APPENDIX 4

A-4.0 ELKS RUN AND UNT/POTOMAC RIVER RM 12.8 (TEAGUE'S RUN)

A-4.1 Watershed Information

Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) are in the eastern portion of the Potomac Direct Drains watershed TMDL study area. Elks Run drains approximately 18.1 square miles (11,598 acres), and UNT/Potomac River RM 12.8 (Teague's Run) drains 1.8 square miles (1,165 acres), as shown in Figure A-4-1. The dominant landuse in the Elks Run watershed is grassland, which covers 29 percent of the watershed. Other important landuse types include pasture (21 percent), cropland (17 percent), forest (14 percent) and urban/residential (13 percent). Landuse in the UNT/Potomac River RM 12.8 (Teague's Run) watershed is split between grassland (33 percent), cropland (31 percent), forest (21 percent), and urban/residential (8 percent). There are three impaired streams in the two watersheds, Elks Run, Elk Branch and UNT/Potomac River RM 12.8 (Teague's Run), that are addressed in this TMDL development effort. Figure A-4-2 shows the impaired streams and associated pollutants.

Before establishing Total Maximum Daily Loads (TMDLs), WVDEP performed monitoring throughout the Potomac Direct Drains watershed to better characterize water quality and refine impairment listings. Monthly samples were taken at six stations in the Elks Run watershed and six stations in the UNT/Potomac River RM 12.8 (Teague's Run) 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. 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.

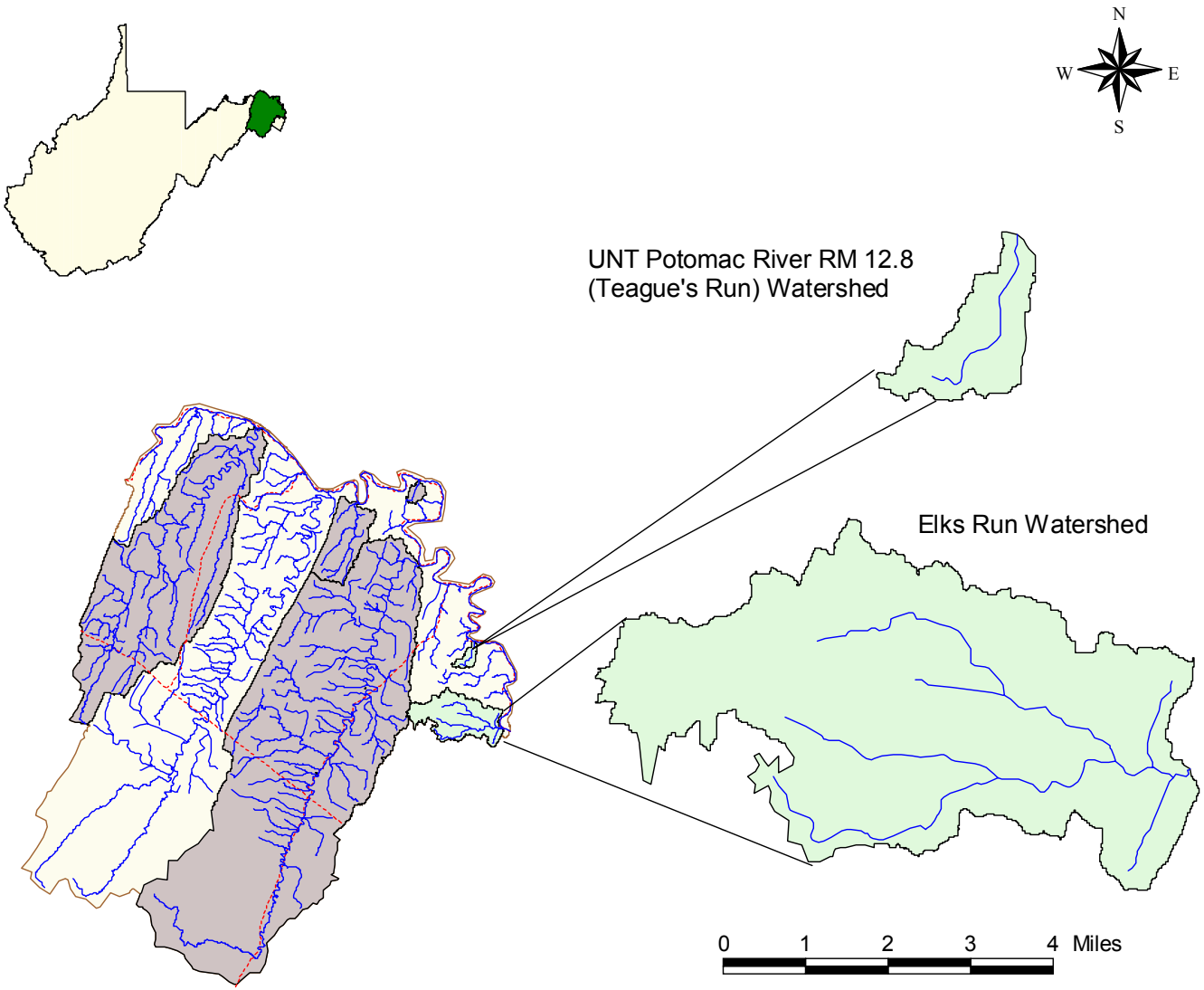
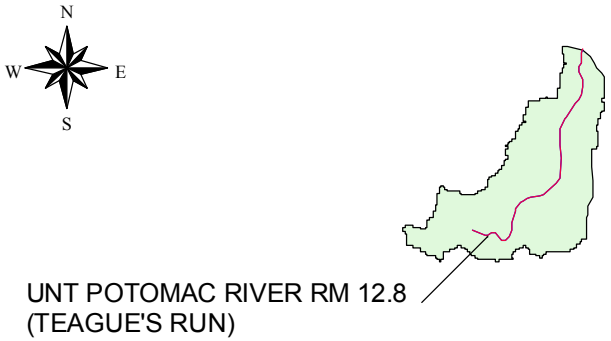


