APPENDIX 4

A-4. CAMPBELLS CREEK

A-4.1 Watershed Description

Campbells Creek is in the northern portion of the Upper Kanawha watershed, as shown in Figure A-4-1, and drains approximately 39.87 square miles (25,516 acres). Figure A-4-2 shows the land use distribution in the watershed. The dominant land use is forest, which covers 94.10 percent of the watershed. Another important land use type is urban/residential (3.42 percent). All other individual land cover types account for less than 2 percent of the total watershed area.

There are 11 impaired streams in the watershed, including Campbells Creek itself. Figure A-4-3 shows the impaired segments and the pollutants for which each is impaired.

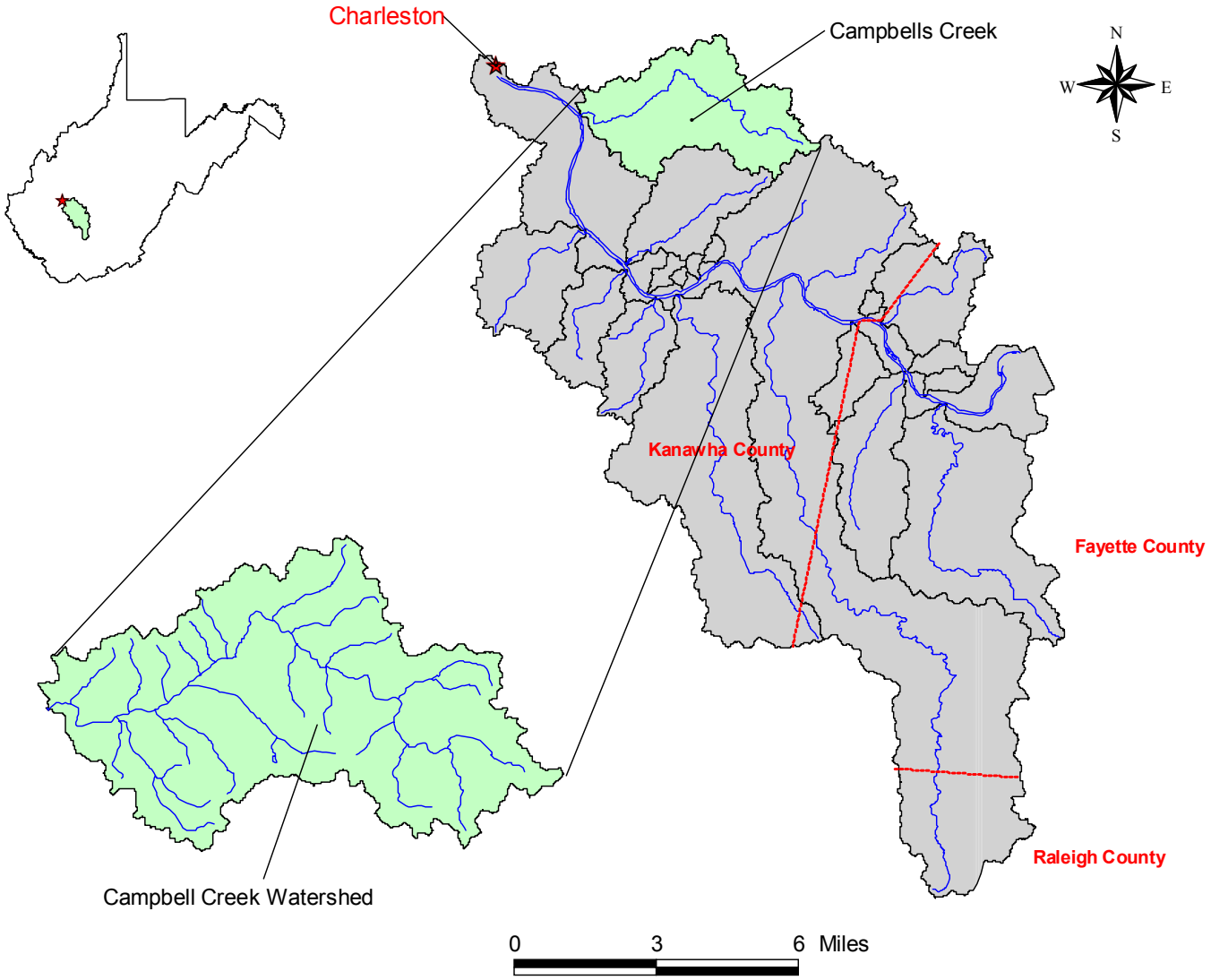

Figure A-4-1. Location of the Campbells Creek watershed

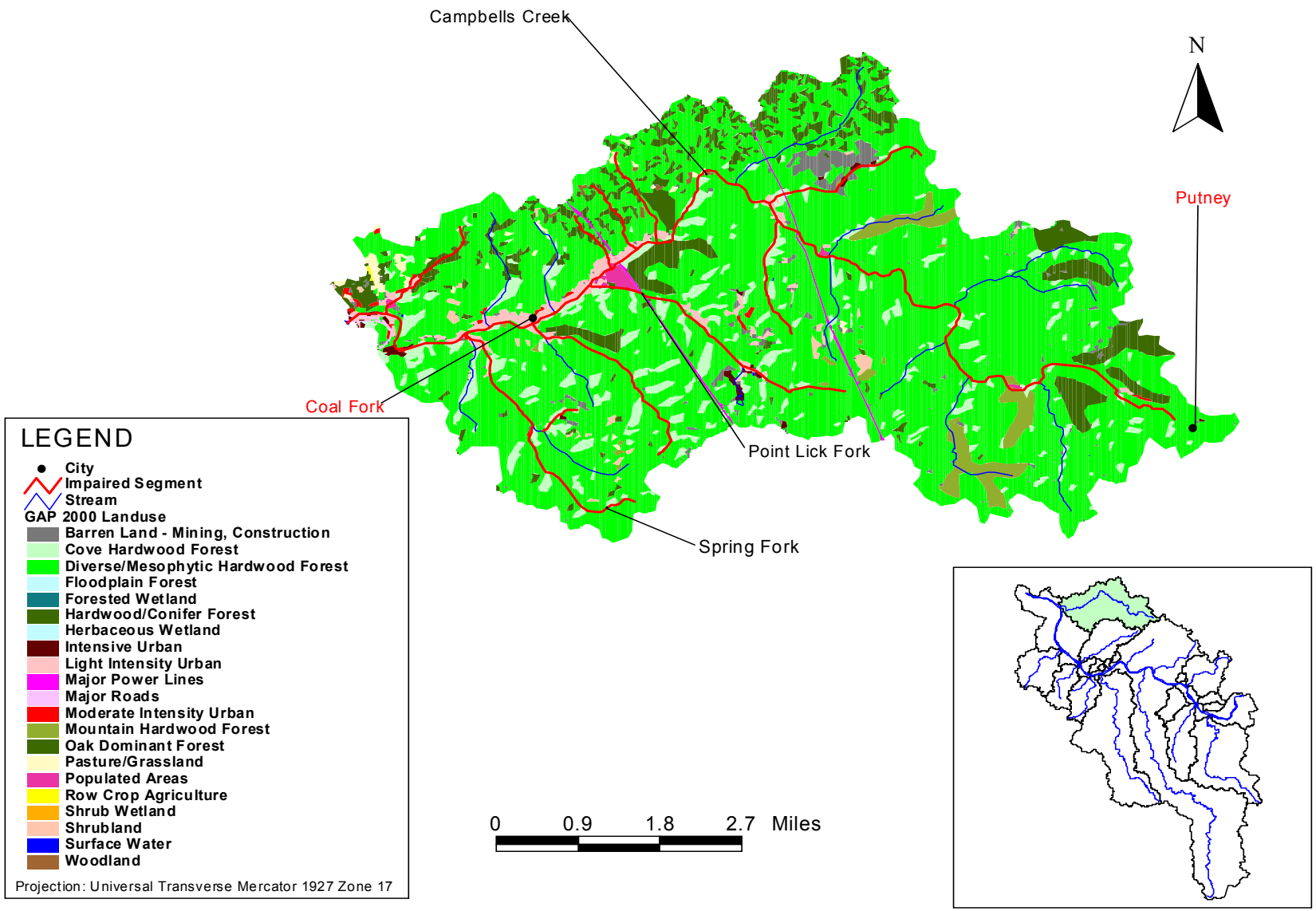

Figure A-4-2. Land use distribution in the Campbells Creek watershed

Stream	Aluminum	Iron	Manganese	pH	Biological	Fecal Coliforms
Campbells Creek					X	X
Dry Branch	X				X	X
Spring Fork	X					X
UNT/Left Fork /Spring Fork		X				
Coal Fork						X
Point Lick Fork						X
Wash Branch						X
Cline Branch						X
Big Bottom Hollow		X			X	X
Rattlesnake Hollow			X			
UNT/Campbells Creek						X

