APPENDIX 2

A-2. BOOMER BRANCH

A-2.1 Watershed Description

Boomer Branch is in the eastern portion of the Upper Kanawha watershed, as shown in Figure A-2-1, and drains approximately 2.94 square miles (1,881 acres). Figure A-2-2 shows the land use distribution for the watershed. The dominant land use is forest, which covers 60.63 percent of the watershed. Other important land use types include urban/residential (19.41 percent) and barren/mining land (17.68 percent). All other individual land cover types account for less than 2 percent of the total watershed area.

Boomer Branch is the only impaired stream in the watershed. Figure A-2-3 shows the impaired stream segment and the pollutants for which it is impaired.

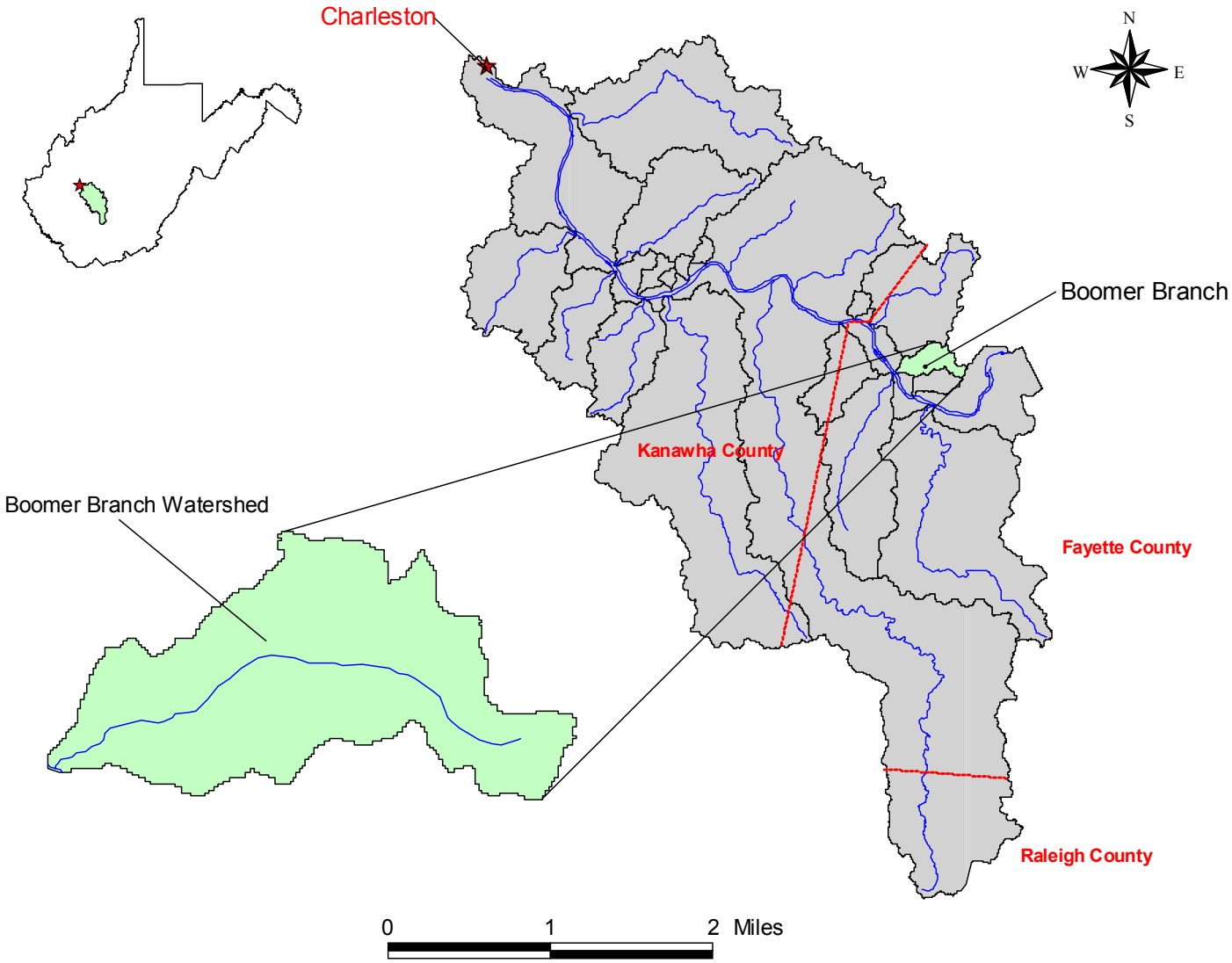

Figure A-2-1. Location of the Boomer Branch watershed

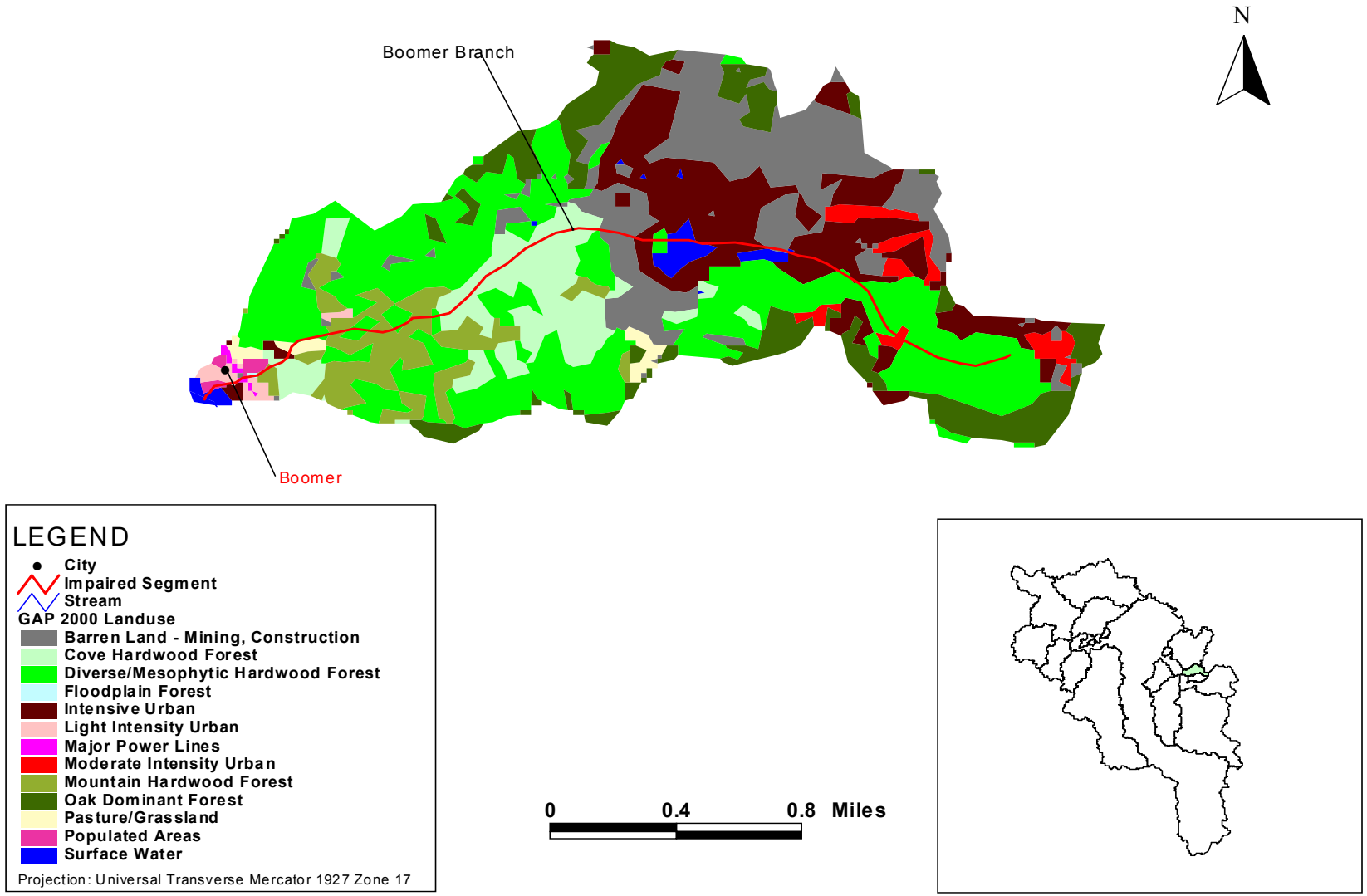

Figure A-2-2. Land use distribution in the Boomer Branch watershed

Stream	Aluminum	Iron	Manganese	pH	Biological	Fecal Coliforms
Boomer Branch	X				X	

