load reductions and units necessary to achieve the TDML

SUB ID	Total Load Reduction Required from Pasture counts/yr.	Total Load Reduction Required from Onsite Sewer Systems counts/yr.	Animal Units to be Impacted to Reach Load Reduction Goal for Pasture 1 AU = 1.35E+10 counts/yr.	Homes to be Impacted to Reach Load Reduction Goal for Onsite Sewer Systems	Pasture Acres to be Treated to Address Iron Reduction	Lbs./yr. of Iron Reduced by decreasing erosion on Pasture acreage to Tolerable Levels	Cropland Acres to be Treated to Address Iron Reduction	Lbs./yr. of Iron Reduced by decreasing erosion on Cropland acreage to Tolerable Levels	Other Lands Acres to be Treated to Address Iron Reduction	Lbs./yr. of Iron Reduced by decreasing erosion on Other Lands acreage to Tolerable Levels	Feet of Streambank to be Treated to Address Iron Reduction	Lbs./yr. of Iron Reduced by decreasing erosion on Streambanks to Tolerable Levels
1101	1.37E+12	3.39E+09	101	4	79	156	44	111	12	40	2859	0
1102	7.26E+12	0.00E+00	538	0	119	423	3	8	9	63	3487	27220
1103	2.02E+12	3.18E+09	150	2	33	118	0	0	28	76	4325	670
1104	1.15E+12	0.00E+00	85	0	21	60	0	0	1	6	1730	28884
1105	3.94E+11	6.26E+09	29	3	17	34	0	1	6	18	4845	968
1106	0.00E+00	0.00E+00	0	0	0	0	5	13	12	83	6533	2192
1107	6.91E+12	0.00E+00	512	0	299	982	0	0	17	66	4271	8407
1108	1.08E+12	3.83E+10	80	16	47	132	2	6	42	447	9632	4307
1109	5.10E+11	1.75E+10	38	7	22	73	0	0	17	201	12780	1526
1110	0.00E+00	0.00E+00	0	0	0	0	0	0	13	50	1114	5720
1111	2.99E+12	2.09E+10	222	8	122	293	0	0	17	217	10164	1693
1112	0.00E+00	0.00E+00	0	0	0	0	7	25	19	78	1433	21097
1113	9.13E+12	4.88E+10	677	19	225	732	26	92	32	447	9829	3651
1114	4.21E+12	3.08E+10	312	12	151	542	25	89	60	280	2617	14796
1115	5.65E+12	3.08E+10	418	12	141	453	0	0	17	231	7363	2159
1116	1.65E+11	2.71E+10	12	11	12	48	13	48	34	280	1555	9658
1117	6.33E+11	5.99E+09	47	2	5	62	0	0	17	53	1127	6884
1118	1.81E+12	1.11E+10	134	4	44	150	0	0	20	221	5622	913
1119	3.68E+12	1.45E+10	272	6	84	304	0	0	9	131	4489	1697
1120	1.36E+12	4.11E+10	101	16	63	201	9	33	57	352	12574	2795
1121	8.73E+12	1.66E+10	646	18	432	926	87	218	107	366	5164	22462
1122	1.91E+13	5.13E+09	1417	2	452	1,112	0	0	411	1788	8532	468
1123	7.71E+10	0.00E+00	6	0	13	29	0	0	0	0	1375	0
1124	4.53E+10	0.00E+00	3	0	16	49	0	0	3	24	807	11021
1125	5.55E+11	1.55E+09	41	1	13	80	0	0	6	56	5507	99
1126	9.43E+12	9.47E+09	699	4	167	679	0	0	481	2909	18462	7869
1127	3.55E+11	2.09E+09	26	1	15	61	0	0	16	344	6169	18
1128	5.93E+12	6.68E+09	439	3	26	516	0	0	11	112	4419	1884
1129	3.66E+12	0.00E+00	271	0	100	187	0	0	6	77	1551	765
1130	2.09E+12	9.09E+09	155	4	100	223	0	0	20	234	6824	0
1131	2.23E+12	0.00E+00	165	0	59	129	0	0	1	4	3722	0
1132	5.61E+12	5.73E+09	415	3	106	292	0	0	20	199	0	224
1133	3.65E+12	6.96E+09	271	3	43	193	0	0	4	58	0	0

Table 14. Timeline to achieve required load reductions

	1st Half 2020	2nd Half 2020	1st Half 2021	2nd Half 2021	1st Half 2022	2nd Half 2022	1st Half 2023	2nd Half 2023	1st Half 2024	2nd Half 2024	1st Half 2025	2nd Half 2025
SWS 1102-1120												
Bacteria from Pasture	9.79E+12	1.96E+13	2.94E+13	3.92E+13	4.90E+13							
Bacteria from Septic	5.93E+10	1.19E+11	1.78E+11	2.37E+11	2.97E+11							
Iron from Pasture	921	1842	2763	3684	4605							
Iron from Cropland	63	126	189	252	315							
Iron from Other Land	660	1320	1980	2640	3300							
Iron from Streambank Erosion	29047	58094	87141	116188	145235							
SWS 1101,1121, 1123, 1129, 1131 1132, 1133, 1130, 1122												
Bacteria from Pasture					9.30E+12	1.86E+13	2.79E+13	3.72E+13	4.65E+13			
Bacteria from Septic					9.38E+09	1.88E+10	2.81E+10	3.75E+10	4.69E+10			
Iron from Pasture					649	1298	1947	2596	3245			
Iron from Cropland					65	130	195	260	325			
Iron from Other Land					553	1106	1659	2212	2765			
Iron from Streambank Erosion					4783	9566	14349	19132	23915			
SWS 1124-1128												
Bacteria from Pasture								3.26E+12	6.52E+12	9.78E+12	1.30E+13	1.63E+13
Bacteria from Septic								3.96E+09	7.92E+09	1.19E+10	1.58E+10	1.98E+10
Iron from Pasture								277	554	831	1108	1385
Iron from Cropland								0	0	0	0	0
Iron from Other Land								689	1378	2067	2756	3445
Iron from Streambank Erosion								4178	8356	12534	16712	20890

MANAGEMENT MEASURES

All management measures to be installed to restore these streams must come about with the voluntary cooperation of the landowners. To do this the project managers will offer a variety of practices which can be specifically designed or combined to suit the circumstances for each farm or residence. The BMPs will comply with the NRCS standards and the criteria of the programs funding the practices.

