APPENDIX 3

A-3. SCRABBLE CREEK AND RICH CREEK

A-3.1 Watershed Information

Scrabble Creek and Rich Creek are two small watersheds in the northwestern portion of the Gauley River watershed. Scrabble Creek drains approximately 4.2 square miles (2,717 acres), and Rich Creek drains approximately 13 square miles (8,307 acres) as shown in Figure A-3-1.

The dominant landuse in the Scrabble Creek watershed is forest, which covers 93.7 percent of the watershed. Other important landuse types include AML land (2.9 percent), and urban/residential (2.9 percent). All other individual land cover types account for less than one percent of the total watershed area. Scrabble Creek and Left Fork of Scrabble Creek are impaired streams in this watershed.

The dominant landuse in the Rich Creek watershed is forest, which covers 63.7 percent of the watershed. Other significant landuse types include mining (27.5 percent), AML (7.7 percent) and urban/residential (1.1 percent). There are five impaired streams in the watershed and WVDEP has identified the mainstem of Rich Creek as a troutwater, each impaired stream is addressed in this TMDL development effort. Figure A-3-2 shows the streams of both watersheds and the pollutants for which each is listed as impaired.

Before establishing Total Maximum Daily Loads (TMDLs), WVDEP performed monitoring in each of the impaired streams in the Gauley River watershed to better characterize water quality and refine impairment listings. Monthly samples were taken at 4 stations in the Scrabble Creek watershed and 13 stations in the Rich Creek watershed (station locations can be viewed using the ArcExplorer project) from July 1, 2003, through June 30, 2004. Monitoring suites at each site were determined based on the types of impairments observed in each stream. Streams impaired by metals and low pH were sampled monthly and analyzed for a suite of parameters including acidity, alkalinity, total iron, dissolved iron, total aluminum, dissolved aluminum, total suspended solids, pH, sulfate, total selenium, and specific conductance. Monthly samples from streams impaired by fecal coliform bacteria were analyzed for fecal coliform bacteria, pH, and specific conductance. In addition, benthic macroinvertebrate assessments were performed at specific locations on the biologically impaired streams during the pre-TMDL monitoring period. Instantaneous flow measurements were also taken at strategic locations during pre-TMDL monitoring.