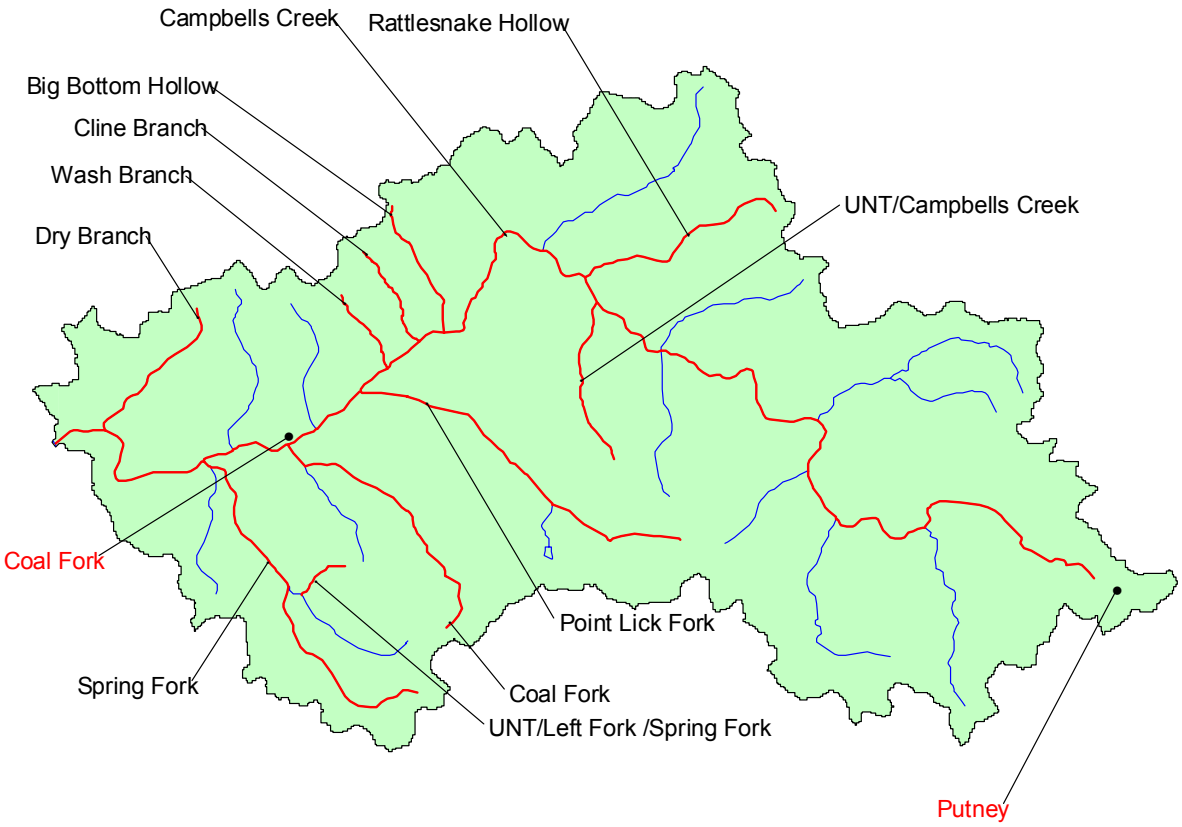

Figure A-4-3. Impaired waterbodies in the Campbells Creek watershed

A-4.2 Pre-TMDL Monitoring

Before establishing Total Maximum Daily Loads (TMDLs), WVDEP conducted monitoring in each of the impaired streams in the Upper Kanawha watershed to better characterize water quality and to refine impairment listings. Monthly samples were taken at 339 stations throughout the Upper Kanawha watershed from July 1, 2001, through June 30, 2002. The locations of the pre-TMDL monitoring sites in the Campbells Creek watershed are shown in Figure A-4-4. Monitoring suites at each site were 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 (e.g., total iron, dissolved iron, total aluminum, dissolved aluminum, total manganese, total suspended solids, pH, sulfate, and specific conductance). Monthly samples from streams impaired by fecal coliform bacteria were analyzed for this parameter, pH, and specific conductance. Appropriate monitoring suites were also selected for streams with multiple impairments. For example, if a stream was impaired by metals and fecal coliform bacteria, the samples were analyzed for total iron, dissolved iron, total aluminum, dissolved aluminum, total manganese, total suspended solids, pH, sulfate, specific conductance, and fecal coliform bacteria. In addition, benthic macroinvertebrate assessments were performed at specific locations on the biologically impaired streams during the pre-TMDL monitoring period. When conditions allowed, instantaneous flow measurements were also taken at the pre-TMDL sampling locations.

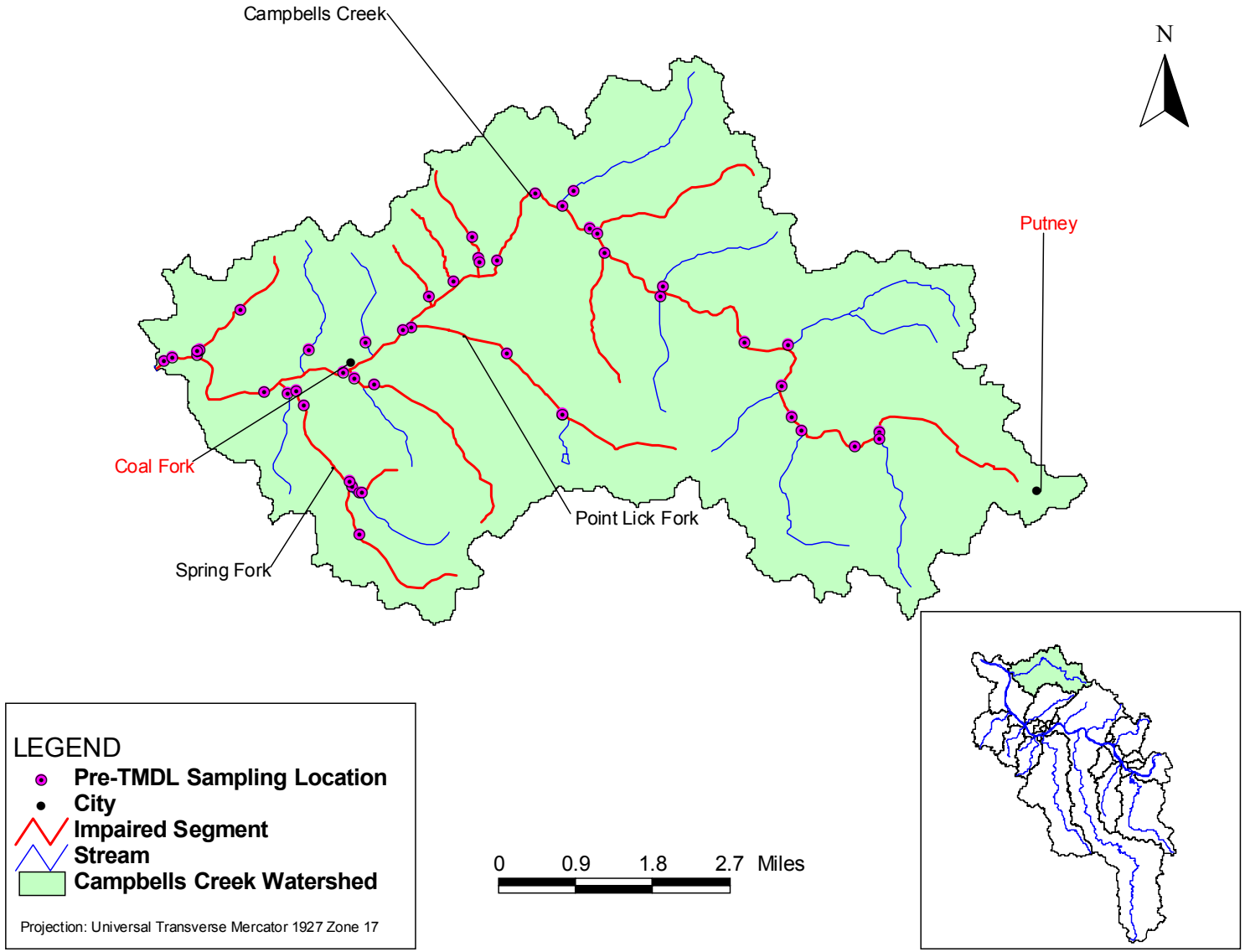

Figure A-4-4. Pre-TMDL monitoring stations in the Campbells Creek watershed

A-4.3 Metals Sources

This section identifies and examines the potential sources of aluminum, iron, and manganese in the Campbells Creek watershed. Sources can be classified as either point sources (permitted) or nonpoint sources (non-permitted). Mining- and non-mining-related permits are used to classify metals and pH point sources. Metals nonpoint sources are diffuse, non-permitted sources such as abandoned or forfeited mine sites.