Figure A-4-1. Location of the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) watersheds



TMDL	Impairment	
Stream Name	Fecal Coliform	Biological
Elks Run	X	X
Elk Branch	X	X
UNT Potomac River RM 12.8 (Teague's Run)	X	X

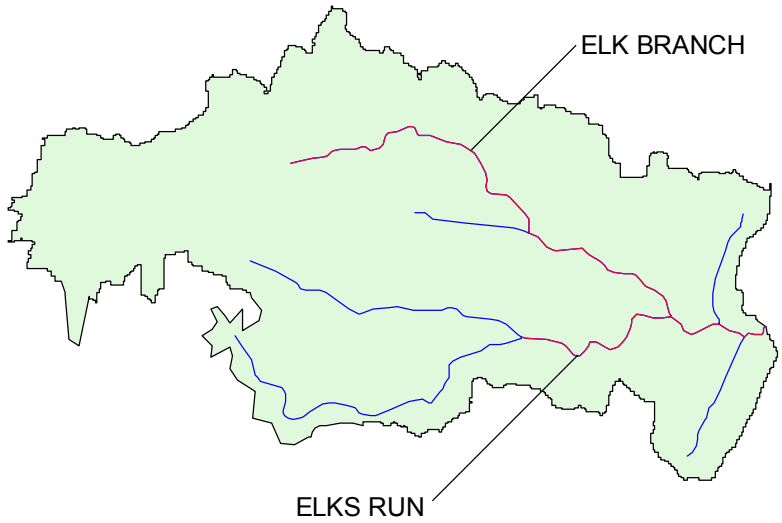


Figure A-4-2. Waterbodies and impairments under TMDL development in the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) watersheds

A-4.2 Fecal Coliform Bacteria Sources

This section identifies and examines the potential sources of fecal coliform bacteria in the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) watersheds. Sources can be classified as either point sources or nonpoint sources. Point sources include permitted discharges from sewage treatment facilities. 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 urbanized areas.

A-4.2.1 Fecal Coliform Bacteria Point Sources

In the Elks Run watershed, one privately owned sewage treatment plant discharges treated effluent. The discharge is regulated by the General NPDES Permit for small privately-owned sewage treatment plants (Permit Number WV0103110, Registration Number WVG550533). The location of the outlet is shown in Figure A-4-3. There are no other effluent discharges from sewage treatment plants, combined sewer overflows, sanitary sewer overflows, or discharges from municipal separate storm sewer systems in the Elks Run watershed.
There are no known point source discharges of fecal coliform bacteria in the UNT/Potomac River RM 12.8 (Teague's Run) watershed.