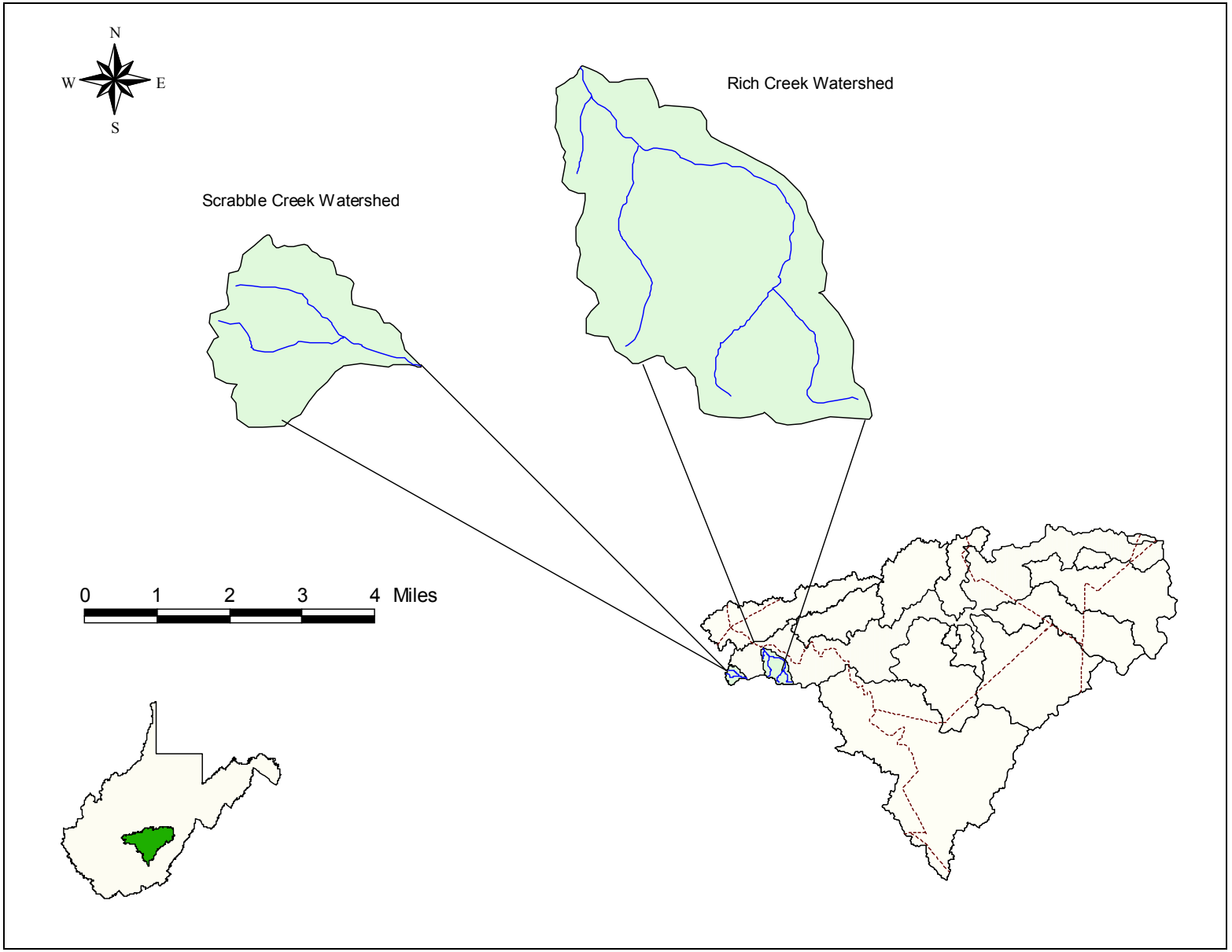
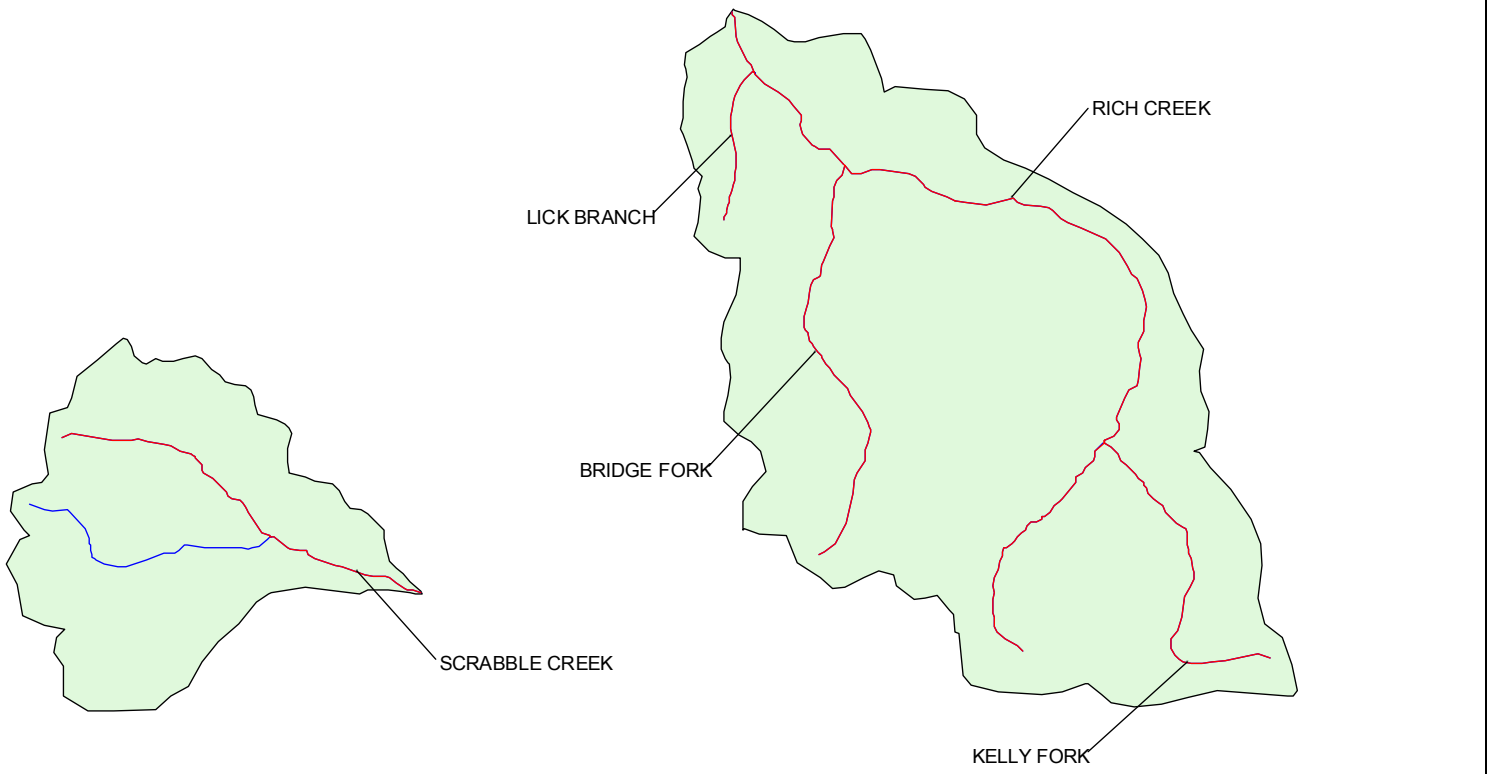