Pollution 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 in detail by collecting Global Positioning System data and water quality samples for laboratory analysis. WVDEP personnel recorded physical descriptions of the pollutant sources: the number of outfalls, the source of the outfalls, and the general condition of the stream in the vicinity of the outfalls. These records were compiled and electronically plotted on maps using GIS software. This information was used in conjunction with additional data to characterize pollutant sources.

Based on scientific knowledge of sediment/metal interaction and knowledge of soils in West Virginia, it is reasonable to conclude that sediments contain high levels of aluminum and iron, and, to a lesser extent, manganese. Control of sediment-producing sources may be necessary to meet water quality criteria for dissolved aluminum, total iron, and total manganese during critical high flow conditions.

A-4.3.1 Metals Point Source Inventory

As described in the main 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 point sources can be classified into two major categories: permitted non-mining point sources and permitted mining point sources. Only mining-related point sources exist in the Campbells Creek watershed.

Permitted Non-mining Metals Point Sources

Non-mining NPDES permits are not present in the Campbells Creek watershed.

Permitted Mining Metals Point Sources

WVDEP's *HPU* GIS coverage was used to determine the locations of the mining permits; detailed permit information was taken from WVDEP's *ERIS* database system. There are 120 mining-related NPDES outlets in the Campbells Creek watershed, the locations of which are indicated in Figure A-4-5. The permits related to these outlets are listed in the Technical Report. The list identifies each responsible party and the total number of outlets that discharge into the Campbells Creek watershed. The Technical Report also contains detailed information regarding NPDES/Article 3 permit relationships, specific data for each permitted outlet, and permit limits for each mining-related NPDES outlet.

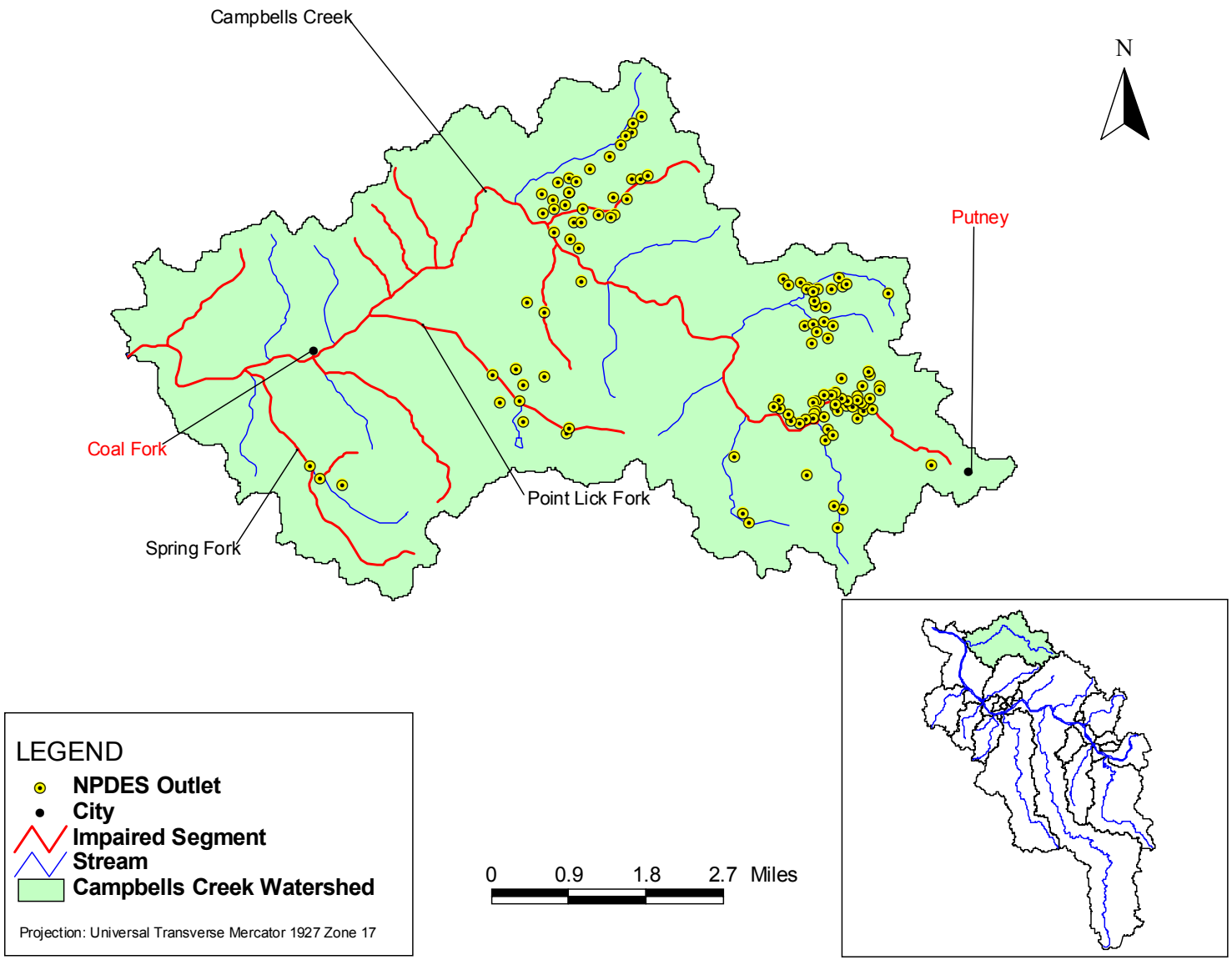

Figure A-4-5. NPDES outlets in the Campbells Creek watershed

A-4.3.2 Metals Nonpoint Source Inventory

In addition to point sources, nonpoint sources contribute to metals-related water quality impairments in the Campbells Creek watershed. Nonpoint sources are diffuse, non-permitted sources. Abandoned mines can create acid mine drainage, which contributes low pH and high metals concentrations to surface and subsurface waters; therefore, abandoned mine lands can be a significant non-permitted source of metals and pH impairment. 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 mining-related non-permitted source. 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.