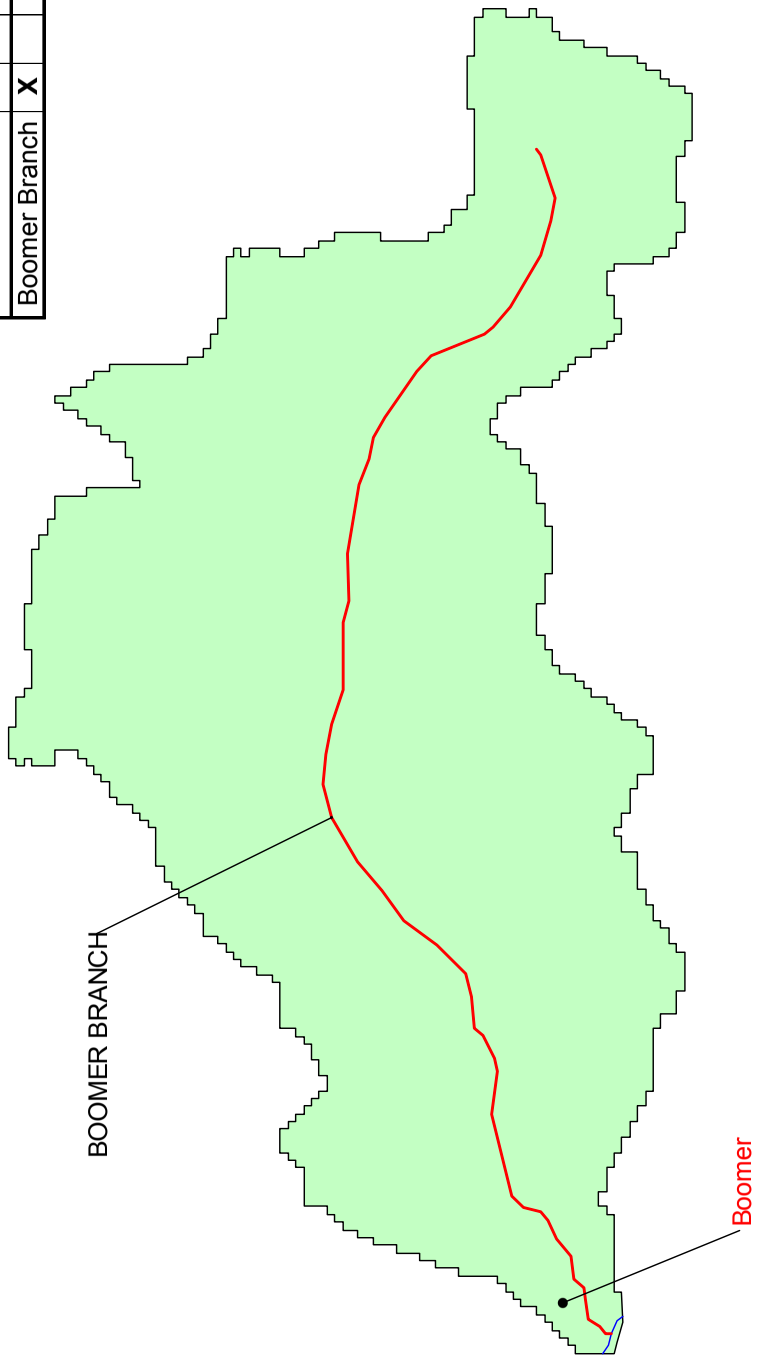

Figure A-2-3. The impaired waterbody in the Boomer Branch watershed

A-2.2 Pre-TMDL Monitoring

Before establishing Total Maximum Daily Loads (TMDLs), WVDEP conducted monitoring in each of the impaired streams 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 stations in the Boomer Branch watershed are shown in Figure A-2-4. 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.

