

## APPENDIX 2

### A-2. CROSS CREEK

#### A-2.1 Watershed Description

Cross Creek is in the southern portion of the Upper Ohio North watershed, as shown in Figure A-2-1, and drains approximately 79.46 square miles (50,853.86 acres). Figure A-2-2 shows the land use distribution for the watershed. The dominant land use in the watershed is forest, which covers 60.33 percent of the watershed. The other important land use type is agriculture (35.33 percent). Barren/mining land and urban/residential land each account for less than 2 percent of the total watershed area.

There are five impaired streams in the Cross Creek watershed, including Cross Creek itself. Figure A-2-3 shows the impaired segments and the pollutants for which each is impaired.

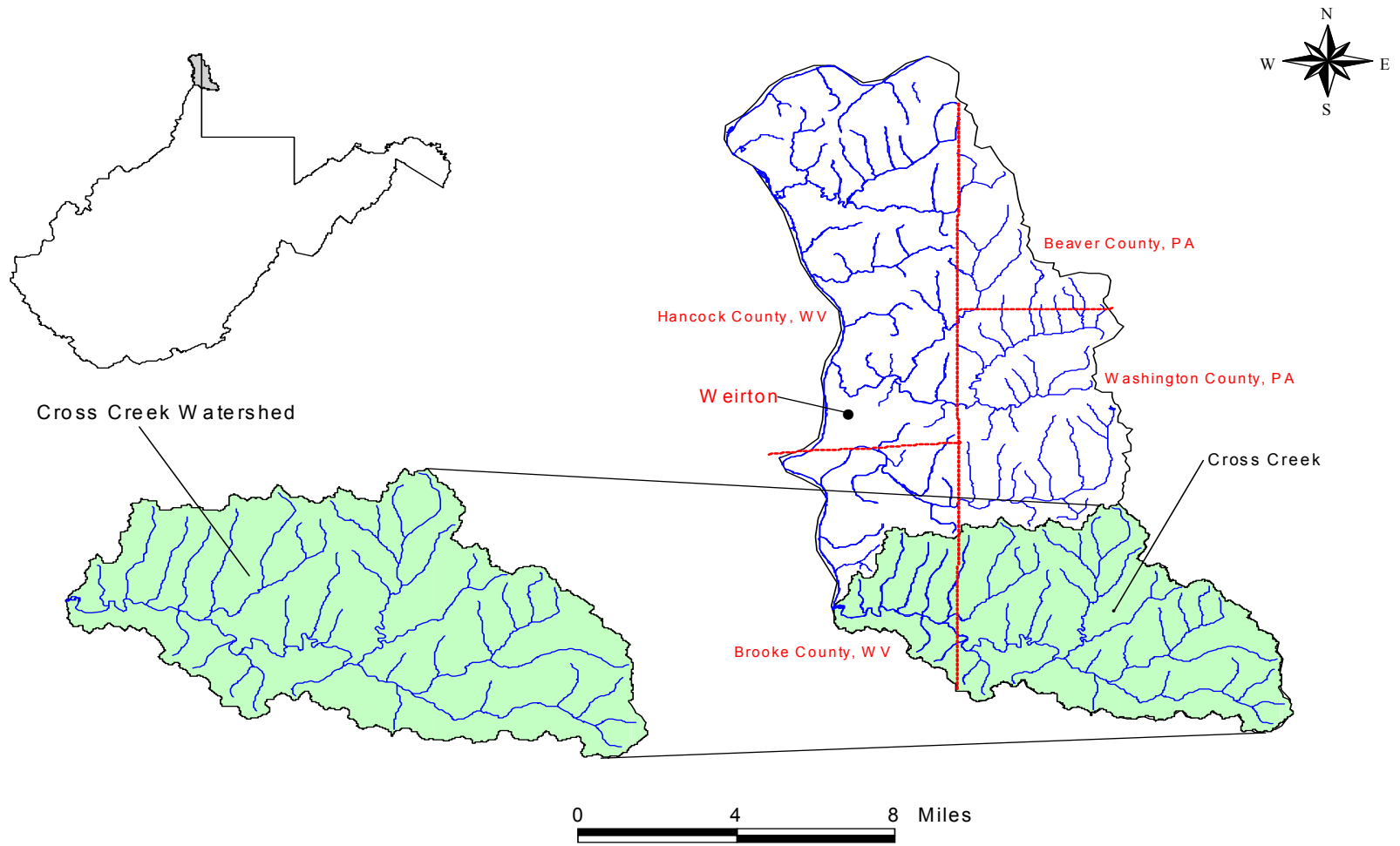


Figure A-2-1. Location of the Cross Creek watershed

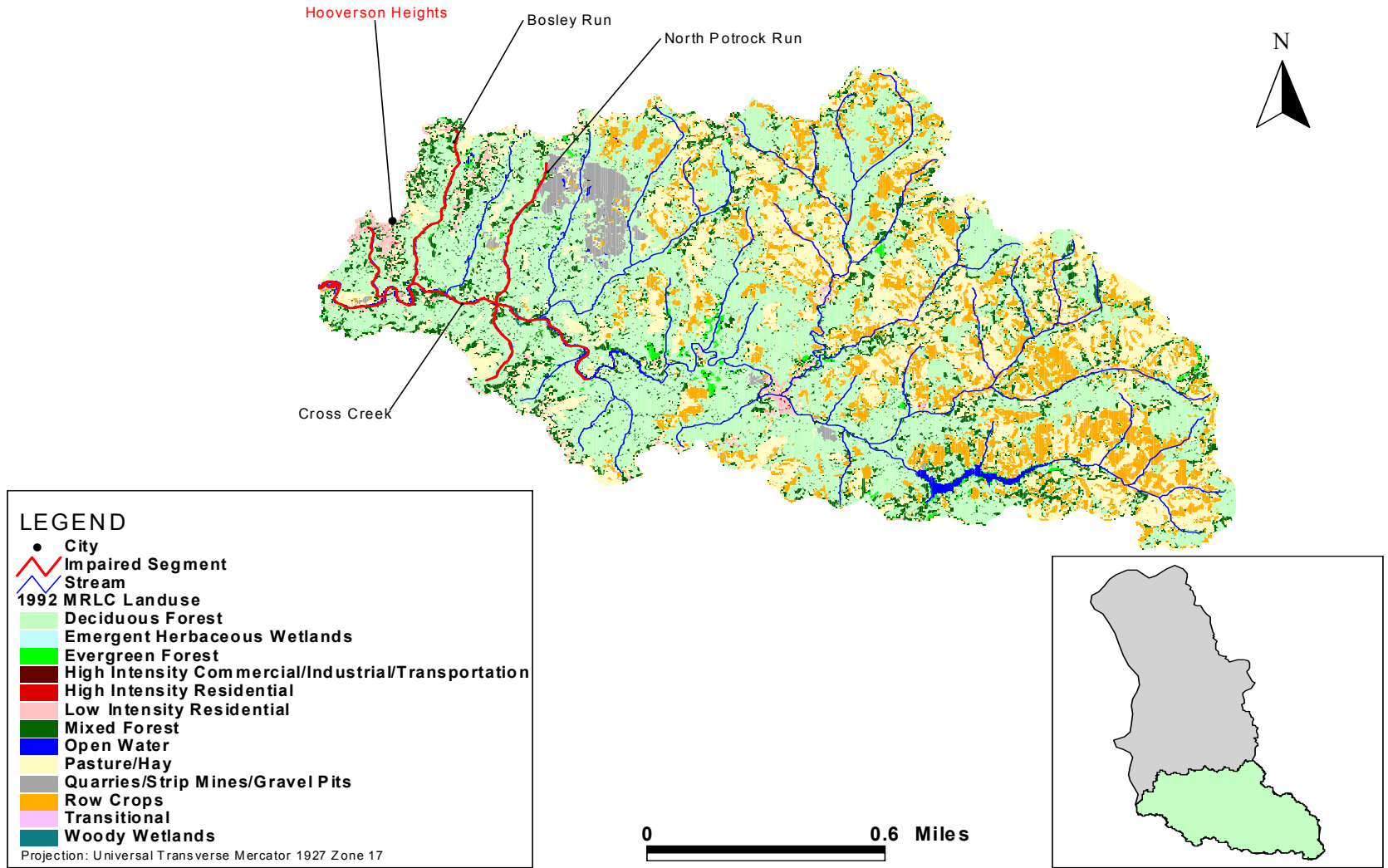


Figure A-2-2. Land use distribution in the Cross Creek watershed

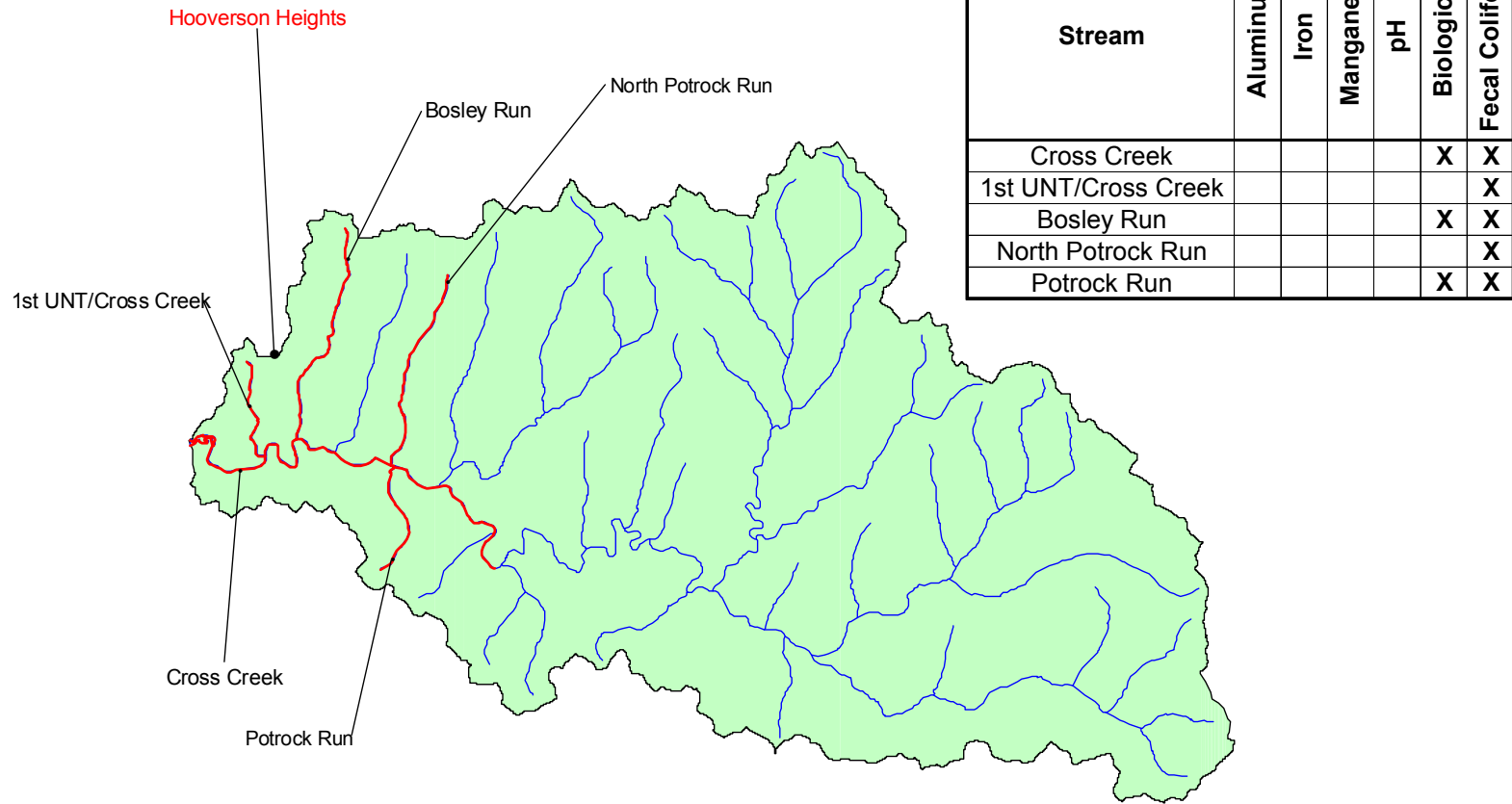


Figure A-2-3. Impaired waterbodies in the Cross Creek watershed

### **A-2.2 Pre-TMDL Monitoring**

Before establishing Total Maximum Daily Loads (TMDLs), WVDEP conducted monitoring in each of the impaired streams in the Upper Ohio North watershed to characterize water quality and to refine impairment listings. Monthly samples were taken at 96 stations from July 1, 2001, to June 30, 2002. The locations of the pre-TMDL monitoring stations in the Cross Creek watershed are shown in Figure A-2-4. The parameters monitored 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 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. Benthic macroinvertebrate assessments were performed at specific locations on the biologically impaired streams during the pre-TMDL monitoring period. Appropriate monitoring suites were 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. When conditions allowed, instantaneous flow measurements were also taken at the pre-TMDL sampling locations.

### **A-2.3 Metals and pH Sources**

No streams in the Cross Creek watershed have metals impairments or pH impairments addressed in this report.