Figure A-3-1. Location of the Scrabble Creek and Rich Creek watersheds



TMDL	Impairment					
Stream Name	**Fe**	**Al**	**pH**	**Se**	**FC**	**BIO**
Rich Creek	x				x	
Lick Branch					x	
Bridge Fork	x					
Kelly Fork					x	
Scrabble Creek					x	

Figure A-3-2. Waterbodies and impairments under TMDL development in the Scrabble Creek and Rich Creek watersheds

A-3.2 Iron Sources

This section identifies and examines the potential sources of iron impairment in the Rich Creek watershed. Sources can be classified as point sources (specific sources subject to a permit) or nonpoint sources (diffuse sources). Mining and non-mining-related permitted discharges are potential point sources of iron. Iron nonpoint sources are non-permitted sources such as abandoned or forfeited mine sites.

Pollutant sources were identified using statewide geographic information system (GIS) coverages of point and nonpoint sources, and through field reconnaissance. As part of the TMDL process, WVDEP documented pollution sources by describing the pollutant source in detail, collecting Global Positioning System data, and if necessary, collecting a water quality sample for laboratory analysis. WVDEP personnel recorded physical descriptions of the pollutant sources, such as the number of outfalls, the source of the outfalls, and the general condition of the stream in the vicinity of each outfall. These records were compiled and electronically plotted on maps using GIS software. This information was used in conjunction with other information to characterize pollutant sources. Significant iron sources in the watershed are shown in Figure A-3-3.

On the basis of scientific knowledge of sediment/metals interaction and knowledge of West Virginia's soils, it is reasonable to conclude that sediments contain high levels of aluminum and iron. Control of sediment-producing sources might be necessary to meet water quality criteria for total iron during critical high-flow conditions. Although some of these sediment-producing sources are not shown in Figure A-3-3 (e.g., agricultural areas and unpaved roads), specific details relative to these sources are discussed in section A-3.2.2.

A-3.2.1 Iron Point Source Inventory

As described in the TMDL Report, the National Pollutant Discharge Elimination System (NPDES) program, established under Clean Water Act Sections 318, 402, and 405, requires permits for the discharge of pollutants from point sources. Metals and pH point sources can be classified into two major categories: permitted non-mining point sources and permitted mining point sources.

In the Rich Creek watershed, all point sources of iron are mining-related. WVDEP's HPU GIS coverage was used to determine the locations of the mining permits; the detailed permit information came from WVDEP's ERIS database system. There are 67 mining-related NPDES outlets in the Rich Creek watershed. The permits related to these outlets are listed in the Technical Report, which shows the name of each responsible party and the total number of outlets that discharge to each watershed. The Technical Report also contains specific data for each permitted outlet (including effluent type, drainage areas, and pump capacities) and permit limits for each of the mining-related NPDES outlets.