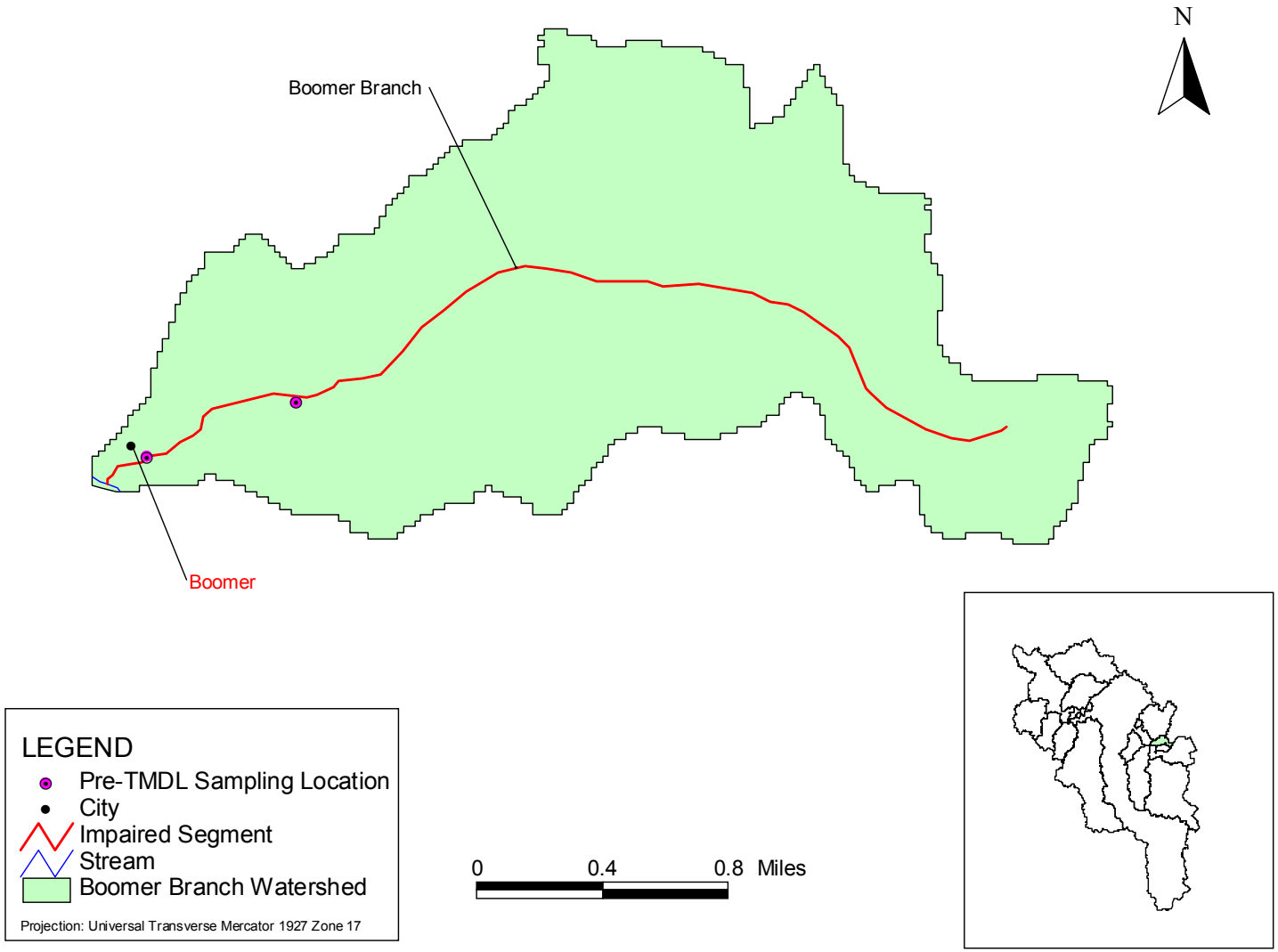

Figure A-2-4. Pre-TMDL monitoring stations in the Boomer Branch watershed

A-2.3 Metals and pH Sources

This section identifies and examines the potential sources of metals and pH impairment in the Boomer Branch watershed. Sources can be classified as either point sources (specific sources subject to a permit) or nonpoint sources (diffuse sources). Metals and pH point sources are classified by mining- and non-mining-related permits. Metals and pH 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 interactions and knowledge of West Virginia's soils, 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-2.3.1 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 and pH point sources can be classified into two major categories: permitted non-mining point sources and permitted mining point sources. Only mining-related point sources of metals exist in the Boomer Branch watershed.