Abandoned Mine Lands and Bond Forfeiture Sites

Based on the identification of a number of abandoned mining activities in the Campbells Creek watershed, abandoned mine lands are a significant non-permitted source of metals in the watershed. WVDEP's Office of Abandoned Mine Lands identified locations of abandoned mine lands in the Campbells Creek watershed. In addition, source-tracking efforts by WVDEP's Division of Water and Waste Management identified and characterized one abandoned mine source (a mine discharge) in the watershed.

WVDEP's Division of Land Restoration, Office of Special Reclamation, made bond forfeiture data available. This information included the status of both land reclamation and water treatment activities. Seven bond forfeiture sites are present in the Campbells Creek watershed.

The locations of abandoned mine lands and bond forfeiture sites are shown in Figure A-4-6.

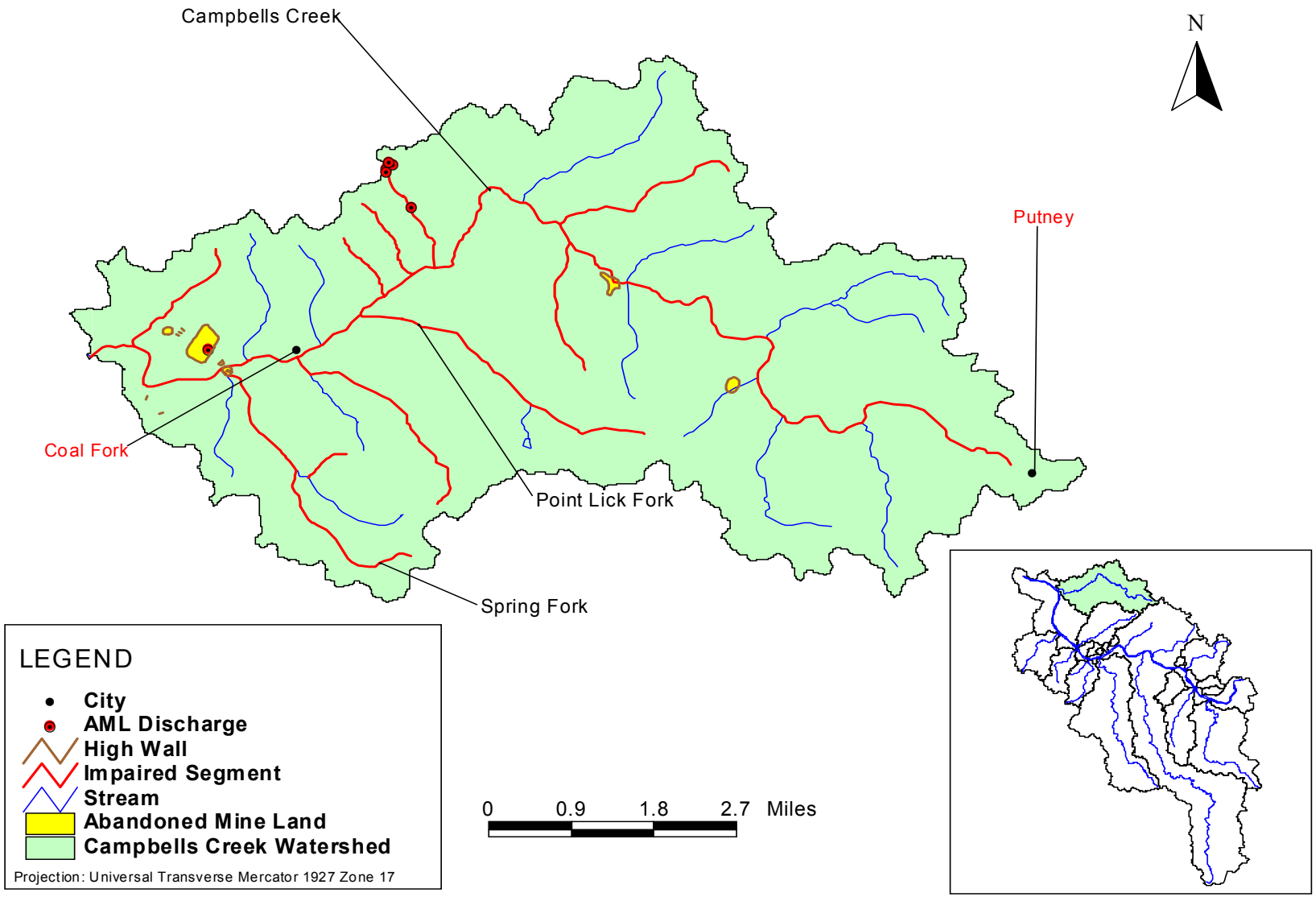

Figure A-4-6. Abandoned mine lands and bond forfeiture sites in the Campbells Creek watershed

Land Disturbance Activities

Land disturbance resulting from agriculture, forestry, oil and gas operations and the construction and use of roads can contribute metals to streams; areas in the watershed related to these activities are discussed below.

Agriculture

Based on the GAP 2000 land use coverage, agricultural areas cover 152 acres (0.60 percent) of the watershed.

Forestry

The active logging operations in the Campbells Creek watershed are shown in Table A-4-1. The disturbed areas associated with these operations are estimated to cover 769 acres (3.0 percent) of the total watershed area.

