APPENDIX 3

A-3. DEEP GUT RUN

A-3.1 Watershed Description

Deep Gut Run is in the northern portion of the Upper Ohio North watershed, as shown in Figure A-3-1, and drains approximately 2.76 square miles (1,769.45 acres). Figure A-3-2 shows the land use distribution for the Deep Gut Run watershed. The dominant land use in the watershed is forest, which covers 65.05 percent of the watershed. Other important land use types include agriculture (28.07 percent) and urban/residential land (6.33 percent). All other individual land cover types account for less than 1 percent of the total watershed area.

There are two impaired streams in the Deep Gut Run watershed, including Deep Gut Run itself. Figure A-3-3 shows the impaired segments in the Deep Gut Run watershed and the pollutants for which they are impaired.

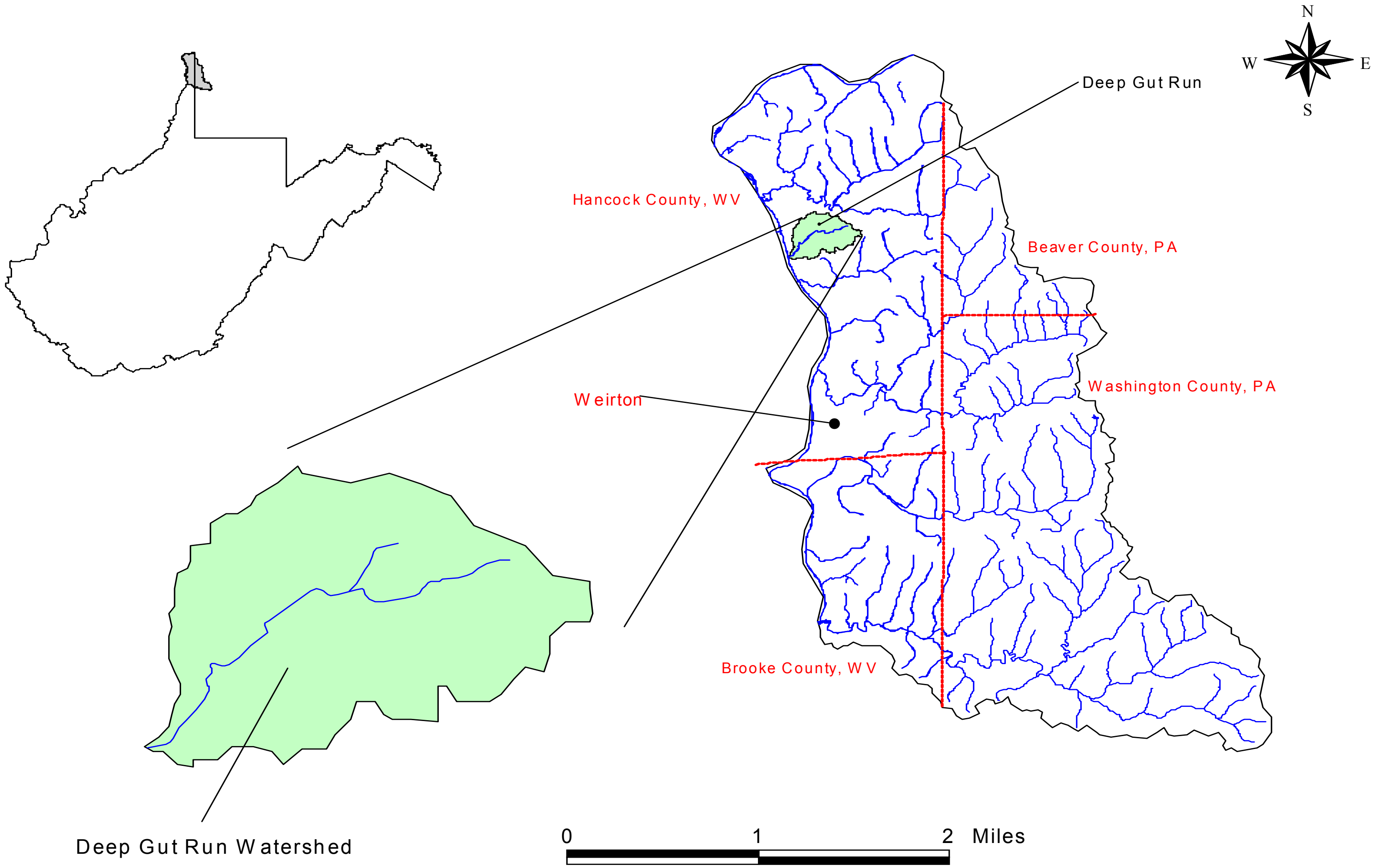


Figure A-3-1. Location of the Deep Gut Run watershed

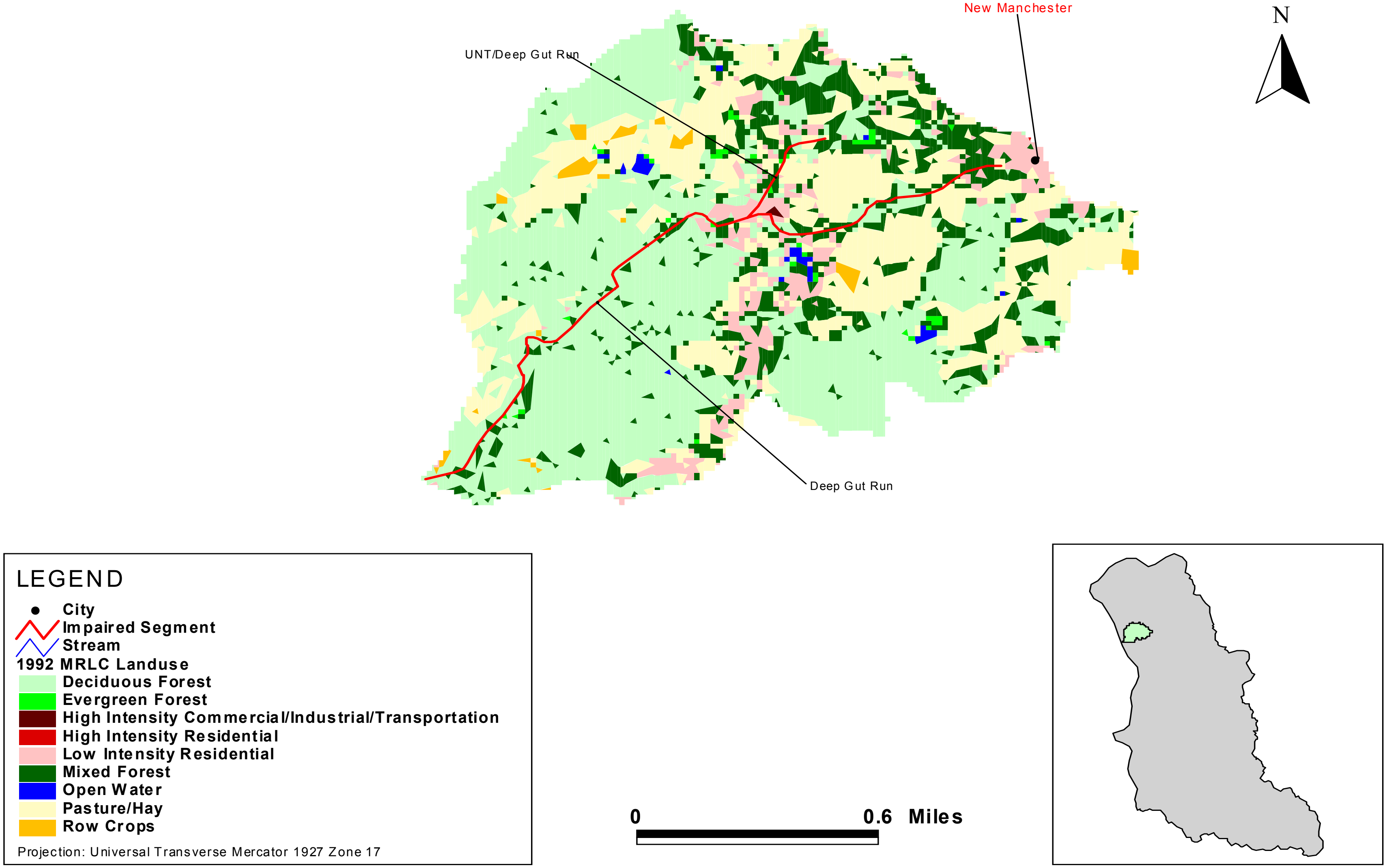
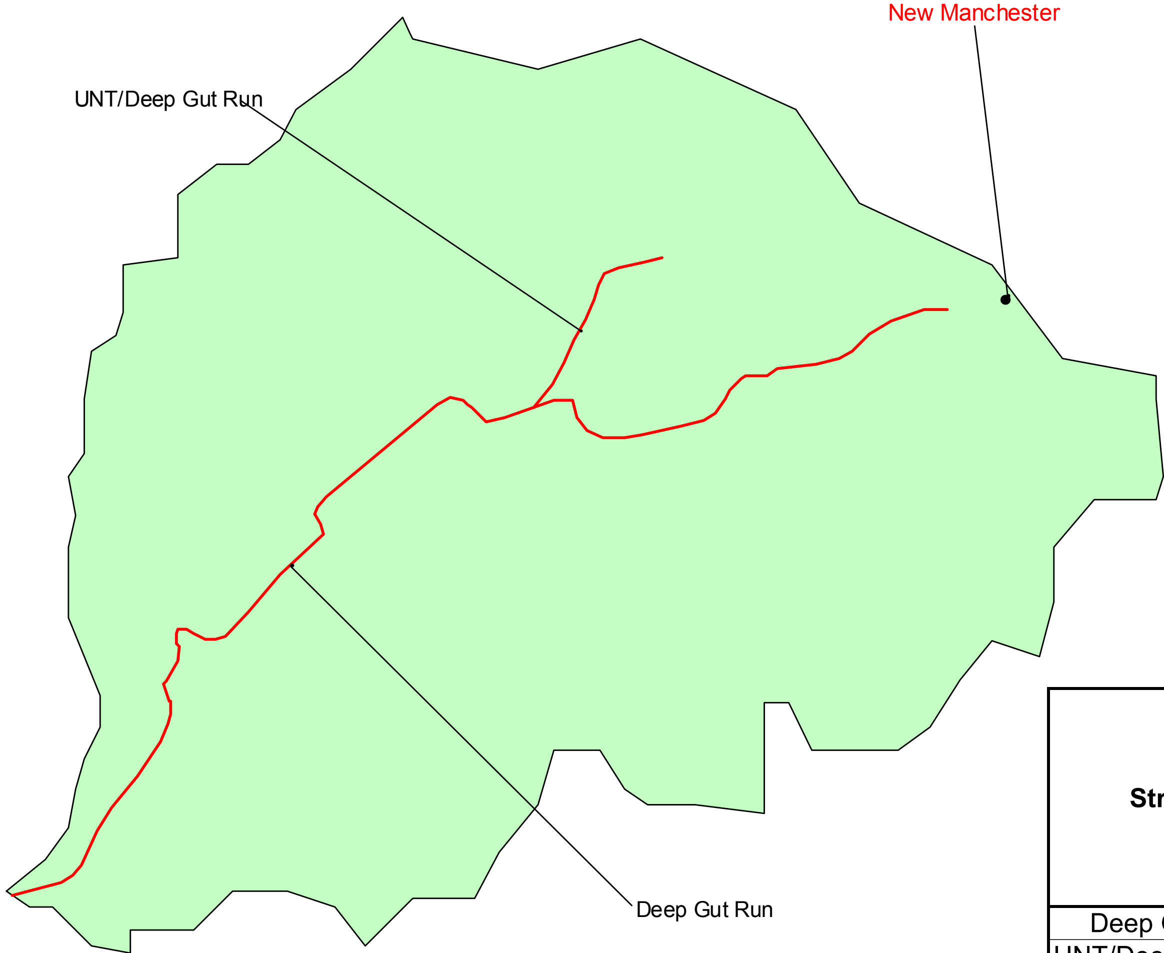