Permitted Non-mining Metals Point Sources

Non-mining NPDES permits are not present in the Boomer Branch watershed.

Permitted Mining Metals Point Sources

WVDEP's *HPU* GIS coverage was used to determine the locations of the mining permits; subsequent detailed permit information was obtained from WVDEP's *ERIS* database system. Fourteen mining-related NPDES outlets were found in the watershed (Figure A-2-5). 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 Boomer Branch 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.

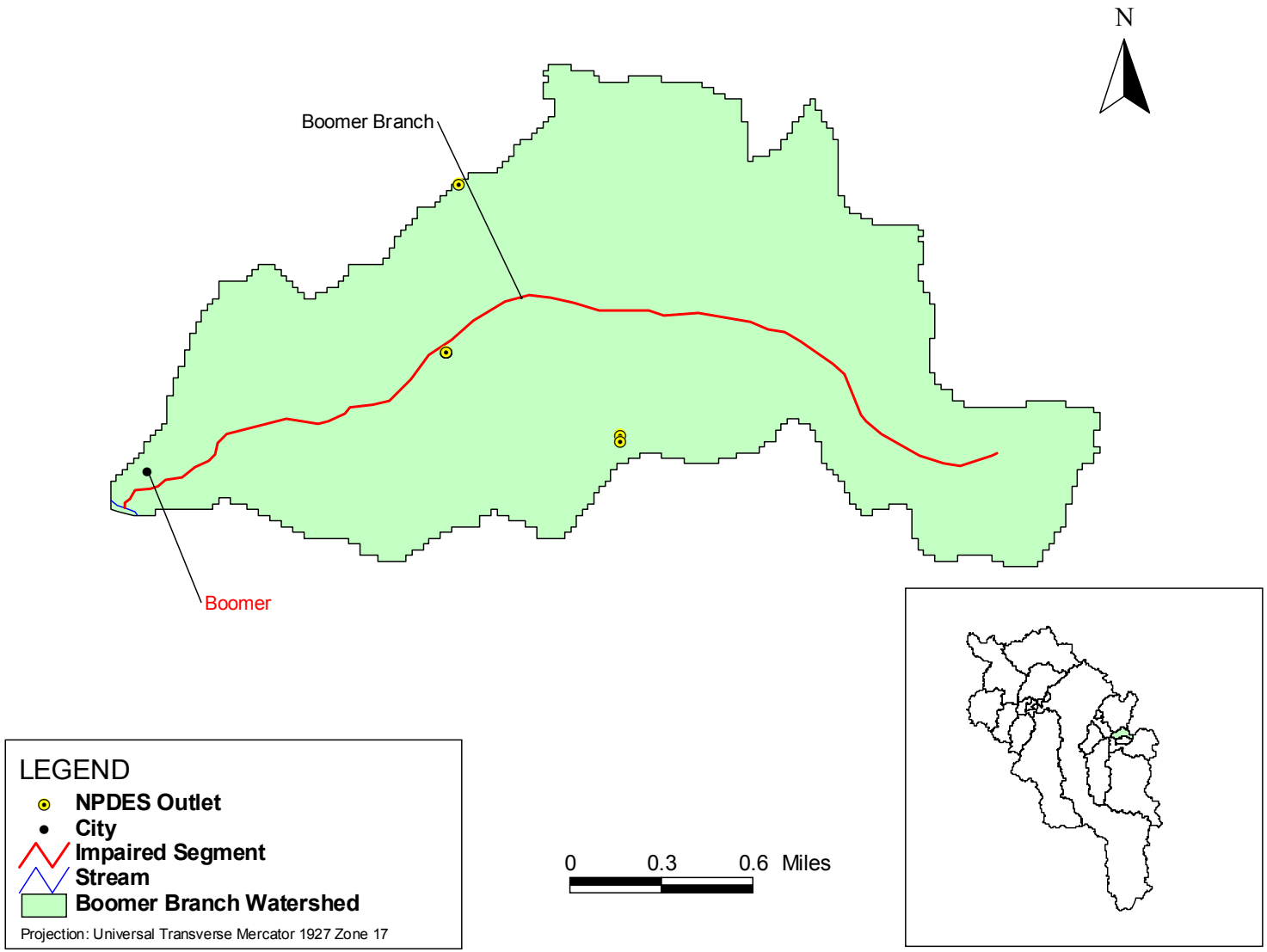

Figure A-2-5. NPDES permits in the Boomer Branch watershed

A-2.3.2 Metals Nonpoint Source Inventory

In addition to point sources, nonpoint sources contribute to metals-related water quality impairments in the Boomer Branch watershed. Nonpoint sources are diffuse, non-permitted sources. Abandoned mine lands can be a significant non-permitted source of metals and pH impairment. Abandoned mines can contribute acid mine drainage, which produces low pH and high metals concentrations in surface and subsurface waters. Similarly, facilities that were subject to the Surface Mining Control and Reclamation Act of 1977 but forfeited their bonds or abandoned operations can be a significant mining-related non-permitted source. Various non-mining land disturbance activities can also be nonpoint sources of metals, delivering metals along with excess sediment to waterbodies. 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

Abandoned mine lands and bond forfeiture sites are not present in the Boomer Branch 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. The areas related to these activities and the number of sites in the Boomer Branch watershed are discussed below.

Agriculture
Based on the GAP 2000 land use coverage, agricultural areas cover 18.2 acres (0.97 percent) of the Boomer Branch watershed.

Forestry
The active logging operation in the Boomer Branch watershed is shown in Table A-2-1. The disturbed area associated with this operation is estimated to cover 500 acres (26.6 percent) of the total watershed area.

Table A-2-1. The logging site in the Boomer Branch watershed

Logging Site ID	Area of Logging Site (acres)	Percentage of Watershed	Logged Area that Consists of Roads/ Landings (acres)	Percentage of Total Logging Area that Consists of Roads/Landings
K-74: L-1	500	26.6%	31.5	6.3%

Oil and Gas Wells
There are three active oil and gas wells in the Boomer Branch watershed, the locations of which are shown in Figure A-2-6. Based on the survey by WVDEP's Office of Oil and Gas, it is estimated that 0.48 acre (0.03 percent) of the watershed is disturbed by the active well sites (including areas associated with access roads).