A-4.2.2 Fecal Coliform Bacteria Nonpoint Sources

Pollutant source tracking by WVDEP personnel identified scattered areas of high population density without access to public sewers in the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) watersheds. Human sources of fecal coliform bacteria in these areas include sewage discharges from failing septic systems, and possible direct discharges of sewage from residences (straight pipes). An analysis of 911 emergency response addressable structure data combined with WVDEP source-tracking information yielded an estimate of 1,273 unsewered homes in the Elks Run watershed, and 98 unsewered homes in the UNT/Potomac River RM 12.8 (Teague's Run) 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-4-3 shows the estimated cumulative untreated flow from failing septic systems in each modeled subwatershed. . For a more detailed description of failing septic system fecal coliform modeling, please refer to the Potomac Direct Drains Watershed TMDL Technical Report.

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 rural areas, agricultural activities can contribute fecal coliform bacteria to receiving streams through surface runoff or direct deposition. The percentages of watershed area under urban/residential, pasture and crop landuses in Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) are described in Section A-4.1, above.

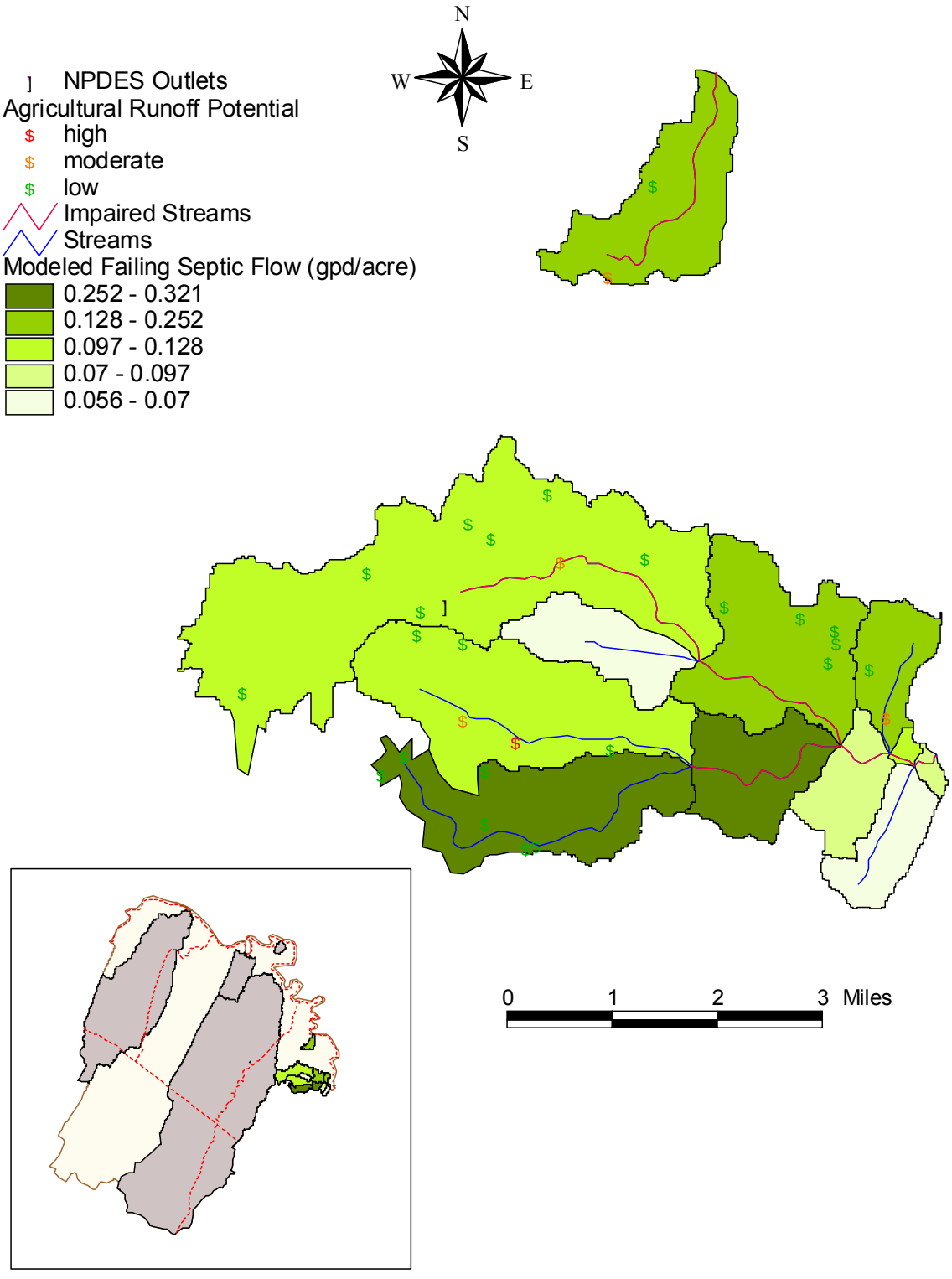


Figure A-4-3. Fecal coliform sources in the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) watersheds

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 the Division of Natural Resources, and storm sampling conducted in the Kanawha State Forest. Although wildlife contributions of fecal coliform bacteria were considered in modeling, they were not found to be a significant source.