Figure A-3-2. Land use distribution in the Deep Gut Run watershed



Stream	Aluminum	Iron	Manganese	pH	Biological	Fecal Coliforms
Deep Gut Run	X	X	X	X	X	
UNT/Deep Gut Run			X			

Figure A-3-3. The impaired waterbodies in the Deep Gut Run watershed

A-3.2 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 Deep Gut Run watershed are shown in Figure A-3-4. 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.

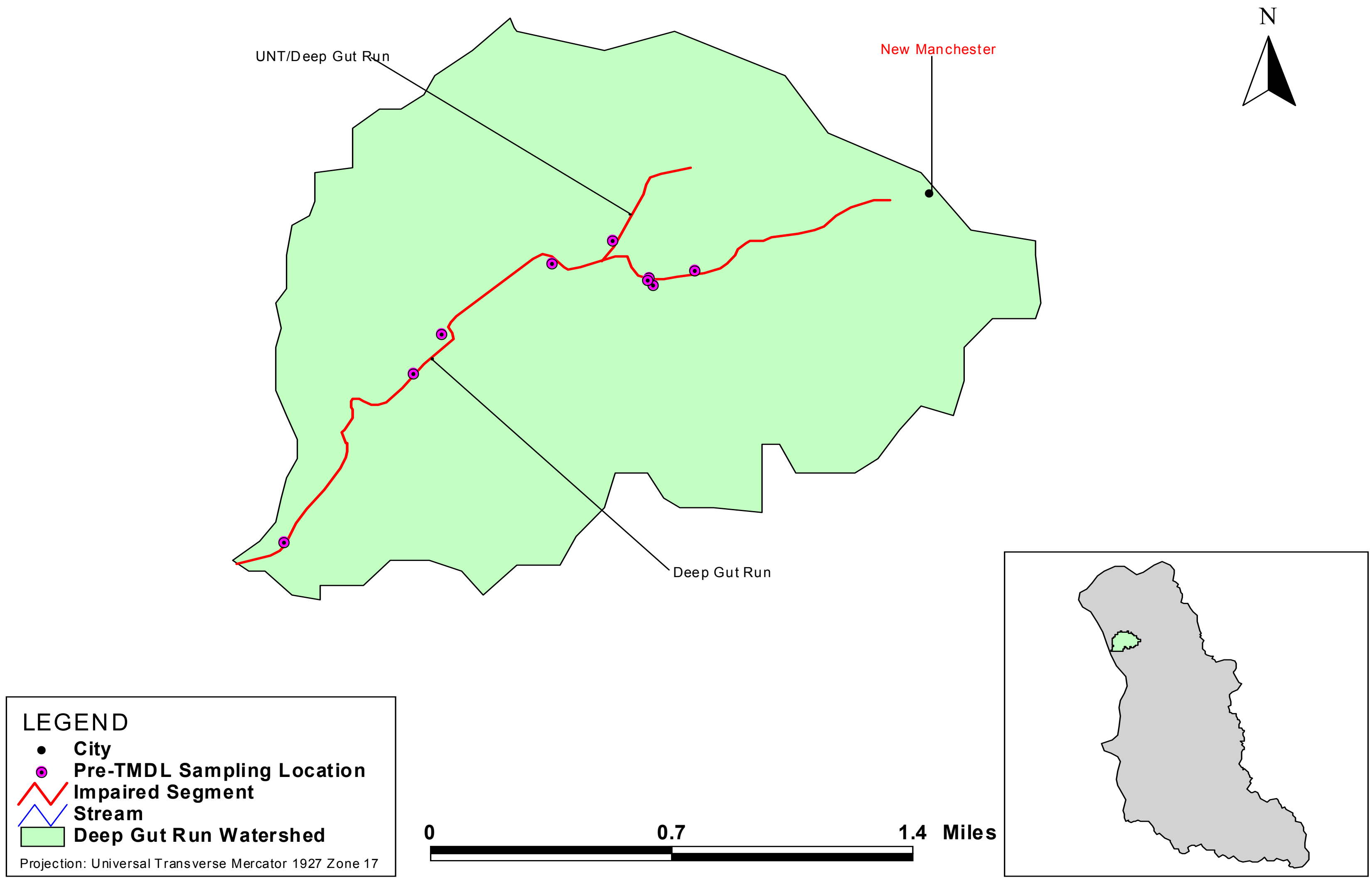


Figure A-3-4. Pre-TMDL monitoring stations in the Deep Gut Run watershed

A-3.3 Metals and pH Sources

This section identifies and examines the potential sources of aluminum, iron, manganese, and pH impairment in the Deep Gut Run watershed. Sources can be classified as either point sources (specific sources subject to a permit) or nonpoint sources (non-permitted). Metals and pH point sources are classified by the mining- and non-mining-related permits issued by WVDEP. 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) coverage of point and nonpoint sources, and through field reconnaissance. As part of the TMDL process, WVDEP documented pollution sources by describing each pollution source in detail, collecting Global Positioning System data, and if necessary collecting a water quality sample for laboratory analysis. WVDEP staff 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.