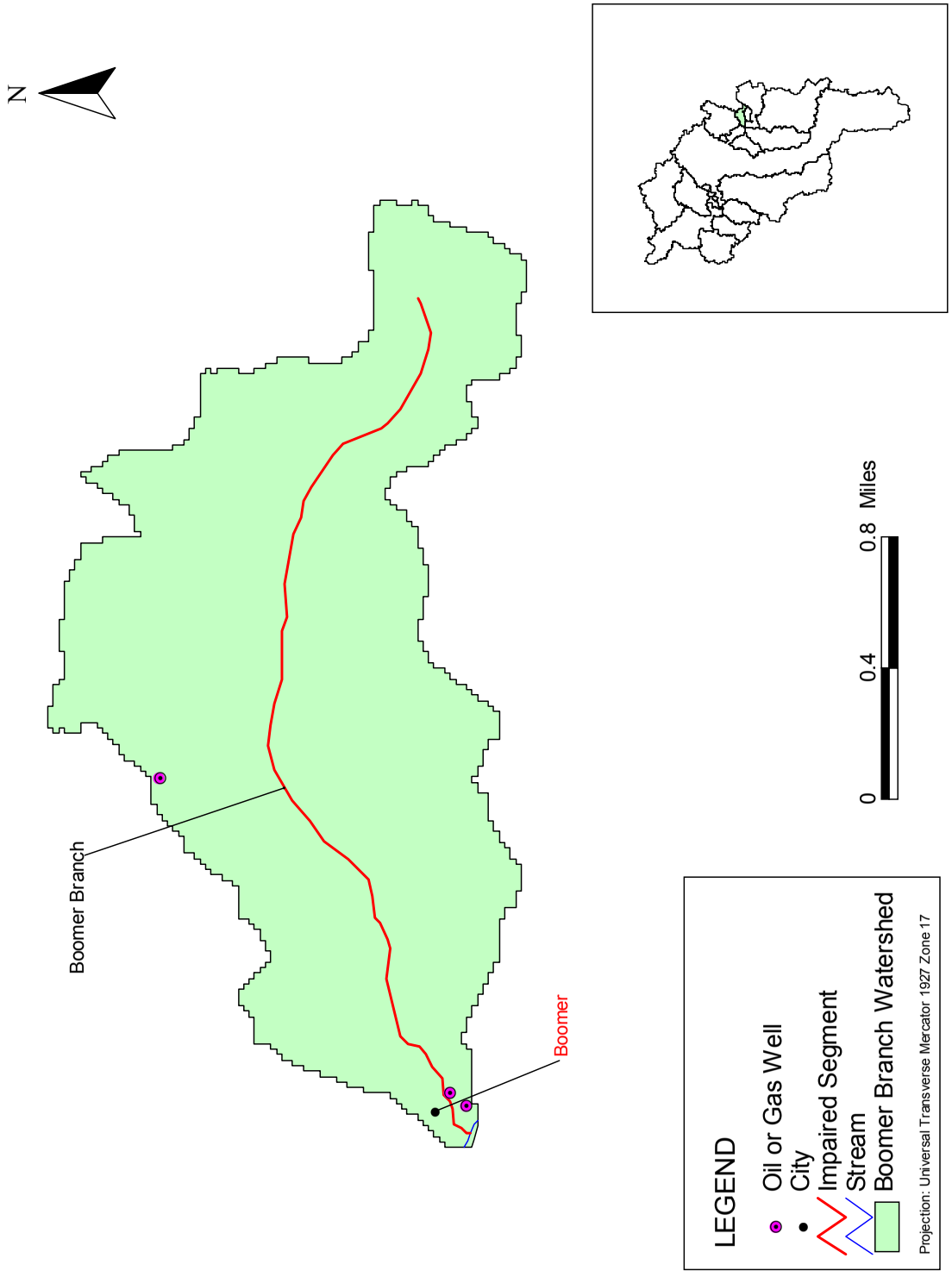

Figure A-2-6. Oil and gas wells in the Boomer Branch watershed

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

Table A-2-2. Road miles by type in the Boomer Branch watershed

Road Type	Road Distance (miles)	Road Area (acres)	Road Area as Percentage of Watershed
Total paved	2.46	5.18	0.28%
Total unpaved	17.08	25.54	1.36%

A-2.4 Fecal Coliform Bacteria Sources

There are no fecal coliform impairments in this watershed.

A-2.5 Stressors of the Biologically Impaired Stream

In the watershed, one stream is biologically impaired, and a TMDL has been developed for it. This stream is identified in Table A-2-3 along with the primary stressor of its benthic community and the TMDL required to address the cause of biological impairment. Refer to the main report for a detailed description of the stressor identification process.

Table A-2-3. Primary stressor of the biologically impaired stream in the Boomer Branch watershed

Stream	Primary Stressor	TMDL Required
Boomer Branch	Aluminum toxicity	Aluminum

The aluminum TMDL presented in Table A-2-6 addresses the aluminum toxicity biological stressor. Please refer to section A-2.3 for source information.

A-2.6 TMDLs for the Boomer Branch Watershed

A-2.6.1 TMDL Development