A protected riparian zone with fencing and tree plantings in a tributary of Mudlick Run. Photo: Alvan Gale

The BMPs to be established for restoration of the Anderson Run watershed will be designed based on an assessment of the farm, consultation with the farmer and an assessment of the impact to the stream. A conservation plan for each farm will prescribe a combination of practices which will result in a cumulative pollution reduction. Below are BMPs that will be used to reduce pollution in the Anderson Run watershed.

Nutrient management plan (NMP): A nutrient management plan is a written site-specific plan which describes how the major plant nutrients (nitrogen, phosphorus and potassium) are to be managed annually. The goal of nutrient management planning is to maximize yield while minimizing adverse environmental effects. The plan will address the most critical farm nutrient problems through measures to manage fertilizers and animal manures to reduce runoff, erosion and nutrient loss. A nutrient management plan should provide for on-farm or off- farm transport of the animal manures produced or used on the farm.

Litter utilization: Litter utilization according to the producer's nutrient management plan incorporates the proper storage and usage of poultry litter as it is generated on the farm. Litter should be stored on a site with less than 15 percent slope and be located at least 50 feet from all drainage ways, surface or other seasonally high-water areas. Litter should also be stored 100 feet from wellheads and 50 feet from property lines. Litter should be protected to prevent water from entering the litter either from rain or storm water runoff. Coverage may include but is not limited to litter or manure storage facilities and tarps or plastic.

Land application: Land application guidelines should be based on an assessment of the farm's nutrient status of nitrogen or phosphorus. Annual production estimates should also be considered. A manure analysis should be performed annually. A soil analysis should be performed every three years when your nutrient management plan is updated.

Manures or litter should not be applied to land with more than 25 percent slope unless sufficient vegetative cover is present to retain and utilize the applied nutrients. Manure or litter should not be applied within 50 feet of any water source or sink-hole or within 100 feet of a wellhead. Timing should be based on nutrient requirements of the crop, field conditions and weather. Land application on fallow land, dormant crops, frozen/snow covered ground or saturated land is not recommended.

Animal waste management systems: Livestock and poultry operators implement practices for proper storage, handling, and use of wastes generated from confined animal operations. This includes a means of collecting, scraping, or washing wastes and contaminated runoff from confinement areas into appropriate waste storage structures. For poultry operations, litter sheds are typically used. Livestock feeding areas commonly utilize waste storage structures or move animal feeding areas away from the streamside.

Animal mortality/composting facility: Composting is the preferred method of poultry mortality disposal based on biosecurity and effectiveness. Composting can also result in increased nitrogen stabilization, aids in elimination of disease, the abatement of flies and odors and the reduction of potential surface and ground water contamination. Incineration, sanitary landfill and rendering are effective mortality disposal methods, but they are more expensive than composting.

Runoff control: This is a class of BMPs designed to direct water away from pollution sources and slow down and filter runoff before it enters the stream. These BMPs can include guttering, diversion ditches, grass swales, wetlands and filter strips.

Livestock exclusion (alternative watering, fencing, armored stream crossings): To reduce occurrences of livestock coming into direct contact with a stream or other waterway, a narrow strip of land along the streambank can be fenced off. Alternative watering sources, such as spring development and wells with pipelines and troughs, must then be provided for the livestock. This will prevent livestock from defecating in or close to the stream and reduce streambank erosion.

Heavy use area protection: The stabilization of areas frequently and intensively used by people, animals or vehicles by establishing vegetative cover, surfacing with suitable materials, and/or installing needed structures. This could include increasing the size of HUAP concrete pads at the end of poultry houses. This is to ensure the capturing of loose poultry manure, to stay on the pad and not run off.

Conservation easements: These easements compensate landowners for voluntarily restricting their activities in sensitive areas in perpetuity.

Riparian buffer practices: Areas of vegetation (herbaceous or woody) that are tolerant of intermittent flooding or saturated soils and that are established or managed in the transitional zone between terrestrial and aquatic habitats.

Filter strip: A strip or area of herbaceous vegetation situated between cropland, grazing land, or disturbed land (including forestland) and environmentally sensitive areas.

Manure/litter transfer: The removal of manure or litter from the watershed to be used as fertilizer elsewhere. To comply with the goals of the Chesapeake Bay Program, a litter transfer program, with an added supplementation of alternative fertilizer application (urea), is a viable option to reduce nutrient and fecal loadings into local waters and the Chesapeake Bay. Providing incentives for manure transfer will reduce excess nutrient application within the watershed, while allowing for application of those nutrients in other areas that require such supplementation.

Stream Restoration: A change to the stream corridor that improves the stream ecosystem by restoring the natural hydrology and landscape of a stream and helps improve habitat and water quality conditions in degraded streams. Use this BMP if the specific project design is not known. Feet must be specified.