Based on scientific knowledge of sediment/metal interaction and knowledge of soils in West Virginia (Watts et. al., 1994), 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-3.3.1 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. There are no permitted mining sources in the Deep Gut Run watershed.

A-3.3.2 Metals Nonpoint Source Inventory

Nonpoint sources contribute to metals-related water quality impairments in the Deep Gut Run watershed. Nonpoint sources are diffuse, non-permitted sources. Abandoned mine lands can be a significant source of non-permitted 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

Source-tracking efforts by WVDEP's Division of Water and Waste Management have identified three abandoned mine sources (sources can include discharges, seeps, portals, culverts, refuse piles, diversion ditches, or ponds), which are shown in Figure A-3-5. There are no bond forfeiture sites in the watershed.

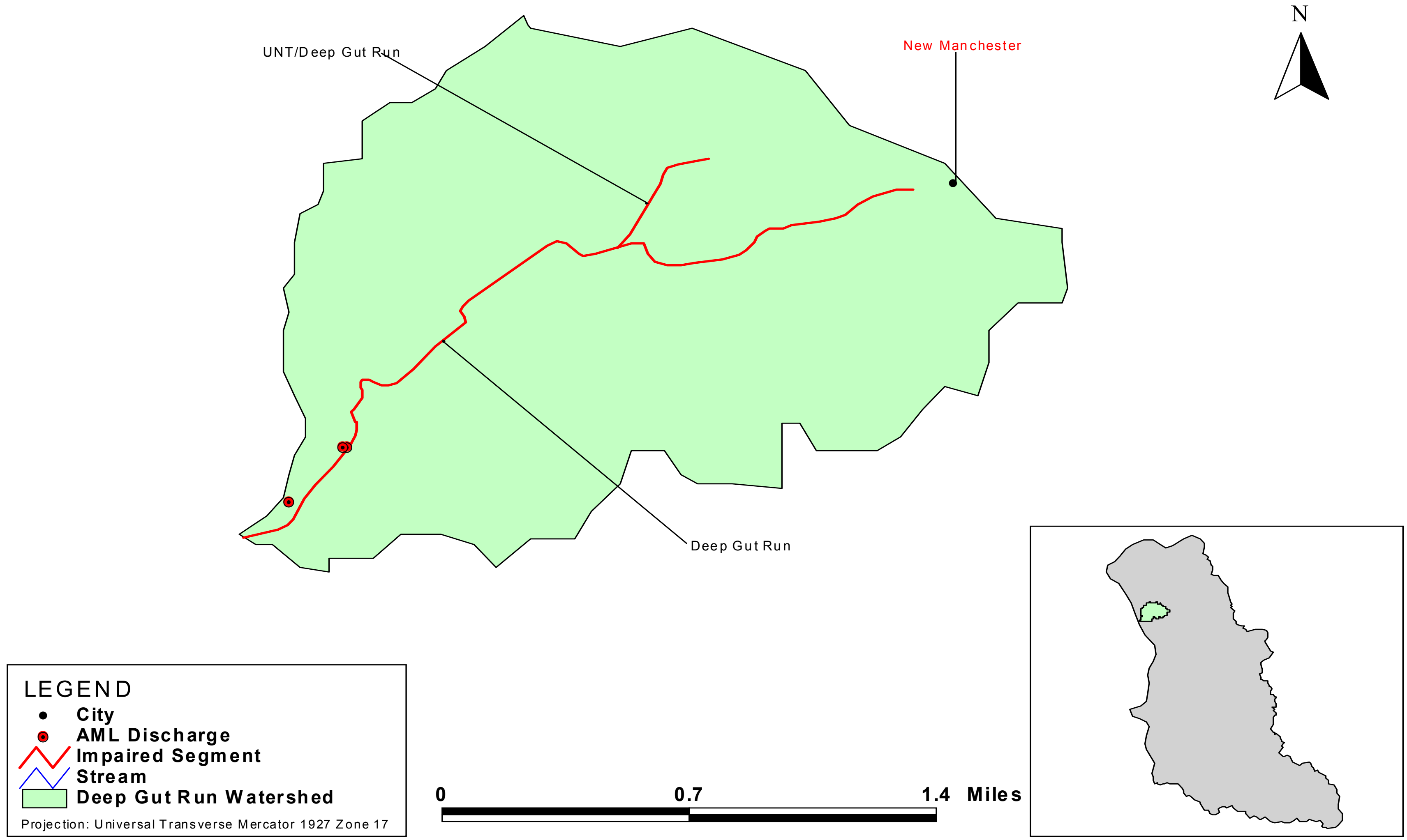


Figure A-3-5. Abandoned mine lands in the Deep Gut Run watershed

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 related to these activities and the number of sites in the Deep Gut Run watershed are discussed below.