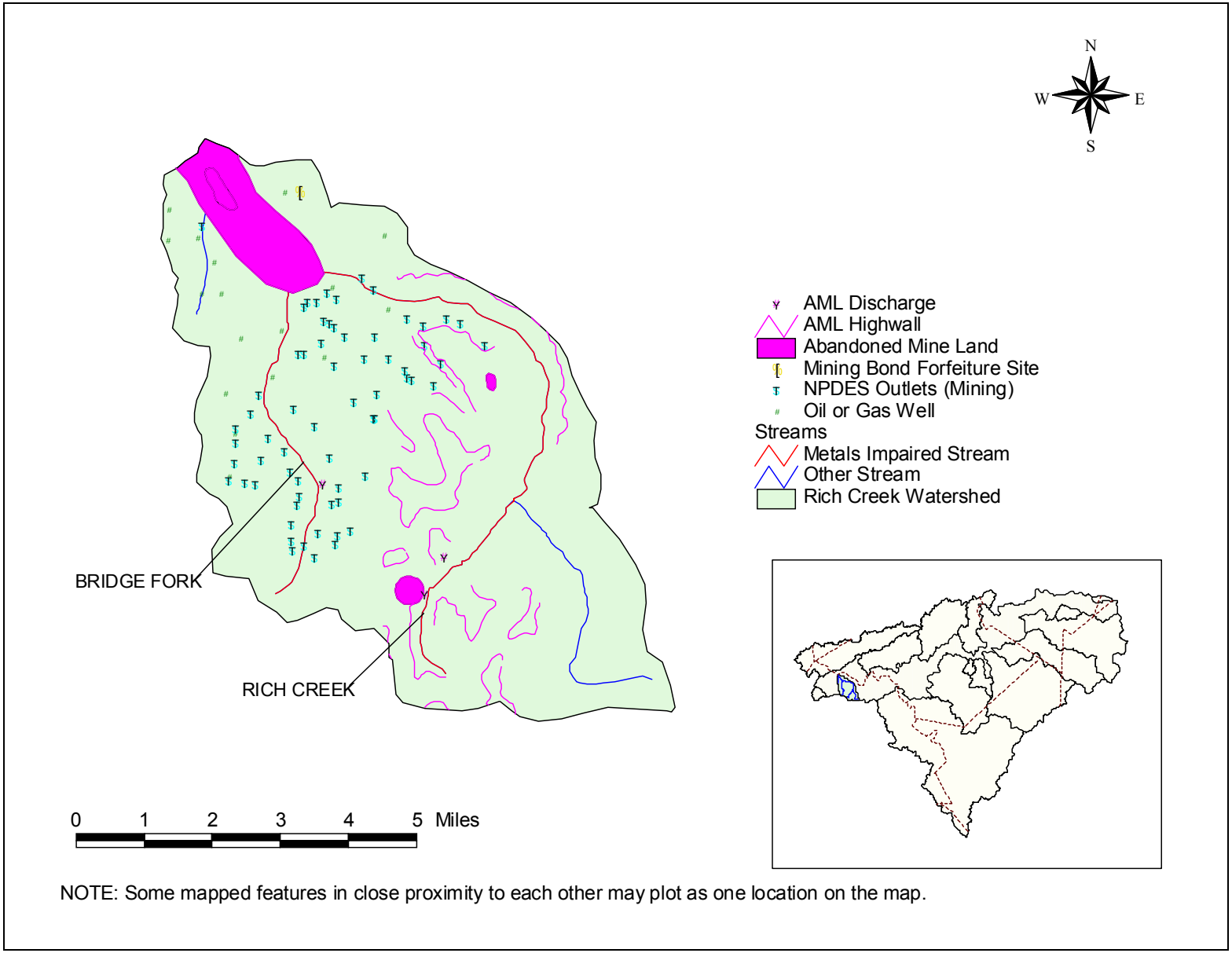


Figure A-3-3. Metals sources in the Rich Creek watershed

A-3.2.2 Iron Nonpoint Source Inventory

In addition to point sources, nonpoint sources also contribute to the iron impairments in the Rich Creek watershed. Nonpoint sources are diffuse, non-permitted sources. Abandoned mine lands and facilities that were subject to the Surface Mining Control and Reclamation Act of 1977, and forfeited their bonds or abandoned operations can be a significant non-permitted source of metals. Non-mining land disturbance activities can also be a nonpoint source of metals, causing metals to enter waterbodies as a component of sediment. Examples of such land disturbance activities are agriculture, forestry, oil and gas wells, and the construction and use of roads. The applicable land-disturbing activities in the Rich Creek watershed are discussed below.