A-4.3 Sediment Sources

Sediment TMDLs are presented herein for Elks Run, Elk Branch and UNT/Potomac River RM 12.8 (Teague's Run). Excess sediment has been identified as a significant stressor in relation to biological impairment of those waters.

Table A-4-1 displays the areas of landuses considered to be significant sediment sources in the watersheds of the sediment-impaired waters. In addition to those upland sources of sediment, streambank erosion constitutes a significant sediment source in Elks Run. This section discusses point and nonpoint sources of sediment that are present in the watersheds.

Table A-4-1. Upland Sediment sources in the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) TMDL watersheds

Stream	Total Watershed Area (acres)	Cropland Area (acres)	Pasture Area (acres)	Residential/ Urban/Roads Area (acres)	Existing Stormwater Construction GP Sites (acres)
Elks Run	11,598	1,859	2,309	1,726	665
Elk Branch	6,008	1,184	332	881	517
UNT/Potomac River RM 12.8 (Teague's Run)	1,165	360	54	110	0

A-1.3.1 Sediment Point Sources

Point sources of sediment include permitted loadings from traditional NPDES permitted outlets with effluent limitations for Total Suspended Solids (TSS), and the precipitation-induced loadings associated with stormwater NPDES permits.

Individual and General NPDES Permits for sewage treatment facilities contain technology based TSS effluent limitations. One permitted outlet is located in the Elks Run watershed. One facility is subject to the Multi-Sector Stormwater General Permit in the Elks Run watershed with its outlet subject to TSS benchmarks of 100 (mg/). Both outlets are recognized in the sediment modeling process and assigned wasteload allocations that allow for continued discharges under existing permit conditions.

Site registrations under the Construction Stormwater General Permit are the most significant sediment point sources in the Elks Run watershed. 13 existing and pending sites, constituting 665 disturbed acres, are represented. Of that area, 517 acres are located in the Elk Branch watershed. Model representation is precipitation-based and couples the design precipitation with the disturbed acreages and an assumption that proper installation and implementation of the Best Management Practices (BMPs) associated with the permit will achieve an approximate 60 percent reduction of barren land sediment loadings. The existing extent of registered sites exceeds the allocated acreage for both Elks Run and Elk Branch. Effective TMDL implementation will involve a nine percent and 32 percent reduction of existing registered area, respectively.

There are no known point source discharges of sediment in the UNT/Potomac River RM 12.8 (Teague's Run) watershed.

A-1.3.2 Sediment Nonpoint Sources

Land disturbance can increase sediment loading to impaired waters. Significant upland nonpoint sources of sediment in the watersheds include barren land, cropland, unpaved roads, and pasture lands, for which pre-TMDL source tracking determined moderate or high water quality impact. Residential and urban landuses are not considered to be significant upland sediment sources, but the increased percentage of impervious area associated with that landuse can increase the volume and velocity of stormwater runoff and accelerate streambank erosion.

Agricultural landuses are the most significant sediment nonpoint sources in all three impaired streams. Crop and pasture lands make up 25 percent of the land area of the Elk Branch watershed, 36 percent of the land area of the Elks Run watershed, and 36 percent of the land area of the UNT/Potomac River RM 12.8 (Teague's Run) watershed.

Streambank erosion is a significant source of sediment in Elks Run and Elk Branch. The poor riparian habitat and unstable streambanks were addressed by streambank erosion allocations that reduce the loading to the characteristics of the reference stream, Buzzard Run. Streambank erosion was not considered to be a significant sediment source in UNT/Potomac River RM 12.8 (Teague's Run).

The sediment loadings from non-pasture grassland and forested areas are not considered to be significant sediment sources and their sediment contributions are categorized as "background" in the load allocations. Forestry and oil and gas production are not prevalent in the watershed and are also categorized in the background loading.