Miscellaneous BMPs

- *Conservation tillage practices* improve crop residue management and increase soil tilth and organic matter. Such practices may include no-till and minimum tillage practices.
- *Crop rotation* utilizes legume nitrogen and nutrient residuals in the soil.
- The use of *cover crops* for fallow land or over-wintering of crop land.
- *Vegetative buffer zones and grassed filter strips* are utilized for stream and sinkhole protection. This should be a 35-foot minimum.
- *Grassed waterway* is a natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff.
- *Strip cropping, and contour farming* slows surface water runoff.
- *Diversion systems* route storm water away from facilities and storage sites.
- *Constructed wetlands* are typically engineered complexes of saturated substrates, emergent and submergent vegetation and water. They are used to slow runoff to the stream and use natural processes to reduce fecal coliform and nutrients.

Excluding cattle and other livestock from the stream becomes a vital BMP for reducing fecal coliform loads.

Septic systems: Completely failing systems require the installation of a new or upgraded system. New or upgraded systems will be installed in compliance with Health Department regulations based on home size and soil porosity and must be approved by the Hardy County Health Department Sanitarian. The average cost for such a project is about $7500 but can range widely due to specific circumstances. Similar efforts in other watersheds throughout the state have used a combination of Section 319 grants administered through DEP and low interest loans from the On-Site Loan Program (OSLP) to fund these system replacements.

Periodically failing systems are usually systems where pumping the system combined with proper maintenance will solve the problem. One potential solution that has been used successfully is to offer residents partial payment coupons for septic tank pumping in combination with an educational effort to inform homeowners how to maintain their system in the future. In most cases this has cost less than $500 per home.

BMP efficiencies

The BMP efficiencies are set by the Chesapeake Bay Program (CBP) and are reflective of extensive research into the effectiveness of a wide variety of BMPs. The CBP has focused on nutrients and sediment and has not considered the effectiveness of BMPs to reduce fecal coliform. A substantial amount of research has been done on the removal of fecal coliform for stormwater BMPs used in more urban watersheds. The research conducted for agricultural BMPs is less substantial and varies widely in results over different regions of the country. A methodology for determining BMP efficiency for fecal coliform was developed by the Cacapon Institute based on modeling done in Virginia and used in the watershed-based plans for the Lost River and Mill Creek watersheds, both within the Potomac Basin.

TABLE 15: BMP EFFICIENCIES

BMP	EFFICIENCY %			
	FC	TN	TP	SED
Composting Litter	100	0	0	NA
Forest Buffer	60	55	65	65
Grass Buffer	51	37	65	65
Offsite water w/ fence	60	60	60	75
Offsite water w/o fence	30	30	30	38
Runoff Control	100	100	100	NA
Prescribed Grazing	17.5	11	24	30
Cover Crop	17.5	20	15	20
Heavy Use Protection	20	20	20	40
Manure Transfer	100	100	100	NA

A method for determining efficiency for fecal coliform was used by Cacapon Institute in Appendix B of the Lost River Watershed Based Plan. Monitoring fecal coliform and nutrient concentrations in affected waters has shown that fecal bacteria may move more readily than phosphorus but less than nitrate-N. This would indicate a removal efficiency between nitrogen and phosphorus and so an average of the two was used in the other mentioned watershed-based plans. This method tends to give a conservative estimate of BMP effectiveness between a minimum and a maximum which will be more appropriate to insure an adequate amount of removal to achieve stream restoration.

TECHNICAL AND FINANCIAL RESOURCES

Technical Resources

West Virginia Conservation Agency (WVCA): WVCA will be the applicant for CWA Section 319 grants on this effort and will provide the technical assistance needed for implementation. The WVCA coordinates statewide conservation efforts to conserve natural resources, control floods, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, conserve wildlife and assist farmers with conservation practices. The WVCA Environmental Conservation Specialists (CES) will coordinate with other agencies and work directly with landowners to implement the practices called for in this watershed-based plan. The WVCA ES will also conduct monitoring to determine the environmental results for the three impaired streams. They will also produce grant proposals and status reports.

West Virginia Department of Agriculture (WVDA): WVDA has an extensive water quality monitoring program throughout the Potomac basin and has been monitoring Anderson Run since 1998. WVDA protects plant, animal and human health and the state's food supply through a variety of scientific and regulatory programs.

Natural Resources Conservation Service (NRCS): NRCS is the federal agency that works directly with farmers for designing and installing practices. In West Virginia, they work closely with the WVCA for installing BMPs. NRCS also implements the Environmental Quality Incentives Program (EQIP)

Farm Service Agency (FSA) – FSA implements the Conservation Reserve Enhancement Program (CREP).

West Virginia Department of Environmental Protection (DEP): DEP is the agency with primary responsibility for protecting the environment including stream water quality. The Watershed Improvement Branch (WIB) within DEP administers the §319 grants and the Basin Coordinators in the program work closely with project managers to accomplish the approved watershed-based plans including assistance, if needed, with monitoring. The WIB also has experience and materials for outreach, education and volunteer monitoring. DEPs Watershed Assessment Branch (WAB) includes the programs that develop the integrated watershed report with the 303(d) list of impaired streams, the TMDL and conduct water quality monitoring around the state. After completion of the installation of practices it will be WAB that makes the final determination if the TMDL has been fully implemented. The Onsite Loan Program is also administered by DEP, in conjunction with the WV Housing and Development Fund.

The Hardy County Health Department (HCHD): HCHD has the primary responsibility of inspecting and approving all on-site wastewater systems in Hardy County. HCHD must conduct the initial survey to locate failing on-site systems. Through their contacts with homeowners the education of how to maintain an on-site system will be affected. HCHD Sanitarian must select, inspect and approve all practices to be used in the treatment of failing septic systems.

Financial Resources

Clean Water Act §319 Grants: §319 funds are provided to the state by the US Environmental Protection Agency (EPA). In West Virginia, these funds are distributed by the DEP for agencies or organizations who are conducting projects related to nonpoint source pollution. §319 grants require a minimum match from non-federal funds of 40%.

WVCA: provides cost share for agricultural practices associated with an approved §319 grant proposal.