Abandoned Mine Lands and Bond Forfeiture Sites
Based on the identification of a number of abandoned mining activities in the Rich Creek watershed, abandoned mine lands are a significant non-permitted source of iron impairment in the watershed. WVDEP's Office of Abandoned Mine Lands identified the locations of abandoned mine lands in the Rich Creek watershed. In addition, source tracking efforts by WVDEP's Division of Water and Waste Management identified and characterized three abandoned mine sources (seeps).

WVDEP's Division of Land Restoration, Office of Special Reclamation, provided bond forfeiture information and data. This information included the status of both land reclamation and water treatment activities. There is one bond forfeiture site that comprises approximately six acres in the Rich Creek watershed.

Land-Disturbing Activities
Based on the GAP 2000 landuse coverage, there are less than two acres of row crop agriculture in the Rich Creek watershed, and no observed row crop agriculture in the Scrabble Creek watershed. During the pre-TMDL sampling period there were three acres of active timber harvest in the Scrabble Creek watershed and none in the Rich Creek watershed. The Scrabble Creek watershed contains 21 active oil and gas wells, which, based on the survey by WVDEP's Office of Oil and Gas, are estimated to comprise 29 acres (0.01 percent). The Rich Creek watershed contains 23 active oil and gas wells, which, based on the survey by WVDEP's Office of Oil and Gas, are estimated to comprise 32 acres (0.003 percent). The length and area of paved roads were calculated using the Census 2000 TIGER/Line files roads coverage for West Virginia. Information on unpaved roads from TIGER was supplemented by digitizing any unpaved roads shown on topographic maps that were not included in the TIGER shapefile. There are 3.0 miles of paved roads and 7.6 miles of unpaved roads in the Scrabble Creek watershed. There are 10.9 miles of paved roads and 14.1 miles of unpaved roads in the Rich Creek watershed.

A-3.3 Fecal Coliform Bacteria Sources

This section identifies and examines the potential sources of fecal coliform bacteria in the Scrabble Creek and Rich Creek watersheds. Sources can be classified as either point sources or nonpoint sources. Potential point sources include effluent discharges of sewage treatment facilities and collection system overflows. Potential nonpoint sources of fecal coliform bacteria include failing or nonexistent on-site sewage disposal systems, stormwater runoff from pasture

and cropland, direct deposition of wastes from livestock, and stormwater runoff from residential and urban areas.

A-3.3.1 Fecal Coliform Bacteria Point Sources

There are no point source discharges of fecal coliform bacteria in the Scrabble Creek or Rich Creek watersheds.

A-3.3.2 Nonpoint (Non-permitted) Fecal Coliform Bacteria Sources

Pollutant source tracking by WVDEP personnel identified scattered areas of high population density without access to public sewers in the Scrabble Creek and Rich Creek watersheds. Human sources of fecal coliform bacteria from these areas include sewage discharges from failing septic systems, and possible direct discharges of sewage from residences (straight pipes). WVDEP source tracking information yielded an estimate of three unsewered homes in the Scrabble Creek watershed, and 208 unsewered homes in the Rich Creek watershed. A septic system failure rate derived from geology and soil type was applied to the number of unsewered homes to calculate nonpoint source fecal coliform loading from failing septic systems. Figure A-3-4 shows the geographic distribution of estimated failing septic system nonpoint sources in the watershed.