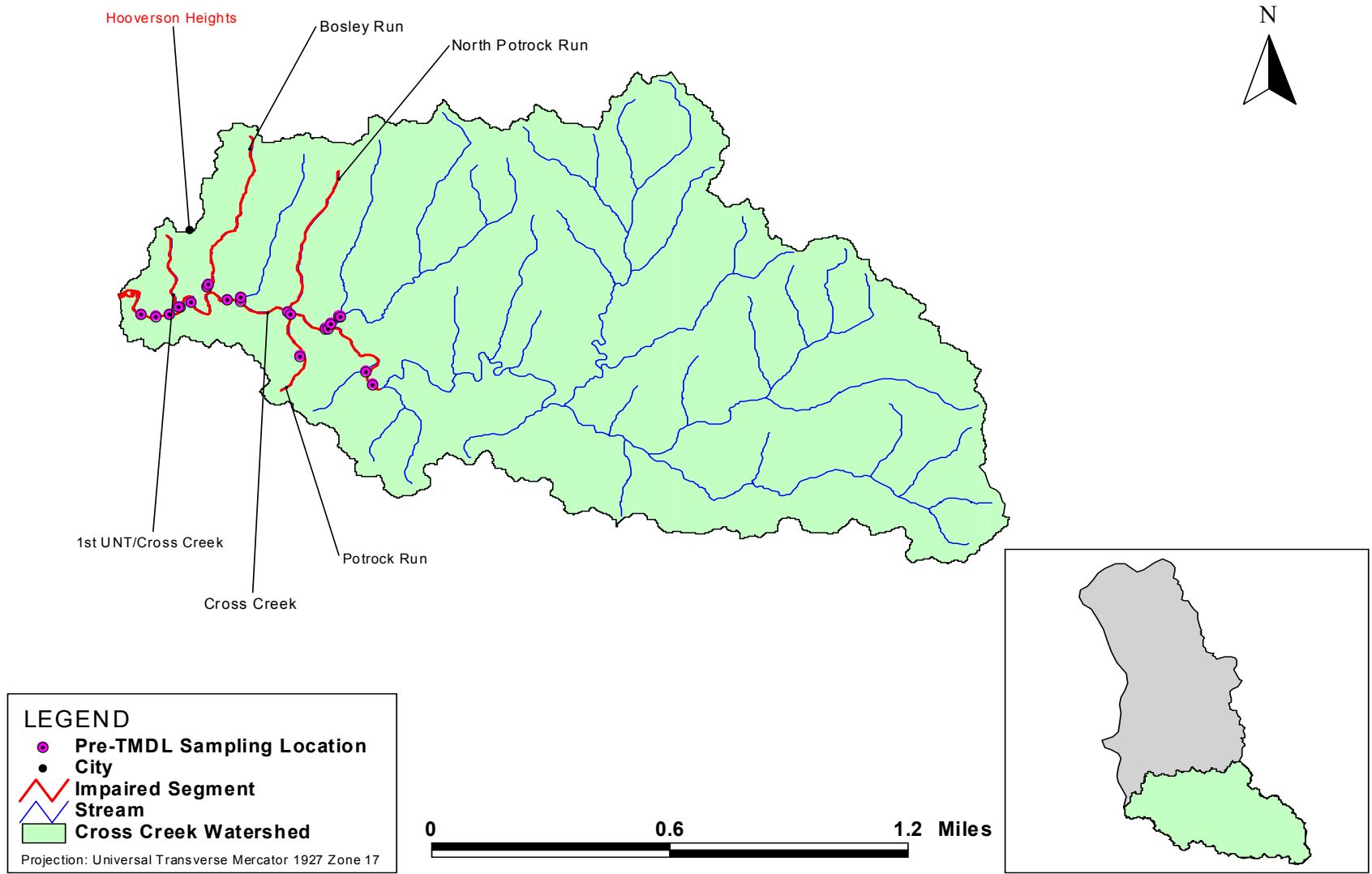


Figure A-2-4. Pre-TMDL monitoring stations in the Cross Creek watershed

## **A-2.4 Fecal Coliform Bacteria Sources**

This section identifies and examines the potential sources of fecal coliform bacteria in the Cross Creek watershed. Sources can be classified as either point sources (specific sources subject to a permit) or nonpoint sources (non-permitted). 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-2.4.1 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 Cross Creek watershed there are nine discharge permits. Eight are general sewage permits and one is a POTW, or publicly owned treatment works, for the City of Follansbee. The POTW permit has two outlets; one is located on the first unnamed tributary of Cross Creek and the other is located in the Allegheny Steel Run watershed.

### **A-2.4.2 Nonpoint (Non-permitted) Fecal Coliform Bacteria Sources**

Pollutant source tracking by WVDEP personnel identified areas of high population density without access to public sewers in the Cross Creek watershed. 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). The West Virginia Bureau for Public Health estimates septic tank failure rates in this area to be 70 percent in the first 10 years (WV Bureau for Public Health 2003). Source tracking by WVDEP personnel yielded an estimate of 1,331 people living in unsewered homes in the Cross Creek watershed. A project is currently under development by the Brooke County Public Sewer District, which will extend a sewer line to Louise at Ebenezer Run, and will provide public sewer service to the majority of the unsewered population. Figure A-2-5 shows the unsewered population estimates for the Cross 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 be a significant source, delivering bacteria present in litter and in the waste of pets and wildlife to the waterbody. Rural stormwater runoff can transport significant loads of bacteria from livestock pastures, livestock and poultry feeding facilities, and manure storage and application. In the West Virginia portion of the Cross Creek watershed, there were isolated areas in which livestock had access to a stream. Agricultural land uses are prevalent in the Pennsylvania portion of the watershed.

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.