Conservation Reserve Enhancement Program (CREP): CREP is a voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water. CREP addresses high-priority conservation issues in priority watersheds as designated by the NRCS State Conservationist.

Wildlife Habitat Incentive Program (WHIP): WHIP is a voluntary program for landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land.

Environmental Quality Incentive Program (EQIP): EQIP is a voluntary conservation program that aids farmers who face threats to soil, water, air, and related natural resources on their land. NRCS through

EQIP offers financial and technical assistance to eligible participants to install or implement structural and management practices to promote agricultural production and optimize environmental benefits to help farmers meet environmental requirements on eligible agricultural land.

The WV Onsite State Revolving Fund Program (OSLP): is administered through DEP and WV Housing and Development Fund (HDF). This program can be used to provide loan funding for individual onsite systems as well as homeowner-owned components of decentralized systems

Landowners: Farmers will provide matching funds for practices developed on their property. Much of these funds will be in kind for labor, equipment uses, and materials.

Estimated financial needs

The estimated budget for this effort is based on averages for West Virginia and can vary considerably. Personnel costs are not included in estimating most BMP costs except for conservation planning. In most cases, agricultural technicians are paid from other funding sources.

Some of the operations in the Anderson Run watershed have already been placed under conservation plans with BMPs installed. The planning team estimated the number of practices above based on knowledge of potential opportunities in this area. The costs for implementing this plan will be funded through cooperative combining of Farm Bill programs, §319 funds and Chesapeake Bay funds with state and private funds.

TABLE 16: Cost Estimates for implementation

Practice	Unit Cost	Unit	Quantity	Total Cost	Fecal coliform cfu reduced per unit of BMP	Total Fecal coliform reductions	lbs TSS per unit of BMP	Total TSS reductions
Livestock exclusion fencing	$1.90	linear foot	62,000	$117,800	2.37E+10	3.372E+11	92	1309
Forested buffer	$2,000.00	acres	27.4	$54,800	2.37E+10	6.49E+11	80	2192
Grass buffer	$122.52	acres	20	$2,450.40	2.01E+10	4.03E+11	80	1600
Armored stream crossing (5x500ft^2)	$5. 88	sq. foot	2,500	$14,700	*see livestock exclusion fencing*			
Pasture division fencing (prescribed grazing)	$1.53	linear foot			n/a	n/a	n/a	n/a
Roof runoff controls	$2,500.00	system	7	$17,500	3.95E+10	2.76E+11	n/a	n/a
Alternative water source	$4,000.00	unit	5	$20,000	1.18E+10	5.92E+10	47	235
Heavy use protection		Sq. foot	10,000		7.90E+09	7.90E+13	49	490000
Concrete	4.63	Sq. foot	5,000	$23,150.00				
Gravel	$1.14	Sq. foot	5,000	$5,700.00				
Stream restoration	$118.31	Linear ft	20,000	$2,366,200.00	n/a	n/a	248	4960000
Septic pumping	$300.00	unit	30	$9,000.00	4.15E+11	1.24E+13	n/a	n/a
Septic repair	$7,300.00	unit	10	$73,000.00	1.66E+12	1.66E+13	n/a	n/a
Litter transfer (an annual practice)	$10.00	ton/yr	(200) x3 yrs	$6,000	3.95E+10	2.37E+13	n/a	n/a
Dirt &Gravel Road BMPs	$7.05	ft	7500	$52,875	n/a	n/a	1.76	13200
Cover Crops		acres	25		9.72E+07	2.43E+09	25	625
				$2,763,175		1.3343E+14		5469161
Total $515,275					**Goal**	1.12E+14		5440427

EDUCATION AND OUTREACH

In any watershed restoration effort informing and educating the residents of the watershed and all other stakeholders is vital. In rural watersheds with a small population, the most important form of communication is done face to face. NRCS and WVCA staff will directly inform each farmer about the water quality issues as well as productivity issues. These agencies will work closely with each farmer to design and customize each conservation plan to meet the TMDL while helping the farmer improve his operation.

WVCA and the NRCS are involved in educational and training programs in the Moorefield area and include sites in Anderson Run in some of those events. Both agencies are involved in training for technical staff to implement conservation programs. Training workshops for CREP and other BMPs is a part of the standard educational program for both agencies. As these projects are implemented in Anderson Run even more focus on field days and training programs in the watershed will become a part of the educational effort in the area.

An educational emphasis is given to the local schools with programs being presented to teach young people about water related issues. In addition to actual programs both agencies aid local science teachers in presenting their curriculums. The goal of these efforts is to provide students with a greater understanding of the need for conservation and clean water. Youth oriented farming organizations such as 4-H will also be contacted for presentations to their members.

Soil Tunnel Trailer at Mineral County STEM Festival

SCHEDULES AND MILESTONES

WVCA and NRCS, works cooperatively with farmers, will apply for funding for BMP implementation based on an estimate of what can be reasonably accomplished in a two-year period. Funding from EPA and USDA could be applied in the watershed for cost share projects for preventing pollutants from entering the streams of Anderson Run. The timing for requesting funds influences the scheduling of projects. Other factors that influence the schedule include the farmers' business schedules and weather factors.

Each operation whether poultry, livestock or a combination of the two, will be offered a comprehensive conservation plan. Each plan will be designed in consultation with the farmer to reduce pollutants as much as possible while enhancing the farmer's operation. A "toolbox" of BMPs will be applied based on technician assessment and farmer agreement. In poultry, only operations a combination of proper composting, waste management, runoff control and filtering BMPs can expect to achieve a significant reduction of fecal coliform pollution. In operations that are a combination, livestock only or use of waste to fertilize pastures, hayfields or crops, a combination of livestock access control, fencing with riparian buffers and waste management can expect to achieve a 60 to 100% reduction. An average of 80% was used for estimating anticipated load reductions from these kinds of operations for the environmental milestones.