TMDLs and source allocations were developed for the impaired stream in the Boomer Branch 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 in this waterbody 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, and aluminum are shown in Tables A-2-4 through A-2-6 and are presented as annual average loads, in terms of pounds per year. They are presented as average annual loads because they were developed to meet TMDL endpoints under a range of conditions observed throughout the year.

A-2.6.2 TMDL Tables: Metals

Table A-2-4. Iron TMDL for the Boomer Branch watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
BOOMER BRANCH	K-74	Boomer Branch	Iron	5,495	3,696	484	9,675

Table A-2-5. Manganese TMDL for the Boomer Branch watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
BOOMER BRANCH	K-74	Boomer Branch	Manganese	1,644	3,553	274	5,471

Table A-2-6. Aluminum TMDL for the Boomer Branch watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
BOOMER BRANCH	K-74	Boomer Branch	Total Aluminum	5,283	7,273	661	13,217

Table A-2-7. pH TMDLs for the Boomer Branch watershed

There are no pH impairments in this watershed.

A-2.6.3 TMDL Tables: Fecal Coliform Bacteria

Table A-2-8. Fecal coliform bacteria TMDLs for the Boomer Branch watershed

There are no fecal coliform bacteria impairments in this watershed.

A-2.6.4 TMDL Tables: Sediment

Table A-2-9. Sediment TMDLs for the Boomer Branch watershed

There are no sediment impairments in this watershed.