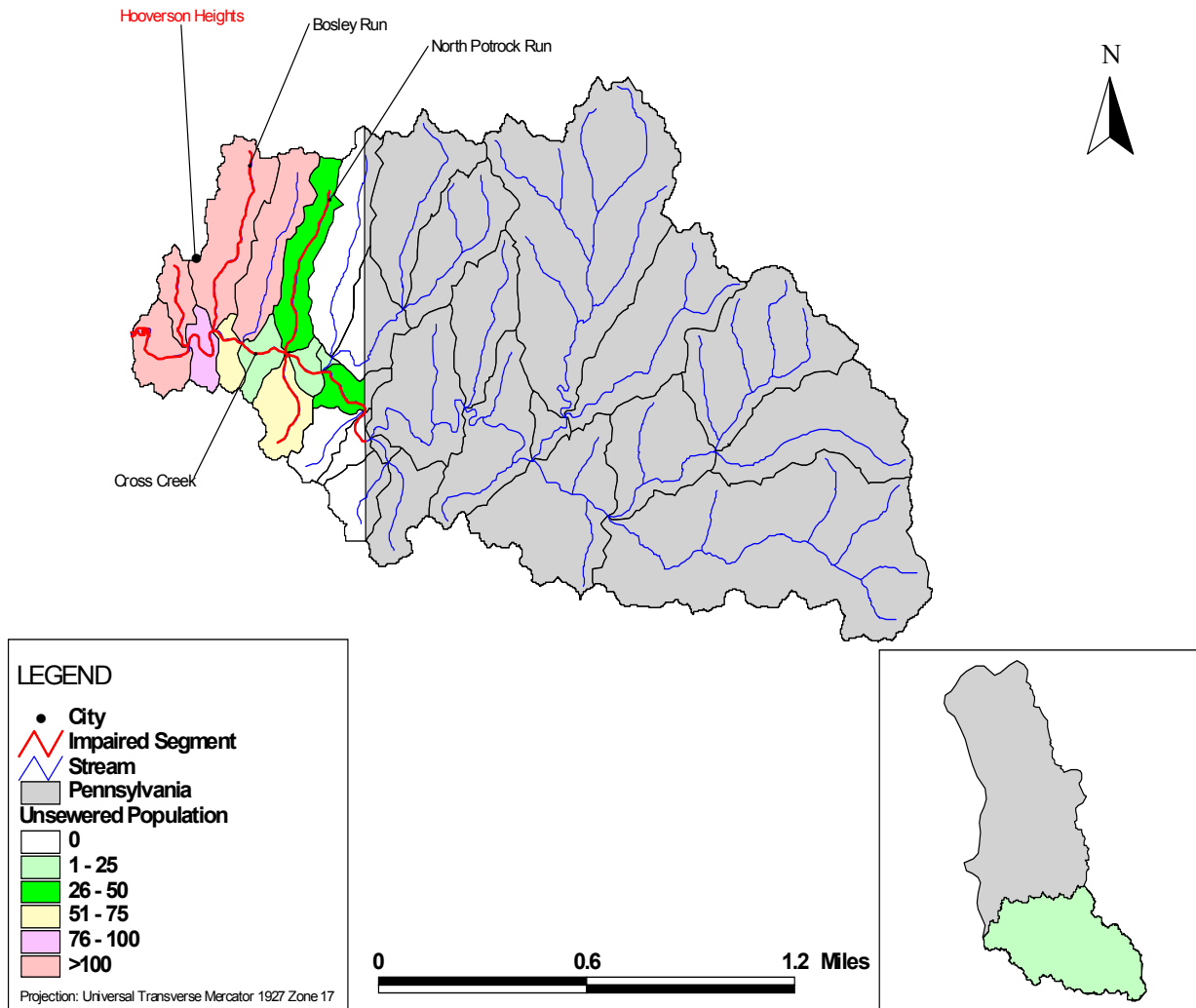


Figure A-2-5. Unsewered population in the Cross Creek watershed



## A-2.5 Sources of Biological Impairment

The Cross Creek watershed has three biologically impaired streams for which TMDLs have been developed. These streams are identified in Table A-2-1 along with the primary stressors to the streams' benthic communities and the TMDLs required to address these impairments. Please refer to the main report for a description of the stressor identification process.

**Table A-2-1.** Primary stressors of biologically impaired streams in the Cross Creek watershed

| Stream      | Primary Stressors                   | TMDLs Required                      |
|-------------|-------------------------------------|-------------------------------------|
| Cross Creek | Organic enrichment<br>Sedimentation | Fecal coliform bacteria<br>Sediment |
| Bosley Run  | Organic enrichment                  | Fecal coliform bacteria             |
| Potrock Run | Organic enrichment                  | Fecal coliform bacteria             |

The fecal coliform TMDLs presented in table A-2-4 are surrogates for the organic enrichment biological stressor. Please refer to section A-2.4 for source information.

### Sediment Sources

Land disturbance resulting from agriculture, forestry, oil and gas wells, and the construction and use of roads can contribute sediment to streams. The areas related to these activities and the number of sites in the Cross Creek watershed are discussed below.

### Agriculture

Based on the Multi-Resolution Land Characteristics coverage, agricultural areas occupy 17,966.39 acres (35.33 percent) of the Cross Creek watershed.

### Forestry

The active logging operations in the Cross Creek watershed are listed in Table A-2-2. The disturbed areas associated with these operations are estimated to occupy 504 acres (0.99 percent) of the total watershed area.