Table A-4-1. Logging sites in the Campbells Creek watershed

Logging Site ID	Area of Logging Sites (acres)	Percentage of Watershed	Logged Area that Consists of Roads/ Landings (acres)	Percentage of Total Logging Area that Consists of Roads/Landings
K-49: L-1	9	0.0%	0.8	9.3%
K-49: L-2	16	0.1%	1.2	7.5%
K-49: L-3	24	0.1%	1.6	6.8%
K-49: L-4	23	0.1%	2.0	8.7%
K-49: L-5	60	0.2%	7.7	12.8%
K-49: L-6	137	0.5%	8.3	6.1%
K-49: L-7	125	0.5%	10.6	8.5%
K-49: L-8	375	1.5%	21.7	5.8%
Total	**769**	**3.0%**	**54.0**	**7.0%**

Oil and Gas Wells

There are 137 active oil and gas wells in the Campbells Creek watershed, the locations of which are shown in Figure A-4-7. Based on the survey by WVDEP's Office of Oil and Gas, it is estimated that 21.98 acres (0.09 percent) of the Campbells Creek watershed are disturbed by the active well sites (including areas associated with access roads).

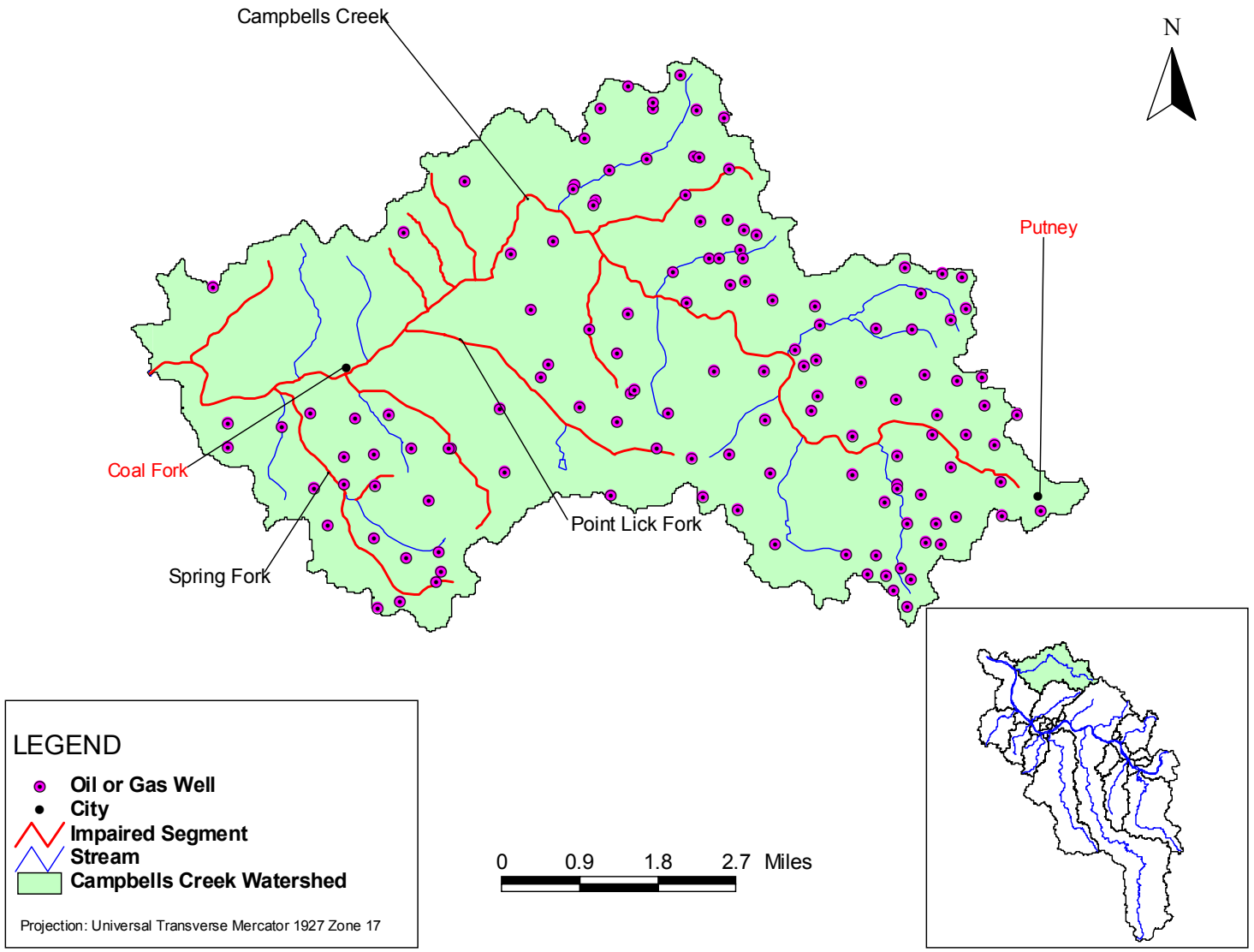

Figure A-4-7. Oil and gas wells in the Campbells Creek watershed

Roads
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 on topographic maps that were not included in the TIGER shapefile. Table A-4-2 summarizes the length, area, and percentage of total watershed area for both paved and unpaved roads in the Campbells Creek watershed.

Table A-4-2. Road miles by type in the Campbells Creek watershed

Road Type	Road Distance (miles)	Road Area (acres)	Road Area as Percentage of Watershed
Total paved	67.64	130.08	0.51%
Total unpaved	239.95	367.99	1.44%

A-4.4 Fecal Coliform Bacteria Sources

This section identifies and examines the potential sources of fecal coliform bacteria in the Campbells Creek watershed. Sources can be classified as either point sources (specific sources subject to a permit) or nonpoint sources (diffuse sources). Point sources of fecal coliform bacteria are classified by several different types of sewage permits and the point source discharges regulated therein. Nonpoint sources are diffuse, non-permitted sources.