Stormwater runoff is another potential nonpoint source of fecal coliform bacteria in both residential/urban and rural areas. Runoff from residential areas can deliver the waste of pets and wildlife to the waterbody. In addition, rural stormwater runoff can transport significant loads of bacteria from livestock pastures, livestock and poultry feeding facilities, and manure storage and application Agricultural activities are not present in the Scrabble Creek watershed and are extremely limited in the Rich Creek watershed. Therefore, fecal coliform bacteria reductions from agricultural landuses are not required the Scrabble Creek drainage or the Rich Creek drainage. Stormwater runoff from residential areas is a source of fecal coliform bacteria; however, no reductions are required from residential/urban areas. WVDEP source tracking determined that the primary sources of fecal coliform in the Scrabble Creek and Rich Creek watersheds are from failing septic systems and/or straight pipe discharges. As a result, the only reductions to fecal coliform sources in the Scrabble Creek and Rich Creek watersheds are from failing onsite septic systems.

A certain “natural background” contribution of fecal coliform bacteria can be attributed to deposition by wildlife in forest and grassland areas. Accumulation rates for fecal coliform bacteria in those areas were developed using reference numbers from past TMDLs, incorporating wildlife estimates obtained from the Division of Natural Resources. In addition, WVDEP conducted storm sampling on a 100 percent forested subwatershed (Shrewsbury Hollow) within the Kanawha State Forest, Kanawha County, West Virginia to determine wildlife contributions of fecal coliform. Although wildlife contributions of fecal coliform bacteria were considered in modeling, they were not found to be a significant source, and reductions were not prescribed.