The animal unit numbers were determined by examining the AUs that have already been placed under EQIP and CREP funded projects. The overall average is approximately 150 AUs per operation. However, livestock only operations had an average AU of approximately 50. These average AUs and efficiencies were used to estimate fecal coliform load reductions. The estimated load reductions for August 2014 reflect the conservation plans already developed by NRCS and expected to be completed by that time.

Regarding failing septic systems, the schedule calls for support to HCHD for a septic system survey. The water quality and land use data obtained in the 90s lead the TMDL to determine that fecal pollution from failing septic systems was insignificant. However, when the new TMDL for the South Branch is submitted it is expected that it will call for a 100% reduction in fecal coliform loading from failing septic systems. This is based on a legal technicality and has no bearing of the significance of loading from failing septic systems. Nor will there be any cost/benefit criteria applied in the new TMDL to determine if spending §319 funds for replacing, repairing or maintaining septic systems is worthwhile. An on-the-ground professional determination of the real impact of failing septic systems needs to be performed to gain an accurate picture of that impact.

TABLE 17. BMP Schedule for Implementation

Septic Schedule for Implementation 319 Funds	
Action	**Completion Date**
Submit Revised WBP to EPA	February 2019
Submit a 319 septic grant proposal	June 2019
Receive 319 funding for septic proposal	June 2020
Repair 6 septic systems	August 2021
Pump 50 septic system	August 2021
Host 1 educational workshop	August 2021
Complete 24 months of monitoring	August 2021
Apply for 2nd septic 319 grant	June 2021
Receive 2nd septic 319 grant	June 2022
Repair 6 septic systems	August 2024
Pump 50 septic system	August 2024
Host 1 educational workshop	August 2024
Complete 24 months of monitoring	August 2024

Stormwater/Forestry/Ag Schedule for Implementation Chesapeake Bay Implementation Grant	
Action	**Completion Date**
Continue to manage Anderson Run CBIG	December 2019
3 acres treated by stormwater BMPs	December 2019
4 acres of tree plantings	December 2020
4 acres of forest buffer	December 2020
Host 1 educational workshop	December 2020
Apply for 2nd Anderson Run CBIG	April 2021
Promote and assist with tracking livestock exclusion (PVCD and CREP implementation)	August 2024
Plant X acres in Cover Crop- promote and assist with tracking through PVCD's CBay BMP Implementation Program	August 2024
Repair X miles of dirt and gravel road	August 2024

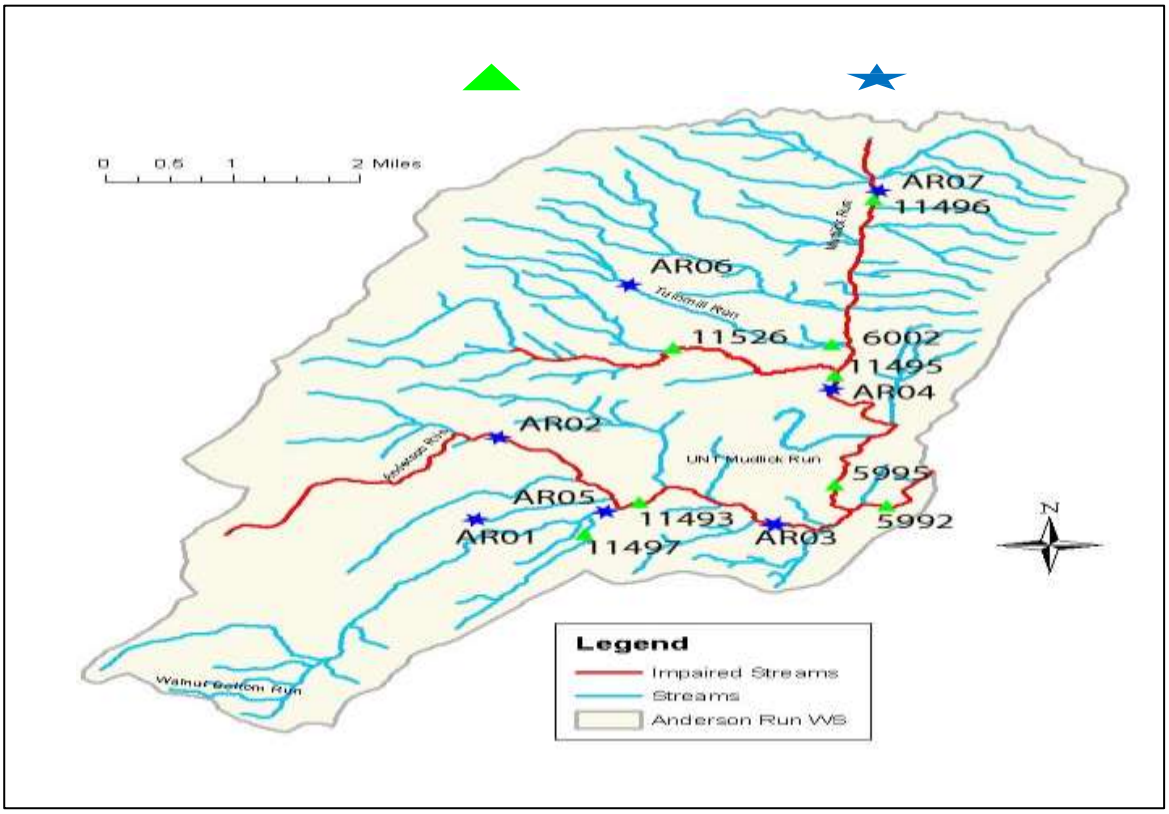
MONITORING

WVDA has been the agency responsible for most of the stream monitoring that has been conducted in the Anderson Run watershed. They will continue this intensive monitoring effort as the restoration effort is implemented. WVDA is now monitoring seven sites which can be expanded to include specific project sites and the lower section of Anderson Run. In 2016, DEP will return to sample their stations as part of the five-year cycle of monitoring.