**Table A-2-2.** Logging sites in the Cross 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 |
|-----------------|-------------------------------|-------------------------|---|--|
| 1071599         | 173                           | 0.34%                   | 0.85  | 0.49%  |
| 1019199         | 133                           | 0.26%                   | 0.25  | 0.19%  |
| 1049402         | 100                           | 0.20%                   | 0.25  | 0.25%  |
| 1036598         | 63                            | 0.12%                   | 0.30  | 0.47%  |
| 1027699         | 11                            | 0.02%                   | 0.25  | 2.27%  |
| 1050202         | 4                             | 0.01%                   | 0.30  | 7.46%  |
| 1005200         | 20                            | 0.04%                   | 0.31  | 1.55%  |
| <b>Total</b>    | <b>504</b>                    | <b>0.99%</b>            | <b>2.51</b>   | <b>1.81 (average %)</b>  |

**Oil and Gas Wells**

Based on data from WVDEP’s Office of Oil and Gas, there are no active oil and gas wells in the watershed.

**Roads**

The length and area of paved and unpaved roads were calculated using the TIGER roads coverage for West Virginia. Table A-2-3 summarizes the length, area, and percentage of total watershed area for both paved and unpaved roads in the Cross Creek watershed.

**Table A-2-3.** Road miles by type in the Cross Creek watershed

| Road Type     | Road Distance (miles) | Road Area (acres) | Road Area as Percentage of Watershed |
|---------------|-----------------------|-------------------|--------------------------------------|
| Total paved   | 156.00                | 319.59            | 0.63%                                |
| Total unpaved | 87.06                 | 166.67            | 0.33%                                |

**A-2.6 TMDLs for the Cross Creek Watershed**

**A-2.6.1 TMDL Development**

TMDLs and source allocations were developed for impaired streams in the Cross 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. These TMDLs represent a successful scenario for which detailed load allocations were developed for specific nonpoint source categories in the West Virginia portion of the watershed. The loadings associated with the individual nonpoint source categories were aggregated and presented in this TMDL report as a gross load allocation for Pennsylvania. This TMDL report does not prescribe specific load or wasteload allocations for the contributing area of Pennsylvania. Instead, it allows Pennsylvania and its stakeholders to determine appropriate and necessary source reductions.

The TMDLs for fecal coliform bacteria and sediment are shown in Tables A-2-4 and A-2-5. The TMDLs for fecal coliform bacteria and sediment are presented as annual loads, in terms of the number of colonies per year and tons per year, respectively.

### A-2.6.2 TMDL Tables: Fecal Coliform Bacteria

**Table A-2-4.** Fecal coliform bacteria TMDLs for the Cross 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) | Pennsylvania Allocation (counts/yr) |
|-----------------|-------------|---------------------------------|----------------|-----------------------------|----------------------------------|------------------------------|------------------|-------------------------------------|
| CROSS CREEK     | O-95        | Cross Creek                     | Fecal coliform | 2.82E+14                    | 2.03E+11                         | 1.49E+13                     | 2.97E+14         | 1.76E+14                            |
| CROSS CREEK     | O-95-0.5A   | 1 <sup>st</sup> UNT/Cross Creek | Fecal coliform | 4.51E+12                    | NA                               | 2.38E+11                     | 4.75E+12         | NA                                  |
| CROSS CREEK     | O-95-A      | Bosley Run                      | Fecal coliform | 1.95E+13                    | NA                               | 1.03E+12                     | 2.05E+13         | NA                                  |
| CROSS CREEK     | O-95-C      | North Potrock Run               | Fecal coliform | 7.68E+12                    | NA                               | 4.04E+11                     | 8.09E+12         | NA                                  |
| CROSS CREEK     | O-95-D      | Potrock Run                     | Fecal coliform | 1.27E+13                    | NA                               | 6.69E+11                     | 1.34E+13         | NA                                  |

NA = not applicable; UNT = unnamed tributary.

### A-2.6.3 TMDL Tables: Sediment

**Table A-2-5.** Sediment TMDLs for the Cross Creek watershed

| Major Watershed | Stream Code | Stream Name | Parameter | Load Allocation (tons/yr) | Wasteload Allocation (tons/yr) | Margin of Safety (tons/yr) | TMDL (tons/yr) | Pennsylvania Allocation (tons/yr) |
|-----------------|-------------|-------------|-----------|---------------------------|--------------------------------|----------------------------|----------------|-----------------------------------|
| CROSS CREEK     | WVO-95      | Cross Creek | Sediment  | 8,719                     | 5                              | 459                        | 9,183          | 1,837                             |