A-4.4.1 Fecal Coliform Bacteria Point Sources

Permitted sources of fecal coliform bacteria that experience effluent overflows or that do not comply with permit limits can cause occasional high loadings of fecal coliform bacteria in receiving streams. In the Campbells Creek watershed, there are two sanitary sewer overflows.

A-4.4.2 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 Campbells Creek watershed. Human sources of fecal coliform bacteria in these areas include undisinfected sewage discharges from failing septic systems, and possible direct discharges of undisinfected sewage from residences (straight pipes). The West Virginia Bureau for Public Health estimates septic tank failure rates in this area to be 70 percent in the first 10 years (Dave Thorton, WV Bureau for Public Health 2003). An analysis of census data from the 1990 Census combined with WVDEP source-tracking information yielded an estimate of 306 people living in unsewered homes in the Campbells Creek watershed. Figure A-4-8 shows the estimated distribution of the unsewered population in the watershed.

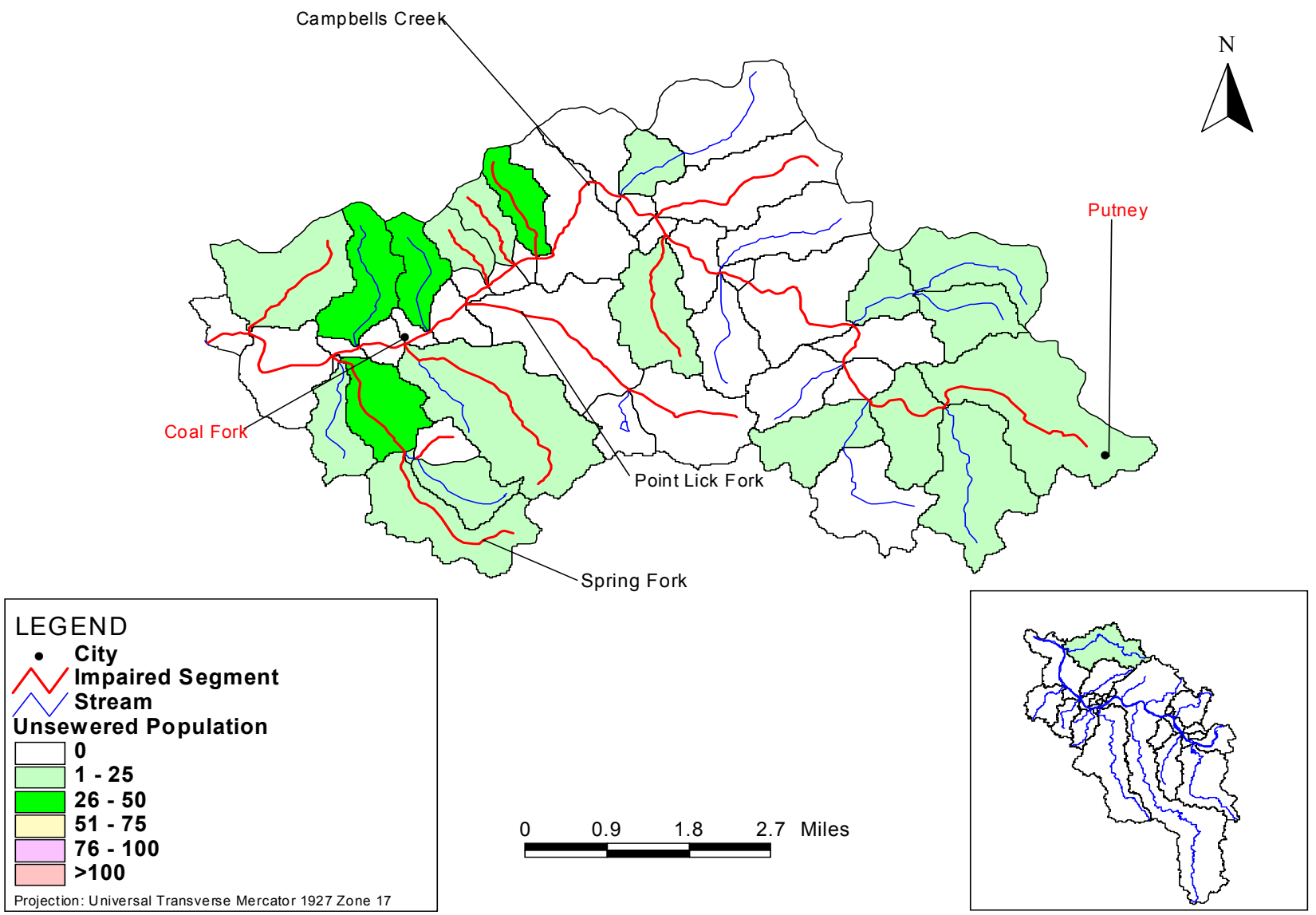

Figure A-4-8. Estimated unsewered population in the Campbells Creek watershed

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. Rural stormwater runoff can also transport significant loads of bacteria from livestock pastures, livestock/poultry feeding facilities, and manure storage and application. In the Campbells Creek watershed, there were isolated areas where dogs were confined near a stream. Cattle, horses, and other agricultural livestock were not found in the area.

Given the small portion of total land area in the Upper Kanawha watershed that consists of residential and agricultural areas, and the low fecal coliform bacteria accumulation rates for forested areas, stormwater runoff from these areas is not considered to be a significant nonpoint source of fecal coliform bacteria, except in localized areas.

A certain "natural background" contribution of fecal coliform bacteria can be attributed to deposition by wildlife in forested areas. Accumulation rates for fecal coliform bacteria in forested areas were developed using reference numbers from past TMDLs, incorporating wildlife estimates obtained from WVDEP's Division of Natural Resources. Although wildlife contributions of fecal coliform bacteria were considered in modeling, they were not found to be a significant source.