WVDA monitors for nine parameters: temperature, dissolved oxygen, pH, turbidity, conductivity, total phosphorus, ammonia-nitrogen, nitrate-nitrogen and fecal coliform. DEP covers the same parameters plus alkalinity. A quality assurance project plan (QAPP) will be developed and approved at least 60-days prior to monitoring plan implementation.

Progress towards restoration will be reported on a semi-annual basis to DEP by WVCA. DEP will then report progress to the EPA. The progress reports will report on all BMPs installed during that period along with an estimated load reduction accomplished by those BMPs and any related water quality data. When any of the three 303(d) listed streams shows consistent results that indicate they are meeting water quality standards, these results will be submitted to DEP.

DEP will confirm those results and make the final determination regarding the removal of any stream from the 303(d) list. When these streams are removed from the 303(d) list WVCA, in cooperation with DEPs WIB, will write a "success story" and submit to EPA.



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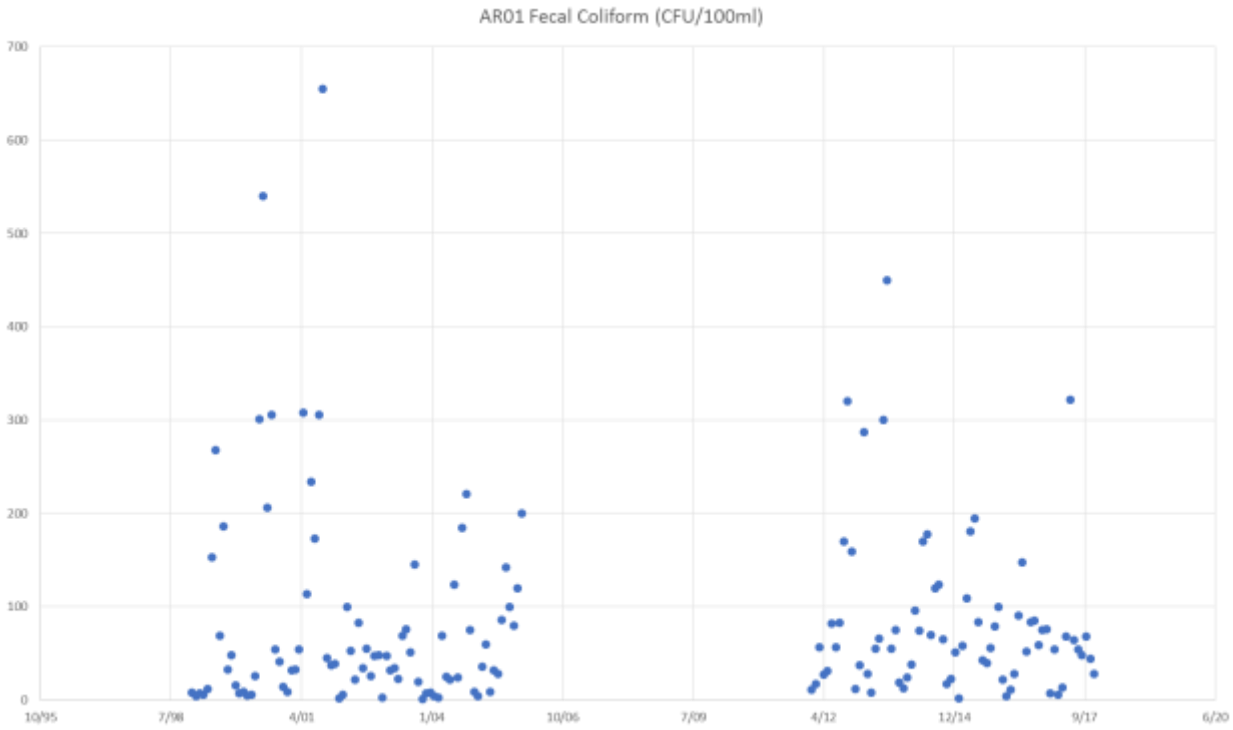
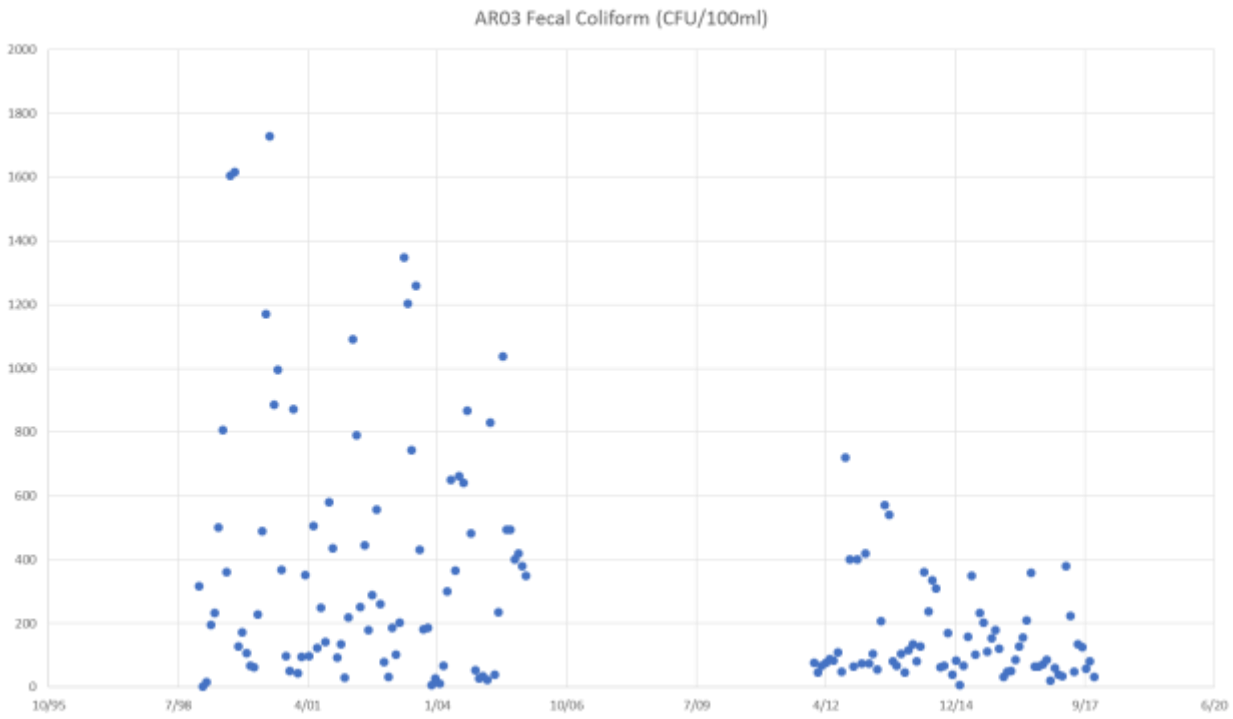
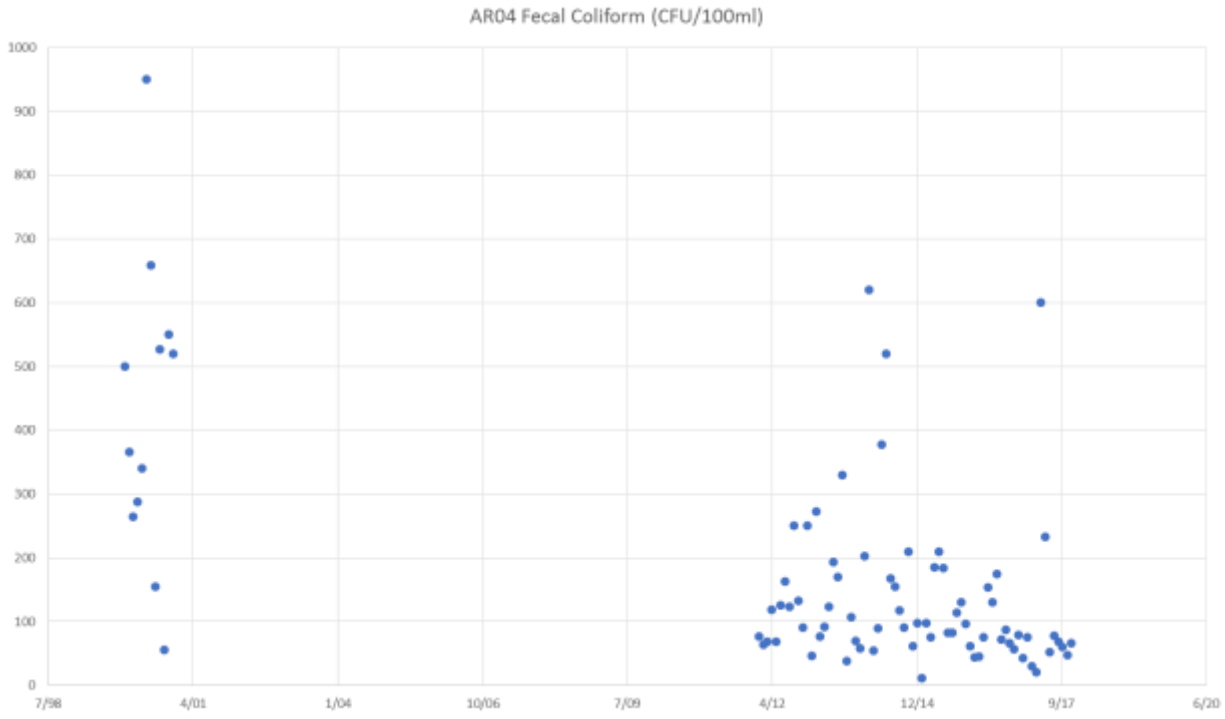
COMMON ACRONYMS