A-4.3 Stressors of Biologically Impaired Streams

Elks Run, Elk Branch, and UNT/Potomac River RM 12.8 (Teague's Run) are biologically impaired. A stressor identification process was used to evaluate and identify the significant stressors of impaired benthic communities. The stressor identification process is detailed in Section 6 of the main report with additional information provided in the Technical Report.

Table A-4-2 displays the biological stressors of the streams' benthic communities and the TMDLs required to address these impairments.

Organic enrichment and sedimentation have been identified as significant biological stressors of all three waterbodies. Where identified as the biological stressor, organic enrichment was linked to violations of the numeric criteria for fecal coliform bacteria. WVDEP determined that the implementation of fecal coliform TMDLs would remove untreated sewage and animal waste, thereby reducing the organic and nutrient loadings causing the biological impairment. Therefore, fecal coliform TMDLs will serve as a surrogate where organic enrichment was identified as a stressor. Where the stressor identification process indicated sedimentation as a causative stressor, WVDEP developed sediment TMDLs.

Table A-4-2. Significant stressors of biologically impaired streams in the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) watersheds

Stream	Biological Stressors	TMDLs Required
Elks Run	Organic enrichment Sedimentation	Fecal coliform Sediment
Elks Branch	Organic enrichment Sedimentation	Fecal coliform Sediment
UNT/Potomac River RM 12.8 (Teague's Run)	Organic enrichment Sedimentation	Fecal coliform Sediment

A-4.4 TMDLs for the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) Watersheds

A-4.4.1 TMDL Development

TMDLs and source allocations were developed for the impairments displayed in Figure A-4-2. Refer to Section 7 of the main TMDL report for a detailed description of the allocation methodologies used in developing the pollutant-specific TMDLs.

The TMDLs for fecal coliform bacteria and sediment are shown in Tables A-4-3 and A-4-4. The TMDLs for fecal coliform bacteria are presented in number of colonies per day. The TMDLs for sediment are presented in tons per day.

Detailed source allocations are provided in the allocation spreadsheets associated with this report. The filterable spreadsheets include multiple display formats that allow comparison of pollutant loadings among categories and facilitate implementation. Displays include mass-based allocations for point and nonpoint sources, concentration-based allocations for traditional point sources, and area allocations for Construction Stormwater General Permit registrations. Mass-based load allocations for nonpoint source categories and their respective contributing areas are also provided for each modeled subwatershed. A brief description of the information presented is included on the "Introduction" tab of each spreadsheet. Sections 7.4.1 and 7.4.2 of the main TMDL report provides a more detailed discussion, and identifies the operable allocations for point sources.

A-4.5 TMDL Tables: Fecal Coliform Bacteria

Table A-4-3. Fecal coliform bacteria TMDLs for the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) watersheds

Major Watershed	Stream Code	Stream Name	Parameter	Load Allocation (counts/day)	Wasteload Allocation (counts/day)	Margin of Safety (counts/day)	TMDL (counts/day)
Elks Run	WVP-1	Elks Run	Fecal coliform	6.44E+10	1.36E+08	3.40E+09	6.80E+10
Elks Run	WVP-1-A	Elk Branch	Fecal coliform	2.15E+10	1.36E+08	1.14E+09	2.28E+10
UNT/Potomac River RM 12.8 (Teague's Run)	WVP-2.2	UNT/Potomac River RM 12.8 (Teague's Run)	Fecal coliform	4.05E+09	NA	2.13E+08	4.26E+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.

A-4.6 TMDL Tables: Biological

Table A-4-4. Biological TMDLs for the Elks Run and UNT/Potomac River RM 12.8 (Teague's Run) TMDL watersheds

Stream	Biological Stressor	Parameter	Load Allocation	Wasteload Allocation	Margin of Safety	TMDL	Units
Elks Run	Organic enrichment	Fecal coliform	6.44E+10	1.36E+08	3.40E+09	6.80E+10	counts/ day
	Sedimentation	Sediment	75.56	1.10	4.03	80.70	tons/day
Elks Branch	Organic enrichment	Fecal coliform	2.15E+10	1.36E+08	1.14E+09	2.28E+10	counts/ day
	Sedimentation	Sediment	17.48	0.82	0.96	19.26	tons/day
UNT/Potomac River RM 12.8 (Teague's Run)	Organic enrichment	Fecal coliform	4.05E+09	NA	2.13E+08	4.26E+09	counts/ day
	Sedimentation	Sediment	2.33	0.00	0.12	2.45	tons/day

NA = not applicable