A-4.5 Stressors of Biologically Impaired Streams

The Campbells Creek watershed has three biologically impaired streams for which TMDLs have been developed. These streams are identified in Table A-4-3 along with the primary stressors of the streams' benthic communities and the TMDLs required to address the cause of biological impairment. A stressor identification process was used to evaluate and identify the primary stressors of the impaired benthic communities. WVDEP is deferring TMDL development for two other biologically impaired waters in the Campbells Creek watershed (Point Lick Fork and Rattlesnake Hollow). The primary stressor in those waters is elevated ionic strength. The information available on the causative pollutant(s) and associated impairment threshold(s) is insufficient to support TMDL development at this time.

Table A-4-3. Primary stressors of biologically impaired streams in the Campbells Creek watershed

Stream	Primary Stressors	TMDLs Required
Campbells Creek	Organic enrichment Sedimentation	Fecal coliform bacteria Sediment
Dry Branch	Aluminum toxicity Organic enrichment	Aluminum Fecal coliform bacteria
Big Bottom Hollow	Sedimentation Organic enrichment Iron possible (secondary)	Sediment Fecal coliform bacteria Iron

The aluminum and iron TMDLs presented in Tables A-4-4 and A-4-6 address the metals toxicity biological stressors, and the fecal coliform TMDLs presented in Table A-4-8 are surrogates for the organic enrichment biological stressor. Please refer to sections A-4.3 and A-4.4 for source information.

A-4.6 TMDLs for the Campbells Creek Watershed

A-4.6.1 TMDL Development

TMDLs and source allocations were developed for impaired streams in the Campbells Creek watershed. 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 to section 7.4 of the main report for a detailed description of allocation methodologies used in the development of the pollutant-specific TMDLs.

The TMDLs for iron, manganese, aluminum, fecal coliform bacteria, and sediment are shown in Tables A-4-4 through A-4-6 and Tables A-4-8 and A-4-9. The TMDLs for iron, manganese, and aluminum are presented as annual average loads, in terms of pounds per year. The TMDLs for fecal coliform bacteria are presented in terms of the number of colonies per year. The TMDLs for sediment are presented in terms of tons per year. All TMDLs are presented as annual average loads because they were developed to meet TMDL endpoints under a range of conditions observed throughout the year.

A-4.6.2 TMDL Tables: Metals

Table A-4-4. Iron TMDLs for the Campbells Creek watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
CAMPBELLS CREEK	K-49-B-2-A	UNT/Left Fork /Spring Fork	Iron	422	NA	22	445
CAMPBELLS CREEK	K-49-G.2	Big Bottom Hollow	Iron	1,153	NA	61	1,213

NA = not applicable; UNT = unnamed tributary.

Table A-4-5. Manganese TMDLs for the Campbells Creek watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
CAMPBELLS CREEK	K-49-I	Rattlesnake Hollow	Manganese	174	1,978	113	2,265

UNT = unnamed tributary.

Table A-4-6. Aluminum TMDLs for the Campbells Creek watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
CAMPBELLS CREEK	K-49-A	Dry Branch	Total Aluminum	1,099	NA	58	1,157
CAMPBELLS CREEK	K-49-B-2-A	Spring Fork	Total Aluminum	4,776	NA	251	5,027

NA = not applicable; UNT = unnamed tributary.

Table A-4-7. pH TMDLs for the Campbells Creek watershed

There are no pH impairments in this watershed.

A-4.6.3 TMDL Tables: Fecal Coliform Bacteria

Table A-4-8. Fecal coliform TMDLs for the Campbells Creek watershed

Major Watershed	Stream Code	Stream Name	Parameter	Load Allocation (counts/yr)	Wasteload Allocation (counts/yr)	Margin of Safety (counts/yr)	TMDL (counts/yr)
CAMPBELLS CREEK	K-49	Campbells Creek	Fecal coliform	1.21E+14	NA	6.39E+12	1.28E+14
CAMPBELLS CREEK	K-49-A	Dry Branch	Fecal coliform	1.58E+13	NA	8.33E+11	1.67E+13
CAMPBELLS CREEK	K-49-B	Spring Fork	Fecal coliform	6.17E+12	NA	3.25E+11	6.49E+12
CAMPBELLS CREEK	K-49-D	Coal Fork	Fecal coliform	4.63E+12	NA	2.44E+11	4.87E+12
CAMPBELLS CREEK	K-49-F	Point Lick Fork	Fecal coliform	1.58E+13	NA	8.34E+11	1.67E+13
CAMPBELLS CREEK	K-49-F.5	Wash Branch	Fecal coliform	1.70E+12	NA	8.94E+10	1.79E+12
CAMPBELLS CREEK	K-49-G	Cline Branch	Fecal coliform	7.87E+11	NA	4.14E+10	8.29E+11
CAMPBELLS CREEK	K-49-G.2	Big Bottom Hollow	Fecal coliform	3.49E+12	NA	1.84E+11	3.67E+12
CAMPBELLS CREEK	K-49-I.3	UNT/Campbells Creek	Fecal coliform	4.64E+12	NA	2.44E+11	4.89E+12

NA = not applicable; UNT = unnamed tributary.

A-4.6.4 TMDL Tables: Sediment

Table A-4-9. Sediment TMDLs for the Campbells Creek watershed

Major Watershed	Stream Code	Stream Name	Parameter	Load Allocation (ton/yr)	Wasteload Allocation (ton/yr)	Margin of Safety (ton/yr)	TMDL (ton/yr)
CAMPBELLS CREEK	K-49	Campbells Creek	Sediment	1,910	331	118	2,359
CAMPBELLS CREEK	K-49-G.2	Big Bottom Hollow	Sediment	19	NA	1	20

NA = not applicable; UNT = unnamed tributary.