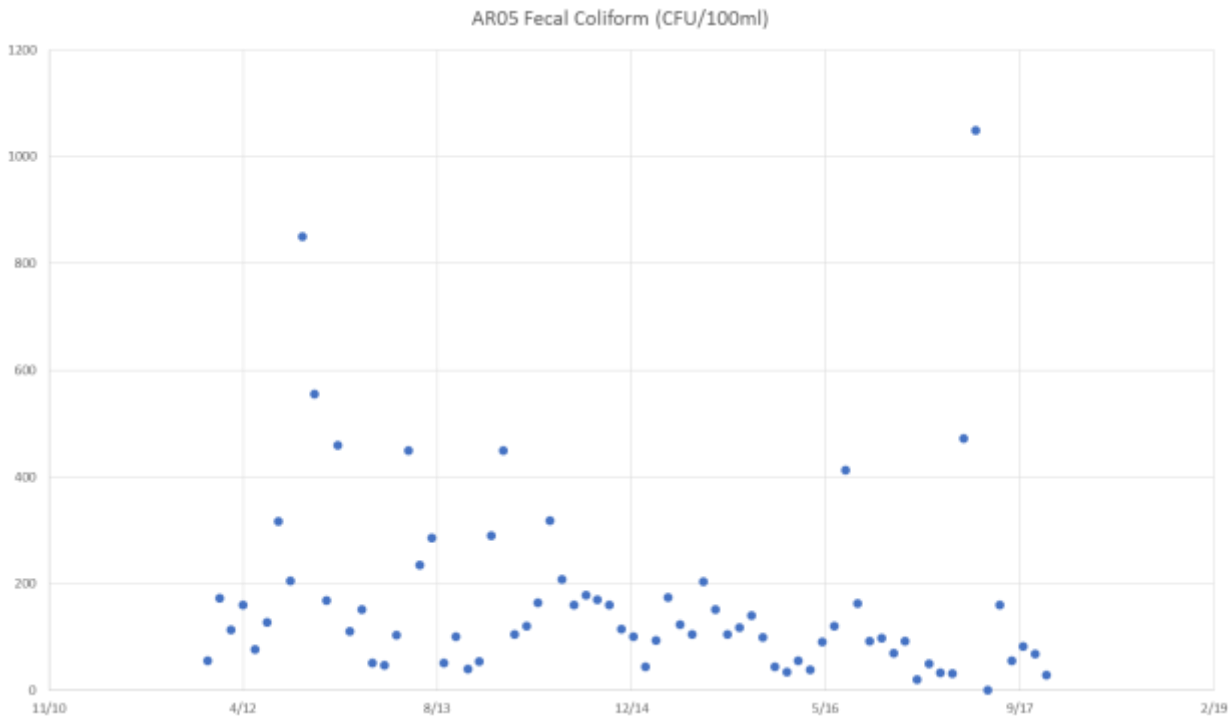
TMDL	Total Maximum Daily Load
WLA	Waste Load Allocation
LA	Load Allocation
LR	Load Reduction
MOS	Margin of Safety
BL	Baseline
SI	Stressor Identification
USEPA or EPA	US Environmental Protection Agency
DEP	WV Department of Environmental Protection
WVCA	WV Conservation Agency
WVDA	WV Department of Agriculture
NRCS	Natural Resource Conservation Service
FSA	Farm Service Agency
HCHD	Hardy County Health Department
BPH	Bureau of Public Health
WAB	Watershed Assessment Branch
OSLP	On-Site Loan Program BMP (Best Management Practice)
WQ	Water Quality
ES	Environmental Specialist
AU	Animal Unit