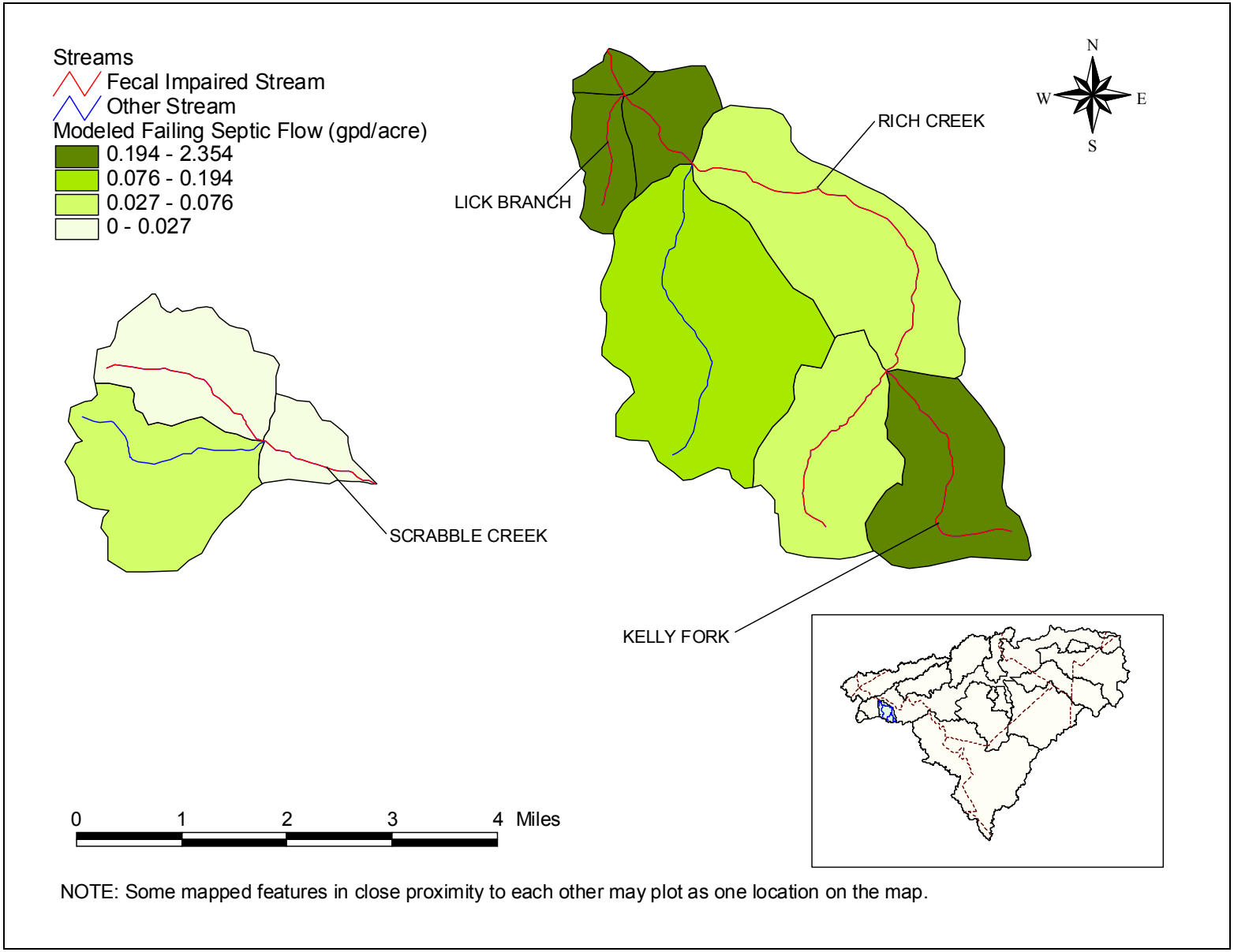


Figure A-3-4. Fecal coliform sources in the Scrabble Creek and Rich Creek watersheds

A-3.4 Stressors of Biologically Impaired Streams

Scrabble Creek and Left Fork/Scrabble Creek are biologically impaired streams in the Scrabble Creek watershed. No streams in the Rich Creek watershed have been identified as biologically impaired. A stressor identification process was used to evaluate and identify the primary stressors of impaired benthic communities. The stressor identification process is detailed in the TMDL Report with additional information provided in the Technical Report. Ionic stress has been determined to be the primary stressor for the biological impairment of Scrabble Creek and Left Fork/ Scrabble Creek. WVDEP is deferring biological TMDL development for those waters because information available on the causative pollutants and associated impairment thresholds is insufficient to support TMDL development at this time.

A-3.5 TMDLs for the Scrabble Creek and Rich Creek Watersheds

A-3.5.1 TMDL Development

TMDLs and source allocations were developed for impaired streams in the Scrabble Creek and Rich Creek watersheds. A top-down methodology was followed to develop these TMDLs and allocate loads to sources. Headwaters were analyzed first because they have a profound effect on downstream water quality. Loading contributions were reduced from applicable sources for these waterbodies, and TMDLs were developed. Refer the TMDL Report for a detailed description of the allocation methodologies used in developing the pollutant specific TMDLs.

The TMDLs for iron and fecal coliform bacteria are shown in Tables A-3-1 and A-3-2. The TMDLs for iron are presented as annual daily loads, in pounds per day. The TMDLs for fecal coliform bacteria are presented in number of colonies per day. All TMDLs were developed to meet TMDL endpoints under a range of conditions observed throughout the year.

A-3.6 TMDL Tables: Metals and pH

Table A-3-1. Iron TMDLs for the Rich Creek watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lbs/day)	Wasteload Allocation (lbs/day)	Margin of Safety (lbs/day)	TMDL (lbs/day)
Rich Creek	WVKG-6	Rich Creek	Iron	15.7	14.2	1.6	31.5
Rich Creek	WVKG-6-B	Bridge Fork	Iron	3.6	11.7	0.8	16.1

A-3.7 TMDL Tables: Fecal Coliform Bacteria

Table A-3-2. Fecal coliform bacteria TMDLs for the Scrabble Creek and Rich Creek watersheds

Major Watershed	Stream Code	Stream Name	Parameter	Load Allocation (counts/day)	Wasteload Allocation (counts/day)	Margin of Safety (counts/day)	TMDL (counts/day)
Scrabble Creek	WVKG-1	Scrabble Creek	Fecal coliform	8.72E+09	NA	4.59E+08	9.18E+09
Rich Creek	WVKG-6	Rich Creek	Fecal coliform	2.55E+10	NA	1.34E+09	2.68E+10
Rich Creek	WVKG-6-A	Lick Branch	Fecal coliform	1.04E+09	NA	5.49E+07	1.10E+09
Rich Creek	WVKG-6-D	Kelly Fork	Fecal coliform	3.81E+09	NA	2.00E+08	4.01E+09

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