Agriculture

Based on the Multi-Resolution Land Characteristics coverage, agricultural areas cover 496.75 acres (28.07 percent) of the Deep Gut Run watershed.

Forestry

Active logging operations were not present in the Deep Gut Run watershed.

Oil and Gas Wells

Based on data from WVDEP's Office of Oil and Gas, there were no active oil and gas wells in the Deep Gut Run watershed.

Roads

The length and area of paved and unpaved roads were calculated using the Census 2000 TIGER/Line files roads coverage for West Virginia. Table A-3-1 summarizes the length, area, and percentage of total watershed area for both paved and unpaved roads in the Deep Gut Run watershed.

Table A-3-1. Road miles by type in the Deep Gut Run watershed

Road Type	Road Distance (miles)	Road Area (acres)	Road Area as Percentage of Watershed
Total paved	13.12	26.57	1.50%
Total unpaved	4.80	9.06	0.51%

The elevated metals concentrations did not correlate to sediment in the stream during high flow events. Therefore, under low flow conditions, the abandoned mine seeps appear to be the dominant source of metals in the watershed.

A-3.4 Fecal Coliform Bacteria Sources

Streams in the Deep Gut Run watershed are not impaired by fecal coliform bacteria.

A-3.5 Stressors of the Biologically Impaired Stream

Deep Gut Run is the only biologically impaired stream in the watershed, and TMDLs have been developed for it. The stream is identified in Table A-3-2 along with the primary stressors of the stream's 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-3-2. Primary stressors of biologically impaired Deep Gut Run

Stream	Primary Stressors	TMDLs Required
Deep Gut Run	Metals toxicity (Al, Fe) Acidity (pH)	Aluminum Iron pH

The iron and aluminum TMDLs presented in Tables A-3-3 and A-3-5 are surrogates for the metals toxicity biological stressors. Please refer to section A-3.3 for source information.

A-3.6 TMDLs for the Deep Gut Run Watershed

A-3.6.1 TMDL Development

TMDLs and source allocations were developed for impaired streams in the Deep Gut Run watershed. A top-down methodology was followed to develop 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 these waterbodies and TMDLs were developed. Refer to section 7.4 in 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, and pH are shown in Tables A-3-3 through A-3-6. The TMDLs for metals are presented as annual average loads, in terms of pounds per year.

A surrogate approach was used for the pH TMDLs: it was assumed that if in-stream concentrations of metals (iron and aluminum) are reduced to meet water quality criteria (or TMDL endpoints), the pH will meet the water quality standard. This assumption was verified by running the Dynamic Equilibrium In-stream Chemical Reactions (DESC-R) model for an extended period under TMDL conditions (conditions where TMDL endpoints for metals were met). A long-term, daily average, equilibrium pH was calculated based on the daily equilibrium pH output from the DESC-R model. The result is shown in Table A-3-6 for the pH-impaired stream in the Deep Gut Run watershed. Refer to the Technical Report for a detailed description of the pH modeling approach.

A-3.6.2 TMDL Tables: Metals

Table A-3-3. Iron TMDLs for the Deep Gut Run watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
DEEP GUT RUN	WVO-101	Deep Gut Run	Iron	5,390	NA	284	5,674

NA = not applicable.

Table A-3-4. Manganese TMDLs for the Deep Gut Run watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
DEEP GUT RUN	WVO-101	Deep Gut Run	Manganese	270	NA	14	285
DEEP GUT RUN	WVO-101-E	UNT/Deep Gut Run	Manganese	7	NA	2	9

Table A-3-5. Aluminum TMDLs for the Deep Gut Run watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
DEEP GUT RUN	WVO-101	Deep Gut Run	Aluminum	2,137	NA	112	2,249

NA = not applicable.

Table A-3-6. pH TMDLs for the Deep Gut Run watershed

Major Watershed	Stream Code	Stream Name	Parameter	pH* (Under TMDL conditions)
DEEP GUT RUN	WVO-101	Deep Gut Run	pH	7.48

*Predicted pH assumes that all metals (aluminum, iron, manganese) meet TMDL endpoints.