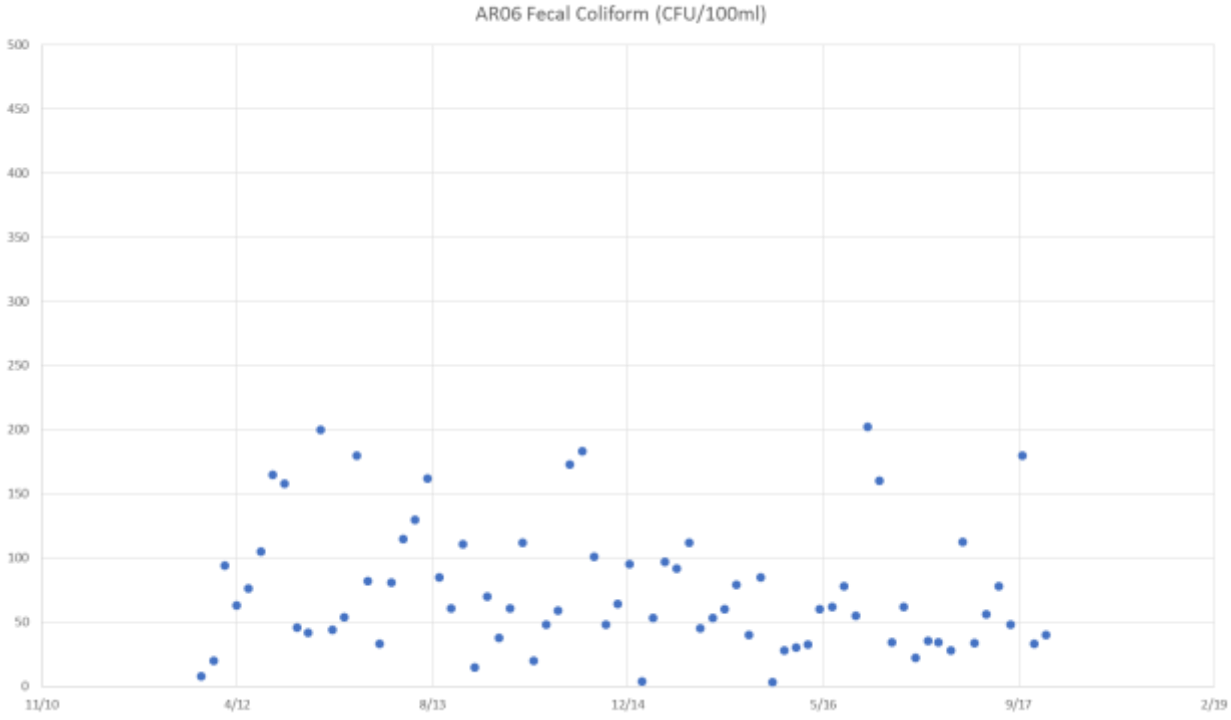
Appendix A: WVDA Anderson Run Fecal Coliform Monitoring Data




AR03 Fecal Coliform (CFU/100ml)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
10/95
7/98
4/01
1/04
10/06
7/09
4/12
12/14
9/17
6/20


AR04 Fecal Coliform (CFU/100ml)
1000
900
800
700
600
500
400
300
200
100
0
7/98
4/01
1/04
10/06
7/09
4/12
12/14
9/17
6/20


AR05 Fecal Coliform (CFU/100ml)
1200
1000
800
600
400
200
0
11/10
4/12
8/13
12/14
5/16
9/17
2/19


AR06 Fecal Coliform (CFU/100ml)
500
450
400
350
300
250
200
150
100
50
0
11/10
4/12
8/13
12/14
5/16
9/17
2/19